TOXIC TREATMENT: CREOSOTE, THE WOOD-PRESERVATION INDUSTRY, AND THE MAKING OF SUPERFUND SITES

By

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LIST OF ABBREVIATIONS

AAAS	American Association for the Advancement of Science
AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
AWPA	American Wood Preservers' Association
CCA	Chromated Copper Arsenate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPL	United States Forest Products Laboratory
NPL	National Priorities List
PCP	Pentachlorophenol
USDA	United States Department of Agriculture

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The wood-preservation industry, which applies chemicals to extend the service life of timber, is one of the largest users of dangerous pesticides in the United States. Additionally, the U.S. Environmental Protection Agency (EPA) has designated many former wood-preservation plants as Superfund sites ranking among the worst hazardous-waste sites in the nation. Wood-preservers and trade organizations, however, have produced much of the existing research, minimizing the industry's long history of pollution and the risks associated with its chemical preservatives, especially coal-tar creosote.

Creosote, an oily distillate of coal, protects wood from rot and decay, but polluted the environment and endangered public and worker health when wood preservers spilled, dumped, and buried millions of tons of toxic waste around their plants. This project investigates how dwindling timber supplies and rising prices at the turn of the twentieth century prompted American railroad companies and other industries to embrace European methods of wood-preservation with creosote as an economical solution that saved money and forests. While American consumers adopted wood preservation reluctantly, they came to accept creosote as their treatment of

choice. To this day, the United States continues to rely on this toxic treatment even though medical professionals first identified creosote’s hazards in the late eighteenth century and many countries have since banned its use.

Employing a blend of social, environmental, labor, and public health histories, this investigation traces creosote’s path from an undesirable byproduct to an indispensable remedy that saved money and conserved precious timber resources—although, paradoxically, at great cost to environmental and human health. Exploring creosote’s hidden history and consequences, this study examines industry and trade publications, newspapers, medical journals, legal cases, and company records.

Building on scholarship that emphasizes the historical roots of environmental inequalities, this project also demonstrates that certain groups in society bore a disproportionate share of the pollution associated with wood preservation. To confront the significant environmental threat that these sites pose, researchers, policymakers, and concerned citizens need a deeper understanding of the making of these sites—especially their origins—and how these locations are connected to the nation’s industrial and environmental pasts.

CHAPTER 1
INTRODUCTION: “A NIGHTMARE CAMOUFLAGED AS A DREAM”

In 1968, Patsy Ruth Oliver moved into Carver Terrace, a newly built African American subdivision in the city of Texarkana, a former railroad boomtown extending across the Texas-Arkansas border. As a single parent struggling to support five children and her mother, Oliver worked as a nurse and as an assembly-line employee at the Lone Star Army Ammunitions Plant. She also supplemented her income cooking for white families.[1] When the Olivers saved enough money to move out of public housing and into a new, modern, ranch-style, brick home in Carver Terrace, the family felt they had attained the “American dream.”[2] Oliver and her neighbors soon realized, however, that Carver Terrace was, as Oliver put it, “a nightmare camouflaged as a dream.”[3]

When it rained, dark crud oozed from the soil around homes, swing sets, gardens, and swimming pools. Puddles of leftover rainwater always seemed to possess “an oily sheen.”[4] Pipes quickly corroded, and noxious sludge trickled from faucets into sinks and bathtubs. Grass and other plants refused to grow. A curious smell permeated the neighborhood; it almost seemed “like someone was brushing hot, sticky tar onto a sun-scorched roof,” one visitor recalled.[5] Residents became ill, experiencing nausea,

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[1] Alexis Jetter, “A Mother’s Battle for Environmental Justice,” in *The Politics of Motherhood: Activist Voices from Left to Right*, ed. Alexis Jetter, Annelise Orleck, and Diana Taylor (Hanover, New Hampshire: University Press of New England, 1997), 54-55.

[2] Patsy Ruth Oliver, “Living on a Superfund Site in Texarkana,” in *Unequal Protection: Environmental Justice and Communities of Color*, ed. Robert D. Bullard (San Francisco: Sierra Club Books, 1994), 77.

[3] Ibid., 77-78.

[4] Jetter, “A Mother’s Battle for Environmental Justice,” 91.

[5] Ibid., 89.

dizziness, nosebleeds, headaches, as well as thyroid, liver, respiratory, and kidney problems.[6] According to Oliver and her neighbors, high rates of cancer, miscarriages, and unusual ailments also haunted Carver Terrace's inhabitants.[7]

Some residents suggested these strange occurrences might be linked to the old wood-treatment facility that white developers bulldozed to construct Carver Terrace.[8] For decades, this plant—and hundreds of others like it around the United States—pressure treated wood with toxic chemicals to prevent it from rotting and decaying. The culprit behind the oily, tarry, and smelly substance disturbing the suburban idyll in Carver Terrace was creosote, a byproduct of coal-tar distillation and one of the most established and enduring wood preservatives.[9]

Government officials did not confirm residents' suspicions about the source of the neighborhood's ills until 1984, when the U.S. Environmental Protection Agency (EPA) recommended the addition of Carver Terrace to the National Priorities List (NPL) of the country's most polluted sites.[10] In the wake of publicized "ecotastrophes," such as Love Canal in Niagara Falls, New York, Congress passed in 1980 what is commonly referred to as Superfund legislation, or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), to fund the identification and cleanup of the

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[6] Ibid., 46-47 and 57-58.

[7] Ibid., 91-92.

[8] Ibid., 47.

[9] Nicholas P. Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production Volume 2: Best Practices in the Wood and Paper Industries* (Amsterdam: Elsevier, 2010), 1; Paul Blanc, *How Everyday Products Make People Sick: Toxins at Home and in the Workplace* (Berkeley: University of California Press, 2007), 226-227; George M. Hunt and George A. Garratt, *Wood Preservation* (New York: McGraw-Hill Book Company, Inc. 1938), 7.

[10] Oliver, "Living on a Superfund Site in Texarkana," 79-80. The site was recommended in 1984, but the EPA did not officially add it until 1986.

nation's worst hazardous-waste sites. CERCLA represented a modern attempt to resolve a longstanding problem—the wide-scale pollution generated by past and present industries.[11]

In the Carver Terrace case, the wood-preservation plant that operated from the early 1900s to 1961 spilled, dumped, and buried millions of tons of toxic waste in its quest to prevent wood structures such as railroad ties, telephone poles, and other timber from deteriorating.[12] This plant represented only one of over 100 wood-preservation facilities in operation by 1915 in the United States.[13] By 1996, over 700 plants across the country had treated wood with creosote and other toxic chemicals.[14] Today, many of these locations have shared Carver Terrace's Superfund status. These calculations do not even include the businesses that manufactured wood preservatives and distilled coal tar, which join wood-preservation sites among the EPA's rankings of the most polluted places.[15]

[11] Craig E. Colten and Peter N. Skinner, *The Road to Love Canal: Managing Industrial Waste Before EPA* (Austin: University of Texas Press, 1996), 3 and 162; Elizabeth D. Blum, *Love Canal Revisited: Race, Class, and Gender in Environmental Activism* (Lawrence: Kansas: University Press of Kansas, 2008), 21.

[12] Oliver, "Living on a Superfund Site in Texarkana," 78; Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention*, 1.

[13] American Wood Preservers' Association, *Handbook on Wood Preservation* (Baltimore, Maryland: n.p., 1916), 20.

[14] Jay Feldman and Terry Shistar, "Poison Poles: A Report About Their Toxic Trail and Safer Alternatives," (Washington, D.C., National Coalition Against the Misuse of Pesticides, 1997), http://www.beyondpesticides.org/programs/wood-preservatives/publications/poison-poles (accessed September 10, 2017).

[15] United States Environmental Protection Agency, "Search for Superfund Sites Where You Live," United States Environmental Protection Agency, https://www.epa.gov/superfund/search-superfund-sites-where-you-live (accessed August 17, 2017).

Once Oliver and other homeowners received official word that they had been living on a toxic “time bomb,” they quickly became frustrated with the government’s limited response to their plight. In 1988, without conducting health surveys or even interviewing residents, the EPA pronounced the site safe for people to continue living there.[16] Carver Terrace residents responded, accusing the EPA of environmental racism and arguing that the color of their skin trapped them in their neighborhood, which became widely known as the “black Love Canal.” [17] Oliver more eloquently described it as a “prison of poison.”[18] She realized that if this community failed to mobilize, it would not have a “chance of a snowball in hell” of escaping this “Toxic Twilight Zone.”[19] Oliver and her neighbors found allies in the growing environmental justice movement, which challenges discriminatory laws, regulations, and practices that prevent access to a healthy environment. As many environmental justice activists maintain, their goal is not to “simply redistribute” environmental hazards but to eliminate them altogether.[20] After an extended campaign, Oliver and her neighbors succeeded in convincing Congress to authorize a buyout and relocation for the Carver Terrace residents.[21] (Figure 1-1)

While activists and scholars often herald this struggle as a major victory for the modern environmental justice movement, Oliver cautioned against complacency. “We’re

[16] Oliver, “Living on a Superfund Site in Texarkana,” 77 and 80.

[17] Jetter, “A Mother’s Battle for Environmental Justice,” 45.

[18] Ibid., 89.

[19] Ibid., 60 and 51.

[20] Energy Justice Network, “Environmental Justice / Environmental Racism,” Energy Justice Network, http://www.ejnet.org/ej/ (accessed August 4, 2017).

[21] Oliver, “Living on a Superfund Site in Texarkana,” 89.

out of Carver Terrace," she admitted, "but it's not out of us."[22] Despite the pollution problems that creosote caused, many Americans still live and work in places contaminated with this toxic treatment. In addition, the wood-preservation industry and its history are often removed from conversations about Superfund sites such as Carver Terrace. Focusing exclusively on the Superfund period obscures the industrial origins of former wood-treatment facilities, minimizes the complexity of these sites' current pollution problems, and absolves the companies that over a century ago ushered in an era of industrial pollution. [23]

To uncover the connections between wood preservation and the nation's industrial and environmental pasts, this study employs a blend of environmental, social, labor, and public health histories, exposing how the chemical preservatives this industry applied affected the environment, but also the people living and working in those environments. I trace creosote's path from an undesirable byproduct to an indispensable "panacea" that saved money and precious timber resources—albeit at great ecological and public-health costs.[24] Wood-preservation advocates promised creosote would significantly extend the life of timber, providing control over nature and the products they extracted from it.[25] While the preservative exceeded their expectations, companies spent centuries applying chemicals that degraded the

[22] Jetter, "A Mother's Battle for Environmental Justice," 96.

[23] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention*, 1.

[24] George Lunge, *A Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor, and the Separation of Them From Valuable Products* (London: John Van Voorst, 1882), 4; Guy Forshey, "Interesting St. Louisans: Hermann von Schrenk," *St. Louis Post-Dispatch* (20 October 1929): 9.

[25] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory: A Decennial Record, 1910-1920* (Madison, Wisconsin: Democrat Printing Company, 1921), 1.

environment and threatened public and worker health. Thus, much like Patsy Ruth Oliver's experiences with Carver Terrace, creosote was, in fact, a "nightmare camouflaged as a dream."[26]

To understand creosote's deceptive nature, this investigation considers the repercussions of this nightmare, but also the motivation behind the dream of wood preservation—to exert control and dominance over wood and the forests that yield this resource. This essential material is vital, strong, cheap, attractive, and, for most of human history, it has been relatively plentiful. While wood is a prized commodity, it is also highly variable, prone to deterioration, difficult to replace once gone, and resistant to attempts at standardization.[27]

Wood's fickle nature has long engendered the desire to chemically preserve and extend the life of timber, especially during periods of perceived scarcity or rapid depletion. While humans experimented with a multitude of preservatives and techniques over millennia, they struggled to find an economical and effective treatment. This quest reached its apex during the early 19th century, a period of rapid industrialization, chemical advancement, and gross overconsumption of wood. Europe industrialized earlier than the United States and confronted these fears first; its researchers also pioneered the use of creosote as a wood preservative. Although this study traces these technological developments in Chapter 2, it focuses more on the reluctant adoption—at

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[26] Patsy Ruth Oliver, "Living on a Superfund Site in Texarkana," in *Unequal Protection: Environmental Justice and Communities of Color*, ed. Robert D. Bullard (San Francisco: Sierra Club Books, 1994), 78.

[27] Harvey Green, *Wood: Craft, Culture, History* (New York: Penguin Books, 2006), xx; Charles M. Haines, "The Industrialization of Wood: The Transformation of a Material" (Ph.D. diss., University of Delaware, 1990), 3.

least initially—of wood preservation in the United States. Americans had long celebrated the nation's abundant forest resources, but their pace of industrialization sparked fears of a timber famine and prompted the simultaneous development of forestry and wood preservation. Despite their early reticence to adopt creosote, the United States—led by railroad magnates, foresters, chemical producers, and conservationists—embraced this toxic treatment as the answer to the dual problem of timber decay and depletion.[28]

This historical context, addressed in Chapters 3 and 4, is essential to understanding the industry's toxic legacy and coping with its continued effects. As environmental scientists, local officials, EPA representatives, and residents throughout the United States attempt to make wood-preservation sites safe for current and future communities such as Carver Terrace, they are "severely handicapped," historical geographer Craig E. Colten argues, "by the lack of readily available information on past industrial processes, former waste disposal methods, and even the location of industrial dumps."[29] While more contemporary wood preservatives such as pentachlorophenol and chromated copper arsenate (CCA), which companies applied in the post-World War II period, are often blamed for the pollution problems at these locations, the wood-preservation industry relied on creosote more extensively and for a much longer period

[28] Sherry H Olson, *The Depletion Myth: A History of Railroad Use of Timber*. (Cambridge, Massachusetts: Harvard University Press, 1971); Haines, "The Industrialization of Wood," 14; American Society of Civil Engineers, "The Preservation of Timber," in *Transactions of the American Society of Civil Engineers* 14 (July 1885): 276.

[29] Craig E. Colten, "Industrial Middens in Illinois: The Search for Historical Hazardous Wastes, 1870-1980," *Journal for the Society for Industrial Archeology* 14, no. 2 (1988): 51; Craig E. Colten, "Historical Hazards: The Geography of Relict Industrial Wastes," *Professional Geographer* 42, no. 2 (1990): 143.

of time.[30] Creosote's quasi-anonymity, related to confusion over its chemical composition and misinformation about its toxicity, helped sweep this "nasty gooey toxic crud," as one Florida citizen derided, "under the rug."[31]

While scholars have completed comprehensive studies of hazardous industries such as lead, asbestos, radium, and vinyl, there are currently no full-length analyses of the wood-preservation industry.[32] Instead, wood-treatment companies and industry organizations have produced much of the existing research, which minimizes the environmental and public health risks associated with creosoted wood. In addition, studies about pollution often privilege "hazardous materials" produced in the post-World War II era, but, as Colten explains, "the large-scale generation of hazardous materials began in the nineteenth century."[33] Creosoting joined coal gasification, petroleum refining, metal finishing, leather tanning, and other early nineteenth and early twentieth-century industries that laid the groundwork for the nation's current hazardous-waste problems.[34]

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[30] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production*, 1; Blanc, *How Everyday Products Make People Sick*, 227-228.

[31] Protect Gainesville's Citizens, "Protect Gainesville's Citizens: Improving the flow and accuracy of information regarding the Cabot Koppers Superfund site," Protect Gainesville's Citizens, http://protectgainesville.org/ (accessed March 4, 2012). The comments discussed above occurred at an October 6, 2010 meeting and activists distributed the lyrics to a protest song, "Under the Rug."

[32] Christian Warren, *Brush with Death: A Social History of Lead Poisoning* (Baltimore, MD: Johns Hopkins University Press, 2000); Gerald E. Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley, CA: University of California Press, 2002); Claudia Clark, *Radium Girls, Women and Industrial Health Reform: 1910-1935* (Chapel Hill, NC: University of North Carolina Press, 1997).

[33] Colten, "Historical Hazards," 143.

[34] Ibid., 143-144.

Creosote's longevity as a wood preservative and pollutant brought its hazards to light much earlier, as Chapter 5 reveals, than standard narratives about wood-preservation sites acknowledge. Medical professionals first identified creosote's risks in the late eighteenth century, and many workers in the industry accused their employers of ignoring their health and safety and minimizing the dangers of exposure to this toxic treatment.[35] Although past and present wood-preservation facilities' proximity to low-income and minority neighborhoods, such as Carver Terrace, is not accidental, there is a much longer history of environmental inequalities associated with the wood-treatment industry and the technology it employed.[36]

Since the study of environmental inequalities grew up alongside this contemporary environmental justice movement, and many of the field's first scholars were active in the movement's early struggles, traditional scholarship rarely examines change over time. Instead, researchers often profile specific communities, focusing exclusively on the period in which activism emerged.[37] Shifting away from these more static works, historical geographers, environmental sociologists, and environmental historians have appealed for a better understanding of how environmental inequalities

[35] Percivall Pott and James Earle, *The Chirurgical Works of Percivall Pott: With His Last Corrections: to Which Are Added, a Short Account of the Life of the Author, a Method of Curing the Hydrocele by Injection, and Occasional Notes and Observations* (Philadelphia: James Webster, 1819), 291-292; *Samuel A. Pinkley v. The Chicago and Eastern Illinois Railroad Company*, 246 Ill. 370; 92 N.E. 896; 1910 Ill. LEXIS 2073, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[36] American Wood Preservers' Association, *Proceedings of the Sixteenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1920), 207.

[37] Robert D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality* (Boulder, Colorado: Westview Press, 1990). See also Eileen McGurty*, Transforming Environmentalism: Warren County, PCBs, and the Origins of Environmental Justice* (New Jersey: Rutgers University Press, 2009).

develop.[38] This dissertation responds to these recent calls for researchers and activists to consider historical roots. Striving for environmental equality requires that our society understand environmental inequalities, and these inequalities have a history.

Adopting this historical approach requires the consideration of not just residents living nearby former wood-preservation sites, but also the workers who confronted prolonged, direct contact with creosote long before occupational health and safety legislation took effect. In the wood-preservation industry, race and social-class variables clearly shaped access to a livable environment. Chapter 6 evaluates how African Americans bore a disproportionate share of the pollution associated with the wood-preservation industry.

While labor and public health historians, industrial hygienists, and physicians specializing in occupational medicine have produced significant work on occupational disease, scholars documenting environmental inequalities have less frequently integrated these findings into their studies.[39] Bridging this gap, I analyze how industrial pollution from wood-treatment facilities impacted workers and the environment in which they labored. Companies, for example, consigned African American laborers to the lowest-paid, unskilled positions, ensuring they faced significant exposure to toxic

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[38] Julie Sze, *Noxious New York: The Racial Politics of Urban Health and Environmental Justice* (Cambridge, Massachusetts: MIT Press, 2007), 47; David Naguib Pellow, *Garbage Wars: The Struggle for Environmental Justice in Chicago* (Cambridge, Massachusetts: The MIT Press, 2002), 4 and 163; Jeffrey Stine, afterword to *Echoes From the Poisoned Well*, *Echoes from the Poisoned Well,* ed. Sylvia Hood Washington, Paul C. Rosier, and Heather Goodall (Lanham, Maryland: Lexington Books, 2006), 409.

[39] See, for example, Andrew Hurley, *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill: University of North Carolina Press, 1995).

chemicals.[40] Physicians and industry officials also claimed that African Americans enjoyed a racial immunity against creosote's toxic effects, which encouraged the industry and company owners to neglect the safety and health concerns of these workers.[41]

Much like the chemicals that linger in the soil and water around former wood-preservation sites and in the bodies of workers and residents, the environmental inequalities that the industry manufactured persist long after plants closed and new wood preservatives replaced creosote. To gauge this preservative's widespread impact, we must start by stepping outside of the nightmare trapping Oliver and residents of other communities in a "toxic twilight zone."[42] Instead, this narrative begins centuries before the EPA classified Carver Terrace and hundreds of other wood-preservation sites as hazardous, when creosote represented a new, promising solution to an age-old problem.

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[40] American Wood Preservers' Association¸ *Proceedings of the Fourteenth Annual Meeting of the Wood Preservers' Association* (American Wood Preservers' Association, 1918), 54.

[41] Imre Heller, "Occupational Cancers," *Journal of Industrial Hygiene* 12, no. 5 (May 1930): 175, 179, and 180.

[42] Jetter, "A Mother's Battle for Environmental Justice," 51.

Figure 1-1. Carver Terrace community action group and friends marching for relocation from their contaminated neighborhood. Texarkana, Texas, 1992. Photograph by Sharon Stewart. © Sharon Stewart. http://www.sharonstewartphotography.net/exhibitions/ToxicTourOfTexas/imagePage_texarkana.html?image=1

CHAPTER 2
"THE GREAT DESIDERATUM": THE PROBLEM OF WOOD PRESERVATION AND THE RISE OF CREOSOTE

The author of a late nineteenth-century treatise on "the art of wood preserving" pronounced the problem of protecting this essential material to be a "subject of urgent importance."[1] Decay, rot, and "boring insects and parasites" all contributed to the deterioration of wood and constituted a "serious evil" that needed to be stopped, especially in America where there was an ever-increasing "demand for lumber" while "the limits of supply are inexorably narrowing."[2] "We cannot reproduce the wealth of the exhausted forests, nor can we hope for an adequate substitute," the author lamented, but he proposed a potential solution: "We may use with more economy what we have—we may make it go further and last longer."[3] In order to achieve this "economy," he suggested, Americans would need to adopt "an efficient wood-preserving process" or a means of chemically preserving the timber so that it would withstand harsh environmental conditions and deter pests.[4] Impregnating wood with creosote, an oily, tarry distillate of coal, the author recommended, would "exclude air, water, and putrescent matter" and effectively preserve the timber since "timber properly creosoted has never been known to rot."[5]

[1] "Destruction of Wood," in *Miscellaneous Papers on Wood* ([Place of publication not identified]: [publisher not identified], 1870), 2 and 1.<https://dds.crl.edu/crldelivery/15242>. While the author remains unidentified, this paper is referenced in the *Alphabetical Catalogue of the Navy Library* (Washington: Government Printing Office, 1891), 126), and is cited as follows: "Destruction of wood. Decay. Action of marine worms. The causes. The prevention. n. p., [1868] [Naval tracts. Vol. 15] 1235:15.

[2] Ibid., 4, 5, and 2.

[3] Ibid., 1-2.

[4] Ibid., 2.

[5] Ibid., 7.

The writer of this paper was not alone in his belief that wood preservation, and more specifically creosote, held the key to resolving what he described as "the great desideratum."[6] For thousands of years, scholars, scientists, entrepreneurs, and charlatans searched for and attempted to profit from chemical preservatives to extend the life of timber.[7] Wood preservers argued their industry should be considered among the oldest "arts" in existence since Noah allegedly preserved the hull of the ark with pitch.[8]

In spite of the long history of wood-preservation, modern audiences often take for granted or are unaware the industry even exists. Wood's status in our culture contributes—at least in part—to its invisibility. As historian Harvey Green explains, it has become both a "familiar and ordinary substance"—a material relied on for thousands of years "for heat, shelter, food preparation, light, tools, weapons, toys, storage, land and sea vehicles, decoration and design."[9] In fact, wood has become so ubiquitous and "familiar" in our society it is often denigrated as "common" even though, as Green notes, "we spend money replicating it artificially" and "its use and appearance send a strong signal of class, status, authenticity, or something less tangible or definable."[10]

As Green alludes, our relationship with wood has historically been and remains a contentious one, especially since industrialization. Historian Charles Haines

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[6] Ibid., 2.

[7] Charles M. Haines, "The Industrialization of Wood: The Transformation of a Material" (Ph.D. diss., University of Delaware, 1990), 30 and 51.

[8] H. Broese Van Groenou, H. W. L. Rischen, Dr. J. Van Den Berge, *Wood Preservation During the Last 50 Years* (Leiden, Holland: A.W. Sijthoff, 1952), v.

[9] Harvey Green, *Wood: Craft, Culture, History* (New York: Penguin Books, 2006), xx.

[10] Ibid.

characterizes the dilemma this way: “Modern industrial production depends on principles such as uniformity, reproducibility, predictability, plasticity and speed. Wood, inherently heterogeneous, variable, and non-uniform, proved difficult to convert to industrial norms.”[11] Thus, the quest to find and develop an effective wood-preserving process represented an effort to impose order and standardize what many viewed as an unstable and rebellious material.

Although some scholars have recently suggested we are experiencing a revival of interest in wood, it has “ceased to be the jack-of-all materials” it once was.[12] As a result, the threat of wood decaying, rotting, or deteriorating does not seem like a particularly “urgent” problem today because of the many available manmade alternatives. In addition, because our culture embraces a “throwaway” attitude, individuals using wood do not share the same fear about the longevity of the material as our ancestors. Whereas previous generations prided themselves on building structures that would withstand the test of time, many people utilizing wood today do not expect, need, or want their materials to last for time immemorial.[13]

Another factor contributing to the current invisibility of the wood-treatment industry is how familiar and prevalent preserved wood is in our modern world. Much of the wood available to consumers today has already been treated with a chemical formula that promises to protect its structural integrity. Consequently, many people

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[11] Haines, “The Industrialization of Wood,” 3.

[12] Green, *Wood*, xx.

[13] Susan Strasser, *Waste and Want: A Social History of Trash* (New York: Owl Books, 1999), 16; Jack Buffington, *The Recycling Myth: Disruptive Innovation to Improve the Environment* (Santa Barbara, California: ABC-CLIO, LLC, 2016), 49.

seem to regard wood preservation as a foregone conclusion or innate characteristic of the lumber they purchase and encounter.[14]

While the problem of wood preservation may seem trivial and obsolete today, it was a crucial issue for so many centuries because there were few affordable and plentiful alternatives to people living in what some scholars describe as the "Wood Age."[15] Wood preservers also received support for their cause from forest conservationists, engineers, urban planners, and Progressive-era reformers who hoped that creosoted timber might provide a solution to problems that threatened American's social, economic, and industrial progress. Our ancestors witnessed and experienced firsthand the expensive and potentially life-threatening consequences that decaying and rotting timber posed. Before wood preservers harnessed creosote, for example, shipworms relentlessly chewed through some of the world's most elite and prized naval vessels, not to mention docks and wharves, causing these structures and symbols of empire to sink, collapse, and crumble. Decaying railroad ties and bridge timbers significantly increased the risk of train derailments and dangerous accidents. While mining remains a hazardous occupation, rotted timbers standing between a work crew and cave-in made a mine even more deadly.[16]

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[14] Green, *Wood*, 37.

[15] Joachim Radkau, *Wood: A History*, trans. by Patrick Camiller (Cambridge, Massachusetts: Polity Press, 2007), 5.

[16] William Chapman, *A Treatise on the Preservation of Timber* (London: T. Davison, Whitefriars, 1817); George Bibel, "The Physics of Disaster," *Scientific American* (August 2, 2013). http://www.scientificamerican.com/article/the-physics-of-disaster/ (accessed November 20, 2016); Mark Aldrich, *Death Rode the Rails: American Railroad Accidents and Safety* (Baltimore: Johns Hopkins University Press, 2006), 1799 and 1874; John Mancoun, "The Protection of Mine Timbers From Fungus," *Mining American* 61 (March 3, 1910): 197; "Protecting Mine Timbers From Fungus," *Fuel: The Coal Operator's National Weekly* 15, no. 1 (April 26, 1910): 37.

In addition to mitigating safety hazards, creosoting gained ground amidst fears of a widespread timber famine and the push for efficiency and more careful management of natural resources.[17] Advocates also touted this preservative as a more sanitary and healthful construction material that could be used to pave city streets and reduce diseases such as yellow fever.[18] On a more global scale, proponents of creosoted timber also emphasized its use as a practical tool of ecological imperialism. Creosoted timber enabled countries such as Great Britain and the United States to build infrastructure and extend economic influence over India, Mexico, Cuba, and other areas, where they deemed both the native wood and the people who lived there as inferior.[19]

Although creosote offered many tangible benefits, it also signified a deeper motivation. By preventing timber from "premature decay," halting the "progress of rottenness," shielding wood from the "the ravages of the termite," and preventing marine structures and ships from "destruction by worms," wood preservers were not simply increasing the life of timber and saving money.[20] Instead, these industrialists viewed their achievement as exerting control over nature, reversing the very order of their environment, and forcing it to suit the needs of a modern society. This perspective is apparent in a 1920 decennial report on forest products research. While the forest

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[17] Sherry H Olson, *The Depletion Myth: A History of Railroad Use of Timber*. (Cambridge, Mass: Harvard University Press, 1971).

[18] "Creosoted Wooden Block Paving" *Engineering Digest* 4 (Dec. 1908): 675.

[19] Norfolk Creosoting Company, *The Preservation of Timber or How to Prevent Decay and Preserve Timber Against the Attacks of the Teredo Navalis or Ship-Worm* (Norfolk, Virginia: W. T. Barron & Co., 1886), 8.

[20] These comments are in the subtitle of Chapman's *A Treatise on the Preservation of Timber*.

initially controlled “primitive man,” the authors explained, “his crude imagination slowly awakened to the arts of life, he finally succeeded in reversing the order of his environment by making the forests more and more serve his material needs.”[21]

After much trial, error, debate, and contention, wood preservers came to recognize creosote as their preservative of choice for reversing the order of their environment, but its ascendancy and acceptance took time. William Chapman, a British civil engineer and author of an 1817 study on wood preservation, pronounced the research in this field to be “an inextricable labyrinth” because “almost every chemical principle or compound of any plausibility has been suggested,” and “the multiplicity and contradiction of opinions” proved challenging for anyone interested in wood preservation to navigate.[22] To understand why so many people continue to prefer creosote to this day, this chapter traces the early history of this industry and the quest for an effective wood-preserving process. Investigating creosote’s predecessors illustrates that the wood-preservation industry’s reliance on toxic treatments is much older than its use of creosote.

While creosote’s appeal has endured for nearly two centuries, wood preservers first proposed and experimented with countless other chemical concoctions in their quest to stave off decay. These many attempts to locate an effective preservative produced a literature on the history of wood preserving that is—as one expert

[21] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory: A Decennial Record, 1910-1920* (Madison, Wisconsin: Democrat Printing Company, 1921), 1.

[22] Chapman, *A Treatise on the Preservation of Timber*, viii.

characterized it in 1913—"voluminous and bewildering."[23] A compilation of past techniques published in 1846 listed 47 unique preparations employed since 1657.[24] Another proponent admitted that the industry had tested "nearly every substance under the sun," and in 1874, Maxime Paulet, a French chemist analyzing wood-treatment methods, identified 174 distinct preservatives that had already been proposed and experimented with.[25] While these lists represent more modern examples of wood preservation, the industry also proudly traced its lineage back to the efforts of "the ancients"—Egyptians, Greeks, Romans, Chinese, and even "savage tribes"—to render wood more resilient.[26] Their methods included saturating wooden structures and building materials with different types of oils such as cedar, olive, and linseed; submerging the wood in salt water and salt lakes; and charring the timber.[27] In a paper presented at the annual meeting of the American Wood Preservers' Association in 1914, Dr. Friedrich Moll described wood preservation as "one of the oldest arts of man" and he reminded the audience, "Reliable and accurate data relating to it are already found in the oldest writings that have been handed down to us. The Roman writers on

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[23] W. F. Goltra, *Some Facts About Treating Railroad Ties* (Cleveland, Ohio: J. B. Savage Company, 1913), 35.

[24] J. A. Stoeckhardt, "List of the Different Processes Adopted for the Preservation of Wood, from the year 1657 to 1846," *Journal of the Franklin Institute* 46 (1848): 55-58. Stoeckhardt's list was originally published in "the Artizan," London, April 1848.

[25] Ibid., 36 and 42; Maxime Paulet, *Traité de la conservation des bois des substances alimentaires et de diverses matìeres organiques* (Paris: J. Baudry, 1874).

[26] Barry A. Richardson, *Wood Preservation* 2nd ed. (London: E & FN Spon, 1993), 4; Goltra, *Some Facts About Treating Railroad Ties*, 35.

[27] Richardson, *Wood Preservation*, 4-7; W. F. Goltra, "History of Wood Preservation," *Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1913), 178.

architecture, such as Cato, Pliny, Vitruvius and Palladius, give us full particulars of the processes applied and substances used."[28]

Although wood-preservation advocates left behind extensive accounts of the different preservatives in circulation, the record is "bewildering" because of the many similar formulations, proprietary products, and conflicting or nonexistent data on their efficacy, especially over time.[29] There were also many different methods for applying the preservatives including brushing, submerging, soaking, and boiling. Some wood preservers made holes in the wood, and then "introduced" the preservative. Others impregnated the wood with the preservative while it was under pressure.[30]

Until the U.S. Congress established the Forest Products Laboratory in 1910 at the University of Wisconsin-Madison, there was no real testing center anywhere to investigate and verify the extravagant claims that many individuals and wood-treatment companies made.[31] This arrogance and overconfidence is visible in advertisements promoting specific treatments. For several years in the early 1890s, representatives from the Finch Wood Preservative Company wrote B. E. Fernow, chief of the U.S. Forestry Department, boasting that they had the "honour" of solving "the problem of wood preservation" and insisting they had "indisputable proofs of its efficiency."[32] The

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[28] Friedrich Moll, "The Preservation of Wood By Means of Corrosive Sublimate (Kyanizing)," *Proceedings of the Tenth Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1914), 237.

[29] Goltra, *Some Facts About Treating Railroad Ties*, 35; Stoeckhardt, *Journal of the Franklin Institute* 46 (1848): 55-58.

[30] Ibid., 181-183;

[31] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory*, 9-12; Charles A. Nelson, "A History of the U.S. Forest Products Laboratory," (Ph.D. diss., University of Wisconsin, 1963), 24.

[32] Letter from Finch Wood Preservative Company to B. E. Fernow, July 27, 1891,

"indisputable" proofs they referred to in the correspondence and advertising often represented anecdotal hearsay rather than, as Fernow complained, credible "evidence of experimentation."[33] Similarly, the Republic Creosoting Company made promises it could not keep in a 1915 advertisement for wood preserved with Reilly Creosote Oil, which it claimed "defies time." Timbers preserved with this solution, Republic Creosoting exclaimed, "are perpetually waterproof."[34]

Companies such as Finch Wood Preserving and Republic Creosoting lacked hard evidence to backup their gloating. Many preservatives sounded promising—in theory—but could not actually be proven effective unless users waited years to field test the treated wood and exposed the material to the harshest possible conditions. There was also a great degree of variation depending on the product's intended use; as many wood preservers concluded, for example, a preservative that seemed effective in one region with a dry, arid climate might not be successful in a humid, wet environment. A sense of urgency to resolve the problem of wood preservation prompted many producers and consumers of treated wood to embrace preservatives that, while advantageous for halting decay and deterring pests, remained too expensive, impractical, and dangerous to use. William Goltra reinforced these challenges in a 1913 American Wood Preservers' Association presentation on the history of preservatives

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Folder: Wood Preservation (purple), Box 46, U.S. Forest Service Newspaper Clipping File, Forest History Society, Durham, North Carolina (Hereafter cited as U.S. Forest Service Newspaper Clipping File); Letter from the Finch Wood Preservative Company to B. E. Fernow, November 11, 1890, Folder: Wood Preservation (purple), Box 46, U.S. Forest Service Newspaper Clipping File.

[33] Letter from B. E. Fernow to George Stuart Smith, no date, Folder: Wood Preservation (purple), Box 46, U.S. Forest Service Newspaper Clipping File.

[34] Advertisement for Republic Creosoting Company, *Proceedings of the Eleventh Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1915), xii or p. 559.

employed. He noted, “Of these processes many of them would, no doubt, prove effective, provided they could be carefully and economically applied, but most of them have not survived, either through cost of material, difficulties in their operation or their inefficiency.”[35] A few memorable treatments from the seventeenth through the nineteenth centuries that did not survive the test of time included coating and rubbing wood with a “mixture of fish oil, rosin and sulphur;” “boiling” wood in a “mixture of linseed oil, sulphate of iron, verdigris, arsenic, and alum;” and submerging wood “for thirty days in the soluble glass” before dunking it “in water acidulated with hydrochloric acid, washed, dried, and rubbed with oil.”[36] Even without reliable data on whether these formulations adequately treated wood, these brief descriptions offer insight into why these methods did not succeed; it was time consuming to apply these preparations and they contained many different ingredients that might have been expensive or hard to obtain.

Wood preservers also learned that some of their experiments could be deadly. In his 1913 history of wood preserving, Goltra addressed the havoc that one proposed wood treatment wrought in Woolwich, England:

> In 1811 Mr. Lukin undertook to treat wood by burying it in pulverized charcoal in a heated oven. He erected a large kiln in Woolwich Dockyard, but an explosion took place on the first trial before the process was completed, which proved fatal to eight of the workmen and wounded twelve. The explosion was like the shock of an earthquake. The experiment was not repeated.[37]

[35] Goltra, “History of Wood Preservation,” 178.

[36] Ibid., 180-184.

[37] Ibid., 184.

Writing about this tragedy in 1875, architect Thomas Allen Britton also noted that the explosion "demolished the wall of the dockyard, part of which was thrown to the distance of 250 feet; an iron door weighing 280 lb. was driven to the distance of 230 feet; and other parts of the building were borne in the air upwards of 300 feet."[38]

Although Lukin's experiment failed because of an explosion, many other wood preservatives proved hazardous because they involved handling or coming in contact with poisonous substances. In 1737, Alexander Emerton secured one of the earliest patents for wood preserving, and his method involved "preparing the timber planks and boards with boyling oyls (sic) which are prepared and mixed to a glutinous consistency for that purpose; then by a covering at severall (sic) times of compounded poisons, powdered glass, stone, dust, and sand."[39] Just as Emerton's patent emphasized "compounded poisons" as a key ingredient, many other wood preservers recognized toxicity as an essential element to an effective treatment. As Goltra concluded in his investigation of the history of wood-preservation methods, "The principal in nearly all has been the same, namely, the injection into the vessels of the wood of some material which. . . gives it a poisonous character."[40] The U.S. Forest Products Laboratory matter-of-factly justified the toxic nature of most wood preservatives in a 1938 bulletin:

[38] Thomas Allen Britton, *A Treatise on the Origin, Process, Prevention, and Cure of Dry Rot in Timber* (London: E. & F. N. Spon, 1875), 121.

[39] Alexander Emerton, British Patent #557 (1737) *Coating or Painting the Timbers of Ships and Buildings*, quoted in Haines, "Industrialization of Wood," 42; "Prevention of decay and Oxidation in Ships," *Journal of the Society of Arts* 572, No. 11 (November 6, 1863): 773.

[40] Goltra, "History of Wood Preservation," 178.

“Toxicity is required in all wood preservatives, in order to make the wood poisonous to the various organisms that damage it.”[41]

While they accepted the need to poison the organisms that might threaten wood, wood preservers seldom considered the potential impact to themselves, workers manufacturing and applying the preservative, or other individuals who might come in contact with these hazardous substances. Although wood preservers’ awareness of potential health risks increased over time, their desire to find an effective preservative made them oblivious to potential health risks. The problem of wood preservation was considered so vital that eighteenth-century scientific societies such as the Academy of Sciences of St. Petersburg, Russia, and the Society for the Encouragement of Arts of London, offered prizes to individuals who developed successful treatments.[42]

Although wood preservers promoted the many benefits their industry could bring, there was also a lot of money to be made in timber treating since wood-preserving companies and timber-treating plants often negotiated lucrative contracts with railroads, shipping companies, and municipalities. Individuals holding patents on wood-preserving treatments might also receive royalties from businesses employing their unique processes. The potential notoriety and profits attracted numerous people with good intentions to the industry, but it also drew individuals and companies driven by a more calculated intent to defraud. Goltra observed, “There are some honest people in the wood-preserving industry, some of them that do good work and a lot of them that mean

[41] Forest Products Laboratory, *Testing Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Dec. 1938), 2.

[42] Haines, “The Industrialization of Wood,” 45 and 46.

to do good work, but there are in this business, as in any other, people who are not doing honest work."[43]

Goltra, who operated his own tie-treating company in the early twentieth century and authored several studies on wood preservation, condemned the prevalence of swindlers and snake-oil salesmen in the industry: "The timber-treating industry has not escaped the wiles of the fakir and the impostor. Unscientific and unscrupulous shell gamesters, peddling worthless processes, have infested the field."[44] Other leaders in the industry heartily agreed. In a 1913 article published in *Scientific American*, Ernest A. Sterling, conceded that "There are also plenty of charlatans in the wood preserving business."[45] According to another source, "the haste to meet the demand for a wood-preserving process" made Americans especially gullible "to some of the crudest and most impracticable schemes."[46]

One such "crude and most impracticable" scheme proved costly, jeopardizing workers' health and generating negative publicity for manufacturers and consumers of treated wood. In 1865, B. S. Foreman patented a dry powder composed of salt, arsenic, and mercuric chloride (corrosive sublimate) that users applied to wood. Excited about the potential for preventing decay in railroad ties, the Memphis and Charleston Railroad purchased the rights to Foreman's preservative for $50,000, but "the poisonous nature

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[43] Goltra*, Some Facts About Treating Railroad Ties*, 6.

[44] Ibid.

[45] E. A. Sterling, "The Development and Status of the Wood Preserving Industry," *Scientific American Supplement* (July 12, 1913): 26.

[46] "Destruction of Wood," in *Miscellaneous Papers on Wood*, 3.

of the ingredients used brought about disaster."[47] Carpenters installing shingles treated with the preservative "were taken very ill, and one of them died."[48] In addition, "arsenic and corrosive sublimate effloresced from the ties along the Memphis and Charleston Railroad," poisoning and killing cattle—attracted to the ties because of the salt. Dead cattle lined the track along a ten mile route, which enraged farmers who forced the railroad to remove the ties at great expense.[49]

Whether the manufacturers of wood preservatives such as Foreman had honorable intentions or not, the proliferation of treatments highlighted the sense of desperation surrounding the availability, longevity, and reliability of wood products and structures. These concerns peaked in Europe first, with the earliest and strongest motivation to locate and perfect a wood-preserving process stemming from the desire to maintain and expand naval power. As historian Charles Haines notes in his study on the industrialization of wood, the establishment of large standing navies in Europe "stimulated interest in the preservation of wood by chemical means."[50] "Sustained naval warfare," Haines observed, characterized the eighteenth and nineteenth centuries, and the problem of wood preservation significantly hampered a nation's ability to protect itself while also threatening trade and commerce.[51] In his 1821 "inquiry into the means which have been taken to preserve the British Navy," John Knowles, a British naval

[47] American Society of Civil Engineers, "The Preservation of Timber," *Transactions of the American Society of Civil Engineers*, 14 (July 1885): 285.

[48] Ibid., 286.

[49] Ibid.

[50] Haines, "The Industrialization of Wood," 14.

[51] Ibid..

administrator and fellow of the Royal Society, justified the strong push for wood preservation: “To naval and commercial countries, there is no object of greater importance than the preservation of their ships.”[52]

Many Europeans—especially those protecting military and commercial interests such as Knowles—grew concerned about the inevitably of a timber shortage. “As the use of any resource intensifies, those who depend on it anticipate future scarcity,” environmental historian Emily Brock argues, and these periods of naval conflict “underscored the importance of maintaining supplies of timber suitable for masts and other ship-framing timbers.”[53] Visible and well-publicized accounts of wood deterioration also exacerbated European fears of timber shortages.

Although mariners and sailors had long taken measures to protect their vessels from rot, decay, and marine borers, their methods enjoyed limited success on the “more massive and less well ventilated” ships common in the eighteenth and nineteenth centuries.[54] While these towering vessels signified imperial might, the dank and dark environment within their holds created an ideal environment for wood deterioration. Preventing decay and rot troubled British officials and scientists, in particular, since, as Knowles noted, Great Britain “has long claimed and enjoyed the sovereignty of the seas, and a great proportion of the trade of the world.”[55] As a result, he insisted, “this is

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[52] John Knowles, *An Inquiry Into The Means of Which Have Been Taken to Preserve the British Navy* (London: Winchester and Farnham, 1821), i.

[53] Emily K. Brock, “New Patterns in Old Places: Forest History for the Global Present,” in *The Oxford Handbook of Environmental History*, ed. Andrew Isenberg (New York: Oxford University Press, 2014), 163.

[54] Haines, 14.

[55] Knowles, *An Inquiry Into the Means Which Have Been Taken to Preserve the British Navy*, i.

a subject on which her vital interests depend."[56] Tragic incidents such as the 1782 sinking of the *HMS Royal George* illustrated the gravity of the problem. (Figure 2-1)

On August 29, 1782, this 100-gun British battleship, docked at Spithead and "heeled over" in the water for routine maintenance and restocking, sank in a matter of minutes.[57] Over 900 people drowned, including many women and children visiting with crew members before the ship departed for Gibraltar. In the wake of the wreck, British authorities investigated and tried to determine who was at fault for the disaster. Ultimately, they concluded that "some material part of her frame gave way, which can only be accounted for by the general state of the decay of her timbers."[58] In an 1842 account of the shipwreck and the inquiry that followed, Julian Slight noted that "Admiral Milbank saw her in dock at Plymouth, and found her so bad, that there was not a sound timber in her; the officers of the yard said she was so very bad, they could scarcely find fastenings for the repairs she underwent."[59] Addressing why the sinking of the *Royal George* was so disturbing, Slight, explained:

> Volcanos, earthquakes, and shipwrecks, are usually preceded or attended with fearful indications and concomitants; while in the present instance all was calm and still, and as free from apprehension of evil, as any family might be supposed to be in the midst of its usual avocations, recreation or enjoyments. At a moment, totally unapprehended, the briny element extended its voracious jaws, and nearly 1000 of our fellow-creatures, male and female, wherein a moment ingulphed in a premature watery grave.[60]

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[56] Ibid.

[57] Richardson, *Wood Preservation*, 5; Julian Slight, *A Narrative of the Loss of the Royal George At Spithead, August 1782*, 5th ed. (Portsea: S. Horsey, 1842).

[58] Slight, *A Narrative of the Loss of the Royal George at Spithead*, 74.

[59] Ibid.

[60] Ibid., v-vi.

As the quote suggests, tragedies like this one proved especially frightening because they seemed to strike without warning. Although a state-of-the-art vessel like the *Royal George* might appear to be in tip-top shape, who knew what "evil" lurked beneath the ship's decks. Assessing the impact of the disaster, one British writer contended, "The circumstance vibrated in the breast of an entire nation, and resounded in the extremities of the whole civilized globe."[61]

While this significant loss of life was unusual, incidents such as the *Royal George* were not uncommon. William Chapman, a British civil engineer, who published an account of wood-preservation techniques in 1817, dedicated his treatise to the lords commissioners of the admiralty, commenting that their "ardent desire to apply a remedy to the rapid decay of the British navy" and the "rottenness which has so much pervaded our navy" motivated his investigation.[62] Contemporary newspaper reports and periodicals publicized alarming news about ships such as the *Queen Charlotte* whose timbers were found to be rotten in 1812 even though the ship had seen no actual service, or the *Rodney*, a new ship launched in 1809 that returned in 1812 "so utterly rotted as to be paid off" since it was no longer seaworthy.[63] Examining this serious problem, British newspaper editor and author Robert Mudie acknowledged "it is by no means a rare occurrence for vessels to be so much damaged while on the stocks, as to

[61] Ibid.

[62] Chapman, *A Treatise on the Preservation of Timber*, iii and vi.

[63] R. Mudie, *Autumn; or the Causes, Appearances, and Effects of the Seasonal Decay and Decomposition* (London: Thomas Ward & Co., 1837) 278-279.

require extensive repairs before they are fit for launching; and that others have barely put to sea before they had to be broken up and sold for firewood."[64]

While tragedies such as the *Royal George* and negative publicity about the plight of the British navy stoked an interest in wood preservation, Europeans began to pursue treatment methods more aggressively as they observed the mayhem that shipworms could cause. Although they resemble worms, these bivalve mollusks attach to the bottoms of wooden boats, piles, docks, planks, and piers before steadily burrowing and tunneling through the wood, seriously compromising the material's structural integrity in the process. Scientists estimate the shipworm genus to be "about 20 million years old," and, as one scholar argued, when "humankind appeared at the shoreline with dugouts, boats and piers, the adaptations made the shipworm a mightier enemy to seafaring than all pirates and warships."[65] Many researchers, for example, now maintain that the shipworms' depredations against the Spanish Armada in 1588 when the fleet docked in Lisbon severely incapacitated the Spanish ships long before Sir Francis Drake and English naval forces officially defeated the Armada.[66]

Although there are many distinct species of shipworms, people seldom distinguished among these species when discussing their attacks. Instead, they collectively referred to these marine borers as "teredo," named after the *Teredo* genus. As environmental historian Derek Nelson has demonstrated, the word teredo became

[64] Ibid., 279.

[65] Kai Hoppe, "Teredo navalis: the cryptogenic shipworm," in *Invasive Aquatic Species of Europe: Distribution, Impacts and Management* ed. Erkki Leppäkoski, Stephan Gollasch, Sergej Olenin (Dordrecht: Kluwer Academic Publishers, 2002), 117.

[66] Ibid.; Derek Briggs and Peter R. Crowther, *Palaebiology II* (Malden, Massachusetts: Blackwell Publishing, 2001), 274.

associated with the destruction these organisms caused and the fear that they incited.[67] When Gottfried Sell, also known as Sellius, produced one of the earliest studies of these creatures in 1733, he described them as a “wicked beast, the worst plague that angry Nature could inflict on man.”[68] The author of an 1852 article viewed the teredo similarly, suggesting that it “seems to have registered a vow to extinguish the vitality of as many human beings as lies within its power.”[69] These derogatory comments emphasized how most individuals viewed shipworms as deliberately subversive, and Nelson observes that the expression “ravages of teredo” became so common that “the word teredo rarely appeared separate from this phrase.”[70]

As the above examples reveal, people came to view the teredo as relentless, sneaky, and calculating because it often remained undetected until disaster struck and the wood crumbled and disintegrated. While the exterior of the wood might appear perfectly stable and intact to casual observers, it was actually severely weakened.[71] (Figure 2-2) In a paper presented to the American Society of Civil Engineers in 1898, Charles Snow noted, “More than 50% of the weight of the wood may be removed by the teredo, without being greatly evidenced upon the surface. . .Wood may appear to be

[67] Derek Lee Nelson, “The Ravages of Teredo: The Rise and Fall of Shipworm in US History, 1860-1940,” *Environmental History* 21 (2016): 105.

[68] John Gwyn Jeffreys, *British Conchology* (London: John Van Voorst, 1865), 130.

[69] “Shell Fish: Their Ways and Works,” *The Living Age* 34 (July 1852): 24.

[70] Nelson, “The Ravages of Teredo,” 102.

[71] Phillip Lopate, “Excursus: Shipworms,” in *Waterfront: A Walk Around Manhattan* (New York: Knopf Doubleday Publishing Group, 2008), 131; Nelson, “The Ravages of Teredo,” 100.

quite sound and yet be so weakened that much of it can be crushed by the hand. Failure, therefore, frequently comes suddenly."[72]

Although it might seem farfetched to grant so much power to an "insignificant shell-fish," Europeans and Americans learned hard lessons about the damage the teredo could produce when left unchecked.[73] In Holland in 1731, for example, shipworms annihilated the wooden dike networks that constrain the sea, threatening the Dutch with significant flood damage and prompting them to rebuild the country's sea defenses with stone.[74] The "cosmopolitan" teredo, as Nelson describes it, made an appearance in San Francisco in 1913; by 1921 it had become so prevalent and destructive of the city's piers, wharves, and docks that its impact exceeded "a modern-day cost of three billion dollars."[75]

In addition to hampering commerce and resulting in considerable expense, the teredo's consumption of wood could also result in more life-threatening consequences. In February 1902, the large coal bins along the waterfront in Tampico, Mexico—held up by wooden beams—collapsed without warning, crushing over 30 people to death—including many women and children. The culprit, as identified by eyewitnesses,

[72] Charles H. Snow, "Marine Wood Borers," in *Proceedings of the American Society of Civil Engineers* 24 (New York: American Society of Civil Engineers, 1898), 409.

[73] "Shell Fish: Their Ways and Works," 24.

[74] Nelson, "The Ravages of Teredo," 106; Jan Albert Bakker, *Megalithic Research in the Netherlands, 1547-1911: From 'Giant's Beds' and 'Pillars of Hercules' to Accurate Investigations* (Leiden: Sidestone Press, 2010), 60-62.

[75] Nelson, "The Ravages of Teredo," 107; Allen Burdock, *Out of Eden: An Odyssey of Ecological Invasion* (New York: Farrar, Straus, and Giroux, 2006), 197.

authorities, and journalists, was the vile teredo, dubbed "insects that cause ruin" in a *Biloxi Daily Herald* article about the incident.[76]

The teredo attacks, although separated by time and space, were not isolated incidents. As Nelson demonstrates, these marine borers "terrified coastal communities with unexpected damages, ranging in the millions of dollars annually."[77] Though they despaired over the "ravages of the teredo," humans fueled the pandemic by inadvertently transporting the organisms all over the world, especially during the Age of Exploration.[78] Failing to recognize the role they played in the spread of shipworms, many people demanded that the teredo's predations be stopped. Nelson argues that the teredo was an "unconscious architect" of "coastal landscapes and urban waterfronts" because these marine borers limited development and influenced "what people could build and where."[79] At the time, however, teredo's victims—those negatively impacted by the shipworms—viewed them as conscious architects of destruction, anthropomorphizing these mollusks and regarding their actions as intentional and calculated.

Advocates of wood preservation capitalized on this attitude, and they came to view and describe decay, rot, and the organisms that caused timber to weaken, molder, and lose its strength as insidious, treacherous, and surreptitious. In the *Southern Pacific Bulletin*, a Southern Pacific Railroad publication, a writer pronounced the "sly teredo" as

[76] "Insects That Cause Ruin," *Biloxi Daily Herald*, February 18, 1902.

[77] Nelson, "The Ravages of Teredo,"

[78] Hoppe, "Teredo navalis: the cryptogenic shipworm," 116.

[79] Nelson, "The Ravages of Teredo," 101-102.

more destructive to “docks and wharves than the T. N. T.,” and he recommended preservative treatment to deter the pests.[80] Another exposé on wood deterioration described dry rot as “one of the most powerful and insidious of those enemies to earthly perpetuity.”[81] In its promotional materials on wood preservation, one company even suggested that destructive agents such as rot, decay, insects, and marine borers conspired and colluded to assault wood: “For these enemies of wood are allies and play into each other’s hands.”[82]

Confronting these “ruinous” foes, European wood preservers in the early nineteenth century declared war, assaulting their “enemies” with a host of toxic treatments.[83] One of the earliest methods they endorsed was kyanization or kyanizing, which called for steeping or immersing wood in mercuric chloride, also known as bichloride of mercury and more commonly referred to as corrosive sublimate. This chemical compound took the form, as Irish physician John Moore Neligan explained in his 1864 study *Medicines: Their Uses and Administration*, of a “white, semi-transparent, crystalline mass, or as a white powder,” which though odorless “has an intensely acrid and disagreeable taste.”[84] As its nickname implied, corrosive sublimate indeed “acts as a caustic poison,” and many physicians recommended referring to it as corrosive sublimate rather than mercuric chloride to avoid confusing it with its less powerful

[80] Chas F. Heath, “Bridging the Bay with Our Ferries,” *Southern Pacific Bulletin* 10, no. 3 (March 1921): 5.

[81] “Dry Rot,” *The Family Magazine* (Boston: Redfield and Lindsay, 1837): 226.

[82] Thomas Rodd, Jr., *The Preservation of Wood* (Pittsburgh: The Rodd Company, 1919), 27.

[83] P. M. Moir, “Preserving Timber,” *Van Nostrand’s Eclectic Engineering Magazine* 1 (1869): 151.

[84] John Moore Neligan, *Medicines: Their Uses and Administration* 6th ed. (Dublin: Fannin & Co., 1864), 547.

cousin—mercurous chloride or calomel.[85] Pierre-Jean-Claude Mauduyt da la Varenne, an eighteenth-century French physician and naturalist well acquainted with the use of corrosive sublimate in taxidermy to protect specimens from insects and mold, characterized it as "a dreadful poison" that should not be available to the masses because "To place it into ignorant or reckless hands is to entrust them with a weapon with which by merely touching it they can injure themselves."[86] Nelligan reinforced this assessment, acknowledging, "Corrosive sublimate is a powerful irritant poison, a few grains producing death preceded by rapid and excessive inflammation of the digestive tube, with great derangement of the nervous system, and coma."[87]

Despite its toxicity, many physicians celebrated mercuric chloride for its powerful antiseptic properties. This compound also enjoyed popularity as a medicine ingested or applied externally to treat skin ailments, rheumatism, arthritis, and venereal diseases including syphilis. As the eminent eighteenth-century British toxicologist Alfred Swaine Taylor documented, however, misuse and overdose of corrosive sublimate also led to violent and painful deaths.[88]

Corrosive sublimate's toxic nature led several physicians and intellectuals to theorize that it would stymie the organisms that caused wood to deteriorate. In 1705,

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[85] Jonathan Pereira, "Lectures on Materia Medica, Or Pharmacology, and General Therapeutics: Lecture 49," *London Medical Gazette* (June 25, 1836), 473; Alfred Swaine Taylor, *Of Poisons In Relation to Medical Jurisprudence and Medicine* (Philadelphia: Blanchard and Lea, 1859), 398. Finlay Dun, *Veterinary Medicines: Their Actions and Uses* 9th ed. (New York: William R. Jenkins, 1899), 515.

[86] Pierre-Jean-Claude Mauduyt, "Lettre a l'auteur de ce Recueil, sur la maniere de conserver les animaux desseche," *Obs. phys. hist. nat. et arts* 2 (1773): 391, quoted in Paul Lawrence Farber, "The Development of Taxidermy and the History of Ornithology," *Isis* 68 (1977): 556.

[87] Nelligan, *Medicines*, 548.

[88] See Chapter 10 in Alfred Swaine Taylor's *Of Poisons In Relation to Medical Jurisprudence and Medicine* (Philadelphia: Blanchard and Lea, 1859).

French physician and scientist William Homberg reported that this substance deterred insects when applied to timber, and French scholar De Boissieu recommended its use as a wood preservative in 1767. In spite of these sporadic reports, mercuric chloride did not gain favor as a wood preservative until 1832, when John Howard Kyan patented its use. Kyan, born in Dublin, Ireland, in 1774, learned about the problem of wood preservation at an early age since his father owned copper mines in Wicklow and battled decaying mine timbers and supports. After experimenting with different chemicals, Kyan grew convinced that mercuric chloride would stop decay in its tracks.[89]

Aware of the British navy's struggles with wood deterioration, Kyan launched an experiment in 1828 designed to attract the Admiralty's interest and support. With their approval, Kyan subjected blocks of wood—some treated with corrosive sublimate and others left untreated—to the "fungus pit" at the Woolwich dockyard, "a subterranean chamber lined with wood in the worst possible stages of corruption" intended to create "a perfect hot-bed" for rot and decay.[90] Workers at Woolwich attested "that a month in *the hole* is worse for a piece of timber, than ten years in almost any possible situation out of it."[91] After several years, Kyan staged a reveal in front of some of the leading naval commanders and chemists of the day. When Woolwich workers removed Kyan's treated blocks from this "cesspool" they found the kyanized blocks intact and

[89] Sidney Lee, "Kyan, John Howard." *Dictionary of National Biography: Volume 31, Kennett-Lambart* (London: Smith, Elder, & Co., 1892) 347.

[90] Benjamin Homans, ed. "Dry Rot," *Military and Naval Magazine of the United States* 2, no. 3 (November 1833): 133.

[91] Ibid.

pronounced the wood sound. In contrast, the untreated blocks had decomposed and crumbled.[92]

After patenting his method in 1832 and gaining the support of esteemed chemists such as Michael Faraday, who promoted this new process of kyanizing timber in an 1833 lecture at the Royal Institution, Kyan received "large contracts" to treat wood for ships, buildings, railroad ties, telegraph poles, and even poles used to raise hops for the beer industry.[93] Kyan and his unique wood-treatment process enjoyed considerable acclaim, with his achievements immortalized in a popular ditty of the period:

> Have you heard,—have you heard,—
> Anti-dry-rot's the word?
> Wood will never wear out, thanks to Kyan, to Kyan!
> He dips in a tank,
> Any rafter or plank,—
> And makes it immortal as Dian, as Dian![94]

Many people believed, as the song lyrics rejoiced, "gone is the day of that glutton Decay," and Kyan's supporters proudly insisted his "discovery" was as "imperishable" as the wood he treated.[95] Other individuals pursuing wood preservation, however, cast doubts on the efficacy and safety of his process. Thomas Jefferson Cram, a colonel in the U. S. Army Corps of Engineers recalled an 1838 "experiment" with kyanized railroad ties installed along a route outside of Baltimore, Maryland. After laying only one mile of

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[92] Friedrich Moll, "The Preservation of Wood By Means of Corrosive Sublimate (Kyanizing)," in *Proceedings of the Tenth Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1914), 240.

[93] Moll, "The Preservation of Wood By Means of Corrosive Sublimate," 240; George Birkbeck, *A Lecture on the Preservation of Timber by Kyan's Patent for Preventing Dry Rot* (London: John Weale, 1834), 23-24; Blanc, *How Everyday Products Make People Sick*, 224.

[94] "Kyan's Patent—The Nine Muses—And the Dry Rot," *Bentley's Miscellany: Volume 1* (London: Richard Bentley, 1837), 95.

[95] Ibid.; "Dry Rot," *The Family Magazine*, 229.

track, Cram noted, “The process, however, was so unhealthy, salivating all the men, it had to be abandoned.”[96] Cram’s observation that the workers placing the ties began “salivating,” proved disturbing since excessive salivation is a key symptom of mercury poisoning.[97]

Additional evidence indicated that the workers Cram described were not alone in finding the process of kyanizing timber “unhealthy.”[98] In 1841, the *British and Foreign Medical Review* alerted the medical and scientific community to the risks of kyanized timber: “From the ready absorption of this poisonous liquid through the skin, the mere manipulation of the timber exposes the workmen to much danger.”[99] The authors cautioned that workers “should be warned not to dip their hands in the liquid more than can be avoided,” and advised wearing protective clothing. In addition, the *British and Foreign Medical Review* recommended that “the earth on which any of the poisonous liquid may fall, should after a time be dug up and buried in a deep hole.”[100] Potential public health risks also troubled some individuals. If kyanized wood, for example, was used for fuel, “the mercury contained in old wood might be thus volatilized and spread in vapour through the apartments of a house, leading to the slow destruction of life by

[96] Thomas Jefferson Cram, *Report Upon the Decay and Preservation of Timber* (Washington, D.C. Engineer Department, 1871), 5.

[97] Peter J. Baxter and Hideki Igisu, “Chapter 26: Mercury,” in *Hunter’s Diseases of Occupations* 10th ed., edited by Peter J. Baxter, Tar-Ching Aw, Anne Cockcroft, Paul Durrington, and J. Malcolm Harrington (Boca Raton: CRC Press, 2010), 217.

[98] Cram, *Report Upon the Decay and Preservation of Timber, 5.*

[99] John D. Forbes, ed., “On Kyanised Timber,” *The British and Foreign Medical Review* 11 (April 1841): 532.

[100] Ibid.

giving rise to protracted illness."[101] Also, some physicians worried about widespread contamination or poisoning if kyanized timber was "ignorantly used in the construction of tubs, barrels, cisterns, spouts, for the holding of water, milk, and other fluids."[102]

While the *British and Foreign Medical Review* urged "that some precautions should be taken by a government in allowing the application of this process" and they questioned "whether some harmless substitute" existed, these warnings do not appear to have resonated within the industry.[103] In 1842, Sir Edwin Chadwick, an English social reformer, released a landmark report exposing the need for better housing and sanitation among Great Britain's workers, but his study also referenced the potential hazards of kyanized timber. Although, as Paul Blanc argues, "Industrial health and safety is almost entirely missing from the pages of his report," Chadwick observed, "Some workmen employed in 'Kyanzing' wood become frequently ill from the fumes created in the process."[104]

Rather than acknowledging the toxicity of corrosive sublimate or the dangerous working conditions under which these wood preservers worked, Chadwick and the employer blamed the workers for negligence. "Admonitions to care were found to be of no avail, and the employer at length gave notice that he would discharge entirely from employment the first that was attacked with the peculiar illness produced by the fumes

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[101] Ibid.

[102] James Copland, *A Dictionary of Practical Medicine*: *Volume 1* (New York: Harper & Brothers Publishers, 1845), 158.

[103] Forbes, "On Kyanised Timber," 532.

[104] Blanc, *How Everyday Products Make People Sick*, 187; Edwin Chadwick, *Report To Her Majesty's Principal Secretary of State for the Home Department From the Poor Law Commissioners on an Inquiry into the Sanitary Condition of the Laboring Population of Great Britain* (London: W. Clowes and Sons, 1842), 258.

of the metal," Chadwick reported.[105] Apparently, these threats and intimidation proved effective since he concluded, "This threat was acted upon, and no other cases of illness afterwards occurred."[106] Workers at the kyanizing plant learned that a condition in keeping their jobs was to remain silent about occupational hazards, which did not disappear. Weighing the benefits and costs of different wood preservatives in an 1885 study, Sir Samuel Bagster Boulton, an English authority on wood preservation, maintained that "corrosive sublimate "has the drawback of producing injurious effects upon the workmen employed in handling it."[107]

It was not potential health risks, however, that doomed kyanization, but rather the poor performance of the treated timber in wet and humid conditions—the environments in which wood deteriorated rapidly. Launching an extensive investigation into wood preservation, the American Society of Civil Engineers published the results of its study in 1885. Although the committee praised kyanized timber's ability to extend the life of bridges, trestles, and fences "for twenty to thirty years," engineers concluded that in instances where "timber is exposed to moisture, Kyanizing is of doubtful utility."[108] The "washing out of the corrosive sublimate," made this method ineffective for "cross-ties, pavements and work exposed to constant moisture."[109] Boulton reinforced these

[105] Chadwick, *Report To Her Majesty's Principal Secretary of State for the Home Department From the Poor Law Commissioners on an Inquiry into the Sanitary Condition of the Laboring Population of Great Britain*, 258-259.

[106] Ibid., 259.

[107] Samuel Bagster Boulton, *The Preservation of Timber By the Use of Antiseptics* (New York: D. Van Nostrand, 1885), 19.

[108] American Society of Civil Engineers, "The Preservation of Timber," 256 and 255.

[109] Ibid., 256.

findings, arguing that "Kyanizing has met with a considerable amount of success in comparatively dry situations; but in water, and particularly in sea-water, it appears to have invariably failed."[110] This meant that wood preserved with corrosive sublimate was no match against the "voracity of the teredo," which rendered kyanization of limited utility in many areas of the world.[111]

Although, as Blanc notes, Kyan enjoyed a "brief dynasty" since "for six years Kyanization was the only patented process on the market," emerging competition from other preservative methods soon sealed its fate.[112] In addition to highlighting the failure of mercuric chloride in wet and humid environments and its inability to fight the teredo, Kyan's competitors questioned how reliable and consistent kyanized wood could be if the timber was only steeped in the solution rather than forcibly injected under pressure, which soon became the standard method of administering wood preservatives. Recognizing the limitations of his process, Kyan attempted to switch to a pressure-impregnation method, but the corrosive sublimate ate through the metal cylinders that held the preservative, or as one of Kyan's proponents reluctantly admitted, "the plant in question was, however, soon destroyed by the corrosive action of the sublimate."[113]

To cut costs, some contractors also diluted the mercuric chloride solution they immersed the timber in, which decreased its ability to preserve wood. Reflecting on this trend and Kyanizing's downfall, the American Society of Civil Engineers explained, "To

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[110] Boulton, *The Preservation of Timber By the Use of Antiseptics*, 19.

[111] "Shell-Fish: Their Ways and Works," 24; T. B. Hartley, "On the Effects of the Worm on Kyanized Timber exposed to the action of Sea Water, and on the use of Greenheart Timber from Demerara, in the same situations," *The Civil Engineer and Architect's Journal* 4 (January 1841): 22.

[112] Blanc, *How Everyday Products Make People Sick*, 224.

[113] Moll, "The Preservation of Wood By Means of Corrosive Sublimate," 240 and 247.

speak in plain terms, it led them to cheating, and Kyanizing fell into contempt in England. Moreover, the process is very tedious, because of the length of time required to impregnate the timber."[114] Although Kyanizing still retained some devout followers, a new method of treating timber with a solution of zinc chloride, which William Burnett patented in 1838, soon received greater interest and initial acclaim.[115]

In his position as physician general of the Royal Navy, Burnett was well acquainted with the problems of wood deterioration that plagued British vessels, but he was also aware of sanitation issues that jeopardized the health of the crews onboard.[116] To treat wood, but also serve as an antiseptic, disinfectant, and preserver of medical and lab specimens, Burnett recommended the compound zinc chloride, also known as "zinc butter," a "white deliquescent, wax-like substance" and "a powerful caustic."[117]

Burnett's original method of treating timber, often referred to as "Burnettizing," paralleled Kyan's process—it involved "steeping" the timber in a solution of zinc chloride mixed with water.[118] In an 1839 article in the *Army and Navy Chronicle*, Burnett and the boosters of his patented approach assessed the strengths of this wood-preservative technique:

> This process is moreover perfectly innoxious, and cannot by possibility endanger health, either in its preparation or in its application. All the timbers and ceiling of a ship may, therefore, be impregnated with the solution, without the slightest prejudicial effect to the crowded inmates of

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[114] American Society of Civil Engineers, "The Preservation of Timber," 252.

[115] Richardson, *Wood Preservation*, 7.

[116] Sir William Burnett, *Reports and Testimonials Respecting the Solution of Chloride of Zinc* (London: S. Mills, Crane Court, 1850).

[117] Walter Renton Ingalls, *Production and Properties of Zinc* (New York: The Engineering and Mining Journal, 1902), 163.

[118] American Society of Civil Engineers, "The Preservation of Timber," 257.

> its close confines. It purifies bilge-water. And further, this valuable preparation is comparatively inexpensive in its use.[119]

Advocates of Burnettizing emphasized its safety, especially when compared with corrosive sublimate and other virulent poisons used to preserve wood, but zinc chloride still posed a health risk to workers and individuals who encountered the compound. As Albert Henry Buck explained in a 1904 study, "When brought into contact with raw surfaces or mucous membranes it acts as a corrosive."[120] Exposure to zinc chloride or its fumes commonly result in "skin burns and ulcerations," eye irritation, nausea, headaches, and respiratory and pulmonary problems.[121] Claiming that zinc chloride was "perfectly innoxious," as Burnett and his supporters did, was an exaggeration. Nevertheless, when compared with its competition, zinc chloride—as Blanc argues—posed "considerably less toxic risk for applicators, consumers, and the environment."[122]

The main appeal of zinc chloride, however, had little to do with environmental or occupational health and safety concerns, but rather its affordability and availability—especially in the United States. Zinc chloride ranked, according to Goltra, as "the cheapest of all the preservatives" even though, as Howard F. Weiss, a director of the Forest Products Laboratory and an authority on wood preservation, demonstrated, it was "very toxic against wood-destroying fungi, offering about the same resistance as

[119] "Burnett's Dry Rot Preventive," *Army and Navy Chronicle* 9, no. 6 (August 8, 1839): 82.

[120] Albert Henry Buck ed., "Zinc, Poisoning By," *A Reference Handbook of the Medical Sciences: Volume 8* (New York: William Wood and Company, 1904), 340.

[121] Ibid., 340; T. S. S. Dikshith, *Handbook of Chemicals and Safety* (Boca Raton: CRC Press, 2011), 282-283.

[122] "Burnett's Dry Rot Preventive," 82; Blanc, *How Everyday Products Make People Sick*, 226.

coal-tar creosote."[123] Unlike coal-tar creosote, zinc chloride could also be more easily manufactured in a laboratory rather than extracted as a byproduct of a complex coal-distillation process. Long after European wood preservers dismissed zinc chloride as a viable wood preservative, many American consumers still depended on it because they could not cheaply or easily import creosote from countries such as Germany or England, nations with more advanced coal-gas industries.[124]

In spite of being easy to access and cost effective, several major weaknesses kept the industry from embracing zinc chloride as the best solution to "the great desideratum" of wood preservation.[125] Similar to Kyan, Burnett originally called for submerging the timber in a solution of the salt mixed with water. As Kyan learned with mercuric chloride, however, this approach often failed to yield an even or thorough treatment of the wood. The American Society of Civil Engineers' 1885 report on wood-preservation described the application of zinc chloride in this manner as "exceedingly tedious and somewhat ineffective."[126]

Although Burnett and his supporters later devised a way to adapt the process for impregnating wood with coal-tar creosote under pressure to suit zinc chloride, other problems also troubled users of this process.[127] Many wood preservers tended to over-apply preservative treatments thinking that this would better protect the wood, but

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[123] Goltra, "History of Wood Preservation, 186. Howard F. Weiss, *The Preservation of Structural Timber* (New York: McGraw-Hill Book Company, Inc., 1915), 73.

[124] Blanc, *How Everyday Products Make People Sick*, 226; Richardson, *Wood Preservation*, 7.

[125] "Destruction of Wood" in *Miscellaneous Papers on Wood*, 2.

[126] American Society of Civil Engineers, "The Preservation of Timber," 257.

[127] Ibid.

applying too much zinc chloride actually weakened timber. Addressing a failed experiment with Burnettized railroad ties along the Pennsylvania, Wilmington, and Baltimore Railroad, the line's president, Isaac Hinckley, described how ties oversaturated with zinc chloride "were as brittle as a carrot," and easily snapped before workers even installed them along the track.[128] The Philadelphia and Reading Railroad experienced a similar failure when the solution of zinc chloride was too strong; "the elasticity and strength of the wood was destroyed," its chief engineer concluded.[129]

Controlling the concentration of the solution so that it would adequately preserve the timber but not compromise its strength proved to be a delicate balancing act, but the most significant limitation of zinc chloride was its extreme solubility in water.[130] When exposed to wet or humid conditions, this preservative quickly leached out of wood, which significantly restricted the locations in which it could be used and also resulted in its failure against the teredo and other marine borers. Assessing the utility of different wood preservatives, Weiss maintained that it was "inadvisable to use zinc-treated timbers in wet localities" because zinc chloride's "chief fault is its solubility in water."[131]

Although some railroads in the American West found Burnettizing successful in their arid environment, this process had, as Blanc notes, "largely disappeared by the 1920s" and was abandoned by the European industry much earlier.[132] The same year

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[128] Ibid., 262.

[129] Ibid., 262.

[130] Ibid., 263; Goltra, "History of Wood Preservation," 186.

[131] Weiss, *The Preservation of Structural Timber*, 73.

[132] Blanc, *How Everyday Products Make People Sick*, 226; Howard F. Weiss, "A Comparison of Zinc Chloride With Coal-Tar Creosote For Preserving Cross-Ties," in *Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association*, 71; Mark Aldrich, "From Forest Conservation to

that Burnett patented his process, for example, naval administrator and geographer John Barrow expressed discontent with the existing preservative methods: “It is to be hoped that we shall have no more tampering with dry-rot doctors and their nostrums for the preservation of Her Majesty’s ships. The steeping of large logs of timber in solutions of any kind is perfectly useless.”[133] As Barrow alluded, the wood-preservation industry needed a more thorough preservative process, but it also hoped for a stronger and more reliable chemical that would meet the demands of consumers in wet and humid environments prone to the most severe wood deterioration.

Creosote answered the call. The word “creosote,” which German scientist and industrialist Carl Ludwig von Reichenbach coined in the early 1830s, originally referred to tar distilled from beechwood. Isolating the different chemicals produced during the distillation process, Reichenbach applied the Greek words “kreas” and “soter” meaning flesh preserver, to one particular distillate that appeared to have great antiseptic properties, and which he experimented with as a meat preservative.[134] Influenced by Reichenbach's discovery, nineteenth-century physicians and pharmacists extolled the virtues of beechwood creosote as a sedative and painkiller, but also to treat respiratory conditions such as tuberculosis and coughs, skin ailments, dental problems, infected

Market Preservation: Invention and Diffusion of Wood-Preserving Technology, 1880-1939,” *Technology and Culture* 47, no. 2 (April 2006): 317.

[133] Sir John Barrow, *The Life of George Lord Anson* (London: John Murray, 1839), 450.

[134] George Lunge, *Coal-Tar and Ammonia* (London: Gurney and Jackson, 1887), 342; Weiss, *The Preservation of Structural Timber*, 75-76; C. Schorlemmer, “The History of Creosote, Cedriret, and Pittacal,” *The Journal of the Society of Chemical Industry* (March 30, 1885): 152; “Coal Tar and its Products as Preservatives for Wood,” *Scientific American* 20, no. 24 (June 12, 1869): 374.

wounds, digestive issues, internal parasites, and even cancer.[135] Sir John Rose Cormack, a Scottish physician who published one of the first studies of creosote in 1836, noted that many regarded it as a "universal remedy." While he acknowledged that confidence in its curative powers had been inflated, Cormack pronounced it to be "nevertheless a most valuable addition to the modern Materia Medica."[136]

Wood-tar creosote's increasing popularity as a panacea prompted a search for less costly alternatives, and many producers turned to what they assumed was a similar substance—a coal byproduct of the illuminating gas manufacturing process.[137] In the nineteenth century, the manufacture of coal gas for gaslighting had become big business, and, as an 1869 *Scientific American* article reported, this technology was "used almost universally for lighting the buildings and streets of large cities throughout the civilized world."[138] To produce the flammable gases—a mixture of hydrogen, carbon monoxide, methane, and volatile hydrocarbons such as benzene, and toluene—that illuminated streets and homes, manufacturers heated coal in large retorts connected to a furnace.[139]

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[135] John Rose Cormack, *A Treatise on the Chemical, Medicinal, and Physiological Properties of Creosote* (Edinburgh: John Carfrae & Son, 1836), 96-151; A. Atkinson, "A Partial Clinical Study of Creosote," *Maryland Medical Journal* (August 10, 1889): 282-285.

[136] Cormack, *A Treatise on the Chemical, Medicinal, and Physiological Properties of Creosote*, 97.

[137] Walter Sneader, *Drug Discovery* (West Sussex, England: John Wiley & Sons Ltd., 2005), 108-109; Merck & Co., "Substitution," *Merck's Archives of Materia Medica and Drug Therapy* 3, no. 1 (September 1901): 333.

[138] "Illuminating Gas-What it is, and How it is Made," *Scientific American* 20, no. 12 (March 20, 1869): 179.

[139] Frederick Accum, *Description of the Process of Manufacturing Coal Gas, for the lighting of Streets, Houses, and Public Buildings*. 2nd ed. (London: Thomas Boys, 1820), 36; Michael Fremantle, *The Chemists' War: 1914-1918* (Cambridge: The Royal Society of Chemistry, 2015), 65.

Attempting to meet the increasing demand for illuminating gas, companies manufacturing this product multiplied throughout Europe in the first half of the nineteenth century.[140] Gaslighting's success, according to Frederick Accum, an early nineteenth-century German chemist, also “awakened” the public's attention to “the new value of coal,” and he speculated that they “will not rest till the art of lighting with gas is pushed to the utmost of its extent.”[141] Coal came to be seen, as environmental policy researcher Barbara Freese explains, “no mere fuel, and no mere article of commerce,” but rather representative of “humanity's triumph over nature—the foundation of civilization itself.”[142] In addition to lighting the streets and homes of nineteenth-century Europe, coal also provided heat, played an essential role in the manufacture of steel, and powered the engines of industry.[143] Once they awakened to the value of coal, manufacturers, scientists, and entrepreneurs reexamined the nuisance and refuse byproducts of coal gasification.

In addition to the coal gas that powered gaslighting, the distillation process also yielded a waste product known as coal tar.[144] Butler detailed this process:

> When coal is submitted to dry distillation in horizontal or vertical retorts, the products of carbonisation are gas, ammoniacal liquor, and tar. The tar comes off in the form of a fog suspended in the gas, from which it is

[140] Fremantle, *The Chemists' War*, 65.

[141] Accum, *Description of the Process of Manufacturing Coal Gas, for the Lighting of Streets, Houses, and Public Buildings*, 4.

[142] Barbara Freese, *Coal: A Human History* (Cambridge, Massachusetts: Perseus Publishing, 2003), 10.

[143] Ibid., 13.

[144] T. Howard Butler, “Fractional Distillation in the Coal Tar Industry,” in *Distillation Principles and Processes*, ed. Sydney Young (London: Macmillan and Co., Limited, 1922), 360-361.

> condensed or scrubbed out by suitable means, when the resulting products contain varying proportions of ammoniacal liquor and tar."[145]

Further distillation of this tar resulted in a number of secondary chemical compounds: oils lighter than water (known as eupion or napthas), oils heavier than water (commonly referred to in the trade as "dead oil"), and pitch (the thick, black residue leftover at the end of the process).[146] George Lunge, a professor of technical chemistry in Zurich and author of a detailed study of coal-tar and its byproducts in 1882, explained that these substances "were for many years regarded as refuse products which were not merely without value, but caused considerable inconvenience and expense for their removal."[147] Raphael Meldola, a British chemist echoed a similar sentiment in an 1890 lecture on coal: "In the early days of gas manufacture this black, viscid, unsavoury substance was in every sense a waste product. No use had been found for it, and it was burnt, or otherwise disposed of."[148]

As Lunge and Meldola emphasized, coal-gas producers viewed coal tar as a nuisance and a burden. Since each ton of coal harnessed to produce illuminating gas resulted in about "30 litres of tar," they needed to find a use for this unpopular substance.[149] The more coal countries produced and consumed, the more coal tar became an inconvenience. In 1876, for example, England—a leader in industrialization

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[145] Ibid., 361.

[146] Boulton, *The Preservation of Timber by the Use of Antiseptics*, 29-30.

[147] George Lunge, *A Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor, and the Separation of Them From Valuable Products* (London: John Van Voorst, 1882), 4.

[148] Raphael Meldola, *Coal and What We Get From It: The Romance of Science* (London: Society for the Promotion of Christian Knowledge, 1890), 68.

[149] Fremantle, *The Chemists' War*, 67.

and coal gasification—used an estimated 10 million tons of coal to produce illuminating gas, which according to Lunge, required them to dispose of or find alternative uses for 450,000 tons of coal tar.[150] Seeking a profitable application for its excessive waste, coal manufacturers launched "a chemical industry of enormous dimensions," advancing fields such as wood preservation and developing new products such as synthetic dyes and explosives.[151] In a late nineteenth-century conference presentation, engineer C.S. McKinney, conveyed the popular admiration for the many, varied uses of what had only recently been viewed as a worthless waste product:

> The wizard of the laboratory touches with his magic wand the black malodorous product of the gas retorts, and from it evolves colors of exquisite brilliancy; perfumes as delicate and sweet as those from the most fragrant flowers; flavors to delight the daintiest tastes; explosives more powerful than the nitro-glycerine, and medicines to cure the ills, and soothe the pains of suffering humanity.[152]

This newfound fascination with coal tar and a longstanding confusion over terminology led to its use as a replacement for wood-tar products. After his work with wood tar, Reichenbach theorized that the same "flesh preserver" or heavier oils he described as "creosote" could also be derived from other types of tar. Although some of his colleagues such as German chemist Friedlieb Runge contended that the heavier oils in coal tar were unique from the creosote Reichenbach isolated from beechwood, many chemists, physicians, manufacturers, and consumers viewed the chemical and physical

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[150] Lunge, *A Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor, and the Separation of Them From Valuable Products*, 8.

[151] Ibid., 4.

[152] C.S. McKinney, "Wood-Preservative Chemicals Derived From Coal-Tar Products," Paper read before the Engineering Association of the South (April 8, 1897): 1-2. U.S. Forest Service Newspaper Clipping File, Box 46 Folder Wood Preservation purple.

properties to be so similar that the tendency to conflate the two substances became almost universal.[153] Reporting on this creosote conundrum in an 1885 paper published in *The Journal of the Society of Chemical Industry*, scholar Carl Schlorlemmer remarked that “a confusion arose, which was kept up with an obstinacy unparalleled in the history of our science.”[154] While the decision to substitute coal-tar creosote for wood-tar creosote was born out of a persistent misperception that they were equivalent and even identical, it resulted in significant economic gain for coal-gas manufacturers and coal-tar distillers. Since the “dead oil” of coal-tar was also described as “creosote” and thought to have similar properties to its wood-tar counterpart, manufacturers marketed and sold it as a substitute for beechwood creosote at a fraction of the cost, monetizing a waste product of an already lucrative manufacturing process.[155]

Although many physicians, pharmacists, and scientists soon warned that it was not a suitable replacement or alternative to the genuine beechwood creosote since it was much more of an irritant and a poison than its namesake, the term “creosote” came to refer, almost universally, to coal-tar creosote—especially once the wood-preserving industry recognized its potential value.[156] One study, published by the New York State Pharmaceutical Association, found that “over 40 percent of the samples of creosote collected on orders for 'Beechwood Creosote,' or 'Creosote U.S.P.,' from druggists in

[153] H. E. Roscoe and Carl Schlorlemmer, “Hydroxybenzenes and Allied Bodies,” in *A Treatise on Chemistry: Volume III, Part III* (New York: D. Appleton and Company, 1890), 99; Schorlemmer, “The History of Creosote,” 152.

[154] Schorlemmer, “The History of Creosote, Cedriret, and Pittacal,” 152.

[155] Sneader, *Drug Discovery*, 108-109; Merck & Co., “Substitution,” 333; Weiss, *The Preservation of Structural Timber*, 75-76.

[156] Weiss, *The Preservation of Structural Timber*, 76; Boulton, *The Preservation of Timber By the Use of Antiseptics*, 22.

various parts of the state" were actually coal-tar creosote.[157] The pharmaceutical corporation, Merck & Company, pronounced this tendency to substitute coal-tar creosote, "the cheaper article" for "beechwood creosote, "the dearer one" to be "a most alarming condition of affairs" because "beechwood creosote is comparatively harmless, while coal-tar creosote is distinctly poisonous; substitution of coal-tar creosote for beechwood creosote may, therefore, cause the gravest consequences."[158] Addressing the gravity of the problem, a pharmacist from Missouri noted, "I do not doubt but what the coal-tar creosote is often dispensed for the beechwood creosote. The average person would not notice the difference, and might kill the patient."[159] Another source warned, "An alarming and reprehensible degree of looseness still prevails in some places, *leading directly to the serious danger of Creosote substitution*."[160] Disturbed by the adulteration of wood-tar creosote with coal-tar creosote, one concerned medical expert crusaded against these "spurious creosotes," demanding to know "how is it possible that a body of men so particularly trained in the art of recognizing and distinguishing powerful medicinal agents, can have been so ignorant or so reckless as to imperil human life by dangerous substitutions such as have been officially reported?"[161]

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[157] Merck & Co., "Substitution," 333.

[158] Ibid.

[159] Ibid.

[160] "On Creosote" in *The Proceedings of the American Pharmaceutical Association at the Forty-Ninth Annual Meeting* (Baltimore: American Pharmaceutical Association, 1901), 278.

[161] Merck & Co., "Memorial To Urge the Abolition of Spurious Creosotes," 193.

Regardless of these strident warnings, coal-tar creosote's misassociation with wood-tar creosote proved long-lasting. One American wood preserver, for example, characterized creosote as “a term commonly applied to any coal or wood tar product which looks nasty and smells bad.”[162] Critical of what he described as the “lax use of the word,” Weiss—a wood-preservation expert and director of the U.S. Forest Products Laboratory—argued in 1914 that creosote “conveys but little to those conversant with the subject and is confusing to those unfamiliar with commercial practice.”[163] Although experts such as Weiss and pharmacists and physicians endorsed a more precise nomenclature that specified “coal-tar creosote” or “wood-tar creosote,” many people in the business of wood preservation simply used the term “creosote.”[164] As Paul Blanc has argued, this deceptive labeling actually benefited the wood-preservation industry since coal-tar creosote “carried with it some of the cachet of a new pharmaceutical” and “from the perspective of wood fiber, the flesh was indeed preserved.”[165]

In spite of its etymological connection to the popular medicinal, however, this wood preservative proved as poisonous as many of its predecessors. As the fifth and sixth chapters of this dissertation explore, its toxic nature remained hidden from workers, consumers, and the general public although its use as a wood preservative steadily increased. When workers filed lawsuits alleging that their exposure to coal-tar creosote threatened their health, wood-preservation companies preyed on this

[162] McKinney, “Wood-Preservative Chemicals Derived From Coal-Tar Products,” 4.

[163] Weiss, *The Preservation of Structural Timber*, 76.

[164] Ibid., 76-77.

[165] Blanc, *How Everyday Products Make People Sick*, 227.

confusion over creosote's toxic nature and turned it to their advantage. They insisted that it was frequently employed for medical purposes and could not possibly harm workers.[166]

The confusion over creosote's identity was not simply the result of individuals misusing the term. Instead, the conflict also stemmed from coal-tar creosote's inherent complexity. In contrast to many other wood preservatives as well as other chemical agents derived from coal, chemists found it nearly impossible to precisely define coal-tar creosote's chemical makeup. Environmental scientists Ronald Wyzga and Lawrence Goldstein contend, “Coal tar is a complex mixture that has not been and probably cannot be characterized fully with respect to its chemical constituents.”[167] No two samples of coal tar or the creosote it yields possess the exact same chemical formula because the origin of the coal, the process used to manufacture or distill it, and the “age of the tar can affect its composition.”[168] Even today, scientists struggle to divine the specific chemicals that comprise creosote. Pollution experts Nicholas Cheremisinoff and Paul Rosenfeld describe the challenge of standardizing and analyzing creosote's chemical configuration: “There are approximately 300 chemicals that constitute the

[166] See, for example, *Republic Creosoting Company v. Hiatt*, 212 Ind. 432; 8 N.E.2d 981; 1937 Ind. LEXIS 329, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015); *Missouri Pacific Railroad Company, Thompson, Trustee, v. McKamey*, 205 Ark. 907; 171 S.W.2d 932; 1943 Ark. LEXIS 254, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[167] Ronald E. Wyzga and Lawrence S. Goldstein, “Assessing the Carcinogenic Potency of Environmental Coal Tars, By-Products of Coal Gasification,” in *Toxicology of Chemical Mixtures: Case Studies, Mechanisms, and Novel Approaches*. ed. Raymond S. H. Yang (San Diego, California: Academic Press, Inc., 1994), 83-84.

[168] Ibid., 83-84 and 7.

major compositional mix in coal-tar creosote; however, there can be up to 10,000 different chemicals in all within a typical mixture."[169]

Chemists had long recognized this wood preservative's variable nature. In his 1922 study of distillation, Thomas Howard Butler advised, "The composition of coal tar. . . varies so enormously, according to its mode of production, that it is useless to attempt to give any definite analysis."[170] For centuries, this chemical complexity plagued manufacturers trying to produce a consistently effective wood preservative, but also for researchers, workers, and concerned citizens investigating the occupational and environmental health risks associated with this toxic treatment.

While the wood-preservation industry eventually profited from the "muddle" over coal-tar creosote versus wood-tar creosote, experts initially dismissed coal-tar preservatives as inferior to corrosive sublimate, zinc chloride, and wood-tar products.[171] When applied through the traditional brushing or steeping techniques, coal-tar distillates did not effectively penetrate the wood pores, and resinified and hardened too quickly, which prevented adequate coverage.[172] Other researchers also found that it dried too quickly, causing "rents in the coat" that left much of the wood surface vulnerable.[173] A

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[169] Nicholas P. Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production Volume 2: Best Practices in the wood and Paper Industries* (Amsterdam: Elsevier, 2010), 10.

[170] Butler, "Fractional Distillation in the Coal Tar Industry," 364.

[171] Merck & Co., "Memorial To Urge the Abolition of Spurious Creosotes," 193.

[172] "Coal Tar and Its Products As Preservatives For Wood," 375.

[173] Lunge, *A Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor, and the Separation of Them From Valuable Products*, 79.

significant technological innovation—pressure treatment—rendered coal-tar distillates such as creosote more viable as wood preservatives.

Departing from the antiquated surface-level treatments that Kyan and Burnett employed, Franz Moll obtained a British patent in 1836 for a new method of treating timber with coal-tar products in a heated and closed vessel under pressure. Up to this point, as Goltra noted, most wood preservers “merely steeped and weighed down [timber] in liquid contained in a large trough or vat made of wood or iron.”[174] If they hoped to expedite the steeping process, which usually took days, wood preservers might use an open fire to heat the vat containing the timber and preservative solution, but this proved dangerous because many preservatives were highly flammable.[175] Treating the timber using Moll’s pneumatic pressure process forced the preservative deep into the wood rather than merely coating its exterior. The process that Moll pioneered, however, required a tedious series of treatments with different distillates of coal-tar, which he thought would prepare or season the wood for the final application of the heavier, “dead oils” or creosote.[176] While his laboratory experiments appeared promising, Moll's approach was not adopted as a practical method since many regarded the initial applications of lighter distillates to be unnecessary, time consuming, and costly.[177] Two years later in 1838, John Bethell patented a more streamlined pressure-

[174] Goltra, “History of Wood Preservation,” 193.

[175] Ibid..

[176] “Coal Tar and Its Products As Preservatives For Wood,” 374-375.

[177] Goltra, “History of Wood Preservation,” 187; Richardson, *Wood Preservation*, 7-8.

impregnation process that improved Moll’s method and revolutionized the field of wood preservation.[178]

Although Bethell is often celebrated for ushering in the rise of coal-tar creosote, he never directly mentioned the term “creosote” in his patent and did not endorse its use exclusively.[179] The “dead oil” he referred to was only one of eighteen different substances recommended in his patent for an “Invention of Improvements in Rendering Wood, Cork, Leather, Woven and Felted Fabrics, Ropes and Cordage, Stone and Plaster or Compositions, either more Durable, or less Pervious to Water, or less Inflamable.”[180] As Bethell's patent description suggested, he was not exclusively focused on preserving wood, but rather improving the strength and quality of many materials regularly exposed to the elements.[181] Rather than relying on the same technique of steeping or immersing timber that Kyan, Burnett, and others endorsed, Bethell advocated the use of “an air and water tight vessel or tank” constructed of strong metal that could withstand significant internal pressure, and had “a lid or door to it which is made to screw on air-tight.”[182] After sealing the material to be treated inside, operators used pneumatic pumps to remove as much air as possible from the chamber and create a vacuum that helped extract moisture from items, which prepared the item to absorb as much preservative as possible. After pumping the desired amount of

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178 Goltra, “History of Wood Preservation,” 187.

179 Boulton, *The Preservation of Timber By the Use of Antiseptics*, 22.

180 American Creosoting Company, *Pioneer Work in Modern Wood Preservation: Bethel, Boulton, Chanute* (Louisville, Kentucky: n.p., 1929), 2.

181 Ibid.; Goltra, “History of Wood Preservation,” 187.

182 American Creosoting Company, *Pioneer Work in Modern Wood Preservation*, 3.

preservative into the tank, the operator increased the pressure inside the chamber to force the preservative to thoroughly saturate the material.[183]

Addressing the “mixtures” one might pump into the tank, Bethell separated the substances “into three classes.”[184] The first included chemicals that would improve durability, the second contained solutions that would also help with waterproofing, and the third featured substances that might help with fireproofing. In addition to whale oil, fish oil, and beeswax dissolved in spirits of turpentine, Bethell classified the “dead oil” of coal tar among the second class of substances, observing that it would be “chiefly applicable to wood that is much exposed to the weather, as for railroad sleepers, piles, out-door posts and fences, &c, &c.”[185]

While Bethell alluded to the potential uses of creosote as a wood preservative, he did not foresee its ascendancy. The wood-preservation industry, however, capitalized on coal-tar creosote’s medicinal mystique and connection to coal, a symbol of industrialization and advanced technology. According to its proponents, creosote played a vital role in advancing modern industrial society because it conserved money and scarce timber resources, protected marine interests, and enabled empires to extend influence over far-flung continents.

When Europe industrialized and expanded its railroad networks rapidly in the nineteenth century, this placed an unprecedented and startling demand on already limited timber resources since railroads relied heavily on wood for trestles, bridges, and

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[183] Ibid.; Goltra, “History of Wood Preservation, 193.

[184] American Creosoting Company, *Pioneer Work in Modern Wood Preservation*, 5.

[185] Ibid., 7.

cross-ties or “sleepers,” the wooden beams placed under the rails for support. Before railroads harnessed coal for steam power, the lines also depended on wood for fuel. As civil engineer A. M. Wellington calculated in an 1887 economic investigation of railways, approximately one mile of track necessitated an average of 2,640 ties.[186] This number increased over time to about 3,000 ties per mile of track as railroads attempted to improve the safety and longevity of their lines.[187] Geographer William Black estimated that 140 average oak trees yielded sufficient ties for only one mile of track, which underscores how greedily railroads consumed timber. These figures did not even factor in the wood also needed for supporting structures, which was difficult to determine and varied considerably. The limited lifespan of untreated ties also exacerbated European concerns about a timber crisis because even when made of more durable hardwoods such as oak, untreated ties only lasted about five to nine years in optimal conditions. Coal-tar creosote, when applied using Bethell’s pressure-treating process, could potentially triple the longevity of timber, significantly decreasing costs for railroads and conserving timber supplies in the process.[188]

This preservative also offered another cost-saving benefit to consumers because it alleviated the strain on more durable and scarce hardwoods such as oak by increasing the utility of woods previously regarded as inferior. When thoroughly and properly pressure treated with coal-tar creosote, species of wood such as pine, gum,

[186] Arthur M. Wellington, *The Economic Theory of the Location of Railways* (New York: John Wiley & Sons, 1887), 776.

[187] Aldrich, *Death Rode the Rails*, 58.

[188] William R. Black, *Sustainable Transportation: Solutions and Problems* (New York: The Guilford Press, 2010), 16.

maple, and birch enjoyed a much longer service life.[189] "Creosoting," one proponent of wood-preservation explained, "permits us to use inferior woods which without preserving would be of little or no value."[190] Another advocate stressed how this would conserve natural resources:

> It is not only in prolonging the life of the kinds of structural timber already in common use that wood preservation lessens the drain upon the forests; an equally important factor is the opportunity it gives to use the so-called 'inferior' timbers, which in a natural state decay too rapidly to permit their use where a fairly long life is imperative.[191] Thus, consumers realized even greater savings because they could substitute cheaper varieties of wood and replace it less frequently.

While pressure-treating wood with creosote significantly extended the life of timber, its chief advantage over its predecessors was its effectiveness in wet and humid conditions, which provided much greater protection against shipworms. Researchers around the globe hailed its victory over "ravages of the teredo."[192] In 1878, Belgian chemist and naturalist Eduard Heinrich von Baumhauer pronounced creosote to be "the only means which can be regarded with great certainty as a true preservative against the injury to which wood is exposed from the teredo."[193] A French engineer waging war against marine borers in the late nineteenth century confidently declared, "The teredo

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[189] Isabelo Lagniton, "Methods of Preserving Timber" (Bachelor of Science Civil Engineering, University of Illinois 1910), 32; Hunt and Garratt, *Wood Preservation*, 7.

[190] Thomas Rodd, Jr., *The Preservation of Wood* (Pittsburgh: The Rodd Company, 1919), 40.

[191] W. F. Sherfesee, *Wood Preservation in the United States: U.S. Department of Agriculture, Forest Service Bulletin 78* (Washington: Government Printing Office, 1909), 30.

[192] E.H. von Baumhauer, "The Teredo Navalis, and the Means of Preserving Wood From Its Ravages," *Popular Science Monthly* (August 1878): 400.

[193] E.H. von Baumhauer, "The Teredo Navalis, and the Means of Preserving Wood From Its Ravages," *Popular Science Monthly* (September 1878): 557.

will not attack wood properly creosoted."[194] Reinforcing the conclusions of European researchers, John Oakes, an American engineer, maintained, "creosote is to the teredo a disagreeable and possibly poisonous substance in which he will not or can not live."[195] "For timber in very wet situations or exposed to marine worms, creosoting is the only method which insures success," the American Academy of Civil Engineers affirmed.[196] Although hopeful inventors patented "close to a thousand teredo-proofing devices and compounds" by the late nineteenth century, as environmental historian Derek Nelson acknowledges, only creosote "proved to be a blanket repellent that stifled most wood borers."[197]

Although cheaper wood preservatives such as zinc chloride existed, many Europeans adamantly preferred creosote. Baumhauer argued that creosoted timber would "last four or five times longer than when unprepared, while experience shows that wood treated with sulphate of copper or chloride of zinc (Burnettizing) is neither protected from the teredo nor the influences of humidity and of the atmosphere."[198] These unique qualities became even more important as European and, later, American powers extended economic and military influence over other regions of the world in the nineteenth and twentieth centuries.

As imperialists invaded and attempted to dominate both the landscape and the indigenous peoples of India, Africa, Latin America, and South Asia, they relied on wood

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[194] Ibid.

[195] John C. Oakes, *Creosotes and Creosoting* (n.p., 1909), 5.

[196] American Society of Civil Engineers, "The Preservation of Timber," 276.

[197] Nelson, "The Ravages of Teredo," 110.

[198] Baumahuer, "The Teredo Navalis," (September 1878): 558.

to maintain and expand their empires, cutting timber, laying railroad track, constructing ports and towns, digging mines, and shipping materials and goods.[199] In regions where the tropical climate and insects preyed on wood, this dependency proved costly, which further motivated government officials and entrepreneurs to embrace coal-tar creosote to protect their global investments. Geographer Erlend Eidsvik, for example, documented the local, national, and international trade networks that supplied European colonies in South Africa with creosoted railway sleepers in the nineteenth and early twentieth centuries. According to Eidsvik, the "considerable demand for railway sleepers" provided the Norwegian shipping operation A. L. Thesen and Company with ample business as it fulfilled contracts with colonial governments.[200] Exporting creosote from Yorkshire, England, the company "freighted" it on Norwegian vessels, then contracted with local woodcutters to secure timber for creosoting.[201] Colonial governments and business partners supplied European equipment and established creosoting plants in their colonies.[202]

Boulton observed a similar process at work in India, describing the challenges British engineers faced when building railways because "it was speedily discovered that the timber found in that country was subject to very rapid destruction by decay, and by

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[199] Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981); Daniel R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940* (New York: Oxford University Press, 1988); Andrew Dow, *The Railway: British Track Since 1804* (South Yorkshire: Pen & Sword Books Ltd., 2014).

[200] Erlend Eidsvik, "Liminal But Not Omnipotent: Thesen & Co.—Norwegian Migrants in the Cape Colony," in *Navigating Colonial Orders: Norwegian Entrepreneurship in Africa and Oceania*, ed. Kirsten Alsaker Kjerland and Bjorn Enge Bertelsen (New York: Berghahn Books, 2015), 86.

[201] Ibid.

[202] Ibid.

the attacks of insects."[203] Bemoaning the "serious difficulty" of "procuring suitable sleepers," the engineers resorted to importing creosoted Baltic timbers.[204] Although native Indian hardwoods such as teak, sal, and deodar would later come to be prized for their resiliency and durability, westerners in the nineteenth and early twentieth centuries, considered the indigenous trees to be inferior to European resources.[205] One expert commented, "India possesses coal, iron, and almost everything else; but she does not produce a good timber-tree for sleepers."[206] These attitudes also mirrored prevailing assumptions about colonial subjects as inferior, unrefined, and savage.[207]

According to a 1904 survey conducted by the International Railway Congress and published in its 1904 bulletin, railroad lines in Uganda, Trinidad, Jamaica, Cuba, Mexico, and British Guiana—under European control—depended on creosoted ties and timbers along their lines. Although many of these railways initially imported creosoted timbers from Europe, they soon turned their attentions to the native woods to save shipping costs and obtain an adequate supply for their ever-expanding ventures.[208] When Europeans and Americans rapidly depleted their alternatives, they readily

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[203] Boulton, *The Preservation of Timber By the Use of Antiseptics*, 16.

[204] Ibid.

[205] Ibid.; "On the Scarcity of Wood Suitable for Railway Sleepers in India," *Transactions and Proceedings of the Botanical Society of Edinburgh* 10 (1870): 199.

[206] Ibid.

[207] Ibid.

[208] International Railway Congress, "Appendix II: Abstracts of Statistics and Evidence in Regards to Railways in Tropical Countries Outside of India," in *Bulletin of the International Railway Congress* (Brussels: P. Weissenbruch, 1904), 830.

exploited and creosoted indigenous hardwoods to support and advance the business of colonialism.[209]

Environmental historian Alfred Crosby persuasively argued, “the success of European imperialism has a biological, an ecological component.”[210] Thus, attempts to control the environments, resources, and peoples of other regions represented “ecological imperialism.”[211] Wood preservation played a leading role in this process, promoting the destruction of local timber resources, polluting the landscape, and subjecting indigenous peoples to occupational and environmental health risks associated with coal-tar creosote. “The domination of nature involves and necessitates the control of human beings,” environmental historian Andrew Hurley contends, and as is often the case, marginalized groups lower in the social and economic hierarchies typically bear “a disproportionate burden of environmental hazards.”[212] The individuals who bore an unequal share of these hazards were typically colonial subjects, immigrants, and racial minorities, forced to live and work at or in close proximity to these facilities.

As creosoted timber and its associated health and environmental impacts debuted in locations across the globe, wood preservers also found opportunities to apply their technology to other transportation markets, specifically the search for a type

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[209] Pallavi V. Das, *Colonialism, Development, and the Environment: Railways and Deforestation in British India, 1860-1884* (New York: Palgrave Macmillan, 2015), 51-52.

[210] Alfred Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900.* 2nd ed. (Cambridge: Cambridge University Press, 2015), 7.

[211] Ibid.

[212] Andrew Hurley, *Environmental Inequalities* (Chapel Hill: University of North Carolina Press, 1995), 182 and 24.

of pavement that was quiet, easy to maintain, sanitary, and affordable. As historian David O. Whitten maintains, “The human quest for an ideal pavement is nearly as old as the search for the perfect god.”[213] During their crusades for better infrastructure, humans experimented with countless materials such as stone, rubber, ferrous metals, concrete, and asphalt, but since ancient times, our ancestors have been consistently drawn to wood because of its strength, accessibility, and affordability. Limited archeological evidence of wooden roads exists today, however, because the chief disadvantage of wood as a paving material was its susceptibility to rot, decay, and insects. The advent and growing popularity of wood-preservation technology in the nineteenth century made wood a more practical and long-lasting paving option. As Europe and the United States industrialized and the population of cities mushroomed, a newfound sense of urgency during this period also prompted a reconsideration of wood-paved streets.[214]

Brick and stone lined the boulevards of urban Europe and the United States, but when “hundreds of steel-tired wagon wheels and horseshoes” clambered down narrow thoroughfares, they generated a maddening din amplified by surrounding buildings. Metal horseshoes and wheels quickly deteriorated even the strongest pavement, producing a “stone-powder that blows everywhere” and creating “depressions and irregularities that catch dirt and make street-cleaning so difficult.”[215] One critic noted that the brick and stone roads were not the only casualty of the hooves and wheels; there

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[213] David O. Whitten, “A Century of Parquet Pavements: Wood as a Paving Material in the United States and Abroad, 1840-1940,” *Essays in Economic and Business History* 15 (1997): 209.

[214] Ibid.

[215] “Horses in Cities,” *New York Times*, 24 July 1881, 6.

was also the “wear and tear which the noise inflicts upon the nervous system.”[216] Uneven pavement also posed a danger to horses, passengers, and cargo, while making it difficult or impossible to sanitize “incessantly manured” streets.[217]

Although many early nineteenth-century municipalities had experimented with wooden blocks and planks as alternatives to brick and stone, without creosote’s preservative strength, the wood readily absorbed moisture and rotted. When waterlogged, the blocks bloated and expanded, producing a pitted and unstable surface that could not withstand the pounding hooves and crushing carriage wheels. The pavement's troughs and furrows “filled with stagnant water, decaying animals and vegetations,” making travel unpleasant but also treacherous to one’s health.[218] In addition to the ever-present horse manure that littered the streets, untreated wood also “absorbed urine and bled it out as ammonia on hot days” and the blocks “sweated putrid fluid in hot weather,” compounding the discomfort and public health risks one endured when traversing city streets.[219] As American chemists reported in an investigation of wooden pavements, “Uncreosoted wood, filled with the foul drainage of the street, cannot fail. . . to produce a bad effect upon the atmosphere.”[220] Gravely concerned about the public health risks of wooden streets vulnerable to decay, they warned, “pestilential disease will in the course of time follow the paving with wood unless it is

[216] Ibid.

[217] Ibid.

[218] *St. Louis Post Dispatch*, 4 June 1881.

[219] Clay McShane and Joel Tarr, *The Horse in the City: Living Machines in the Nineteenth Century* (Baltimore: Johns Hopkins University Press, 2007), 34-35; Dianne Timblin, “History on the Road: Cleveland’s Hessler Court,” *Forest History Today* (Spring 2008): 52.

[220] “Wooden Pavements: Importance of Creosoting,” in *Miscellaneous Papers on Wood*, 69.

first made secure against decay by some chemical process which will thoroughly interrupt the utter demolition of the material."[221]

Creosote, advocates claimed, resolved these woes, creating a safer, more sanitary, and tranquil urban landscape. An early twentieth-century report on creosoted wood-block paving issued by the U.S. Department of Agriculture concluded, "Its durability, noiselessness under heavy traffic, and sanitary properties are its chief advantages."[222] A 1913 advertisement for this material recommended it specifically for "streets of heavy travel."[223] Percy Boulouis, an engineer in Liverpool, England, also touted its benefits. "It is the quietest of all known pavements," he declared while praising its resiliency, affordability, and ease of repair.[224] Proponents also insisted it was safer for horses (and their passengers) since it provided animals with a "better foothold" than stone or asphalt and "if a horse falls, he can rise more easily."[225] The waste horses and other animals produced could also be removed with simple sweeping, and the creosote supposedly prevented excrement from soaking into the pavement.[226]

Another expert admired the elasticity of treated wood, which "instead of resisting the pressure or percussion of passing vehicles, like such an incompressible substance

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[221] Ibid., 71.

[222] Forest Service, U.S. Department of Agriculture, "Treated Wood Block Flooring" (Washington: U.S. Department of Agriculture, April 1916), Folder Paving and Pavement, Box 28, US Forest Service Newspaper Clipping File, Forest History Society, Durham, North Carolina.

[223] Advertisement in *The Proceedings of the Ninth Annual Meeting of the American Wood Preservers Association* (Baltimore: The Peters Publishing Company, 1913), xi.

[224] Ibid.

[225] Ibid.

[226] Whitten, "A Century of Parquet Pavements: Part 2," 161.

as granite, yields to it sufficiently to counteract friction."[227] This unique characteristic helped make the surface smoother, dampened sound, and prevented wear and tear on the pavement, but also horses and travelers.[228] In addition to making travel more comfortable, Whitten explains, "Wood blocks were also useful in filling gaps around trolley tracks. The flexible wood was less likely to crack, break, or wander from the vibrating iron or steel rails."[229]

Producers of treated wood-block paving also exploited the widespread belief that creosote possessed healing and antiseptic properties. In the nineteenth century, city officials, medical professionals, engineers, and concerned citizens desperately sought potential solutions that might ameliorate disease outbreaks connected to cholera, yellow fever, tuberculosis, typhoid, and other contagions. The push for creosoted wood-block paving demonstrated a shift away from the traditional view that disease was simply—as historian Charles Rosenberg explained in his classic study *The Cholera Years*—a "moral dilemma."[230] Instead, in the mid-nineteenth-century first Europeans and later Americans, began conceptualizing disease as a "social problem" that demanded immediate attention and sanitary reform such as securing clean water, removing sewage and garbage, and improving paving.[231]

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[227] Robert Mudie, ed., "Wood Paving in London and the Provinces," *The Surveyor, Engineer, and Architect: For the Year 1841* (London: Wm. S. Orr and Co., 1841), 185.

[228] Ibid.

[229] Whitten, "A Century of Parquet Pavements: Part 2," 163.

[230] Charles Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: University of Chicago Press, 1962), 228.

[231] Ibid., 228; Martin Melosi, *The Sanitary City: Environmental Services in Urban America from Colonial Times to the Present*. *Abridged Edition* (Pittsburgh: University of Pittsburgh Press, 2008), 40-41

While most people—including doctors and sanitation engineers—continued to believe “miasmas” or “filth and foul smells” rather than microorganisms caused epidemics, they correctly deduced “environmental sanitation” would help fight disease.[232] Unless treated with creosote, one report argued, wood paving would be reduced to “large masses of decayed vegetable matter” that produced the miasmas that endangered public health.[233] “The very air breathed is contaminated,” the report affirmed, and widespread epidemics would occur without a chemical preservative and disinfectant such as creosote.[234] Creosote's boosters insisted that it was “a constant and powerful disinfectant against all the malarious influences” that menaced city streets.[235] Even as the view became more common that germs—not miasmas—caused disease, researchers continued to have faith in creosoted pavement and adapted their terminology accordingly. The author of a 1908 article in *Engineering Digest* pronounced creosoted pavement to be a “health protector rather than a disease breeder as many pavements are” because “creosote is a powerful germicide.”[236] Another boasted that it was “perfectly sanitary,” and explained, “Creosoted wood being absolutely non-absorbent, such a pavement takes up none of the liquids of the street and furnishes no lodgment for any substance deleterious to health.”[237]

[232] Ibid., 5.

[233] “Wooden Pavements: Importance of Creosoting,” in *Miscellaneous Papers on Wood*, 71.

[234] Ibid.

[235] Ibid.

[236] “Creosoted Wooden Block Paving,” *Engineering Digest* 4 (Dec. 1908): 675.

[237] Norfolk Creosoting Company, *Creosoted Timber: Its Preparation and Uses* (Philadelphia: The Heywoods, 1900), 49.

This unique “sanitary” property, many believed, made this paving material “especially well adapted to the streets of tropical and sub-tropical cities,” environments often plagued with disease but also where untreated paving materials quickly succumbed to rot and decay.[238] Towns and cities also installed creosoted wood blocks in congested areas where citizens' health was of particular concern—public and government buildings, hospitals, churches, and schools.[239] Experts cited and recommended its use in “factories, warehouses, machine shops, foundries, various types of platforms, wharves, and docks, and for such miscellaneous purposes as hotel kitchens, hospitals, laundries, and slaughter houses,” places that sustained great use and where sanitation was often an issue.[240] Whitten characterizes the use of creosoted wood-block paving as a “special substance for selected streets,” and its advocates hoped it would promote public health and wellbeing while serving as a symbol of a modern “sanitary city.”[241]

Hailing creosoted wood-block paving as an engineering and sanitation marvel, cities throughout Europe and the United States covered their streets with this material. (Figure 2-3) A 1913 advertisement noted, “Almost every European city has extensive areas of this pavement” and a publication in a lumber trade journal from the same year bragged that London and Paris featured over 300 and 400 miles, respectively, of

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[238] Ibid.

[239] Whitten, “A Century of Parquet Pavements: Part 2,” 162-163.

[240] Forest Service, U.S. Department of Agriculture, “Treated Wood Block Flooring” (Washington: U.S. Department of Agriculture, April 1916), Folder Paving and Pavement, Box 28, US Forest Service Newspaper Clipping File, Forest History Society, Durham, North Carolina.

[241] Whitten, “A Century of Parquet Pavements: Part 2,” 163; Melosi, *The Sanitary City*, 224.

creosoted pavement.[242] American cities followed suit, with Galveston, Mobile, Indianapolis, New York, Boston, and Chicago, leading the way. Galveston laid some of the first creosoted blocks in the United States in 1873, and even in a climate known for its heat, humidity, and violent storms, the pavement supposedly “gave satisfactory service for nearly thirty years, and was destroyed only by” the storm surge of the great hurricane of 1900.[243] Discussing the popularity of this pavement, Henry L. Collier, a civil engineer, emphasized its geographical appeal, “It can be found as far north as the Canadian cities and as far south af (sic) Havana; from Boston to Seattle; from Jacksonville to San Francisco; from Minneapolis to Brownsville.”[244] He rhapsodized, “Climate conditions do not affect it. Under the Northern snows for weeks, or under the tropical sun, it has proven the best of all pavements.”[245]

While champions of creosoted wood block paving such as Collier regarded it as “more nearly approaching the ideal pavement than any yet known to engineers,” others expressed concern about “its buckling, bleeding, and slippery character.”[246] Charles Dickens detested treated wood-block paving, noting that “quality of surface seems utterly unattainable, that the knavish contractors supply blocks so rotten as to be worthless a few days after they are put down, and that the horses are continually

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[242] Advertisement in *The Proceedings of the Ninth Annual Meeting of the American Wood Preservers Association* (Baltimore: The Peters Publishing Company, 1913), xi; H.L. Collier, “Historical Review of the Growing Use of Creosoted Wood Block Paving,” *Lumber Trade Journal* 19, no. 1 (May 1913): 23.

[243] Collier, “Historical Review of the Growing Use of Creosoted Wood Block Paving,” 7.

[244] Ibid.

[245] Ibid.

[246] “Creosoted Paving Block History in the South,” *Lumber World Review* (October 25, 1913): 27.

slipping and frequently falling on the perilous highway."[247] He also complained about how "unpleasant" it was "to be semi-asphyxiated" by the "fumes" of the preservative while walking.[248] These unpleasant characteristics associated with creosoted wood-block paving ran counter to what its advocates admired about this material, and they defended their product by blaming the "knavish contractors" or swindlers, and accusing some manufacturers of treating the wood improperly or failing to use quality creosote.[249]

These unsatisfying encounters with creosoted pavement underscored a central problem with the growing wood-preservation industry in the nineteenth century—a lack of standardization and professionalization that hindered communication among manufacturers and prevented consistent quality of the treated material. Consumers of creosoted timber had to rely on the honesty of the individuals preserving and selling the product. An engineer experienced with treating railroad ties conceded, "It is very important that thoroughly honest work be done when creosoting timber. The process is one in which it is extremely easy to do bad work without the fact being known to the inspector unless he is thoroughly expert."[250] Similarly, after an exhaustive investigation on wood-preservation methods in 1885, the American Academy of Civil Engineers concluded, "It thus appears that there is no process of wood preserving the efficacy of

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247 Charles Dickens, "A Journey Due North," *Household Words: A Weekly Journal* 14 (November 15, 1856): 427.

248 Ibid.

249 Ibid.

250 "Appendix A: Experience on the Louisville & Nashville Railroad with Creosoted Piles and Timber," *Proceedings of the Tenth Annual Convention of the American Railway Engineering and Maintenance of Way Association* 10 (1909): 634.

which, when well done, is better established than creosoting, but there is also no process where more bad work has been done, either from design or ignorance."[251]

As this evidence reveals, even experienced "inspectors" struggled to evaluate the quality of treated timber, and without standards and regulations consumers had no way of knowing if the treated material they installed would live up to advertisers' promises and their own lofty expectations. In spite of these misgivings, many Europeans considered creosote's risks acceptable given its potential to conserve limited natural resources, to fight off the teredo's onslaught, to conquer new regions of the world, and to sanitize and modernize towns and cities. By the late nineteenth century, Europeans regarded creosote as champion over all other preservatives. In 1884, Boulton declared that it had "entirely extinguished its rivals" and "took the place of the others by a species of 'survival of the fittest.'"[252]

Although wood preservers discovered many applications for creosote and creosoted timber, the demand for railroad ties drove the growth and expansion of the wood-preservation industry in both Europe and the United States. Americans, however, adopted this technology more reluctantly than Europeans because of the cost, the challenge of acquiring creosote, and the stubborn belief that wood preservation was unnecessary since many still perceived the U.S. timber supply as limitless. While European wood-preserving experts such as Boulton crowed about creosote's supremacy, the American Academy of Civil Engineers espoused a bleak perspective about the wisdom of creosoting. In their 1885 report, the committee complained about

[251] American Society of Civil Engineers, "The Preservation of Timber," 257.

[252] Boulton, *The Antiseptic Treatment of Timber*, 27.

the cost of creosote since "the supply in this country is not equal to the demand, so that it has to be imported from England."[253] On top of the expense of importing creosote, wood preservers had to fund a facility with pressure-treating equipment and pay laborers to handle ties, work the plant, and run the machines. "This cost in most cases will be prohibitory," the committee asserted, "and it will generally be cheaper to let the ties rot and to replace them at present prices."[254] Even in locations prone to teredo attack such as the Gulf of Mexico coast, they predicted, "It will not frequently happen that it is cheaper, in view of cost and accruing interest, to let the *teredo* eat the piles, than to incur the expense of creosoting the timber to keep him out."[255]

By the close of the nineteenth century, Europeans had embraced pressure-treatment with creosote as a victory over nature, but their American counterparts did not yet accept creosote as a solution to "the great desideratum."[256] In fact, Americans had yet to fully realize or confront their reckless relationship with the nation's forest resources, and American industries—particularly railroads—remained unconvinced about the economic benefits of creosoting on a wide scale. Wood-preservation advocates, however, recognized that railroads and their gluttonous appetite for timber held the key to unlocking this industry's potential.[257]

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[253] American Society of Civil Engineers, "The Preservation of Timber," 276.

[254] Ibid..

[255] Ibid., 277.

[256] "Destruction of Wood," in *Miscellaneous Papers on Wood*, 2.

[257] Ibid.

Figure 2-1. Sinking of H.M.S. Royal George at Spithead Augt 29 1782; etching; no date. Creator: Ackermann & Co. and S. Horsey, Jr. Wikipedia, https://en.wikipedia.org/wiki/HMS_Royal_George_(1756)#/media/File:Sinking_of_Royal_George_1782.jpg.

Figure 2-2. Timber tunnelings by Teredo navalis, the Teredo Worm. Stevenston Beach, North Ayrshire, Scotland. Wikipedia, https://en.wikipedia.org/wiki/Teredo_navalis#/media/File:Teredo_navalis_in_a_branch.JPG.

Figure 2-3. 1910 Detail of “Nicholson” pavement on Madison. 1910 Memphis, Tennessee. Historic-Memphis, http://historic-memphis.com/memphis/street-scenes/street-scenes.html.

CHAPTER 3
"BEFORE A WHEEL CAN TURN A TREE MUST DIE": AMERICAN RAILROADS AND THE NEED FOR WOOD PRESERVATION

In October 1893, Howard Miller, a general agent for the Union Pacific Railway, presented a paper examining "the relation of railroads to forestry" at the Columbian Exposition in Chicago.[1] Over 27 million people attended this massive world's fair commemorating the 400-year anniversary of Christopher Columbus's arrival in the "New World" and celebrating cultural, intellectual, and industrial achievements. Although the exotic exhibits and carnivalesque amusements drew many visitors to the Exposition, fair organizers also sought to educate and inform the public about important issues of the day through the World's Congress Auxiliary.[2] This organization hosted conferences, meetings, and lectures—including Miller's—about topics such as agriculture, music, religion, medicine, education, public health, engineering, and social reform.[3] Presented in a city that owed much of its growth and wealth to the railroad, Miller's speech reflected a growing concern about the future of America's forest resources and the belief that railroads, in particular, devastated the sylvan landscape.[4]

"The end of the forests of this country is in sight," Miller proclaimed. Throughout the United States, he observed, "The rugged oak and the sentinel pine crash to the earth with shattered limbs and broken heart at the stroke of the axe in the hands of the

[1] Howard Miller, "The Relation of Railroads to Forestry," in *Proceedings of the American Forestry Association at the Tenth, Eleventh, and Twelfth Annual Meetings, Washington, December, 1891, 1892, and 1893 and at the World's Fair Congress, Chicago, October 18 and 19, 1893* (Washington, D.C.: American Forestry Association, 1894), 158.

[2] Norm Bolotin and Christine Laing, *The World's Columbian Exposition: The Chicago World's Fair of 1893* (Chicago: University of Illinois Press, 2002), 20.

[3] Ibid., 20 and 142.

[4] Miller, "The Relation of Railroads to Forestry," 158.

woodsman."[5] Although critical of poor forest management practices in general, he held railroads principally accountable for unrestrained deforestation: "Of all the destructive and insatiable agents contributing to the depletion of forests, perhaps none are more voracious than railroads. Before a wheel can turn a tree must die."[6]

Given his position as a general agent for the Union Pacific, one of the largest railroads in the U.S., which declared bankruptcy in the same month and year of his Columbian Exposition speech, Miller's stance on the issue of declining forest resources is surprising. Although he viewed the railroad or "iron highway" as a "necessity" and "indispensable" to the advance of "civilization and progress," Miller believed that our society and culture had become complacent about its "denuded forest where once, within our recollection, were Gothic arch and 'God's first temples.'"[7] The complacency Miller criticized resulted from a lack of understanding about just how much wood railroads consumed.

While often associated with nineteenth-century symbols of industry such as coal, iron, and steel, railroads required an extraordinary supply of wood to support their infrastructure. [8] Despite metallurgical innovations in the late nineteenth century, railroads continued to depend on wood for fuel, cars, bridges, trestles, culverts, station houses and other buildings, telegraph poles, rails, fences, and crossties or sleepers—

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[5] Ibid., 161.

[6] Ibid., 159.

[7] Ibid., 161 and 159.

[8] Eric Rutkow, *American Canopy: Trees, Forests, and the Making of a Nation* (New York: Scribner, 2012), 100; J. R. McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (New York: W. W. Norton & Company, 2000), 308.

the wooden beams placed under the rails for support.[9] (Figure 3-1)These ties—the railroad's "single largest use of timber" according to historian Eric Rutkow—"acted as cushions and shock absorbers, ensuring a smoother and safer ride."[10] To support the "mountainous loads" as well as the "vibrations and impact of the trains passing over it," railroad engineers relied on wooden crossties because they were "strong, elastic, resistant to shock and fatigue from vibrating, easily replaced and relatively inexpensive."[11]

Although the railroad industry experimented with alternatives such as stone, concrete, and steel, operators and passengers generally preferred wooden ties for the same reasons that many engineers and travelers preferred wood-block road paving to stone. Wooden ties cost less and could be produced easily, but they also ensured a quieter, more comfortable, and less jarring ride compared with other more rigid materials.[12] As a Forest Service publication extolling the virtues of wooden crossties explained, "In spite of all the new materials and technical improvements developed since the first railroad was built in the United States, the wood crosstie is so well adopted to its function that it has defined all competition."[13]

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[9] Rutkow, *American Canopy*, 104.

[10] Ibid., 104.

[11] USDA Forest Service, "The Railroad Tie: A National Forest Product," in *Wood In Our Lives: Products from the National Forests* (Washington, D.C.: USDA Forest Service, n.d.).

[12] Rutkow, *American Canopy*, 104.

[13] USDA Forest Service, "The Railroad Tie," n.d.

To feed the “insatiable juggernaut of the vegetable world” and meet the increasing demand for wooden ties, railroads rapaciously consumed trees.[14] (Figure 3-2) Underscoring the extent of the railroad’s depletion, Miller calculated how “every railroad in the United States represents the death of a forest.”[15] At the time that he addressed audiences at the World’s Congress Auxiliary in 1893, “about 225,000 miles” of track already crisscrossed the United States, with “the annual addition of about 5,000 to 6,000 miles of new road.”[16] Although estimates varied, railroads laid about 2,500 to 3,000 ties per mile of track, and “a good tie” was no less than “8 feet in length.”[17] Based on these figures, which he found “significantly appalling,” Miller argued that a tree “1 foot in diameter and 5 feet from the ground to the first limb” would only generate 3 ties.[18] Even with conservative estimates, Miller concluded, “A forest of 800 trees would probably furnish ties for one mile of railroad, and at this rate the railroads of the United States would require 180,000,000 forest trees of the most valuable kinds for ties alone.”[19]

Miller derided these excesses, delivering Americans a grim warning: “He may overdraw on Nature’s bank, but sooner or later his drafts are protested. We speak of inexhaustible fertility, but there is no such thing in nature. Like unlimited credit, it is only

[14] Miller, “The Relation of Railroads to Forestry,” 159.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] Ibid.

a phrase embodying a later day of reckoning."[20] Although the future of forest resources appeared bleak and he seemed to call Americans to arms over this destruction, Miller also justified the railroad's position and its general lack of interest in sustainable forestry practices: "It may be broadly stated that railroad managers, as a rule, do not care for the future of forestry as much as for the returns of today. A railroad corporation is not a charitable organization, nor is it in the field for philanthropic purposes."[21] Railroads and their "moneyed constituency," Miller observed, cared about how to "create dividends today for the present living stockholders" and were content to "leave the next generation to take care of itself."[22] Miller supposedly found this situation to be a "sad commentary on civilization," but claimed he wanted the "tree man" or those in favor of timber preservation and conservation to understand what they were up against.[23] Instead of blaming the railroads for their lack of environmental stewardship, Miller incriminated a much larger, nebulous force—"the refusal of that sensitive entity known as capital to surrender any present certainties for future benefits to people yet unborn."[24]

When Miller attributed the destruction of forests to the unseen power of capital, he excused the railroad from any responsibility and offered little insight into how to correct the problem. While this view is not surprising given his connection to a large railroad corporation, Miller highlighted a central challenge that both the fields of forestry and wood-preservation faced in the nineteenth and early twentieth centuries. As long as

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[20] Ibid., 158.

[21] Ibid., 161.

[22] Ibid.

[23] Ibid., 161-162.

[24] Ibid.

railroad lines had access to plentiful and cheap timber supplies for their ties, there was no economic incentive to adopt preservative techniques. Consequently, for much of the nineteenth century, railroads indiscriminately consumed timber resources for their ties, and no "later day of reckoning," as Miller threatened in his 1893 speech at the Chicago World's Fair, appeared in sight.[25]

Railroads first had to recognize that the present and future supply of timber would not support their demand for crossties before they embraced coal-tar creosote as a solution to their crosstie needs. On the surface, the railroad tie may appear to be an unremarkable and inconsequential object, or, as historian James Cronin argued, "A rough-hewn chunk of wood, probably the most utterly utilitarian, functionally designed object in the whole range of commerce and industry."[26] Nevertheless, the railroads' ravenous appetite for the nation's best trees—white oak, longleaf pine, and chestnut—became a flashpoint, around which foresters, conservationists, and wood-preservation advocates began to mobilize. This chapter traces railroads' assaults on the forests, but also considers the origin of this attitude in American history.

American railroads' initial lack of interest in forest conservation and wood preservation reflected the nation's longstanding and complex relationship with its once abundant forest resources. Americans, as historical geographer Michael Williams observed, have long struggled to see "the wood for the trees"—both literally and figuratively.[27] Historian Eric Rutkow echoes this sentiment, arguing that Americans

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[25] Ibid., 158.

[26] James E. Cronin, *Hermann von Schrenk, A Biography* (Chicago: Kuehn, 1959), ix.

[27] Michael Williams, *Americans and Their Forests: A Historical Geography* (Cambridge: Cambridge University Press, 1989), xvii.

share a “long lineage” of “realizing that they had abused their great renewable resource when it was too late.”[28] While hindsight no doubt increased Williams’s and Rutkow’s understanding of how Americans interacted with their forests, even contemporary witnesses remarked on the curious attitude Americans displayed toward “the most visually dominant vegetation on the continent.”[29]

In 1836, James Hall, a former soldier, lawyer, judge, and chronicler of the American West, classified the United States as a “wooden country” “not merely from the extent of its forests, but because in common use wood has been substituted for a number of the most necessary and common articles—such as stone, iron, and even leather.”[30] “Not only has it been unnecessary to economise in this article,” Hall announced, “but every where in the United States. . . the *destruction* of timber has been a desirable object.”[31]

European visitors also reinforced Hall’s perspective. After traveling extensively across the U.S. in the early 1830s, Alexis de Tocqueville, a French diplomat and scholar, reported, “In Europe people talk a great deal of the wilds of America, but the Americans themselves never think about them; they are insensible to the wonders of inanimate nature and they may be said not to perceive the mighty forests that surround them till they fall beneath the hatchet.”[32] Although the forest’s wonders failed to capture

[28] Rutkow, *American Canopy*, 5.

[29] Williams, *Americans and Their Forests*, 3.

[30] James Hall, *Statistics of the West at the Close of the Year 1836* (Cincinnati: J. A. James & Co., 1836), 101.

[31] Ibid., 100.

[32] Alexis de Tocqueville, *Democracy in America*, trans. Henry Reeve (New York: J. & H.G. Langley, 1840), 74.

their interest, de Tocqueville went on to assess Americans' real motivation: "Their eyes are fixed upon another sight: the American people views its own march across these wilds, draining swamps, turning the course of rivers, peopling solitudes, and subduing nature."[33]

Today, this shortsightedness seems decidedly at odds with the geography of a nation that possessed "some of the most spectacular tree resources on the planet."[34] Precise calculations of America's forest landscape remain elusive because many viewed it as "so common that no one bothered to write about it, let alone collect statistics, and the extent of the forest and the amount of clearing went unrecorded."[35] In spite of these difficulties, researchers estimate "forests once covered almost half of the contiguous states, a staggering 950 million acres."[36] Even with rough approximations, the nation's "diverse geography" provides "ideal soil for almost any type of tree" and the U.S. enjoys the distinction as being "home to the world's biggest trees (the giant sequoias), the world's tallest trees (the coastal redwoods), and the world's oldest trees (the bristlecone pines)."[37] While promoting the forest wealth of the United States and encouraging the cultivation of the nation's magnificent trees, horticulturist Andrew Fuller proudly stated in 1866, "There is no country on the globe that possesses such a

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[33] Ibid.

[34] Rutkow, *American Canopy*, 8.

[35] Williams, *Americans and Their Forests*, 4.

[36] Rutkow, *American Canopy*, 8.

[37] Ibid., 8.

numerous variety of valuable forest trees as America."[38] This profusion of trees certainly shaped how American citizens came to view their environment, but Rutkow also argues, "No other country was populated because of its trees quite like the United States. Nowhere else has the culture been so intimately associated with wood."[39]

Although Europeans like Tocqueville regarded the American perspective on nature as unusual and ill-advised, they often failed to recognize how the views that Americans inherited from Europe also played an essential role in conceptualizing both the forest and its potential resources.[40] Long before European explorers and settlers encountered the massive woodlands of North America, they equated forests with wilderness, which as historian Roderick Nash maintained, "was instinctively understood as something alien to man—an insecure and uncomfortable environment against which civilization has waged an unceasing struggle."[41] Since classical times, the "mythology and set of cultural mores" that influenced these visitors to the "New World" depicted forests as dark, menacing, untamed, and savage areas that needed "felling, firing, grazing, and cultivating so that they could become civilized abodes."[42]

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[38] Andrew Fuller, *The Forest Tree Culturist: A Treatise on the Cultivation of American Forest Trees* (New York: The American News Company, 1866), 11.

[39] Ibid., 7.

[40] Alexander Porteous, *Forest Folklore, Mythology, and Romance* (New York: McMillan, 1928); Henry Nash Smith, V*irgin Land: The American West As Symbol and Myth* (Cambridge, Mass: Harvard University Press, 1978).

[41] Roderick Nash, *Wilderness and the American Mind*, 5th ed. (New Haven: Yale University Press, 2014), 6.

[42] Williams, *Americans and Their Forests*, 10.

In this traditional view, decreasing “the amount of wilderness,” Nash explained, “defined man’s achievement as he advanced toward civilization.”[43] William Bradford, the founder and future governor of the Plymouth Colony in present-day Massachusetts, exemplified this perspective on the forests. When Plymouth settlers surveyed their surroundings in 1620, Bradford reported that they encountered a “hidious & desolate wilderness, full of wild beasts & willd men and what multituds ther might be of them they knew not.”[44] According to Bradford, the “whole countrie, full of woods & thickets, represented a wild & savage heiw.”[45] As these comments implied, Bradford and his fellow colonists sought to tame and civilize their physical environment by clearing, cultivating, and conquering the wildness and savageness of their surroundings.

Even as these vast forest regions repulsed many who settled in what would become the United States, the environment also offered great economic opportunities. Trees represented, as Eric Rutkow contends, “the ideal marketable commodity for a colonial expedition: unlimited in supply, simple to harvest, and able to serve as the raw material for countless manufactured goods.”[46] Richard Hakluyt, a late sixteenth-century English geographer and proponent of British colonization and settlement in North America, declared the region “infinitely full fraughte with swete wooddes of ffyrr, cedars, cypres, and with divers other kinds of goodly trees.”[47] As soon as possible, Hakluyt

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[43] Nash, *Wilderness and the American Mind*, 9.

[44] William Bradford, *History of Plymouth Plantation* (Boston: Massachusetts Historical Society, 1856), 78.

[45] Ibid., 79.

[46] Rutkow, *American Canopy*, 13.

[47] Richard Hakluyt, *Discourse on Western Planting*, ed. Charles Deane (Cambridge: Press of John Wilson and Son, 177), 105.

recommended, colonists should begin the work of “settinge up mylles to sawe them” so that “wee may with spede possesse infinite masses of boordes of these sweet kindes, and these frame and make ready to be turned into goodly chestes, cupboordes, stooles, tables, deskes, &c., upon return.”[48]

The abundance of these forest resources impressed Hakluyt and others investing in and pushing for colonization and settlement in North America because Europe, and particularly, England, experienced what Hakluyt termed a “present wante of tymber in the realme.”[49] This careful phrasing minimized the timber crisis that afflicted England and other European countries since at least the thirteenth century.[50] Citizens of these empires depended on wood to cook and heat their homes; people who could not afford firewood, which increased in price due to shortages, starved or froze to death.[51] Emphasizing the importance of wood to the empire’s success, English intellectual and writer John Evelyn informed the Royal Society in 1662, “we had better be without gold than without timber.”[52] The bountiful forests of North America—government officials, business investors, and potential settlers hoped—might alleviate this problem. Frances

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[48] Ibid.

[49] Ibid.

[50] Brooke Hindle, ed., *America’s Wooden Age: Aspects of its Early Technology* (Tarrytown, New York: Sleepy Hollow Restorations, 1975), 3; Williams, *Americans and Their Forests*, 5; Joachim Radkau, *Wood: A History*, trans. Patrick Camiller (Malden, Massachusetts: Polity Press, 2012), 2 and 137;

[51] Sean Adams, *Home Fires: How Americans Kept Warm in the Nineteenth Century* (Baltimore: Johns Hopkins University Press, 2014); Rutkow, *American Canopy*, 13.

[52] John Evelyn, *Silva: Or, A Discourse of Forest Trees* (London: A. Ward, 1786), 216.

Higginson, a Puritan minister in Salem, Massachusetts, underscored this need and pronounced, “Here is good living for those that love good fires.”[53]

In addition to home heating and cooking, wood also fed the fires of manufacturing industries and played a vital role in leather making, copper smelting, glassmaking, iron forging, and other industrial processes.[54] As the last chapter discussed, wood also proved crucial to shipbuilding and the expansion of naval power.[55] The English ships built at the time Hakluyt praised the sylvan resources of North America, “required about two thousand mature oaks, which meant at least fifty acres of forest had to be stripped.”[56] In addition, empires needed alternate supplies of lighter wood for the great masts, often over 100 feet tall and several feet wide, which braced the ship’s sails and withstood fierce storms and intense battles.[57] The tar, pitch, turpentine, and other naval-stores products that shipbuilders used to construct and maintain these colossal vessels also motivated the quest to locate great stands of timber.[58] In a promotional tract about the resources awaiting potential investors and colonists in Virginia, the Virginia Company boasted about the region’s cornucopia of trees, especially when compared with “the scattered Forrest of England” and the

[53] Francis Higginson, *New-Englands Plantation: with the Sea Journal and Other Writings* (Salem, Massachusetts: Essex Book and Print Club, 1908), 102.

[54] Hindle, *America’s Wooden Age*, 4; Rutkow, *American Canopy*, 14.

[55] Radkau, *Wood*, 137.

[56] Rutkow, *American Canopy*, 14;

[57] John Perlin, *A Forest Journey: The Story of Wood and Civilization* (Woodstock, Vermont: The Countryman Press, 2005), 282; Rutkow, *American Canopy*, 14.

[58] Ibid.

“diminished Groves of Ireland” that could not hope to “supply the defect of our Navy.”[59] “When in Virginia there is nothing wanting, but only mens labour, to furnish both Prince, State and merchant, without charge or difficulty,” the company crowed.

The conviction that indeed forests were commodities for the good of a nation and its people persisted long after colonies secured their independence from Great Britain. Justifying America’s westward expansion and the removal of Native Americans from their homelands, President Andrew Jackson questioned the logic of anyone who disagreed with his position in an 1830 address:

> What good man would prefer a country covered with forests, and ranged by a few thousand savages to our extensive Republic, studded with cities, towns, and prosperous farms, embellished with the improvements which art can devise or industry execute, occupied by more than 12,000,000 happy people and filled with all the blessings of liberty, civilization, and religion?[60]

In Jackson’s eyes and the eyes of many Americans, a deforested landscape symbolized advancement, opportunity, success, and security. This prevailing attitude contributed to an American tradition of viewing “the forest as an enemy to be overcome by any means fair or foul,” as American historian Francis Parkman concluded in 1885.[61] William B. Greeley, who became chief of the U.S. Forest Service in 1920, echoed Parkman’s assessment, commenting that the U.S. had a “great national appetite for

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[59] Peter Mancall, ed., *Envisioning America: English Plans for the Colonization of North America, 1580-1640* (Boston, New York: Bedford Books, 1995), 129, 132.

[60] Andrew Jackson, “Jackson’s Message to Congress on ‘Indian Removal,’” in *Our Documents: 100 Milestone Documents from the National Archives* (Oxford: Oxford University Press, 2003), 71.

[61] Francis Parkman, “The Forests and the Census,” *The Atlantic Monthly* 55, no. 332 (June 1885): 836.

wood," evidenced by their "energetic attack upon the forests."[62] Based on these ideas, many citizens regarded railroads and the other industries clearing the forests and utilizing wood as performing a vital service that civilized the landscape and moved the nation forward.

The country's bountiful forest resources, traditional fears and beliefs about wilderness, the need to make colonial ventures profitable, and the desire to satisfy a demand for scarce timber produced what historian Brooke Hindle identified as "a technology broadly based upon wood and a society pervasively conditioned by wood."[63] (Figure 3-3) While timber scarcity compelled Europeans to economize their resources, Americans did not share these misgivings—at least, for most of the nineteenth century. As a result, Rutkow explains, "Intensive wood use had become a profound part of the national mind-set."[64] James Hall, the nineteenth-century American author who classified the U.S. as a "wooden country" clearly explained why citizens used wood "with prodigality"—it was simply cheaper and more available than other materials.[65] This meant that Americans harnessed wood "for all purposes to which it is necessarily applied," but they also employed it "in numberless instances, for substances which, under other circumstances, would have been more suitable."[66]

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[62] W. B. Greeley, "The Relation of Geography to Timber Supply," *Economic Geography* 1, no. 1 (March 1925): 2-3.

[63] Hindle, *America's Wooden Age*, 3.

[64] Rutkow, *American Canopy*, 70.

[65] Hall, *Statistics of the West at the Close of the Year 1836*, 101-100.

[66] Ibid., 100-101.

Economist Nathan Rosenberg affirmed Hall's assessment, explaining, "wood was a far cheaper raw material," which contributed to America's total dependence on this substance.[67] He also maintained that America's industrial experience differed significantly from that of Europe, especially Great Britain, because of "the profusion of forest resources" in North America.[68] "Whereas much of Britain's early industrialization effort should be understood as a deliberate attempt to overcome the constraints imposed by dependence upon organic materials, Americans possessed no similar inducement," Rosenberg argued.[69] Because countries like Great Britain lacked the abundant resources that Americans enjoyed, they had to develop alternate technologies, harness other materials, and use wood sparingly. In contrast, the natural "endowment" Americans enjoyed allowed them to focus on "technology specifically geared to the intensive exploitation of natural resources."[70] A comparison of circular saws in America and England highlighted these differences. John Richards, a nineteenth-century expert in woodworking equipment and operation, informed readers that circular saws in America were typically twice the width of the saws English woodworkers used. This increased size led to more waste, but Richards observed this was not a concern to most Americans.[71] Increase Lapham, a naturalist, geologist, and

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[67] Nathan Rosenberg, "America's Rise to Woodworking Leadership," in *America's Wooden Age: Aspects of its Early Technology*, ed. Brooke Hindle (Tarrytown, New York: Sleepy Hollow Restorations, 1975), 38.

[68] Ibid.

[69] Ibid., 41.

[70] Ibid.

[71] John Richards, "The Development of Wood-Working Machinery," *The Engineering Magazine* 16, no. 6 (March 1899): 932-933.

surveyor who designed landmark projects such as the Erie Canal, connected the nation's increased prosperity and industrial power to its forest resources. He admitted in 1858 that "Few persons. . .realize . . .the amount we owe to the native forests of our country for the capital and wealth our people are now enjoying."[72] Without an abundant and affordable supply of wood, he contended, "we should be reduced to a condition of destitution."[73]

Although many European visitors commented on Americans' "wastefulness" of wood, Rosenberg described this as a general feature of the country's technological adaptation."[74] A comparison of lumber consumption in the United States and the United Kingdom highlights how improvidently Americans exploited wood. From 1799 to 1869, the U.S. consumption of timber steadily outpaced that of the U.K. by more than half. In 1799, Americans consumed over 300 million board feet of timber while residents in the U.K. only consumed about 100 million board feet. These numbers continued to climb, and by 1869, Americans devoured almost 13 billion board feet while citizens in the United Kingdom only used about 2 billion board feet.[75] In the early nineteenth century, Rutkow notes, "Americans on a per capita basis consumed almost six times more lumber than their British counterparts," and "as late as 1840, roughly 95 percent of the nation's energy needs for heating, lighting, and locomotion still came from trees."[76]

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[72] Increase Lapham, "The Forest Trees of Wisconsin," *Wisconsin State Agricultural Society, Transactions*, 4 (1855): 196-197.

[73] Ibid.

[74] Rosenberg, "America's Rise to Woodworking Leadership," 54.

[75] This information is available on p. 56 Rosenberg's chapter.

[76] Rutkow, *American Canopy*, 70.

Reflecting on the country's unquenchable appetite for wood in 1925, Greeley, chief of the U.S. Forest Service, further reinforced Americans' gross consumption of timber: "In 1840 the per capita consumption of lumber probably did not exceed 100 board feet. By 1906 it had become 516 board feet."[77]

The terminology Americans employed to describe their country's forest wealth also stressed profligacy. Historical geographer Michael Williams observed that Americans traditionally referred to "rough-cut wood and felled trees" as "lumber" not "timber," which "was indicative of attitudes, for these materials were something that 'lumbered the landscape'; they were useless and cumbrous."[78] A 1906 article in the journal *Wood Craft* labeled the curious term "lumber" as a "pure Americanism," rarely "used in Great Britain or on the continent of Europe, where 'timber' and 'wood' or 'wood goods' are the terms used."[79] Williams summarized this uniquely American outlook: "Standing timber was regarded as a waste material, of which there was an overabundance; in many places it had a value of less than zero. Bare land was worth more than land and trees."[80] Hall and other Americans residing in the United States during this period forecast no change in how Americans used timber, at least not until wood "shall cease to be cheaper than the substances which might be used in its place."[81]

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[77] Greeley, "The Relation of Geography to Timber Supply," 2-3.

[78] Williams, *Americans and Their Forests*, 4.

[79] "Timber and Lumber," *Wood Craft* (May 1906): 48.

[80] Williams, *Americans and Their Forests*, 4.

[81] Hall, *Statistics of the West at the Close of the Year 1836*, 101.

When combined with the potential for profit and the motivation to civilize the landscape, this disparaging view of trees prompted wide-scale deforestation. By removing trees and subduing the physical environment, as Andrew Jackson's 1830 speech implied, Americans fulfilled their "manifest destiny." According to this idea, first articulated by nineteenth-century magazine editor and booster John O'Sullivan, God bestowed a divine right on Americans to expand westward toward the Pacific, extending the nation's physical boundaries, but also its power.[82] Under the mantle of this doctrine, Americans removed all obstacles—including trees—that limited or threatened their growing empire.

Railroads served as the engine of Manifest Destiny, providing the crucial "infrastructure of westward expansion" and linking distant regions together.[83] Analyzing the impact of railroads on American history, Christian Wolmar, a British journalist and railway historian, asserted that railroads "transformed American society, changing it from a primarily agrarian economy to an industrial powerhouse."[84] In addition, railroads catalyzed the "economic development that enabled the country to become the world's richest nation.[85] This transformation occurred in a relatively short span of time. By 1840, only about 2,800 miles of railroad track existed in the U.S., but this figure increased to almost 200,000 miles of track by the turn of the twentieth century, which distinguished

[82] John O'Sullivan, "The Great Nation of Futurity," *The United States Democratic Review* 6, no. 23 (November 1839): 426-430.

[83] Rodney P. Carlisle and J. Geoffrey Golson, *Manifest Destiny and the Expansion of America* (Santa Barbara, California: ABC-CLIO, 2007), 65.

[84] Christian Wolmar, *The Great Railroad Revolution: The History of Trains in America* (New York: Public Affairs, 2012), xix.

[85] Ibid.

the United States' railroad network as the largest in the world.[86] In 1866, an American horticulturalist described the onslaught that ensued when railroads whittled their way across the landscape: "Even where railroads have penetrated regions abundantly supplied, we soon find that all along its track timber soon becomes scarce."[87] This scarcity occurred, he explained, "For every railroad in the country requires a continued forest from one end to the other of its line to supply it with ties, fuel, and lumber for building their cars."[88] Unfortunately, Americans soon learned that the forest was not as continuous as they once thought.

While their European counterparts experimented with coal, iron, steel, and other alternatives much earlier, the operators of American railroads stubbornly stuck with wood, which one historian terms "that stalwart of American development."[89] Compared with these more modern options, wood offered "familiarity" since it was a "well-tried, and relatively low-cost material, which could be improvised, fabricated, and adapted in numerous ways by unskilled labor."[90] Geographer Michael Williams noted that ease of transportation also played a role in its appeal because, "It could be brought onto the site of construction by established means of communication via rivers, or it could come behind the railroads as they splayed across the prairies."[91] While European railroads

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[86] M. G. Kern, "Report on the Relation of Railroads to Forestry Supplies and Forestry," in Department of Agriculture Forestry Division, Bulletin No. 1 (Washington: Government Printing Office, 1887), 12; Todd Timmons, *Science and Technology in Nineteenth-Century America* (Westport, Connecticut: Greenwood Press, 2005), 21. Wolmar, *The Great Railroad Revolution*, 288.

[87] Fuller, *The Forest Tree Culturist*, 12.

[88] Ibid.

[89] Rutkow, *American Canopy*, 100.

[90] Williams, *Americans and Their Forests*, 346.

[91] Ibid.

embraced “steel, earth, and stone” to build “bridges, banks, tunnels” and other infrastructure along railroad lines, Americans preferred wood because it was less expensive and easier to produce and install.[92] Explaining the railroads’ reliance on wood, geographer Sherry Olson argues, “Low in initial cost, of light weight to ship or float, wood could be handled by unskilled labor and framed or fabricated to standard sizes with simple equipment at the building site. Wood could be patched, replaced, and rebuilt more easily than the ‘permanent’ materials.”[93] The railroads’ almost total dependence on this material reinforced Rosenberg’s argument that “intensive exploitation of natural resources” such as wood characterized the nineteenth-century American industrial experience.[94]

Although railroads soon gained a negative reputation for their “terrific onslaught” against trees, some leading foresters also suggested that railroads were no different from other industries in their heavy use of forest resources.[95] In an 1878 report on the status of America’s forests, Franklin B. Hough, known as the “father of American forestry” and the first chief of the U.S. Division of Forestry, emphasized the recurring nature of this exploitation: “It has been observed in all countries and at all periods, that trees furnishing products demanded by commerce or standing in the way of cultivation become an object of inconsiderate waste.”[96] Similar to Hough, H. E. Davis, who worked

[92] Ibid.

[93] Sherry H. Olson, *The Depletion Myth: A History of Railroad Use of Timber* (Cambridge, Massachusetts: Harvard University Press, 1971), 10.

[94] Rosenberg, “America’s Rise to Woodworking Leadership,” 41.

[95] Greeley, ““The Relation of Geography to Timber Supply,” 3.

[96] Franklin B. Hough, *Report Upon Forestry* (Washington: Government Printing Office, 1878).

for the Grasselli Chemical Company in the early twentieth century, depicted the lack of interest in forest conservation as a more widespread issue and one not strictly limited to railroad operators and owners:

> The woodsman chopped down trees, the sawyer in the mill worked on the logs, and lumber manufacturers, wholesalers and retailers were concerned chiefly with immediate sales. Little thought was given to the lasting qualities of wood. What if it did rot, burn, or was eaten by insects? Replacements would merely increase output and revenue. Who cared? Wood was cheap and plentiful."[97]

As Davis's comment implied, few Americans questioned whether their supply of timber would hold up. Instead, they perceived their nation's stock as "inexhaustible."[98] As a result, the country's railroads acted in accordance with this view. Davis also remarked, "Little consideration was given to practicing economy, either in the forest or elsewhere. It seemed unnecessary."[99] Forester M. G. Kern agreed. "At the time when the railways were undertaken, it is evident that an abundance of material for construction existed throughout the timbered district, and that no real value was placed on the material, which, though indispensable, was everywhere encumbering the ground," he reported in an 1887 bulletin.[100] Railroads quickly set about removing these encumbrances, which they accomplished on an unprecedented scale.

The railroads, more so than the transportation revolutions that preceded them, contracted time and space, bringing people, environments, information, and materials in

[97] H. E. Davis, "Wood Preservation: An Economic Gain," *The DuPont Magazine* (June 1930): 4, Folder Wood Preservation 2, Box 47, US Forest Service Newspaper Clipping File, Forest History Society, Durham, North Carolina.

[98] Ibid.

[99] Ibid.

[100] Kern, "Report on the Relation of Railroads to Forestry Supplies and Forestry," 14.

contact faster and more easily than ever before.[101] This meant that when loggers and railroads depleted one region's supply, such as the pine forests of the Northeast, they simply moved on to a new frontier, following the railroad's expansion and extension westward and southward. Onlookers witnessed the railroads' rapid devastation as lines "spread into all regions of the country," and the "effects on the forests could be calculated precisely from the length of the line and the rate of replacement," as Williams explained.[102] Bernhard Fernow, chief of the U.S. Department of Agriculture's Division of Forestry in the late nineteenth century, also emphasized the railroads' impact on previously "distant forest areas," which now lay "within reach of markets."[103] Evaluating the effect of railroads on the development of Chicago and its hinterlands, environmental historian William Cronon addresses how the lumber industry became "less bound to the flooding streams and the wheel of the seasons" since "woodsmen could cut and transport trees year-round."[104] In addition, railroads eliminated loggers' dependence on rivers for transit. "Trees that had never before been marketable because they did not readily float—ash, oak, hickory, maple, and other hardwoods—sold at a profit now that they could ride the rails," Cronon confirmed.[105]

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[101] Valeska Huber, *Channeling Mobilities: Migration and Globalisation in the Suez Canal Region and Beyond, 1869-1914* (New York: Cambridge University Press), 10.

[102] Michael Williams, "Industrial Impacts on the Forests of the United States, 1860-1920," *Journal of Forest History* 31, no. 3 (July 1987): 121.

[103] B. E. Fernow, "Introductory," in *Department of Agriculture Forestry Division, Bulletin No. 1* (Washington: Government Printing Office, 1887), 7.

[104] William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton & Company, 1991), 198.

[105] Ibid.

While railroads opened new regions of the country, drastically increasing the supply of available timber, the demand and the misperception that American forest resources were limitless led to what Fernow criticized as “wasteful and destructive methods of utilization.”[106] The worst offenses, according to foresters, occurred to satisfy the railroads’ need for ties. “By all means the largest consumption and the most valuable timber is that for railway ties,” Kern acknowledged.[107] A nineteenth-century lumber journal also conceded, “There is no branch of the lumber industry where there is more waste of raw material.”[108] The prevalent belief that the American timber supply knew no limits delayed the growth of forestry in the U.S. and also kept railroads and timber interests from professionalizing, standardizing, and testing their ideas about how to manufacture railroad ties. This resulted, as geographer Michael Williams demonstrated, in a “wasteful mode of exploitation” that “had little scientific basis.”[109]

Although they lacked concrete evidence, many individuals in the railroad industry believed that the longevity of ties could be extended if produced from younger, second-growth trees, which wiped out young stands before they could reach maturity, reproduce, and regenerate the forests.[110] Responding to an early 1880s U.S. Division of Forestry canvass about the timber used for railroad ties, the Atchison, Topeka, and Santa Fe Railroad noted, “Prefer young and growing timber, as being more durable than

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[106] Fernow, “Introductory,” 7.

[107] Kern, “Report on the Relation of Railroads to Forestry Supplies and Forestry,” 17.

[108] Quoted in Kern, “Report on the Relation of Railroads to Forestry Supplies and Forestry,” 15-16.

[109] Williams, *Americans and Their Forests*, 349.

[110] Ibid., 349.

that which has stopped growing, or which has reached or passed its maximum vitality."[111] The Baltimore and Ohio and Chicago Railroad concurred, noting, "Young thrifty trees required for good ties," and the Burlington, Cedar Rapids, and Northern Railroad justified, "Small timber preferred, because it is more apt to be sound."[112] In 1890, the U.S. Forestry Division reported that at railroads' insistence, "The bulk of tie material is now largely cut from second growth. . . . From trees that will make only one tie, or at least only one tie from a cut."[113] Fernow derided this widespread misperception: "But the idea that the young wood is more durable because it is young, which seems to prevail among railway managers, must be considered erroneous.[114]" Because railroads preyed on younger trees, Fernow and other foresters remonstrated, "the young promising crop of the future is utilized prematurely."[115]

Making matters worse, many railroads specified that ties be made predominantly from "the inner heartwood," and they simply jettisoned the tree's "outer sapwood."[116] Railroads prized heartwood because, as environmental historian Mark Derr explained, it contained a "dense, hard core of accreted dead cells that combines beauty with

[111] F. B. Hough, "Report on Kinds and Quantity of Timber Used for Railroad Ties," in *Report on Forestry: Volume 4* (Washington: Government Printing Office, 1884), 150.

[112] Ibid., 150 and 151.

[113] Fernow, "Introductory," 7.

[114] B. E. Fernow, "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," in *Department of Agriculture Forestry Division, Bulletin No. 4* (Washington: Government Printing Office, 1890), 18.

[115] Fernow, "Introductory," 8.

[116] Williams, *Americans and Their Forests*, 349.

strength and resistance to decay and termites."[117] While using only the most durable and decay-resistant parts of the tree likely lengthened the tie's life of service, it led to large-scale waste as tie cutters and timbermen discarded the other parts of the tree. Former loggers in the longleaf pine forests of the American South confessed to Lawrence Earley that they "burned up a fortune in timber, but there just wasn't any market for it back then."[118]Another lumberman admitted, "What they throwed away back then is better than what we have now."[119]

Most railroads, according to the U.S. Division of Forestry poll, also favored ties "hewn" by hand with a broad-axe rather than "sawn ties" produced in sawmills.[120] (Figure 3-4) While few articulated clear reasons for this preference, some echoed the Ashburnham Railroad's rationale: "Think a hewn tie will last from one to two years longer than a sawed one, for the reason that hewing shuts up the pores, whereas sawing leaves them open, and not so smooth on the face."[121] Assessing this tendency, Fernow noted, "It is claimed by some roads that hewn ties will last 30 per cent., or from one to three years, longer that sawn. The reason is obvious. The sawn face is more or

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[117] Mark Derr, *Some Kind of Paradise: A Chronicle of Man and the Land in Florida* (Gainesville: University Press of Florida, 1998), 109.

[118] Quoted in Lawrence Earley, *Looking for Longleaf: The Fall and Rise of an American Forest* (Chapel Hill: University of North Carolina Press, 2004), 169.

[119] Ibid.

[120] Fernow, "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," 22.

[121] Hough, "Report on Kinds and Quantity of Timber Used for Railroad Ties," 149.

less rough and collects water, and thus gives opportunity for fungus growth, while the smoother face of the hewn tie sheds the water."[122]

While foresters admitted there might be some logic behind this practice, it led to great waste because the process of hand hewing ties was much less precise. "All the wood that is hewed off is wasted," forestry professor Albert Pulling pronounced in a 1922 *American Forestry* article criticizing the practice of relying on hand-hewn ties.[123] "If the ties were sawed," he argued, "much valuable material could be taken from the tie slabs that would otherwise be a total loss."[124] An article on railroad tie production published in a Michigan farming magazine also detailed how "Hewing is a very wasteful method of tie production."[125] To conserve labor and time, "many of the larger trees are cut with unnecessary high stumps in order to save labor in hewing down the butts. In many other cases the trees are not used as far up into the tops as they might be."[126] In addition to wasting valuable parts of the tree, the author deplored the fact that hewing "leaves in the woods a quantity of litter in the shape of slabs and chips in which fire is often started and the forest seriously damaged."[127]

The railroads' predilection for hewn ties clearly exploited trees, but also the people producing ties. After performing the dangerous work of felling trees, laborers

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[122] Fernow, "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," 22.

[123] Albert V. S. Pulling, "Simple Forest Conservation," *American Forestry* (April 1922): 216.

[124] Ibid.

[125] "Railroad Ties of Loblolly Pine," *The Threshermen's Review* (May 1905): 15

[126] Ibid.

[127] Ibid.

known as tiehacks wielded heavy broadaxes to convert the natural rounded log to a squared off piece of timber, carving out and smoothing the log with the axe to create a straight and even tie. After considerable effort, a tie hack might only produce “one tie to the tree” and the work was far from pleasant.[128] One veteran tiehack described the broad-axe as a “tool the Devil invented for a joke” and pronounced ties to be “misery sticks,” which reinforced the difficulty of the job.[129] Tiehacks often labored in isolated areas, earning money, not at an hourly rate, but by the piece for the number of ties they cut. This piecework system, also employed in wood-preserving plants and discussed in the sixth chapter of this study, often privileged companies at the expense of workers.[130] As historian William Wroten pointed out, much of the money that railroad companies paid for ties, lined contractors’ pockets, not the actual workers hewing ties.[131]

Despite the difficult nature of this labor, people in rural, forest areas often relied on and supplemented their income by producing ties from their own property or working for railroads and lumber companies on a seasonal basis. These jobs “made an important contribution to farm capital and purchasing power in the least-developed parts of the country,” especially the American South and West.[132] Studying the railroad tie industry in the Central Rocky Mountain forests at the turn of the twentieth century,

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[128] Fernow, “Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use,” 22.

[129] Geoff Marples, “The Tiehack: Part 1,”’ *British Columbia Forest History Newsletter* 60 (August 2000): 3 and 1, http://www.fhabc.org/publications/past-newsletters (accessed August 21, 2017).

[130] William Harvey Wroten, Jr., “The Railroad Tie Industry in the Central Rocky Mountain Region: 1867-1900” (Ph.D. diss., University of Colorado, 1956) 242.

[131] Ibid., 251.

[132] Williams, *Americans and Their Forests*, 349.

Wroten found that, “In many communities over fifty per cent—and in some communities over ninety percent—of the forest industry was devoted to the manufacture of ties.”[133] In tie-making regions such as Illinois and Indiana, Olson discovered that “ties were cash crop and local currency.”[134]

Railroads, however, cared little for the economic and social plight of the individuals cutting ties; they cared about securing a steady and cheap supply. While they sometimes purchased ties from individual producers such as small farmers, railroads often turned to larger contractors and lumber companies or even established their own railroad camps where they harvested timber for ties at the same time they constructed their lines.[135] Few scholars have studied the tie industry in detail, likely because, as Wroten suggested, modern technology rendered the tiehacks’ “profession obsolete” and these “operations were carried on far back in the forests” and “many miles from ‘civilization’ ”[136] The labor of these workers is also less visible in the historical record because the companies and industries they worked for frequently considered them to be transient or “casual” laborers.[137]

Despite these challenges, existing scholarship and historical evidence suggest that larger tie-producing operations often harnessed the labor of poor immigrants and African Americans, those lowest in the economic and social hierarchy. When he

[133] Wroten, “The Railroad Tie Industry in the Central Rocky Mountain Region,” 156.

[134] Olson, *The Depletion Myth*, 23.

[135] Wroten, “The Railroad Tie Industry in the Central Rocky Mountain Region,”, 15.

[136] Ibid., 294.

[137] Jeffrey Marcos Garcilazo, *Traqueros: Mexican Railroad Workers in the United States, 1870-1930* (Denton, Texas: University of North Texas Press, 2012), 7.

examined the tie industry in the Rocky Mountain region from 1867 to 1900, Wroten identified tie camps as “melting pots, with a dash of northern Europeans, a sprinkling of Latins, and a few Africans.”[138] Many of the immigrant tie cutters in this area hailed from French Canada, Scandinavian countries, and Italy.[139] In the American South during the same period, railroads learned that they could contract convict labor to produce ties, saving considerable funds in the process.

Arthur Pew, an engineer involved with the construction of “what is supposed to be the cheapest railroad that has ever been built to do a regular freight and passenger business” boasted about keeping costs low with convict labor in an 1890 paper presented to the American Society of Civil Engineers.[140] While “under the direction of skilled foremen,” a group of “about forty convicts” built this railroad, including hewing ties, which ran from Wrightsville to Dublin, Georgia.[141] Pew emphasized the railroads’ labor savings, noting, “The price paid for the convicts was a dollar a day each.”[142] The convicts, of course, did not collect these funds, their jailers did.

While the tie industry appeared to be a predominantly male occupation, in a recent study of black women and convict labor in the New South, historian Talitha LeFlouria suggests this might not have been true across the United States. According to LeFlouria, “Georgia’s railroad system was the first industry to experiment with the use of

[138] Wroten, “The Railroad Tie Industry in the Central Rocky Mountain Region,” 211.

[139] Ibid.

[140] Arthur Pew, “The Cheapest Railroad in the World,” *Transactions of the American Society of Civil Engineers* (September 1890): 112.

[141] Ibid., 112 and 113.

[142] Ibid., 113.

black female prison labor," and by 1874, Grant, Alexander, and Company—an Atlanta-based contracting firm—hired out 32 black female convicts—many of whom were former slaves—to the Macon & Augusta, Brunswick & Albany and Air-Line Railroads."[143] "In the railroad camps operated by William Grant and Thomas Alexander, female convicts did the same kind of work as men," LeFlouria explained, including cutting and hauling railroad ties.[144] They also confronted the same abuses as their male counterparts; brutal "whipping bosses" flogged and beat workers they deemed unproductive, challenging, or troublesome. In addition, female convicts faced vicious sexual assaults and rape.[145]

Free African Americans also found themselves laboring under similar conditions while hewing railroad ties in the forests of the American South. In *Slavery By Another Name*, Pulitzer-Prize winning journalist Douglas Blackmon exposed how whites systematically re-enslaved blacks through oppressive practices such as convict leasing and debt peonage in turpentining, lumbering, railroad building, brick making, and mining operations throughout the region. Even blacks who had not been arrested and sentenced to labor in this terrible environment had few other employment options. Investigating conditions in the early 1900s in Columbiana, an Alabama town located on the Southern Railway's line between Eufaula and Birmingham, Blackmon shows "there were hardly any jobs for cash to be had for a black man, unless he was willing to take

[143] Talitha L. LeFlouria, *Chained in Silence: Black Women and Convict Labor in the New South* (Chapel Hill: The University of North Carolina Press, 2015), 69.

[144] Ibid., 70.

[145] Ibid., 70 and 77.

up a cotton hoe or venture into the giant lumber camps on the rail lines thrusting into the swampy jungle forests below the Florida state line, or across the Georgia border."[146]

Railroad companies often lured African Americans in with the promise to "pay $2 a day for a strong hand who could handle an axe, cutting trees or shaping rail ties."[147] Once there, black workers found themselves isolated and under the control of camp bosses who reinforced their authority with armed guards, dogs, and violence. "And there was no knowing whether the Southern Railway or any other company would keep its word to pay the amount it promised, or even to feed men or keep them out of the rain and swamps," Blackmon reminded.[148] Corrupt county officials also received rewards for returning any workers who tried to escape their terrible conditions. Thus, these "free labor camps" where workers produced railroad ties "functioned like prisons."[149]

While small farmers who cut ties on their own property possessed a greater degree of control over their labor conditions compared with immigrants, convicts, and African Americans, railroad companies still restricted their potential for profit. In the hopes of earning extra money, Williams explained, farmers, laborers, and loggers "cut readily and abundantly and oversupplied the railroad companies, who then controlled the selection of the quantity, quality, and price paid by merely adjusting the freight rate."[150] Because railroads continued opening up new regions of the country and

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[146] Douglas A Blackmon, *Slavery by Another Name: The Re-Enslavement of Black Americans From the Civil War to World War II* (New York: Anchor, 2013), 300.

[147] Ibid.

[148] Ibid.

[149] Ibid.

[150] Williams, *Americans and Their Forests*, 349.

accessing new stands of timber in the 1870s and 1880s, they "never felt the pinch of higher prices, the specter of scarcity, or the need to economize by using substitute materials."[151] The economic control the railroad exerted resulted in vast tracts of tie timber "cut down and delivered to the railroads at below their real value."[152]

Fernow agreed that railroads held all the cards in the tie industry, and there was "but small, if any, profit in the trade" for the individuals who provided the railroad with ties.[153] "The ties are in most cases brought to the railroads by holders of small wood lots," he detailed, "and the price paid is hardly more than fair compensation for labor in making and hauling the ties, no value being placed upon the material itself."[154] American railroads, Fernow charged, could also stymie competition and "keep the price low by raising freight rates, so as to make the exportation of tie timber from its territory unprofitable."[155] Railroad inspectors also regularly culled and "arbitrarily rejected" ties they deemed unacceptable—"at the owner's expense."[156] Calculating the gross waste associated with the railroad tie industry, Fernow calculated "it takes about 35 feet of clear lumber to make a merchantable tie," which only averaged eight feet in length.[157]

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[151] Ibid., 349.

[152] Ibid.

[153] Fernow, "Introductory," 8.

[154] Ibid.

[155] Ibid., 8.

[156] Fernow made these comments in a footnote in Kern, "Report on the Relation of Railroads to Forestry Supplies and Forestry," 16.

[157] Ibid, 15-16; Rutkow, *American Canopy*, 104.

After including the “culls,” he determined, “each tie represents about 75 feet of good merchantable lumber in the standing timber destroyed for it.”[158]

When one factored in the average number of ties that lined a single mile of railroad track—usually between 2,500 to 3,000—and multiplied this figure by the railroad’s ever-increasing track mileage, the amount of timber railroads consumed for ties seemed incomprehensible.[159] Applying Fernow’s estimates to the 163,000 miles of railroad track in the U.S. in 1880, railroads devoured approximately 14.3 billion to 17.1 billion feet of raw timber to produce ties for their lines.[160] After including the timber culls that railroads deemed unacceptable, the rate of timber depletion climbed to between 30.6 billion and 36.7 billion feet of timber.

These calculations did not even factor in the timber needed for ties that wore out or deteriorated and had to be replaced. Decay, rot, and mechanical wear greatly exacerbated the drain on the forests, forcing railroads to replace their ties every five to seven years, although many railroad engineers and foresters claimed the rate of replacement was often more frequent, especially in warm, wet climates.[161] Untreated ties made from durable hardwoods such as oak might exceed this average life expectancy, but when railroads fashioned ties from softer timber such as pine, the

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[158] Ibid., 16.

[159] Arthur M. Wellington, *The Economic Theory of the Location of Railways* (New York: John Wiley & Sons, 1887), 776; Mark Aldrich, *Death Rode the Rails: American Railroad Accidents and Safety, 1828-1965* (Baltimore: Johns Hopkins University Press, 2006), 58.

[160] Cynthia L. Clark, ed., “Railroad,” in *The American Economy: A Historical Encyclopedia, Volume 1* (Santa Barbara, California: ABC-CLIO Books, 2011), 369.

[161] “Railroad Consumption of Timber” *Annapolis Gazette*, July 15, 1873; T. J. Cram, *Report Upon the Decay and Preservation of Timber* (Washington, D.C. Engineer Department, 1871), 4; B. E. Fernow, *Timber Physics: Part 1 Preliminary Report* (Washington: Government Printing Office, 1892), 1.

length of service decreased considerably. In 1885, for example, the Houston and Texas Central Railway complained that short-leaf pine ties "will not last more than two years on or in the ground, or exposed to the weather."[162]

Railroad ties suffered great abuse because they supported what engineer Plimmon Dudley described as the "up-and down movement of the rails under all passing trains" and the "undulation of such tracks."[163] This constant "abrasion of the fibers under the rails" gradually wore down ties.[164] Rail spikes, anchors, bolts, and tie plates, which secured the rails to the ties, might also cause "injury to the wood," increasing its susceptibility to decay and rot and threatening its structural integrity.[165] In addition to the likelihood of mechanical wear, ties also fell victim to the fungi that caused decay and rot since they remained constantly exposed to the elements and faced great extremes and shifts in climate. Because railroads embedded ties in "earth ballast," the dirt, gravel, and sand that formed the base of the track, this damp environment also led to "a constant process of decomposition of the woody fiber," as one forester explained.[166] These factors combined to shape the life expectancy of ties and the rate at which they required replacement. Fernow reinforced the complexity of the situation, arguing "that the life of ties of the same timber varies considerably, not only according to climate, and character

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[162] American Society of Civil Engineers, "The Preservation of Timber," in *Transactions of the American Society of Civil Engineers*, 14 (July 1885): 346.

[163] P. H. Dudley, "Structure of Certain Timber-Ties; Behavior and Causes of Their Decay in the Road-Bed," in *Department of Agriculture, Forestry Division Bulletin No. 1 (Washington: Government Printing Office, 1887),* 55.

[164] Ibid.

[165] Ibid.

[166] Kern, "Report on the Relation of Railroads to Forestry Supplies and Forestry," 18-19.

of the timber, and the treatment the ties receive before being laid, but also according to the character of the road bed and the traffic."[167]

Wood, as an inherently variable material, also resisted the attempts of engineers, lumbermen, and foresters to impose order and uniformity on it.[168] Through trial and error, railroads learned not only that wood from different species exhibited great variation, but wood from trees of the same species and even from different parts of the same tree reflected distinct characteristics and engineering challenges. "Each living tree of the same species, therefore, converted into building material offers a different problem as to its properties, especially its strength, and each stick taken from a different part of the tree shows different quality," Fernow declared in his groundbreaking study *Timber Physics*.[169] This variability, as historian Charles Haines argued, made wood "a heterogenous composite material in which subtle, minor-seeming variations in structure cause major behavioral differences."[170]

Based on these conditions, railroads fought a losing battle to keep their ties in tip-top shape. Although estimates varied widely and many railroads did not keep accurate records, the U.S. Forestry Division reported that lines replaced between 60 and 80 million ties per year.[171] Geographer Sherry Olson "conservatively estimated" the rate of

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[167] Fernow "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," 24.

[168] Charles M. Haines, "The Industrialization of Wood: The Transformation of a Material" (Ph.D. diss., University of Delaware, 1990), 5.

[169] Fernow, *Timber Physics: Part 1*, 2.

[170] Haines, "The Industrialization of Wood: The Transformation of a Material," 5.

[171] Fernow, "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," 13-14.

renewal at 350 crossties per mile of track, and then used this figure to approximate the "millions of ties renewed each year."[172] Her research suggested that railroads replaced approximately 21 million ties in 1870, 37 million ties in 1880, and 70 million ties in 1890.[173] These calculations did not even include the number of ties required for the extension and construction of new track. Even if one applies Olson's estimates, which are lower than the U.S. Forestry Division's figures, the amount railroads paid to replace worn out cross ties is staggering. According to Olson, in 1880, "one major railroad paid thirty cents for hewing and hauling ties to the right-of-way, a cent for contractor's working capital, and an additional seven and a half cents for inspection, loading, stores, and distribution to points of use."[174] Labor costs to install ties added "roughly ten cents more" to this figure, making "the total cost in place" 48.5 cents per tie "or an annual cost over an eight-year life of about six cents."[175] This meant that in 1890, when railroads replaced 70 million ties that decayed and wore out, they spent roughly $42 million for renewals alone.

Most ties, however, did not even enjoy the eight-year service life Olson projected. The price per tie also increased in areas where timbermen and railroads exhausted local resources or regions such as the prairies that initially possessed a limited timber supply.[176] The cost of "labor and hauling" made up most of the expense

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[172] Olson, *The Depletion Myth*, 12.

[173] Ibid.

[174] Ibid., 14.

[175] Ibid.

[176] Ibid., 17.

associated with ties, which reflects what Fernow criticized as the railroads' lack of "value" or regard for "the material itself."[177]

While they did not appear to heed growing concerns about the limits of America's forest resources, railroads recognized cross ties cost their operations significant money. In a 1915 presentation to the American Wood Preservers Association, efficiency engineers Harrington Emerson and T. T. Bower discussed railroads' annual expense to replace ties, emphasizing the ties' significant drain on operating costs because they necessitated "a constant flow for replenishment."[178] Emerson and Bower noted that one railroad replaced ties "at the rate of 5 every minute."[179] Even if timber prices remained low, railroads still had to pay for the transportation, labor, and installation costs associated with tie renewal.

In the hopes of preventing decay, rot, and wear, they turned to trees with a reputation for being strong and resistant to rot, particularly white oak or *Quercus alba*. Americans inherited their affinity for this hardwood from the English who prized it for shipbuilding and barrel staves—especially after overcutting their home supply of oak.[180] Surveying the trees of central and eastern North America, renowned American naturalist and botanist Donald Culross Peattie concluded, "If Oak is the king of trees, as

[177] Ibid., 14; Fernow, "Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use," 8.

[178] Harrington Emerson and T. T. Bower, "A Method for Finding the Annual Charges For Ties," in *Proceedings of the Eleventh Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1915), 181.

[179] Ibid., 181.

[180] Perlin, *A Forest Journey*, 175-176.

tradition has it, then White Oak, throughout its range, is the king of kings."[181] White oaks once grew extensively throughout the central and eastern United States, with a range from "Southern Maine to the southern peninsula of Michigan, southwestern Minnesota, eastern Iowa, and southeastern Nebraska, south to western Florida, through the Gulf states to the Brazos River of Texas and eastern Oklahoma and eastern Kansas."[182]

Although they appreciated its abundance, railroads favored white oak because of its resilience. Engineers such as Plimmon Henry Dudley found "the oak holds a spike with great tenacity, and thus the rail is firmly fastened to the tie," which would minimize mechanical wear and hopefully extend the ties' life of service.[183] Master woodworker Paul McClure also emphasized the wood's appeal for outdoor uses: "Tiny bubble-like structures in the wood pores, called *tyloses*, keep liquids out, even when the wood is repeatedly wet and dried."[184] White oak's natural weatherproofing made it ideally suited for railroad ties, which needed to withstand the elements and resist decomposition.

These innate characteristics helped make "the wood of the white oak," as Dudley claimed, "the one most desired by railroad companies for ties" and they quickly set about clearcutting great stands.[185] By the late 1880s, their efforts had nearly exhausted the supply. Evaluating the railroads' drain on the forest to produce ties, Fernow

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[181] Donald Culross Peattie, *A Natural History of Trees of Eastern and Central North America* (Boston: Houghton Mifflin Company, 1966), 195.

[182] Ibid.

[183] Dudley, "Structure of Certain Timber-Ties; Behavior and Causes of Their Decay in the Road-Bed," 38.

[184] Paul McClure, "White Oak," *American Woodworker* (June 1998): 74.

[185] Dudley, "Structure of Certain Timber-Ties; Behavior and Causes of Their Decay in the Road-Bed," 38.

lamented that oak, “our most valuable timber, furnishes over 60 percent of the material, and not only from choice trees mostly, but from the young growth, which may make ‘one tie to the tree’ or ‘one tie to the cut.’”[186] Condemning this devastation, one American forester announced, “Many millions of young trees of the White Oak tribe are cut annually, each of which make but one tie. When one locality is exhausted, this scene of slaughter of the most valuable young timber is simply shifted to another.”[187]

While not everyone viewed these ravages against the white oak as a slaughter, it became clear to many people that railroads overextended their resources. “The demand for ties of this wood has been so imperative that large extents of territory once covered by this valuable timber have long since been denuded; what remains is so scarce and valuable that few companies are now able to obtain a supply of second-growth for ties,” one source reported.[188] Because railroads pillaged younger trees, they soon found that decay occurred much faster than the mighty oaks grew.

In addition to their depredations of white oak, American railroads hacked through the great longleaf pine forests of the American Southeast, hoping ties produced from this heavy, resinous, and sturdy timber would resist rot, decay, insects, and wear and tear. (Figure 3-5) *Pinus palustris*, known most commonly as the longleaf pine, ranged widely “over nearly 150,000 square miles,” stretching from “the James River in southeastern Virginia as far south as the shores of Lake Okeechobee in the Florida

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[186] Fernow, “Consumption of Forest Supplies By Railroads and Practicable Economy in Their Use,” 14.

[187] Kern, “Report on the Relation of Railroads to Forestry Supplies and Forestry,” 19.

[188] Dudley, “Structure of Certain Timber-Ties; Behavior and Causes of Their Decay in the Road-Bed,” 38.

peninsula and west to southeastern Texas."[189] Geographers estimate that when the Spanish invaded North America in the early sixteenth century, longleaf covered about 60 million acres of the American Southeast, and "mixed with other pines and hardwoods on an additional 30 million acres."[190]

As the name "longleaf" implies, larger cones and longer needles are the most recognizable and distinguishing physical features of the species. Compared with other faster-growing conifers such as slash pine, the slower-growing longleaf also reached greater heights between 50 to 100 feet, with a diameter between 1 ½ to 3 feet.[191] A "fire climax type" tree, longleaf requires "regular fires" to survive and flourish, and it adapted to the semitropical climate and frequent thunderstorms of the American Southeast with "thick bark, large seed size, inconsistent seeding, fall seed sprouting, and slow growth during the tree's early years."[192] The "cleansing" fires common in this region, as one forester explained, also removed underbrush and prevented hardwoods such as oak from choking out the longleaf.[193] In the process, the flames created an open, "park-like" setting that many visitors and naturalists noted when they visited the longleaf forests.[194] "The stately trunks rise forty to sixty feet and then spread out their dense foliage, which joins above like the arches of a cathedral. There is little or no undergrowth, and the view

[189] Earley, *Looking For Longleaf*, 1.

[190] Ibid.

[191] P. L. Buttrick, "Commercial Uses of Longleaf Pine," *American Forestry* (September 1915): 895.

[192] Thomas C. Croker, "Longleaf Pine: The Longleaf Pine Story," *Journal of Forest History* 23, no. 1 (January 1979): 34; Earley, *Looking for Longleaf*, 22.

[193] Croker, "Longleaf Pine," 34.

[194] Ibid.

fades into a maze of the column-like tree trunks," geographer Frederick Emerson remarked.[195] While many critics and visitors stereotyped the sandy, dry soils of this region as "infertile"—commonly denigrating the landscape as "pine barrens"—longleaf prospered in this environment.[196] A long, sturdy taproot, which anchors the top-heavy tree in the loose, sandy soil, while helping it find moisture deep in the ground, is essential to the longleaf's success in an inhospitable climate.[197]

Unknowing consumers and greedy salesmen often lumped longleaf together with other less-durable southern conifers such as loblolly and slash pine, misleadingly identifying any pine from the region as "southern pine" or "yellow pine." Confusion also arose since many states referred to longleaf by local and regional terms such as North Carolina pine, Georgia pine, Florida pine, pitch pine, and longstraw pine.[198] As one longleaf booster proclaimed, however, "the tree itself is absolutely characteristic, and once seen is always known."[199] After experiencing the longleaf pine forests in the late 1820s, for example, British traveler Basil Hall wrote, "There was something, I thought, very graceful in the millions upon millions of tall and slender columns, growing up in solitude, not crowded upon one another, but gradually appearing to come closer and

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[195] Frederick Emerson "The Southern Long-Leaf Pine Belt," *Geographical Review*, Vol. 7, No. 2 (Feb. 1919): 81.

[196] Ibid., 81.

[197] Richard W. Massey, Jr., "A History of the Lumber Industry in Alabama and West Florida, 1880-1914" (Ph.D. diss. Vanderbilt University, 1960), 20; "The Longleaf Pine: Identification and Characteristics," *American Forestry* (September 1915): 896.

[198] Buttrick, "Commercial Uses of Longleaf Pine," 897.

[199] Ibid., 896.

closer, till they formed a compact mass, beyond which nothing was to be seen."[200] Describing the longleaf over a century later, forester Thomas C. Croker observed, "Like huge wooden soldiers lined up in battle formation, the massive trees dotted the rolling coastal plains in a sea of grass. Gentle breezes, laden with a resinous perfume, rippled the long-strawed crowns and generated music both soothing to the ear and slightly mournful."[201] This unique tree also impressed esteemed visitors including naturalists William Bartram and John Muir, who commented on the tree's tall, slender form; the park-like setting of mature longleaf forests; and the vastness of the region.[202]

While the longleaf's uniqueness moved many to wax poetic, not everyone regarded it favorably. As Lawrence Earley demonstrated in his study *Looking for Longleaf*, many viewed these pine forests as "monotonous," "dreary," and "gloomy."[203] Sidney Lanier, a poet and musician that the Atlantic, Gulf and West India Transit Company hired to complete a guidebook on Florida in 1875, acknowledged that the " 'piney-woods' has come to be a phrase conveying a certain idea of inferiority."[204] Although Lanier admired the pines, many Americans did not view the trees as aesthetically pleasing, which helped ensure their destruction at the hands of railroad and timber companies.[205]

[200] Basil Hall, *Travels in North American in the Years 1827 and 1828, Volume 3* **(**Edinburgh: Cadell & Co., 1829), 256.

[201] Croker, "Longleaf," 32.

[202] Earley, *Looking for Longleaf*, 13-16.

[203] Ibid., 16.

[204] Sidney Lanier, *Florida: Its Scenery, Climate, and History* (Philadelphia: J.B. Lippincott & Co., 1876), 71.

[205] Ibid.

Although Americans disagreed over the longleaf's aesthetic virtues, they clearly recognized the value of its timber. Identifying the tree's key attributes, a 1915 *American Forestry* issue devoted to the longleaf emphasized its wood as "heavy, hard, very strong, tough."[206] The writer also noted that the tree was "very resinous" and "durable in contact with soil."[207] Compared with other trees, longleaf contained a large "proportion of heart wood," which attracted railroad companies who insisted on harvesting ties from this portion of the tree, rather than the softer and less decay resistant sapwood.[208] "These tall, straight pines, almost solidly heartwood and with little waste in excess branches, were the lumberman's ideal," historian Richard Massey stated.[209] In addition to its form, which lent itself well to the shaping of ties, poles, beams, and props, many longleaf boosters compared its strength favorably to steel and cast iron.[210] In a 1915 article on the commercial uses of longleaf, Yale trained forester Philip Buttrick asserted, "Weight for weight, it is stronger than steel."[211] These traits rendered longleaf an excellent choice for structural and building timbers, masts, flooring, fencing, and railway ties.[212]

The tree's high resin content also distinguished this area as containing "the greatest turpentine forests in the country," capable of generating great quantities of

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[206] Buttrick, "Commercial Uses of Longleaf Pine," 895.

[207] Ibid.

[208] Ibid.

[209] Massey, "A History of the Lumber Industry in Alabama and West Florida," 21.

[210] Buttrick, "Commercial Uses of Longleaf Pine," 905; Earley, *Looking for Longleaf*, 152.

[211] Buttrick, "Commercial Uses of Longleaf Pine," 905.

[212] Ibid., 896; Earley, *Looking for Longleaf*, 152.

naval stores products used to manufacture pharmaceuticals, varnish, paint thinner, glue, soap, cleaning solvents, lamp oil, and countless other commodities.[213] Before distilling the longleaf's resin into turpentine, rosin, pitch, and other byproducts, naval stores producers had to tap the pines the same way maple sugar harvesters tapped maple trees. They cut wounds in the tree, which prompted the pines to ooze valuable sap they then collected to distill and manufacture these solutions.[214]

Although English colonists and early American settlers eagerly extracted naval stores products as well as timber from the forests of the American Southeast, they could not access some of the largest stands of longleaf or easily export their goods without transportation inland.[215] "Some forms of lumbering had been going on for as long as there was a South," historian Edward Ayers explained, but the industry was generally a seasonal and part-time one until railroads arrived and "freed lumber companies from the tyranny of the river and made the industry a year-round enterprise."[216] After the Civil War, southern states ramped up railroad construction to catch up with the rest of the nation, providing companies with tax breaks and land grants that they could hardly refuse.[217] Attracted to these incentives and the longleaf's untapped potential, especially after decimating the supply of white-pine timber in the North and the Lake states, railroads and timbermen from places including Chicago, Michigan, and Wisconsin,

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[213] Earley, *Looking for Longleaf*, 98; Robert B. Outland, *Tapping the Pines: The Naval Stores Industry in the American South* (Baton Rouge: Louisiana State University Press, 2004), 6.

[214] Outland, *Tapping the Pines*, 6.

[215] Earley, *Looking for Longleaf*, 158.

[216] Edward L. Ayers, *The Promise of the New South: Life After Reconstruction*, 15th Anniversary Edition (New York: Oxford University Press, 2007), 123.

[217] Earley, *Looking For Longleaf*, 160.

eagerly made their way to the longleaf pine belt.[218] The havoc they wrought, as Earley notes, is "considered the most shameful chapter in the history of the American timber industry."[219] Bertram Wells, a botanist and ecologist, reinforced Earley's assessment, pronouncing the longleaf's destruction as "one of the major social crimes of American history."[220]

Railroads, timber companies, and corporate interests relentlessly exploited the longleaf pine until the land appeared "scarred and barren."[221] They practiced "cut-and-run logging," removing "everything in their path" because local and state governments charged higher taxes on "standing timber" than "cutover land."[222] Earley described the decline of longleaf as "death by a thousand cuts," and timber interests made many of those cuts to produce railroad ties.[223]

Charles Mohr, a German-born pharmacist and botanist who served as an agent with the U.S. Division of Forestry in the 1890s, published an exhaustive study investigating the resources of the southern pine forests, particularly the longleaf. He exposed the "enormous waste" and the "constant and increasing draft upon the forest" necessary to satisfy the railroads' "demand for ties."[224] Critical of the insistence that ties

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[218] Ayers, *The Promise of the New South*, 124; Earley, *Looking for Longleaf*, 159-160.

[219] Earley, *Looking for Longleaf*, 167.

[220] B. W. Wells and I. V. Shunk, "The Vegetation and Habitat Factors of the Coarser Sands of the North Carolina Coastal Plain: An Ecological Study," *Ecological Monographs* 1, no. 4 (1931): 487.

[221] Derr, *Some Kind of Paradise*, 109.

[222] Earley, *Looking for Longleaf*, 168.

[223] Ibid., 3.

[224] Charles Mohr, *The Timber Pines of the Southern United States* (Washington: Government Printing Office, 1897), 47.

“must be all heartwood and free from blemish,” he pointed out that railroads also only accepted the lowest portion or “butt cuts” of trees, which contributed to greater waste.[225] “On an average 10 cross-ties are cut from 1 acre, each tie representing a log which would make at least 75 superficial feet of lumber,” Mohr determined.[226] Even solid heartwood longleaf ties only lasted about “five or six years, and 3,000 ties are needed for 1 mile of road,” which worsened the strain on these forests.[227] Applying these figures in 1897, Mohr underscored the ensuing devastation: “Hence, for the construction of the 3,240 miles of railroad traversing the forest east of the Mississippi River, nearly 10,000,000 ties have been required, which being renewed every six years involves an annual cut of 116,000,000 feet, board measure, to which must be added the amount exported to other regions.”[228]

As railroads continued to expand and deplete alternate sources for ties, their annual cut of longleaf drastically increased. Evaluating the tree’s commercial uses in 1915, Buttrick noted, “The annual cut is estimated at 12,500,000,000 feet, its nearest rival is Douglas fir, which is estimated at 5,200,000,000 feet. Its old rival, white pine, has fallen off to about 2,500,000,000 feet.”[229] Reviewing annual statistics, he reported that “1907 seems to have been the banner year, when a cut of 13,215,185,000 feet was

[225] Ibid.

[226] Ibid.

[227] Ibid.

[228] Ibid.

[229] Buttrick, “Commercial Uses of Longleaf Pine,” 903.

reported."[230] Railroads also used much of the timber from this cut, consuming "34,215,000 yellow pine ties" in that year alone.[231]

Although these statistics are striking, the numbers do not adequately convey the scars this abuse inflicted on the landscape. Loggers, according to Earley, often left stumps "2 feet or higher" rather than the standard "18 inches."[232] They also discarded the tops of the trees, wasting a significant portion and leaving behind a wrecked and ruined landscape.[233] Forester Laurence Walker, concluded, "This was not simply a harvest."[234] Instead, he argued, the longleaf forests looked like a "panzer division had met its enemy there."[235] Nobel-Prize winning author William Faulkner depicted the aftermath in his 1932 novel *Light in August*. Abandoning the cutover land, the loggers, timbermen, and mills left behind a "a stumppocked scene of profound and peaceful desolation, unplowed, untold, gutting slowly into red and choked ravines beneath the long quiet rains of autumn and the galloping fury of vernal equinoxes."[236] (Figure 3-6)

When the timbermen and railroads cut and ran, as Faulkner's description suggested, the great longleaf pine forests did not rebound. Buttrick lamented that longleaf had no "future as a second growth tree" because "it does not 'come back' after

[230] Ibid., 903.

[231] Ibid., 906.

[232] Earley, *Looking for Longleaf*, 168.

[233] Ibid.

[234] Laurence Walker, *The Southern Forest: A Chronicle*, (Austin: University of Texas Press, 1991), 131.

[235] Ibid.

[236] William Faulkner, *Light in August* (New York: Vintage International, 1990), 5.

lumbering" since it "seeds very infrequently and grows slowly."[237] "When the area has been logged," he explained, "the burning of the slash, which invariably follows, kills all the smaller trees which have been left, and the annual grass fires, together with the absence of seed trees keep more from coming in."[238] By the early twentieth century, many foresters, ecologists, and botanists pronounced the longleaf well on the way to becoming extinct. In 1915 Buttrick concluded his analysis of the longleaf pessimistically: "So longleaf has become commercially, almost botanically, extinct over whole sections and they are now barrens indeed."[239] A few years later in 1923, forester Reginald D. Forbes, ominously announced, "The plain truth of the matter is that in county after county, in state after state of the south, the piney woods are not passing, but have passed."[240] Although the railroads, loggers, and timbermen did not succeed in totally wiping out the longleaf pine forests, they still remain "among the most seriously endangered ecosystems in the United States."[241] Earley compares the damage inflicted on a "scale similar to the chestnut blight," a catastrophic epidemic that also intensified fears about a national timber famine and raised concerns about the railroads' use of forest resources.[242]

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[237] Buttrick, "Commercial Uses of Longleaf Pine," 908.

[238] Ibid.

[239] Ibid.

[240] Reginald D. Forbes, "The Passing of the Piney Woods," *American Forestry* 29 (March 1923), 131-136, 185.

[241] Earley, *Looking for Longleaf*, 2.

[242] Ibid.

Looking for alternative sources to produce ties as they depleted the nation's white oak and longleaf pine forests, railroads also turned to timber from the American chestnut, *Castanea dentata*, which one early twentieth-century forester described as "one of our best known and best loved trees because of its beauty and utility."[243] This iconic tree once peppered the landscape with its "bright foliage, attractively-shaped leaves, toothsome nuts, and stately form" from "southeastern Maine west to southern Indiana and along the Appalachian Mountains to northern Georgia, Alabama, and Mississippi."[244] Accolades for the chestnut's strength, usefulness, and beauty frequently appeared in print. One advocate described it as a "forest marvel."[245] Another ardent admirer pronounced chestnut "one of the leading hardwoods of America," praising how "tall, straight and slender" it was, but also its "durability; its lightness and its abundance."[246] Joseph Russell Smith, a geographer raised in the chestnut woods of Virginia insisted, "No other tree can touch it for all-around efficiency."[247]

Although many prized the chestnut's aesthetic qualities, it was this "efficiency," abundance, and utility that attracted railroads and other manufacturing industries. Compared with other durable, heavy hardwoods such as oak, chestnut timber boasted a surprising lightness, similar in weight to much softer woods such as white pine, yellow

[243] Samuel B. Detweiler, "The American Chestnut Tree," *American Forestry* 21, no. 262 (October 1915): 957.

[244] Ibid., 957.

[245] J. Russell Smith, "The Chestnut blight and Constructive Conservation" in *The Publications of the Pennsylvania Chestnut Tree Blight Commission, 1911-1913* (Harrisburg, PA: W. M. Stanley Ray, 1915), 144.

[246] P. L. Butrick, "Commercial Uses of Chestnut," *American Forestry* 21, no. 262 (October 1915): 963.

[247] Smith, "The Chestnut blight and Constructive Conservation," 144.

poplar, or red spruce.[248] Assessing the commercial value of chestnut, one forester explained why railroads and other manufacturers found the reduced weight—but still resilient wood—so appealing. “This places chestnut in the class of light weight woods, and since railroad freight rates on lumber are based on weight rather than board measure, this gives it an advantage in marketing over many of its heavier competitors,” he determined.[249] In addition, “its convenient form” distinguished chestnut timber as a natural fit for railroad ties, posts, and telegraph and telephone poles, which needed to be tall, straight, and slim.[250] Proponents considered it “a standard telegraph and telephone pole, and a good railroad tie or mine prop” because of its resistance to warping and its strength, even when in contact with wet ground.[251] Because the chestnut contained a “high percentage of valuable chemical substances,” especially tannins needed for leather manufacture, the tree offered added economic benefits since “any chip, top, slab or scrap can be digested for this valuable manufacture.”[252]

The chestnut’s regenerative qualities and speedy growth also impressed foresters, railroad operators and engineers, and other wood users. Philip L. Buttrick, a Yale-trained forester, praised the “commercial uses of chestnut” in a 1915 *American Forestry* article: “If you cut down a chestnut tree, you get many chestnut trees in its place, for, unless the tree is very old, a large number of sprouts spring up from the

[248] Butrick, “Commercial Uses of Chestnut,” 961.

[249] Ibid., 961.

[250] Ibid., 963.

[251] Smith, “The Chestnut blight and Constructive Conservation,” 144.

[252] Ibid., 144.

stump and grow like weeds, in a few years forming a group of thrifty young trees."[253] In a *Popular Science Monthly* article, Arthur Graves contrasted the chestnut's miraculous capacity for growth to "such trees as pine or hemlock," which, when a lumberman cut, "he sounds the death knell of that individual."[254] Chestnuts, as Graves suggested, actually seemed to benefit from felling because "this is just the operation which leads the way to an increase in the number of individuals, for where one tree existed before, now four or five ultimately develop, sprouting from the stump."[255]

To many intensive wood-users such as the railroads, the chestnut seemed an ideal choice of tree to exploit since it thrived and repopulated when frequently cut. American farmers, as Rutkow recalls, had long recognized the chestnut's ability to provide a steady supply of timber and also economic security; they made their "chestnut groves into woodlots that could be harvested periodically and repeatedly, a technique known as coppicing."[256] Smith, the geographer who grew up in the chestnut-rich Appalachian Mountains and helped pioneer the field of economic geography, also highlighted the tree's unique qualities: "No other good tree of the forest can equal it in the speed with which it makes wood."[257] He even compared it directly to the mighty oak, boasting, "By the time the white oak acorn makes a baseball bat the chestnut stump has

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[253] Buttrick, "Commercial Uses of Chestnut," 967.

[254] Arthur H. Graves, "The Future of the Chestnut Tree in North America," *Popular Science Monthly* (June 1914): 564.

[255] Ibid.

[256] Rutkow, *American Canopy*, 212.

[257] Smith, "The Chestnut blight and Constructive Conservation," 144.

made a railroad tie. Cut it down and it throws its shoots up six feet the first year and keeps them going."[258]

As railroads expanded, they needed an ever-increasing supply of wood to accommodate new lines, but also to replace timber that decayed and wore out along their existing routes. The chestnut's capacity to regenerate and proliferate, many foresters and wood consumers believed, would help satisfy industries such as the railroad while also lessening the drain on trees such as white oak, which Americans had significantly depleted. Extensive use of chestnut could also be justified or rationalized since the tree would regenerate. Smith argued, "The United States, with a big timber cut, is within from one to three decades of an era of timber scarcity which will put us in the position of having to go *raise* timber, rather than go find timber."[259] Although not everyone embraced or even accepted the idea that the U.S. faced or would ever face a timber shortage, Smith remained adamant that American industries needed to transition to a "timber-raising" culture. "In the timber-raising epoch," Smith declared, "the chestnut comes to the front."[260]

While American railroads would not heed Smith's advice to cultivate timber rather than merely extract it for many decades to come, they eagerly devoured chestnut trees. According to Buttrick, after white oak became "too valuable to be used indiscriminately as a tie wood, the railroads of the east adopted chestnut as one of their leading woods for this purpose. It was almost as durable as the other woods and much more

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[258] Ibid.

[259] Ibid.

[260] Ibid.

abundant."[261] A 1907 report on forest products in the United States reflected the growing dependency and use of chestnut timber. In that year alone, the Department of Commerce and Labor and the Department of Agriculture's Forest Service Division calculated the total cut of chestnut timber at 653,239,000 board feet with a value of $11,130,547. These figures, the report's authors explained, were "over three times as large and its total value over four and one-half times as great as in 1900."[262]

By the early twentieth century, chestnut had indeed emerged as an omnipresent force in the lives of Americans, even if they did not fully realize the extent of its reach. One early twentieth-century writer claimed that the chestnut "touches almost every phase of our existence," shading "our parks and estates"; constructing homes, businesses, and furniture; tanning shoes; supporting the wires that sent messages via telegraph and telephone; and even composing key ingredients in traditional holiday meals.[263] "At last when the tree can serve us no longer in any other way it forms the basic wood onto which oak and other woods are veneered to make our coffins," he dramatically concluded.[264] While these examples all illustrated the chestnut's ubiquity in American life, the writer focused particularly on how railroad passengers encountered chestnut wood:

> We sit in a railroad train and read newspapers into whose composition chestnut pulp has gone, while our train travels over rails supported on chestnut ties and over trestles built of chestnut piles, along a track whose right-of-way is fenced by wire supported on chestnut posts. On the same

[261] Buttrick, "Commercial Uses of Chestnut," 963.

[262] Department of Commerce and Labor, Bureau of the Census, *The Lumber Cut of the United States: 1907* (Washington: Government Printing Office, 1908), 24.

[263] Buttrick, "Commercial Uses of Chestnut," 961.

[264] Ibid., 961-962.

> train travel goods shipped in boxes and barrels made of chestnut boards and staves.[265]

Although the chestnut initially appeared to be as Smith claimed, "a forest marvel" that satisfied the railroads' need for abundant and durable timber, a ruinous fungus doomed the chestnut's reign and resulted in what Rutkow describes "as one of the worst ecological disasters in the nation's history."[266] In the late nineteenth century, *Cryphonectria parasitica*, more commonly referred to as chestnut blight, invaded the U.S. through imports of Asian chestnut trees and quickly preyed on its American cousin, which possessed no resistance to the invasive disease. Reflecting the xenophobia and anti-Asian sentiment common in the United States in the early twentieth century, one forester identified the chestnut blight as an "undesirable alien from northern China."[267]

Forester Howard Merkel first noticed the fungus afflicting American chestnut trees at the Bronx Zoo in 1904, but it would take researchers years to accurately identify the pathogen and trace its origin.[268] The fungus entered the tree "through cracks in its bark," producing "a sunken canker" that soon girdled the tree, preventing it from collecting the water and nutrients required to survive.[269] Birds, insects, and wind spread the spores of *Cryphonectria parasitica*, and despite efforts to constrain the blight, by the 1950s, few of the approximately 4 billion chestnut trees in the United States remained

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[265] Ibid.

[266] Smith, "The Chestnut blight and Constructive Conservation," 144; Rutkow, *American Canopy*, 218.

[267] Buttrick, "Commercial Uses of Chestnut," 967.

[268] Rutkow, *American Canopy*, 213-214.

[269] M. Ford Cochran, "Back From the Brink," *National Geographic* (February 1990): 133.

untouched.[270] The “merciless fungus,” as Rutkow described it, “traversed some 200 million acres, wiping out virtually every mature specimen along the way,” and killing “between three and four billion” trees.[271] In 1915, Buttrick had already concluded, “The chestnut has been practically exterminated over whole sections where formerly it was common, and in many others it is now being destroyed by the wholesale.”[272] Even more frustrating to many foresters and scientists, Buttrick complained, “No way has been found to definitely check its ravages.”[273] Although, to this day, researchers and scientists continue to hunt for a way to eliminate blight or produce resistant tree strains, the disease reduced the American chestnut to “an understory shrub,” as Rutkow mourned.[274] Foresters such as Buttrick articulated a view that nature had forsaken the chestnut, and so they responded in kind. He reasoned, “It is very poor forestry to favor a tree against which nature has so definitely set her hand.”[275]

The blight’s devastating impact forced railroads and other industries to once again consider alternate options to secure a steady supply of the timber necessary to continue and expand their operations.[276] Although they previously considered chestnut to be, “in modern terms,” as Ford Cochran noted, “a renewable resource,” the blight

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[270] Rutkow, *American Canopy*, 217.

[271] Ibid.

[272] Buttrick, “Commercial Uses of Chestnut,” 967.

[273] Ibid., 968.

[274] Rutkow, *American Canopy*, 217.

[275] Buttrick, “Commercial Uses of Chestnut,” 967.

[276] Rutkow, *American Canopy*, 217.

emphasized the error in that view.[277] Science journalist Susan Freinkel argued, “The chestnut blight arrived at a time when Americans were just starting to recognize that the country’s natural bounty had limits.”[278] By the beginning of the twentieth century, as *Cryphonectria parasitica* attacked and exterminated the popular chestnut trees, Americans also overhunted the once great flocks of passenger pigeons and bison herds to extinction, and fears of a timber famine gripped the nation. Freinkel and other scholars contend, “These early intimations of vulnerability and loss are the anxious roots of modern environmental consciousness.”[279]

As Freinkel suggested, the railroads’ extravagant use of white oak, longleaf, and chestnut timber alerted a growing number of Americans to the issue of natural resource depletion and prompted an emerging push for conservation and wiser use of these resources. Initially, as writer Jeff Forester explains, “The calls for reform were quiet at first and came mostly from academic and scientific circles, but as conditions deteriorated other voices joined the chorus until its demands could not be ignored.”[280] Soon after railroads expanded rapidly across the North American continent following the Civil War, some contemporary scholars articulated early, and strident warnings about the railroads’ wasteful practices and the environmental implications associated with this deforestation. In 1864, George Perkins Marsh, an American diplomat, linguist, and lawyer, published his detailed study *Man and Nature*, in which he exposed the damage

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[277] Cochran, “Back From the Brink,” 131.

[278] Susan Freinkel, *American Chestnut: The Life, Death, and Rebirth of a Perfect Tree* (Berkeley: University of California Press, 2007), 3.

[279] Ibid., 3-4.

[280] Jeff Forester, *The Forest for the Trees: How Humans Shaped the North Woods* (St. Paul, Minnesota: Minnesota Historical Society Press, 2004), 105.

humans wrought on the physical environment. Marsh powerfully argued, “Man has too long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste.”[281] Although Marsh did not single out the railroads, but rather accused “man,” more broadly of being “everywhere a disturbing agent,” he criticized deforestation and “the improvident habits of the backwoodsman and the increased demand for lumber.”[282] As his biographer, David Lowenthal contends, Marsh released his work “at the peak of American confidence in the inexhaustibility of resources” and “it was the first book to controvert the myth of superabundance and to spell out the need for reform.”[283]

Influenced by Marsh’s critique, Frederick Starr an abolitionist, minister, and intellectual, wrote an article published in the 1866 U.S. Commission of Agriculture’s *Annual Report* on the status of American forests and their “destruction and preservation.”[284] Starr’s concerns about forest resources clearly emerged out of anxiety over economic security rather than environmental consequences, but he identified the railroads as a major culprit in the devastation of the nation’s forests. “The railroads consume great quantities of wood, and exhaust the supply along their lines,” he

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[281] George Perkins Marsh, *Man and Nature*, ed. David Lowenthal (Cambridge, Massachusetts: Harvard University Press, 1965), 36.

[282] Ibid., 257.

[283] Marsh, *Man and Nature*, ix.

[284] Frederick Starr, Jr. “American Forests; Their Destruction and Preservation,” in *Executive Documents Printed by Order of the House of Representatives During the First Session of the Thirty-Ninth Congress*, 1865-’66 vol. 15, no. 136 (Washington: Government Printing Office, 1866).

criticized.[285] Focusing specifically on the significant use of forest resources to produce ties, Starr commented:

> When it is remembered that these sleepers are generally sound hemlock, chestnut, and especially oak; that trees are selected to make them of a size just sufficient to furnish one or two sleepers only, (the tree being simply hewn on two sides, and having the heart entire), the destruction of choice timber just approaching a size suitable for sawing is immense.[286]

In addition to this wasteful cutting, Starr also pointed out, "Decayed sleepers are worthless, and are thrown away or given to the hands on the road for firewood."[287] He predicted, "The mere cost of rough timber for sleepers will probably, in time, prove to many of our railroads an expense greater than the first cost of the rails, even including the keeping of the iron rails in repair."[288] Publishing his research just after the conclusion of the American Civil War, Starr recognized that many Americans did not yet see the railroads' deforestation as a threat. He attributed the lack of awareness and action to the fact that "she has had plenty and to spare."[289] "The nation has slept because the gnawing of want has not awakened her," but Starr predicted, "within thirty years she will be conscious that not only individual want is present, but that it comes to each from permanent national famine of wood."[290]

Starr's warning of a widespread, national, timber famine would soon take hold, and critics of the railroads' wanton destruction frequently invoked the specter of famine

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[285] Ibid., 210.

[286] Ibid., 214.

[287] Ibid., 213.

[288] Ibid.

[289] Ibid., 219.

[290] Ibid.

to stir up support for their cause. The railroads' profligacy awakened Americans to the reality of their finite woodlands, and this idea of a railroad-induced timber famine would help develop the field of forestry in the United States while also creating a market and a national fervor for wood preservation. Economic incentive, however, remained the greatest motivator in the adoption of this technology. Ernest A. Sterling, a proponent of wood preservation, an advocate of forestry, and a consultant for railway companies, emphasized this perspective: "It certainly must pay to inject timber with preservatives, or the railroads and other commercial concerns would not undertake it."[291] "Conservation that does not pay will not conserve," Sterling maintained, and wood preservers took this message to heart.[292] Although, in the nineteenth century, railroads adhered to the tenet that "before a wheel can turn a tree must die," the promise of wood preservation soon transformed railroads from the largest consumer of untreated timber to the largest consumer of wood preserved with creosote.

[291] E. A. Sterling, "Wood Preservation As a Factor in Forest Conservation," *American Forestry* (October 1912): 630.

[292] E. A. Sterling, "One portrait," *American Forestry* (June 1915): 731.

Figure 3-1. Railroad ties layed ready for rails. 1910. Frank and Frances Carpenter Collection, Library of Congress Prints and Photographs Division, Washington, D.C. http://www.loc.gov/pictures/item/99614578/.

Figure 3-2. Two-million lodgepole pine ties. 1928. Hawkins Creek, British Columbia. Forest History Society Photograph Collection, Forest History Society, Durham, N.C.

Figure 3-3. Close-up view of log rafts in a log boom at Apalachicola, Florida. 1899. State Archives of Florida, Florida Memory. https://www.floridamemory.com/items/show/259525.

Figure 3-4. Hewing out a tie with a broadaxe. 1940. Pie Town, New Mexico. Photograph by Russell Lee. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/2017742599/.

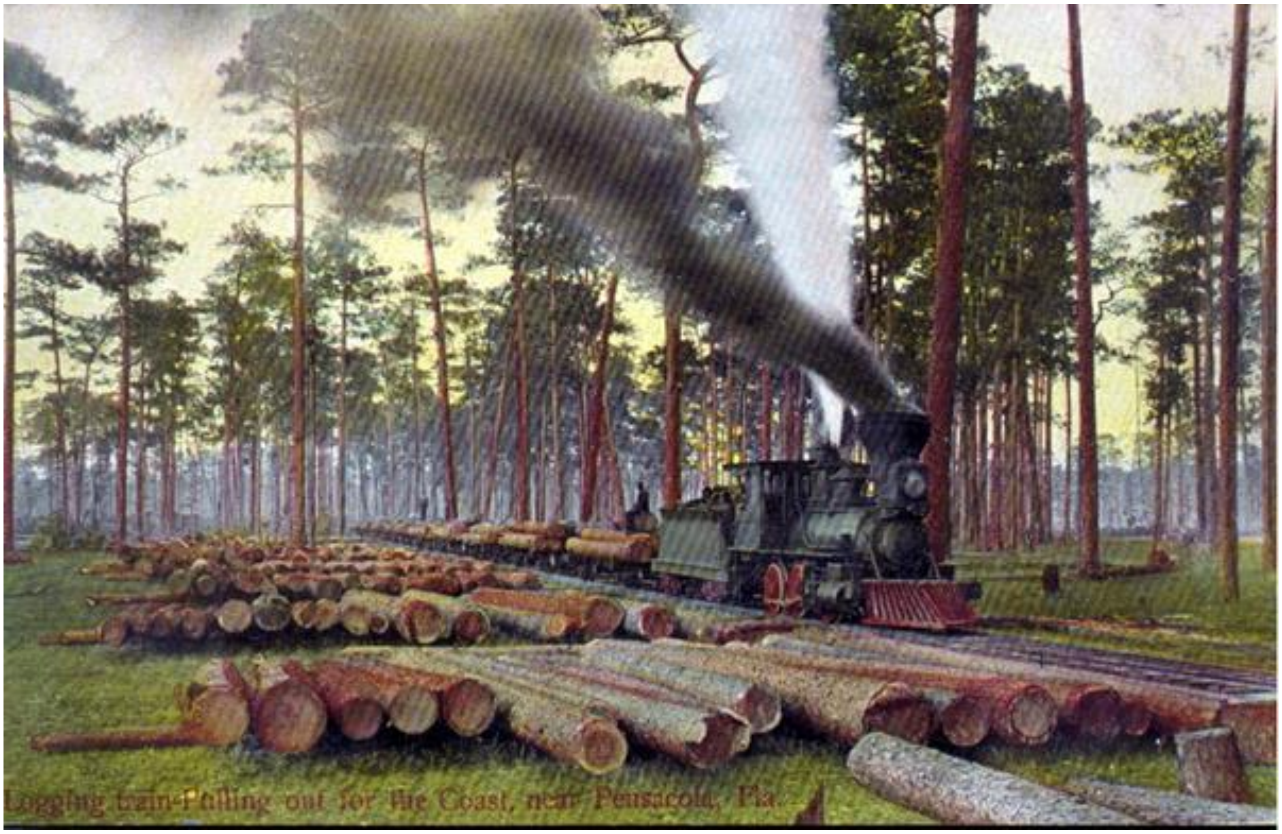

Figure 3-5. Logging train pulling out for the coast - near Pensacola, Florida. 19--?. Color postcard, 9 x 14 cm. State Archives of Florida, Florida Memory. https://www.floridamemory.com/items/show/159792.

Figure 3-6. Clearcut forest. Potlach, Washington. Forest History Society Photograph Collection, Forest History Society, Durham, N.C. http://www.foresthistory.org/Research/photos.html.

CHAPTER 4
"PUTTING THE DOLLAR SIGN ON DECAY": THE ACCEPTANCE AND ASCENDANCE OF CREOSOTE

In an October 1951 *American Forests* article, "Putting the Dollar Sign on Decay," Henry Steer, a U.S. forest economist, insisted that Americans wasted millions of dollars every year and placed an unnecessary strain on the nation's forests with their use of untreated wood. "Do you realize that you and your rural or urban neighbor are throwing nearly 200 million dollars down the drain every year by repairing and replacing buildings with untreated lumber and by using untreated fence posts? And that you are creating a damaging drain on the nation's forests?"[1] Steer questioned. Fortunately, he reassured, there was a simple solution to this economic and forest conservation problem. "Take a tip from the railroads and utility companies and get the maximum service from your timber by protecting it from decay," Steer advised.[2] Applying what he described as "a conservative estimate," he maintained that "treated lumber will last an average of five times as long as untreated" and the "economic significance here is staggering."[3]

By the early 1950s, forestry officials and consumers of wood had such confidence in wood-preservation methods, particularly creosote, that Steer declared, "The preservative treatment of wood to be used in conditions favoring decay is economically sound and *will save you money*."[4] To convince readers his argument was valid, Steer "put the dollar sign on decay," calculating the cost savings that railroads and

[1] Henry B. Steer, "Putting the Dollar Sign on Decay," *American Forests* (October 1951): 28.

[2] Ibid.

[3] Ibid.

[4] Ibid., 68.

utility companies enjoyed through wood preservation.[5] "It is estimated that the railroads in the U.S. and Canada save $775,000 a day—$283,500,000 a year—by using preservatively treated ties. The savings in consumption of wood (at three cubic feet a tie) is more than 212 million cubic feet annually, or almost 600,000 cubic feet a day."[6] Indeed, wood preservation had become so pervasive among railroads at the time Steer wrote his article that "about 95 percent of all ties used by Class 1 Line-Haul railroads are treated."[7] In addition, "practically all poles used by telephone and telegraph, light and power and other utility companies are now given preservative treatment before use."[8]

Steer's article conveyed the idea that railroads and utility companies pioneered wood preservation, and that the practice of treating timber had become a foregone conclusion among these large consumers of wood. Now, he suggested, they graciously passed down their trade secrets to farmers, homeowners, and "country or urban dwellers" who might also reap the economic benefits of treated wood.[9] Steer's article, however, minimized the long struggle that conservationists, foresters, and other wood-preservation proponents faced in convincing railroads that this industrial process was worth their time and their money. For decades, railroads dismissed the individuals criticizing their wasteful use of wood as "agitators" and overzealous "denudatics,"

[5] Ibid., 28.

[6] Ibid., 67.

[7] Ibid., 67.

[8] Ibid., 67-68.

[9] Ibid., 68.

referring to those who warned against senselessly denuding forests.[10] From the railroads' perspective, these individuals threatened the nation's expansion and industrial advancement. As late as 1885, the American Society of Civil Engineers concluded that while pressure-treating wood with coal-tar creosote effectively fought decay, rot, shipworms, and boring insects, ultimately, "It was cheaper to let it rot in the good old way."[11]

To challenge these prevailing views, foresters and wood-preservation proponents had to, as Steer claimed, "put the dollar sign on decay," and persuade railroads that pressure-treating wood with creosote offered immediate and long-term benefits.[12] Supporters of creosoting claimed that it reduced railroad operating costs, preserved the timber supply (and low prices), and improved the railroad's public image. Although "putting the dollar sign on decay" was no small task, fears of a timber famine, the development of forestry, and technological advances soon converted railroads from stubborn skeptics to true believers of wood preservation with creosote.

This chapter explores how railroads came to view wood preservation, especially with creosote, as so essential to their success that they eagerly devoted considerable resources to construct their own timber-treating plants and fund government research on wood preservation. Increasing the life of timber allowed railroads to capitalize on these industrial processes while claiming they conserved natural resources. Although wood-preservation advocates boasted about their more judicious and scientific use of

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[10] Gifford Pinchot, *Breaking New Ground* (Washington, D.C.: Island Press, 1947), 27; Pennsylvania Forestry Association, "Editorial," *Forest Leaves* 3, no. 2 (June 1890): 22.

[11] American Society of Civil Engineers, "The Preservation of Timber," 249.

[12] Steer, "Putting the Dollar Sign on Decay," 28.

timber supplies, economic gain clearly motivated their adoption of this technology. As Bernhard Fernow, chief of the U.S. Forestry Division explained, “Railway corporations are deeply interested in the perpetuity of suitable material for the maintenance of their thousands of miles of track.”[13] The immediate economic returns that creosote offered also blinded railroads and other consumers to longer-term environmental and public health consequences.

Before railroads adopted this technology, the nation had to confront the growing threat of a timber famine, which George Perkins Marsh and Frederick Starr—early advocates of conservation—warned about in the 1860s. This idea became more entrenched in the 1870s, a decade that environmental historian Char Miller describes as “pivotal” to the development of forestry in the United States because it marked a “migration of European ideas that introduced forestry to the American mind and landscape.”[14] This migration proved essential to the growth and expansion of wood-preservation technology in the U.S.

Evaluating the exchange of “people, goods, ideas, and aspirations” across the Atlantic Ocean, historian Daniel Rodgers contends, “the Atlantic functioned for its newcomers less as a barrier than as a connective lifeline.”[15] Rodgers identifies the period between 1870 to 1940 as a unique “trans-Atlantic moment” when Americans were especially amenable “to foreign models and imported ideas—when the North

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[13] Department of Agriculture, Forestry Division, *Report on the Relation of Railroads to Forest Supplies and Forestry* (Washington: Government Printing Office, 1887), 25.

[14] Char Miller, “The Pivotal Decade: American Forestry in the 1870s,” *Journal of Forestry* (November 2000): 6.

[15] Daniel Rodgers, *Atlantic Crossings: Social Politics in a Progressive Age* (Cambridge, Massachusetts: Belknap Press of Harvard University Press, 1998), 1.

Atlantic economy formed, for many strategically placed Americans, a world mart of useful and intensely interesting experiments."[16] Along with more well-known European exports such as social insurance, urban planning, and rural cooperatives, Americans also adopted and adapted ideas about forestry and wood-preserving technology.

Attempting to avert what Marsh and Star warned was an imminent timber famine, scholars such as Franklin Hough looked to European countries, which long faced great timber crises, for potential solutions.[17] The efforts of Hough and many of his contemporaries, as Miller suggests, distinguish them among the intellectual "brokers" Rodgers writes about.[18] These individuals promoted an intellectual exchange between America and Europe, but in so doing, they reflected what Rodgers described as "a suspension of confidence in the peculiar dispensation of the United States from the fate of other nations."[19] Hough and this emerging generation of conservationists debunked the myth of America's inexhaustible forest resources, looked to Europe for guidance on how to mitigate these problems, and challenged railroads and other large consumers of wood to reevaluate their impact on the forests.

Hough, a physician, botanist, and statistician, pursued forest conservation after reviewing state and national census data reflecting the decline of forests and timber supplies that Marsh, Starr, and others foretold. The nation's fast-increasing and "unrestrained appetite for wood" alarmed Hough and he began studying and

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[16] Ibid., 26 and 4.

[17] Miller, "The Pivotal Decade," 7.

[18] Ibid.; Rodgers, *Atlantic Crossings*, 4.

[19] Rodgers, *Atlantic Crossings*, 4.

corresponding with British and German forestry experts, even traveling abroad to meet with these authorities and familiarize himself with the European experience.[20] Many "European geographers and other scientists of the highest eminence," as one contemporary observer noted, had attributed "the rise and fall of nations and civilizations in forest denudation," and their work clearly made an impression on Hough's thinking.[21] At the annual meeting of the American Association for the Advancement of Science (AAAS) in August of 1873, Hough presented his findings. Citing European examples of deforestation that stemmed from overuse, he advised his colleagues that, unless they took action, the United States might find itself with similar "sunburnt and sterile plains."[22]

While Hough warned about the dangers of erosion, climate change, and worsening floods and droughts associated with the clearing of woodlands, his argument in favor of government forestry centered around an economic need. "The economical value of timber, and our absolute dependence upon it for innumerable uses in manufactures and the arts, the rapidly increasing demand for it in railroad construction and the positive necessity for its use in the affairs of common life. . . are too obvious for suggestion."[23] He argued, "It must come to be understood that a tree or a forest,

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[20] Ibid.

[21] Herbert A. Smith, "The Early Forestry Movement in the United States," *Agricultural History* 12, No. 4 (October 1938): 341.

[22] Franklin B. Hough, "On the Duty of Governments in the Preservation of Forests," in the *Proceedings of the American Association for the Advancement of Science* (Salem, Massachusetts: The Salem Press, 1874): 1.

[23] Ibid., 3.

planted, is an investment of capital, increasing annually in value as it grows, like money at interest, and worth at any time what it has cost."[24]

When Hough gathered with his contemporaries at the conference in 1873, "there was, at the time, not a single American forester to be found anywhere, nor a single acre of trees administered according to the tenets of forestry."[25] While American schools offered no courses, let alone degrees, in forestry or silviculture, Europe's longstanding timber scarcity prompted countries on this continent to embrace professional forestry centuries earlier. "The ideas of treating timber as a crop, harvesting trees without destroying the underlying environment, and managing forests to encourage sustainable-yield practices and to minimize waste," as Rutkow explains, had yet to make the voyage over to the United States.[26] At this time, as writer Jeff Forester argues, "most Americans" regarded forestry principles such as "tree planting and fire suppression as European notions, activities for smaller, resource-poor countries."[27] Even Nathaniel Egleston, chief of the newly created Division of Forestry acknowledged in 1882, "Of forestry as an art or science we know very little in this country. Even the word is new to us."[28] Despite a steep learning curve, Hough urged the AAAS to appeal to state and federal government entities to develop and adopt "laws to regulate, promote and protect

[24] Ibid., 4-5.

[25] Rutkow, *American Canopy*, 154.

[26] Ibid.

[27] Jeff Forester, *The Forest for the Trees: How Humans Shaped the North Woods* (St. Paul, Minnesota: Minnesota Historical Society Press, 2004), 108.

[28] Nathaniel Egleston, "What We Owe To the Trees," *Harper's New Monthly Magazine* 64, no. 383: (New York: Harper and Brothers Publishers, 1882): 683.

the growth of wood” in the same way “we find laws necessary in the management of roads and bridges, or of any other great object of public utility.”[29]

Receptive to Hough’s entreaties, the AAAS agreed to petition Congress about the government’s role in forest management, and Hough and other delegates met with members of Congress, the Department of the Interior, and President Ulysses S. Grant. Although the bill they submitted languished for years, Congressman Mark Dunnell of Minnesota, who served on the House Public Lands committee, succeeded in transferring the bill’s status from the Public Lands Committee to general agricultural appropriations. In order to pass this forestry bill, its supporters had to attach it, as historian of the forest service, Harold Steen, notes, “as a rider to an unrelated subject,” which accentuated the general lack of interest and commitment to forestry in the United States at this time.[30] These forestry advocates, forester Herbert Smith recalled, faced an uphill battle because this was an “era of rampant individualism” and “the spoils system and governmental corruption had reached unprecedented dimensions and undermined public confidence.”[31]

Regardless of these challenges, the tactic worked; in 1876, Congress approved $2,000 to conduct a study on forestry and the commissioner of agriculture authorized Hough to perform the investigation, appointing him forester of the United States, the

[29] Hough, “On the Duty of Governments in the Preservation of Forests,” 6.

[30] Harold K. Steen, *The U.S. Forest Service: A Centennial History* (Durham, North Carolina: The Forest History Society in association with the University of Washington Press, 2004), 14.

[31] Smith, “The Early Forestry Movement in the United States,” 341.

nation's first "federal expert on forestry."[32] In 1878, he released the first "report upon forestry," a 650-page compilation of his research that criticized contemporary perspectives on the inexhaustibility of America's forests. On its current path, Hough suggested, the United States followed in the footsteps of other countries in which "trees furnishing products demanded by commerce or standing in the way of cultivation become an object of inconsiderate waste."[33] This attitude then led to a glut of timber on the market, "and ruin is brought upon the greedy but thoughtless adventurers in a business liable to bring an over-supply."[34] Hough put railroads on notice that their unrestrained consumption of wood necessitated an interest in conservation and cultivation of future resources.[35]

Nathaniel Egleston, Hough's successor, also popularized the idea of a timber famine and depicted railroads as a threatening force since they rapidly consumed timber and caused forest fires by "scattering sparks through the countryside."[36] In 1882, Egleston authored a *Harpers' New Monthly Magazine* article on "what we owe to the trees," which censured "man's" treatment of trees as "his enemies."[37] "The history of our race may be said to be the history of warfare upon the tree world," Egleston proclaimed, and he forecast "inevitable disasters" as a result of this shortsighted

[32] Ibid.; Olson, *The Depletion Myth*, 38; Forest History Society, "Franklin B. Hough: 1822-1885," Forest History Society, http://www.foresthistory.org/ASPNET/People/Hough/Hough.aspx (accessed November 15, 2016).

[33] Franklin B. Hough, *Report Upon Forestry* (Washington: Government Printing Office, 1878), 8-9.

[34] Ibid.

[35] Ibid., 112.

[36] Olson, *The Depletion Myth*, 39.

[37] Egleston, "What We Owe to Trees," 675.

approach.[38] “In our own country, Egleston railed, “we have gone to the forest in a kind of freebooter style, cutting, and burning more than we could cut, acting for the most part as though all the while in a frolic or a fight.”[39] After a “century or two of this sort of work,” Egleston observed, “we are waking up to the facts that our once boundless woods are disappearing, and that we are likely to suffer no little less thereby.”[40] While often disparaged by his contemporaries and replacements as a weak, bumbling, and ineffective chief who received his position because of the corrupt spoils system, Egleston continued Hough’s research on gross timber consumption at the hands of the railroads and warned government officials and the public of an imminent timber famine.[41]

Although a meager budget and limited resources continued to plague Hough, Egleston, and their successors, the federal government agreed to create a dedicated Division of Forestry under the Department of Agriculture in 1881. Until this time, there had been “no formal agency.”[42] As a result of this change, the position of “forestry agent” transitioned to “chief” of a division, which suggested an increasing awareness of the importance of forestry in the United States.[43] Nevertheless, Steen found that, in these early years, the Division of Forestry as well as the position that preceded it, were

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[38] Ibid.

[39] Ibid.

[40] Ibid.

[41] Olson, *The Depletion Myth*, 39; Char Miller, “Amateur Hour: Nathaniel Egleston and Professional Forestry in Post-Civil War America,” *Forest History Today* (Spring/Fall 2005): 21-22.

[42] Steen, *The U.S. Forest Service*, 17.

[43] Ibid.

"essentially a one-man operation without statutory permanence" that "made no progress in curbing forestry abuses."[44]

As Fernow, whom Grover Cleveland appointed as the first chief of the Division of Forestry in 1886, emphasized, the Division functioned solely as a "bureau of information."[45] A Prussian-born and trained forester, Fernow personified the Atlantic exchange of ideas and people that Rodgers and Miller highlight. Compared with the established and respected forestry profession in Europe, Fernow articulated frustration with the U.S. Division of Forestry's limited advisory role. He quipped that the organization was "instituted to preach, not to practice, thus exhibiting the incongruous condition of the Government advising the people without applying its own advice to its own property."[46]

Despite the Division's precarious position and lack of authority, Fernow and others understood that information, when carefully released and wielded, could be a powerful tool to convince Americans about the gravity of their forest situation. They hoped that publicizing the devastation of America's woodlands at the hands of railroads and other rapacious consumers of wood might draw attention to their cause and justify the existence and growth of forest conservation in the United States. To accomplish this, its advocates employed the perception of an impending and pervasive timber

[44] Ibid., 21.

[45] B. E. Fernow, "Report of the Chief of the Division of Forestry," in *Annual Report of the Secretary of Agriculture* (Washington: Government Printing Office, 1895), 133. This report was for the fiscal year ending in 1894.

[46] Ibid.

famine, which became—as geographer Sherry Olson concludes—"the keystone in the American forestry bureaucracy and the American public conscience."[47]

Although historians often date the rise of a conservation movement to the Progressive-era reform spirit of the late nineteenth and early twentieth centuries, prevailing fears of a timber famine reveal that the roots of this movement started much earlier.[48] Historian Donald Pisani maintains that a "conservation 'ethic'" emerged in the shadow of this timber famine, and "derived from the fear that abuse of the land threatened the future of American civilization."[49] At its basic level, Pisani suggests, the timber famine and Americans' fervent warnings about this menace "reflected a fear deeper than that of the overuse of an essential natural resource."[50] Instead, it points to the anxiety that "Americans had violated fundamental laws of nature and faced dire consequences."[51] While Americans had long regarded the subjugation of the forests as a symbol of progress and civilization, now they worried that they had gone too far, degenerating to a more savage and primitive state. Environmental historian Char Miller explains this perspective: "our Edenic place in history was slipping away with each swing of an ax."[52] Although methodically clearing the forests represented order and

[47] Olson, *The Depletion Myth*, 39.

[48] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge, Massachusetts: Harvard University Press, 1959).

[49] Donald J. Pisani, "Forests and Conservation, 1865-1890," *The Journal of American History* 72, no. 2 (September 1985): 341.

[50] Ibid., 346.

[51] Ibid.

[52] Char Miller, *American Forests* (Lawrence, Kansas: University Press of Kansas, 1997), 2.

careful control, the voracious and excessive consumption of timber signified a lack of restraint associated with gluttony and depravity.[53]

During the Victorian Age, as Pisani observes, this "contrast between civilization and savagery" enthralled and disturbed Americans, and the country's increasing rate of industrialization and urbanization prompted a reevaluation of forest resources.[54] Scholars, philosophers, and moralists such as Marsh, Starr, Hough, and others articulated the belief that "Once deforestation passed a certain critical point, the process of decay was irreversible, much as a fatal human disease," plunging society into "barbarism."[55] Citing examples of deforestation followed by the decline of great civilizations in Italy, Greece, North Africa, Turkey, Egypt, and Palestine, many Americans predicted that their own nation would soon mirror this descent into "sterility," "desertification," and savagery.[56] In 1875, for example, an editorial in *Scientific American* decried the rapid "waste of woodland" occurring throughout the United States, and reminded readers that "Such waste of woodland has brought ruin to every country that has permitted it."[57] Another article published in *Scientific American* one year later epitomized this perspective. Pronouncing "timber waste" to be "national suicide," the writer bleakly concluded, "We are led to face the fact that a period, so near as to be

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[53] Pisani, "Forests and Conservation," 351.

[54] Ibid., 351.

[55] Ibid., 352.

[56] Ibid.

[57] "Waste Land and Forest Culture," *Scientific American* 32, no. 11 (March 13, 1875): 161.

practically tomorrow, as compared with the history of the race, is at hand when our existence as a nation will end."[58]

While many Americans conceded the inevitability of a timber famine, they struggled to establish a timeframe, which only heightened anxieties. In his 1877 annual report, Carl Schurz, the German-born U.S. Secretary of the Interior, predicted that "the supply of timber in the United States will, in less than twenty years, fall considerably short of our home necessities."[59] In the early 1880s, writers for the journal *Forest and Stream* "forecast a twenty-five-year overall supply."[60] In 1887, Fernow estimated, "There can not be a sufficient supply standing to meet the present requirements of the whole nation for fifty years."[61] These predictions incited great controversy, and as Pisani notes, "varied enormously" because of debates over "what constituted accessible timber," disagreements over "units of measurement," and arguments over what "species of trees were usable or desirable."[62] Regardless of the predicted timeline, Americans encountered dire warnings about the impending timber famine in numerous newspapers, magazines, and publications. As a writer for a contemporary periodical acknowledged, "There is probably not a periodical in the country which has not had more or less to say about the waste of our woodlands."[63]

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[58] "Timber Waste a National Suicide," *Scientific American* 34, no. 7 (February 12, 1876): 97.

[59] Carl Schurz, *Annual Report of the Secretary of the Interior on the Operations of the Department for the Fiscal Year Ended June 30, 1877* (Washington, D.C.: Government Printing Office, 1877), xvi.

[60] Pisani, "Forests and Conservation," 345.

[61] B. E. Fernow, "Our Forestry Problem," *The Popular Science Monthly* (December 1887): 231.

[62] Pisani, "Forests and Conservation," 345.

[63] "Waste Land and Forest Culture," 161.

As the frequency of these portents increased, so did direct accusations against large consumers of wood such as the railroads. One article in *Scientific American* criticized railroads for addressing the timber crisis by merely “sending to the remotest parts of the country for ties” rather than considering longer-term solutions that would benefit the railroads, but also their surrounding communities.[64] The writer even threatened direct intervention and regulation of the railroads if they did not reform: “if the owners of the soil will not restore its natural covering through enlightened self-interest, the inhabitants of the State will have to interfere in self-defense.”[65]

By the 1880s, advocates of forest conservation consistently conjured images of a timber famine, and more directly identified railroads as a villain in this conflict. Charles Sargent, an American botanist and Director of Harvard University’s Arboretum, published a detailed study, or “silvicultural index,” on the “woods of the United States” in 1855.[66] When he conducted a follow-up investigation in 1880 for the U.S. Census, he made a grim discovery. Citing “the great and increasing drains made upon them” and “present reckless methods of forest management,” Sargent noted that some areas of the nation such as the northern pine forests “already, it is true, suffered fatal inroads.”[67] While present resources might still appear extensive, Sargent cautioned readers:

> Great as it is, however, it is not inexhaustible, and the forests of the United States, in spite of their extent, variety, and richness, in spite of the fact that the climatic conditions of a large portion of the country are peculiarly favorable to the development of forest growth, cannot always continue

[64] Ibid.

[65] Ibid.

[66] Forester, *The Forest for the Trees*, 106.

[67] Charles Sargent, *Report on the Forests of North America* (Washington: Government Printing Office, 1884), 490.

productive if the simplest laws of nature governing their growth are totally disregarded.[68]

Sargent accused railroads of consistently trampling on these “laws of nature,” assaulting “vigorous, healthy young trees” for the 60,000,000 ties they produced each year, which endangered both the future of the forests and the products produced from them.[69] According to Sargent, “The railroads of the country, using in the construction and maintenance of their permanent ways vast quantities of timber, inflict far greater injury upon the forests than is represented by the consumption of material.”[70] The damage they caused, he warned, “should cause grave apprehensions for the future, especially in view of the fact that in every part of the country there are now growing fewer seedling trees of species valuable for railway ties than when the trees now cut for this purpose first started.”[71] Sargent’s message also reached a broader audience since he “published ecological warnings in *Harper’s New Monthly Magazine* and the *North American Review*.”[72]

When Fernow assumed control of the Division of Forestry in 1886, he worked diligently to professionalize it and convince Americans that they should embrace “forest management” or “the rational treatment of forests for useful purposes.”[73] As Fernow bluntly explained in an address to the Canadian Forestry Association, forests could

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[68] Ibid.

[69] Ibid., 490 and 493.

[70] Ibid., 493.

[71] Ibid.

[72] Forester, *The Forest for the Trees*, 106.

[73] Andrew Denny Rodgers III, *Bernhard Eduard Fernow, A Story of North American Forestry* (Princeton, New Jersey: Princeton University Press, 1951), 3.

either be “exploited” or “managed.”[74] “Exploiting means to take all the cream, all the useful material you can find, and leave the rest to perdition,” he condemned. “That is exactly what has been done on this continent ever since the first settlers came.”[75] In contrast, forest management, according to Fernow, “is nothing different from agriculture except in the crop which it grows. Forestry uses the soil for the purpose of getting a wood crop.”[76] He lamented that Americans failed to think critically about the causes of forest depletion, and he sought to educate the public about its reckless consumption of wood. [77]

Under Fernow’s direction, a reinvigorated Division released a multitude of reports, bulletins, circulars, and articles evaluating and assessing the extent of the damage to America’s forests, particularly at the hands of railroads. “Railroads,” Fernow reprimanded, “while the carriers of civilization, the promoters of development, have committed many sins for the benefit of the present at the expense of the future by needless forest devastation.”[78] Much of the “needless forest devastation” he referred to occurred to produce railroad ties, and the ever-increasing demand for crossties and the wasteful practices to produce them made railroads a prime target for advocates of a more “rational and economical use of timber.”[79]

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[74] B. E. Fernow, “Concluding Session,” in the *Report of the Fourteenth Convention of the Canadian Forestry* Association (Quebec: Dussault & Proulx Printers, 1913), 120.

[75] Ibid.

[76] Ibid.

[77] Rodgers, *Bernhard Eduard Fernow*, 28.

[78] B. E. Fernow, “Introductory,” in *Department of Agriculture Forestry Division, Bulletin No. 1* (Washington: Government Printing Office, 1887), 11.

[79] Michael Williams, *Americans and Their Forests: A Historical Geography* (Cambridge: Cambridge University Press, 1989), 349.

In addition to railroads' assaults on the forests, many Americans in the late-nineteenth century felt threatened by these corporations and the changes they wrought. As Olson explained, "The railroads were vulnerable in public opinion because of their behavior as local monopolies and their unpopular image as big business against the common man."[80] Publicized excesses, scandals, and corruption during the Gilded Age sensitized Americans to the idea of railroads and the men who operated them as exploitative, irresponsible, and callous.[81] Although certainly not the only industry that abused the nation's timber supply, railroads' publicized and far-reaching devastation of the environment brought the question of conservation to the forefront by the late nineteenth century. While railroads, Fernow and his colleagues charged, "may have done much for the growth and development of our country, they are also responsible for much of the hindrance to reform in the use of our forest resources."[82]

In their campaign against the railroads' shortsighted approach to timber, Fernow and other supporters of forestry resuscitated the idea of wood preservation—already widely accepted in Europe—as an answer to these problems. In 1887, M. G. Kern, an agent for the Division, published what Fernow described as a "more or less exhaustive account of what the railroads of our country have done or are doing to deplete our forests."[83] More precisely than his predecessors, Kern calculated the vast amount of timber—roughly 300,000 acres per year—that railroads required to meet their demand

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[80] Olson, *The Depletion Myth*, 39.

[81] Williams, *Americans and Their Forests*, 349; Forester, *The Forest and the Trees*, 106.

[82] Fernow, "Introductory," 7.

[83] Ibid.

for ties.[84] Confident that the forests could not long sustain this rate of depletion, Kern proposed the chemical preservation of wood as a solution that would "sensibly relieve" this pressure on the country's timber resources. In addition to extending the life of timber, Kern noted, this method would enable railroads and other consumers to make use of species traditionally regarded as "inferior."[85]

This endorsement from the Division of Forestry helped revive the issue of wood preservation in the United States, which many scientific authorities, engineers, and consumers of wood had long regarded as effective, but too expensive to justify the effort and delayed cost savings. When the American Society of Civil Engineers (ASCE) published the results of their detailed research on wood preservation in 1885, for example, they concluded that although "many corporations and individuals, after trying experiments which were more or less successful, abandoned the work as not conferring benefits commensurate with the cost."[86] Although pressure-treating wood with coal-tar creosote effectively fought decay, rot, shipworms, and boring insects, it was simply more cost effective to treat the ties as disposable, letting them rot and decay rather than chemically preserving the wood.[87]

Octave Chanute, a French immigrant and civil engineer who made a name for himself designing American railroads, bridges, and stockyards, headed the ASCE's

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[84] M. G. Kern, "Report on the Relation of Railroads to Forestry Supplies and Forestry," in *Department of Agriculture Forestry Division, Bulletin No. 1* (Washington: Government Printing Office, 1887), 18.

[85] Ibid., 21.

[86] American Society of Civil Engineers, "The Preservation of Timber," in *Transactions of the American Society of Civil Engineers*, 14 (July 1885): 249.

[87] Ibid.

committee on the preservation of timber and ensured that railroads and other large consumers of wood participated in the study.[88] While the committee's report described concerns about whether wood preservation would pay for itself, Chanute predicted a time in the near future when a lack of supply would force railroads to reconsider wood preservation. The "growing scarcity of wood suitable for railroad ties," he warned, would "soon produce advancing prices."[89] The report published in the ASCE's *Transactions* also evoked the idea of a timber famine: "The data on forestry gathered for the census of 1880 have made it apparent that the time has now arrived when railway and other interests must largely resort to the artificial preparation of wood."[90] When connected to the work of Fernow, Kern, and other outspoken critics of railroads' overconsumption, Chanute and the ASCE's research "laid the foundation" for the American wood preservation industry.[91] Their endorsements of wood preservation provided the industry with credibility and a clear purpose—to lessen the burden on America's forests and prevent a timber famine.

While foresters and engineers such as Fernow and Chanute embraced a turn toward wood preservation, large-scale consumers of wood challenged the very premise of a timber famine. One of Fernow's detractors, for example, pronounced his statistics on timber consumption absurd, and argued he had "allowed fancy and vivid imagination

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[88] Simine Short, *Locomotive to Aeromotive: Octave Chanute and the Transportation Revolution* (Urbana: University of Illinois Press, 2011), 117.

[89] American Society of Civil Engineers, "The Preservation of Timber," 249.

[90] Ibid., 248.

[91] Short, *Locomotive to Aeromotive*, 141.

to run riot in the compilation of his latest statistical tabulation."[92] Opponents characterized reports urging conservation as part of the "forest propaganda movement" and they labeled Fernow and the supporters of more careful use of timber resources as "fanatics," "cranks," and "denudatics."[93] Describing these denudatics, the *Northwestern Lumberman*, a trade journal, derided:

> They are the men who belittle our forests; who attempt to create a scare among the people, and make them believe that not only is our source of lumber supply about exhausted, but that our climate and even our national prosperity, will go to the everlasting bowwows because portions of the forests are being cut away; people whose adamantine cheek prompts them, for the purpose of being thought wise to herald the statement that such or such a timbered territory contains a specific number of feet of standing timber, when any man of broad intelligence knows that no man living is possessed of such information.[94]

While some individuals denied and dismissed the possibility of a timber crisis, others voiced indifference to the potential consequences. At the 1893 World's Fair Congress, James Defebaugh, editor of the lumber-trade journal *The Timberman*, objected to misrepresentations of consumers of wood as "ruthless" and "hostile" toward the forests.[95] In reality, "his real feeling," Defebaugh admitted, "is one of entire

[92] B. E. Fernow, "United States Department of Forestry," *The Lumber Trade Journal* (December 15, 1890), Folder: Railroad Ties, Box 32, U.S. Forest Service Newspaper Clipping File, Forest History Society, Durham, North Carolina (Hereafter cited as U.S. Forest Service Newspaper Clipping File). This article was published in the December 1, 1890 issue of *The Lumber Trade Journal*. Fernow responded to his critics in the December 15, 1890 issue.

[93] "Interest in Forestry," *Forest Leaves* 4, no. 10 (August 1894): 155; B. E. Fernow, "The Forestry Problems of the United States," *Pearson's Magazine* 11 (April 1904): 368. Filibert Roth, "The Job Ahead," *New York Forestry* (July 1919): 6.

[94] Pennsylvania Forestry Association, "Editorial," *Forest Leaves* 3, no. 2 (June 1890): 22. The journal *Forest Leaves* reported this exchange between Fernow and the *Northwestern Lumberman*, but does not provide the issue dates of the *Northwestern Lumberman* in which the argument occurred.

[95] J. E. Defebaugh, "Relation of Forestry to Lumbering and the Wood-Working Industries," in *Proceedings of the American Forestry Association* (Washington, D.C.: n.p., 1894), 151.

indifference."[96] Tired of being "scolded" for overconsumption and waste of timber, a sawmill operator insisted, "When we are out of timber, then we will curtail, but until that day, never so help us, Moses!"[97] Similarly, Charles Latimer of the New York, Pennsylvania and Ohio Railroad, rejected the need for wood preservation and timber conservation: "I think the trouble of cutting the forests is very much like killing the bears or killing the buffaloes. If you give up cutting timber for 50 years, the whole country will be overrun with forests, and the question will be how to get rid of them."[98] "The question," he resolved, "is not yet serious."[99]

The propaganda war over the fate of America's forest resources continued to escalate, and Fernow and the Division of Forestry responded to the insults and doubts aimed at their research and conservation efforts. In response to the accusation that he was a "denudatic," Fernow replied, "The 'denudatic,' let me add, is the man with the long head, with broad views, the careful man, the patriotic man, who believes in his duty to his country, besides the obligations to his pocket."[100] He elaborated, "He stands in opposition to the short-sighted and narrow-minded man who grubs for his own selfish ends; who knows nothing beyond his narrow sphere of action; who scorns, because he

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[96] Ibid.

[97] "A Letter," *Northwestern Lumberman* (November 18, 1876), quoted in John Perlin, *A Forest Journey: The Story of Wood and Civilization* (Woodstock, Vermont: The Countryman Press, 2005), 357-359.

[98] Charles Latimer, comment on "Discussion of the Preservation of the Forests," in *Transactions of the American Society of Civil Engineers*, XIV (September 1885): 396-397.

[99] Ibid., 397.

[100] Pennsylvania Forestry Association, *Forest Leaves* 3, no. 2 (June 1890): 22. The journal *Forest Leaves* reported this exchange between Fernow and the *Northwestern Lumberman*, but does not provide the issue dates of the *Northwestern Lumberman* in which the argument occurred.

lacks, that broader humanity which comes with civilization."[101] In other words, the people who resisted attempts to rationalize and economize America's forest resources selfishly stood in the way of reform and progress. Reporting on an interchange between conservationists and their opponents, the *Southern Lumberman* noted that Fernow "protests with much earnestness against the imputation of some sneering smart aleck of lumber trade journalism that his statistics of the consumption of timber for railway ties and other purposes were fanciful and riotously imaginative."[102] The editor also acknowledged, "He produces the figures and the inexorable logic to sustain his position."[103]

This belief that a timber famine loomed on the horizon or was already at hand became a recurring theme in "America's forest history," reaching its zenith in the late nineteenth century.[104] While the nation's timber consumption reached an unprecedented level during this period, scholars such as Joachim Radkau and Sherry Olson suggest that Americans' fears of a crippling timber famine were exaggerated. Radkau observed that "throughout history we find a constant vacillation between the idea that forests are endless and the fear of deforestation and shortage."[105] Because these concerns typically followed periods of significant economic growth, he described

[101] Ibid.

[102] *Southern Lumberman* (January 1, 1891), Folder: Railroad Ties, Box 32, U.S. Forest Service Newspaper Clipping File.

[103] Ibid.

[104] Robert Henry Nelson, *Public Lands and Private Rights: The Failure of Scientific Management* (Lanham, Maryland: Rowman and Littlefield Publishers, Inc., 1995), 51

[105] Joachim Radkau, *Wood: A History*, trans. Patrick Camiller (Malden, Massachusetts: Polity Press, 2012), 4.

this phenomenon as a “wood brake” that “dampened future ambitions by reminding everyone of the limits to growth.”[106] Ultimately, Radkau suggests, this wood brake “had a beneficial effect that stabilized the society of the time.”[107] Similarly, Olson identified the concept of an American timber famine as the “depletion myth.”[108]

Even foresters at the time questioned the likelihood of an actual famine of wood. Ernest Sterling, a leader in forest conservation and wood preservation argued, “The phantom of timber famine has never been very real and its use as a bugaboo or club has been a boomerang.”[109] While Olson explained that the idea of depletion “became a powerful emotional issue, and it was political dynamite,” Sterling recognized that the repercussions of deploying that dynamite could be unpredictable. He warned that the specter of timber famine caused “speculative buying of timber” and instilled doubt in the future of wood products.[110] Fernow himself admitted that it was in foresters’ best interests to propagandize the issue of forest depletion and conservation because their profession depended on it. He advised, “It behooves, then, every forester, to find justification for his art and for his own existence.”[111]

The debate over the reality of an imminent American timber famine distracted from the larger need for more careful use of forest resources. Gifford Pinchot, often

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[106] Ibid., 26.

[107] Ibid.

[108] Olson, *The Depletion Myth*, 2.

[109] E. A. Sterling, “One portrait,” *American Forestry* (June 1915): 731.

[110] Olson, *The Depletion Myth*, 30; E. A. Sterling, “One portrait,” 731.

[111] B. E. Fernow, “Outlook on the Timber Supply in the United States,” *Forestry and Irrigation* (February 1903): 74.

regarded as the “father” of American conservation who served as chief of the Division of Forestry and later the U.S. Forest Service, emphasized how counterproductive such quibbling could be.[112] “Does it matter very much, however, whether we are going to reach the end in twenty-five years or fifty years, or even one hundred years?” Pinchot questioned.[113] “We are not dealing with an agricultural crop, such as wheat, where a shortage can be made good in the course of a year or two. We are dealing with a crop which takes from fifty to a hundred years to mature.”[114] “Common sense,” according to Pinchot, necessitated adopting forest conservation policies and technology such as wood preservation rather than “talking about it for the next fifty years and then beginning to act when we have no timber left.”[115]At some point, Pinchot admonished, “we shall reach the end of our rope.”[116]

While Pinchot fretted about the long-term fate of the nation’s timber supplies, railroads worried more about how a timber famine or the threat of one would impact their immediate budgets and empty their pockets. Jeffrey Oaks, a scholar who extensively researched railroads’ adoption of wood preservation, asserts, “Even in the face of predictions of the deforestation of America, the decision of whether or not to treat ties, and which process to use, always boiled down to cost.”[117] For example, when

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[112] Char Miller, *Gifford Pinchot and the Making of Modern Environmentalism* (Washington, D.C.: Island Press, 2001), 197.

[113] Gifford Pinchot, “Our Vanishing Timber,” *Disston Crucible* (May 1920): 53, Folder: Lumber Supply, purple, Box 20, U.S. Forest Service Newspaper Clipping File.

[114] Ibid.

[115] Ibid.

[116] Ibid., 52.

[117] Jeff Oaks, *Date Nails and Railroad Tie Preservation: Volume 1* (Indianapolis, Indiana: University of Indianapolis Archeology and Forensics Laboratory, 1999), 32.

John William Kendrick, vice-president of the Atchison, Topeka & Santa Fe Railway System, addressed colleagues at the American Railway Engineering Association in 1910, he confided, "Our forests will probably continue with wood for the next thousand years—but at an ever—increasing price."[118] Imperiling the timber supply of future generations did not worry railroad executives such as Kendrick the same way rising crosstie prices concerned them.

According to Kendrick, rising prices had already negatively affected railroads. He noted, for example, that "from 1897 to 1907 the average price of oak and locust ties has increased over 50 percent."[119] Railway companies, Kendrick advised, should anticipate a steady advance in prices because shortages in certain areas would force lines to secure and haul ties from more distant locations. While some railroads enjoyed geographical advantages and possessed sufficient timber wealth that they could extract and produce ties from forests between 10 and 15 miles away, many others had to haul ties by rail an average of 500 miles in 1905. The "longest haul" for ties ranged from 1,200 to 1,700 miles.[120] Fueled by the "ever-increasing population" and the nation's "intensive industrial growth," which depended on "our transportation arteries," wood prices "will mount higher and higher," Kendrick predicted.[121] He observed that railroads

[118] J. W. Kendrick, "Conservation of Cross-Ties by Means of Protection From Mechanical Wear," *Proceedings of the Annual Convention of the American Railway Engineering and Maintenance-of-Way Association* 11 (1910): 581.

[119] Ibid.

[120] Ibid., 582.

[121] Ibid., 581.

self-reported an increase in the cost of cross ties "from 40 to 100 percent" from 1898 to 1903.[122]

Other individuals familiar with the rising demand for wood products and the fear of limited supplies concurred with Kendrick that prices would likely rise. Homer Sackett, a forester specializing in wood utilization, reported that wood prices "have steadily advanced" alongside the per capita consumption.[123] William F. Goltra, a wood preserver and consultant to railroads, agreed with Kendrick and Sackett. He calculated a lumber price increase of "78 per cent in ten years" during the period of 1897 to 1907.[124] Although he acknowledged slight decreases in some years, he maintained that lumber prices "have not, by any means, fallen as much as they have advanced during the preceding ten years."[125] While he pronounced it "vain to prophesy," Goltra projected "prices of lumber and ties will soon be on an upward trend and will continue to advance equally as much during the ensuing twenty years, as they have in the past score of years."[126] Goltra defended the upward trend as "natural and inevitable," the simple result of "a diminishing timber supply coupled with a widening demand for all kinds of timber products," particularly among railroads—the largest consumers.[127]

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[122] Ibid.

[123] H. S. Sackett, "Past and Present Prices of Forest Products," *Report of the National Conservation Commission*, 60th Cong., 2d sess., S.D. 676 (Washington, D.C., 1909), 748.

[124] W. F. Goltra, "Comparative Cost of Ties and Lumber on New York Central Lines West of Buffalo During the Past Twenty Years," *Railway Storekeeper* (June 1909): 103.

[125] Ibid.

[126] Ibid., 111.

[127] Ibid., 102.

While Kendrick, Sackett, Goltra, and other individuals reported drastic price increases in the cost of tie prices during the 1890s and 1900s, scholars examining this economic situation acknowledge that data on crosstie prices are often sparse and subjective. In a detailed examination of railroads' usage of timber, Olson concludes that crosstie price varied widely based on geography, but she ultimately argues that the late 19th century did not see an "upward trend" in tie prices.[128] While Aldrich admits that evidence for increased tie prices is "fragmentary," he ultimately maintains that "tie prices also rose sharply beginning in the late 1890s."[129] When researching railroads' adoption of wood preservation, Oaks found that "the cost of a quality tie nearly doubled from 1898 to the beginning of 1900."[130]

Despite contradictory evidence about crosstie prices, these figures minimized railroads' overall annual costs because they began to rely on woods with a shorter service lifespan, which though initially cheap, cost more in the long run because of maintenance and replacement expenses.[131] The uncertainty of timber prices clearly haunted some railroad executives such as Kendrick, who warned, "No one now living can foretell with any accuracy what the price of timber and ties will then be."[132] While he viewed precise predictions about tie prices as nonsense, Kendrick insisted it was a

[128] Olson, *The Depletion Myth*, 25.

[129] Mark Aldrich, "From Forest Conservation to Market Preservation: Invention and Diffusion of Wood-Preserving Technology, 1880-1939," *Technology and Culture* 47, no. 2 (April 2006): 319.

[130] Oaks, *Date Nails and Railroad Tie Preservation: Volume I*, 33.

[131] Aldrich, "From Forest Conservation to Market Preservation," 321.

[132] Kendrick, "Conservation of Cross-Ties by Means of Protection From Mechanical Wear," 628.

“certainty that the cost of ties will increase more rapidly in the future than it has in the past,” especially in light of the push for timber conservation.[133]

Regardless of the exact timing, or even its possibility, the perception of a timber famine, anxiety over rising wood prices, and the negative publicity aimed at railroads fueled the growth and expansion of wood-preservation in the United States. Although late-nineteenth century conservation advocates depicted the railroads as remiss for their lack of interest in wood-preservation technology, a few American railroads attempted to introduce wood preservation in the United States as early as the 1830s. Following Europe’s kyanizing craze, the Northern Central Railroad in Maryland laid “kyanized chestnut” ties along its line in 1838, and the Chesapeake and Ohio Railroad followed suit in 1840. In 1848, the Locks and Canals Company of Lowell, Massachusetts, established the first dedicated wood-preservation plant in the United States, kyanizing timber used along the locks and canals of the Merrimack River.[134] As discussed in the first chapter, kyanization, or treating wood with corrosive sublimate, proved to be a dangerous and largely ineffective process because the chemicals quickly leached out.

While European wood preservers shifted their focus to other preservatives such as zinc chloride (Burnettizing) and coal-tar creosote, American railroads sporadically experimented with these other methods. In 1856, for example, the Vermont Central Railroad constructed a Burnettizing plant to treat the railroads’ ties and bridge timbers,

[133] Ibid.

[134] Howard F. Weiss, *The Preservation of Structural Timber* (New York: McGraw-Hill Book Company, 1915), 12; E. A. Sterling, “Historical Developments of Wood Preserving in the United States,” *Lumber World Review* (November 10, 1912): 24.

but it only remained in operation for four years before they "abandoned" it.[135] Tracing the early history of wood preservation in America, Howard Weiss reported other early trials with zinc chloride among railroads in the 1860s, but he suggested their experiences were not overly successful because of the steep learning curve about how to properly treat timber and the expense associated with building and maintaining a dedicated plant.[136]

Although European railroads preferred coal-tar creosote to preserve their railway sleepers and any timber that might fall victim to shipworms, American lines initially exhibited a greater reticence in adopting this preservative. Much of their concern revolved around the expense of creosoting, which Mark Aldrich estimated cost "between forty-five and sixty cents per tie" compared with Burnettized ties, which only cost about "twenty-five cents."[137] Without an established chemical industry producing coal-tar distillates such as creosote, American wood preservers typically had to import the preservative from England and Germany, which significantly drove up the cost. Sterling, a forester, wood-preservation advocate, and consulting engineer for railroads, explained the America dilemma concerning creosote: "Tar cannot profitably be distilled for the production of creosote alone, so there must first be an incentive to recover the more valuable products, or a sure market for pitch, before what we are interested in can be produced."[138] Because "its production and distillation is not as attractive commercially"

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135 Weiss, *The Preservation of Structural Timber*, 12.

136 Ibid.

137 Aldrich, "From Forest Conservation to Market Preservation," 317.

138 E. A. Sterling, "The Production and Supply of Coal-Tar Creosote," in *Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1913), 66.

in the United States, Sterling argued, “we have been largely dependent on foreign creosote.”[139]

Despite these difficulties, a few railroads established creosoting plants in the second half of the nineteenth century. The Old Colony Railroad in Somerset, Massachusetts, built a facility in 1865 to impregnate bridge timbers with creosote, and the Louisville and Nashville Railroad constructed a creosoting plant in Pascagoula, Mississippi, in 1875.[140] Similar to their European counterparts, these lines sought to defend their timber from the “ravages of teredo,” and only creosote proved effective. While many Americans still regarded the timber supply as inexhaustible and concurred with the American Society of Civil Engineers that the cost of creosoting was “prohibitory,” the Louisville and Nashville Railroad resorted to this method after a tragic accident.[141] In 1871, shipworms made short work of the wooden piles supporting the trestle bridge over Biloxi Bay, chewing through the timber in less than ten months, and weakening the structure so much that the bridge crumbled, taking a passing freight train with it when it plunged into the bay.[142] To prevent future accidents and protect their investment, the railroad built a $60,000 plant to creosote its timber.[143]

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[139] Ibid., 67.

[140] American Wood Preservers’ Association, *Handbook on Wood Preservation* (Baltimore, Maryland: n.p., 1916), 8-9.

[141] American Society of Civil Engineers, “The Preservation of Timber,” 276.

[142] R. Montfort, “Protecting Piles Against the ‘Teredo Navalis’ on the Louisville and Nashville Railroad Company’s Lines,” *Transactions of the American Society of Civil Engineers* (February 1894): 222.

[143] Ibid.

While a few railroads such as the Louisville and Nashville embraced wood preservation technology early, the majority doubted that it would yield sufficient economic benefit. Exploring the rise and spread of wood-preservation technology, Aldrich found that by 1885, American railroads treated "less than 1 percent of all wooden ties and little else."[144] Addressing the New York Railroad Club in 1903, Fernow rebuked his audience for ignoring wood-preservation methods. "For eighteen years ago all this information was already in the world and could have been applied," Fernow exclaimed, but he characterized railroad operators and financiers as being "speculators and not investors for permanency," focused on investments "for the day, for the year, for the few years" rather than the future.[145]

Railroad men agreed with Fernow's assessment. As Howard Miller coldly informed attendees at the 1893 Columbian Exposition, "a railroad corporation is not a charitable organization, nor is it in the field for philanthropic purposes." [146] Before wide-scale adoption of wood-preservation technology could occur, foresters had to convince railroads that treating timber with creosote was worth their while. The rapid loss of preferred timber for ties and the negative publicity regarding the profligate consumption of wood pressured railroads to consider wood preservation, but past failures, misinformation, and a lack of hard evidence obstructed its widespread acceptance.

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[144] Aldrich, "From Forest Conservation to Market Preservation," 314.

[145] B. E. Fernow, comment in *Official Proceedings of the New York Railroad Club* (Brooklyn, New York: New York Railroad Club, April 17, 1903), 212.

[146] Howard Miller, "The Relation of Railroads to Forestry," in *Proceedings of the American Forestry Association at the Tenth, Eleventh, and Twelfth Annual Meetings, Washington, December, 1891, 1892, and 1893 and at the World's Fair Congress, Chicago, October 18 and 19, 1893* (Washington, D.C.: American Forestry Association, 1894), 161.

While Fernow chastised the railroads for their reluctance to adopt wood-preservation technology, another attendee and presenter at the 1903 New York Railroad Club meeting understood their position. Hermann von Schrenk, a leading plant pathologist, wood-preservation scientist, and consultant for railroads, explained their reluctance: “The great question that always arises with them is how shall we accomplish these methods of preservation, what methods shall we use, and in what way shall we go to work to reduce the expense involved, and get the most rapid results of a process decided on?”[147] To answer these questions, von Schrenk argued, “That involves some close figuring. It involves exact, detailed knowledge of the way in which material can be handled. It involves accurate knowledge and a large amount of statistics as to the length of life of timber, all of which unfortunately are not at hand.”[148]

The hard evidence von Schrenk referenced eluded American wood preservers in the late nineteenth and early twentieth centuries. Even the American Society of Civil Engineers, which appointed a special committee to study wood preservation, acknowledged the existing literature was “very confusing.”[149] Chanute, who authored the committee’s 1885 report, articulated their frustrations: “Not only were there the greatest possible differences in the opinions which were expressed, but the facts seemed to contradict each other. Apparently, the same processes seemed to give different results, and these again differed from the European experience.”[150]

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[147] Hermann von Schrenk, “Forestry and the Preservation of Ties as Relating to the Question of Providing ties for the Use of Railroads,” in *Official Proceedings of the New York Railroad Club* (Brooklyn, New York: New York Railroad Club, April 17, 1903), 205.

[148] Ibid.

[149] American Society of Civil Engineers, “The Preservation of Timber,” 248.

[150] Ibid.

To gather information on wood-preservation experiments in the United States, the committee distributed circulars and collected correspondence, but as Chanute acknowledged, this information was anecdotal and inherently unreliable. Researching past experiments, he explained, "was very tedious" since the lack of written records necessitated relying "upon personal recollections," and oftentimes "it required three or four to recollect the details of one experiment," and tracking down the participants proved challenging since they "had changed their business connection, and were scattered all over the country."[151] Although railroads kept "bales" of detailed records of their tie usage, replacement rates, and wood-preservation attempts, most of these records—as von Schrenk's biographer James Cronin asserted—were utterly "valueless."[152] "Owing to ignorance, carelessness, indifference, oversight or changes in executive and administrative staffs," Cronin noted, railroads often did not follow up on their experiments and there was no standardization among their reports.[153] This disorganized experimentation exacerbated confusion over wood-preservation methods, and further discouraged consumers from adopting this technology.

As von Schrenk concluded, before railroads and other large consumers of wood endorsed wood preservation, they wanted reliable data and step-by-step guidelines that proved creosoting was worth their investment. This required wood preservers to transform their image from "haphazard, hit-or-miss, rule of thumb practitioners" to that of

[151] Ibid.

[152] James E. Cronin, *Hermann von Schrenk A Biography* (Chicago: Kuehn, 1959), 84.

[153] Ibid.

modern, scientific professionals.[154] Collaborating with government forestry officials and engineers provided the wood-preservation industry with scientific cachet and the reputation of being committed to forest conservation.

Although Fernow was a vocal critic of excessive consumption of timber, he recognized that the Division would have to appeal to railroads' commercial interests to convince them to adopt more responsible forest management practices. He devoted much of the Division of Forestry's limited resources "to research in wood technology and spreading this information to the consumers of wood."[155] From 1887 to 1896, under Fernow's purview, the Division conducted over 40,000 "Timber Physics" tests investigating and debunking common misconceptions about wood.[156] As Fernow explained in his introductory remarks to the published research, "there does not exist much reliable published information for general use" about the properties of this material and best practices for using timber.[157] He described this endeavor as "the most comprehensive of the kind ever undertaken anywhere, in this country or in Europe."[158]

Fernow emphasized railroads stood to benefit from these tests because of their extensive use of timber for ties. "There are means of doubling their life easily by using only the more durable kinds, paying proper attention to the handling of the ties and by

[154] Ibid., 83.

[155] Olson, *The Depletion Myth*, 40.

[156] Ibid., 48.

[157] B.E. Fernow, *Timber Physics: Part 1 Preliminary Report* (Washington: Government Printing Office, 1892), 1.

[158] Ibid., 3.

impregnation with fungus-resisting materials or by other processes," he observed.[159] Appealing to the railroads' financial motivation, he stressed the long-term savings of millions of dollars if lines followed the Division's recommendations and preserved their ties. To drum up support among this audience, Fernow included excerpts of letters from railroad engineers supporting the tests. J. D. Hawks, chief engineer of the Michigan Central Railroad Company, conceded that "it is a very expensive matter for us to be compelled to learn the facts as to strength and lasting qualities of all these timbers by experience."[160] He implored, "If the Government would undertake these tests for the people it would be a very great assistance, not only to the railroads, but to other users of timber, as well as those who have timber to sell."[161] Similarly, L. L. Randolph, an engineer for the Baltimore and Ohio Railroad Company, bemoaned the lack of existing information about timber properties and clearly recognized the railroads' inefficiency: "We are using in many cases more timber than should be used, on account of a lack of knowledge of its strength and other properties, and in some cases are running risks which should not be taken, relying on incomplete investigations."[162]

As these comments suggested, railroads had already begun to recognize their own wastefulness and actively sought solutions that would save money. If, in the process, their adoption of wood-preservation technology saved trees, railroads would reap the rewards of a positive public image. In Olson's study of the railroads' use of

[159] Ibid., 1.

[160] Ibid., 5.

[161] Ibid.

[162] Ibid.

timber, she argues that the process of “railroad consolidation”—the mergers, acquisitions, and leases that American lines underwent in the 1870s and 1880s—“encouraged the creation of institutions and methods for collecting information and analyzing economic problems on the railroads as a whole.”[163] Initially, railroads focused on simply analyzing and streamlining their handling and use of wood. As Olson explains, large operations such as the Burlington, Santa Fe, and the New York Central, attempted to economize and improve their efficiency by preventing decay in their own lumberyards with regular cleanups, establishing standard grading and lumber specifications, and controlling their inventory so they did not have an excess of timber rotting and decaying in their railyards.[164]

To conduct these investigations into the timber economy of their lines, railroads established their own testing laboratories where they ran “mechanical tests,” employed “new techniques such as chemical, microscopic, and statistical analysis,” and maintained “systematic service records.”[165] Although, as historian Mark Aldrich notes, “The Pennsylvania Railroad opened the first corporate research laboratory in America in 1874 at Altoona, Pennsylvania,” other large lines quickly followed suit in the late 1870s, hiring professional chemists and engineers to manage and operate these institutions.[166] These railroad research laboratories marked the emergence of the “central corporate

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[163] Olson, *The Depletion Myth*, 44.

[164] Sherry Olson, “Commerce and Conservation: The Railroad Experience,” *Forest History Newsletter* 9, no. 4 (January 1966): 5.

[165] Ibid., 6.

[166] Mark Aldrich, *Death Rode the Rails: American Railroad Accidents and Safety, 1828-1965* (Baltimore: Johns Hopkins University Press, 2006), 48.

R&D laboratory," which economist Joshua Lerner contends remained "a dominant feature of the innovation landscape for most of the twentieth century."[167]

Specialized professional and technical organizations expanded rapidly in the late 19th century, which provided wood-preservation advocates with venues to promote their industry. Although not exclusively focused on railroads or wood preservation, organizations such as the American Society of Civil Engineers and the American Society of Mechanical Engineers, often hosted and featured presentations and articles on the timber-supply question, preventing rot and decay, and chemically preserving timber.[168] Technical societies devoted specifically to railroad engineering, operations, and management also proliferated in the late nineteenth century. In 1899, for example, railroads established the American Railway Engineering Association (AREA), which focused significant attention on wood-preservation technology and research on the best timber for railroad usage. AREA even organized standing committees on crossties and wood preservation.[169] More specialized technical journals including the *Railroad Gazette, Railway Age, Railway Review,* and *the Railway Mechanical Engineer* provided railroads with opportunities to share the findings of their own investigations and personal experiences with timber usage and wood preservation.[170]

Prompted by forest conservationists' warnings of an imminent timber crisis and the growing interest in efficiency and economy among railroads, an "institutional matrix"

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[167] Joshua Lerner, *The Architecture of Innovation: The Economics of Creative Organizations* (Boston, Mass: Harvard Business Review Press, 2012), 28.

[168] Aldrich, *Death Rode the Rails*, 47.

[169] Ibid., 44; Aldrich, "From Forest Conservation to Market Preservation," 320.

[170] Aldrich, *Death Rode the Rails*, 49.

supporting the nascent American wood-preservation industry gradually emerged.[171] In 1904, at the St. Louis World's Fair, a group of twenty-four men, many of them railroad representatives, engineers, scientists, and government foresters, convened and founded the American Wood Preservers' Association (AWPA). This organization's purpose, as one of its longtime members and officers explained, was "to advance the wood preserving industry in all its branches and encourage wood preservation along all lines, and especially the preservation of ties and timber which are used in the maintenance and construction of the great railroads of America."[172]After its inception in 1904, the AWPA met annually, and as Robert Graham notes, "Virtually all significant advances in wood preservation would be published in its *Proceedings*."[173] Meetings provided "the forum for discussion" and "for standardization of specifications of preservatives and their application to wood."[174]

With the AWPA, wood preservers now had a central association that connected supporters, established best practices, and disseminated new research. The organization helped legitimize the industry, especially in the eyes of the railroad owners, operators, and engineers who wanted hard evidence of clear economic benefits before they wasted their time and money chemically treating ties. An emerging group of wood-preservation advocates affiliated with the AWPA also broke down barriers that had long

[171] Charles M. Haines, "The Industrialization of Wood: The Transformation of a Material" (Ph.D. diss., University of Delaware, 1990), 25.

[172] J. H. Waterman, "Wood Preservation and Forest Conservation," *Report of the Fifteenth Annual Meeting of the Canadian Forestry Association* (1913): 73.

[173] Robert Graham, "History of Wood Preservation," in *Wood Deterioration and its Prevention by Preservative Treatments*, ed. Darrel Nicholas 1-30 (Syracuse, New York: Syracuse University Press, 1973), 9.

[174] Ibid.

distanced railroads from government foresters. Although conservation proponents such as Fernow demonstrated a willingness to collaborate with industries in the interests of preventing forest devastation and waste, they spent a great deal of effort and time castigating and lambasting railroads for their depredations. This approach did not endear Fernow and his followers to the railroad industry—the primary market for implementing wood-preservation technology. A new crop of technical experts deployed a different approach.[175]

Hermann von Schrenk, the plant pathologist turned wood-preservation expert who defended railroad executives' hesitancy to embrace wood preservation on a widespread scale, played a critical role in railroads' acceptance of this technology. Rather than reprimanding the railroads for their gluttonous appetites, von Schrenk invited their participation, collaboration, and cooperation.[176] Although many other scientists, engineers, and researchers such as Chanute possessed considerable knowledge and experience with wood preservation, von Schrenk became, as his biographer James Cronin remarks, "Mr. Woodpreserver, a giant standing alone."[177] Railroad men came to regard von Schrenk as "a prophet and leader who could show them the way to better days and longer lasting ties."[178] First, "he had to produce results that would show on cold, statistical reports."[179]

[175] Cronin, *Hermann von Schrenk*, 83.

[176] Ibid., 84.

[177] Ibid., 83.

[178] Ibid.

[179] Ibid.

Born in New York in 1873, von Schrenk followed in his father, Joseph's, footsteps, pursuing advanced degrees in botany.[180] After completing his Ph.D. at Washington University in St. Louis, von Schrenk taught at the Shaw School of Botany, increasingly focusing his research on tree diseases, timber decay, and wood-eating insects.[181] His research captured the interest of the United States Department of Agriculture (USDA), and in 1899, the USDA appointed von Schrenk as a special agent working with the Division of Plant Physiology and Pathology and the Division of Forestry to research diseases plaguing forest trees. Von Schrenk also remained in his position at the Shaw School in St. Louis.[182]

Without centralized testing facilities, the USDA traditionally relied on "the very agriculturists" the institution was designed to help. They appointed "grower 'special agents'" or field testers who volunteered their "labor and land for use in experiments."[183] Shifting away from this approach to professionalize the study of plant pathology and forestry, the USDA began recruiting experts such as von Schrenk to create a "widespread corps of special agents around the country, directly or indirectly controlled from Washington, dedicated to researching an ever growing variety of plant disease subjects."[184] While presenting his research on timber decay to scientific societies, von Schrenk attracted the attention of railroad officials who invited him to attend a

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[180] Ibid., 3.

[181] Guy Forshey, "Interesting St. Louisans: Hermann von Schrenk," *St. Louis Post-Dispatch* (20 October 1929): 5.

[182] Paul D. Peterson and Clay S. Griffith, "Herman von Schrenk: The Beginnings of Forest Pathology in the U.S.," *Forest History Today* (Fall 1999): 30-31.

[183] Ibid., 31.

[184] Ibid.

conference on chemically treating timber to increase its longevity, and they even sent him a railroad pass to cover his transportation. The conference provided von Schrenk with an excellent networking opportunity, and he began corresponding with Leonor Loree, vice-President of the Pennsylvania Railroad, whom he soon visited in Pittsburgh.[185]

According to von Schrenk, the Pennsylvania Railroad's executives and board of directors interrogated him for hours, assessing his knowledge of decay and rot. Impressed with his responses, they asked von Schrenk how they could help further his research. He boldly pronounced government appropriations to be insufficient and "he wondered if the Pennsylvania Railroad would use its influence to get a larger appropriation."[186] Without balking, Loree supposedly asked his stenographer to step in the room so that von Schrenk could dictate his appeal and Loree could send it off. Next, von Schrenk requested that railroad executives send him cross-ties from different wood species because he could not afford to buy them for experiments and the government did not have the money to purchase ties. Promising to "ship them to you at once," Loree then asked von Schrenk what else he required to advance his experiments on decay.[187] Von Schrenk inquired whether the Pennsylvania Railroad might help cover his expenses so he could travel to Europe and study European methods of wood preservation. Loree explained that the Railroad "had no fund for such an undertaking,

[185] Forshey, "Interesting St. Louisans," 5.

[186] Ibid.

[187] Ibid.

but he would see what could be done to raise one, and he started it right there with $500 out of his pocket."[188]

In less than three weeks, Loree secured over $5,000 to fund von Schrenk's European research trip, and the list of donors underscores how important the railroads viewed this matter. Stuyvesant Fish, president of the Illinois Central Railroad; Alexander Cassat, president of the Pennsylvania Railroad; Edward Harriman, a Wall Street tycoon who served as a board member of the Union Pacific Railroad; and George Gould, the son of Jay Gould who also dabbled in finance and railroads, made up the ranks of von Schrenk's benefactors.[189] This encounter launched a lifelong relationship and camaraderie between von Schrenk and American railroads, which eventually isolated him from government bureaucrats including Pinchot who believed he was too familiar and friendly with railroad and lumber interests. Despite the complicated dynamics that von Schrenk navigated, government officials did not interfere with his collaborative railroad work, perhaps because they recognized that railroad support and funding were vital to the success of wood preservation and the larger conservation agenda.[190]

With the financial support of railroad sponsors, von Schrenk made over twelve European trips, traveling throughout England, Germany, France, and Russia to study preservative methods. His experiences confirmed what many researchers had already concluded: the use of coal-tar creosote as a wood preservative enabled Europeans to

[188] Ibid.

[189] Ibid.

[190] Cronin, *Herman von Schrenk*, 113-118.

produce ties that lasted “about twice as long” as any ties Americans produced.[191] On these trips, von Schrenk learned about modifications to Bethell’s pressure-treating process that used less creosote, aiming to improve the economy of creosoting and overcome one of the largest barriers to its adoption—expense.[192]

Convinced that creosote treatments would “revolutionize the cross-tie industry in the United States,” von Schrenk returned prepared to help railroads preserve ties on a large scale.[193] He conducted much of his research at the Mississippi Valley Laboratory in St. Louis, which the USDA, the Shaw School of Botany, and the Missouri Botanical Garden established in 1901. Von Schrenk urged railroads and wood-preservation companies to assist with large-scale testing projects he ran in conjunction with his work for the USDA.[194]

In the fall of 1901, for example, von Schrenk orchestrated a massive test about seventy-five miles outside of Somerville, Texas, along an experimental track owned by the Gulf, Colorado and Santa Fe Railway. An AREA bulletin praised this choice of location because it was “the most noxious place which could be found,” with the heat, humidity, and rainfall typically decaying untreated pine ties in about one year.[195] Von Schrenk secured donations of over 8,000 ties produced from 15 different species of wood from major railroads including the Atchison, Topeka, and Santa Fe; the Missouri

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[191] Forshey, “Interesting St. Louisans,” 5.

[192] Oaks, *Date Nails and Railroad Tie Preservation: Volume 1*, 38-39.

[193] Forshey, “Interesting St. Louisans,” 5.

[194] Peterson and Griffith, “Herman von Schrenk,” 32.

[195] American Railway Engineering and Maintenance of Way Association, “Report of Committee No. III—On Ties,” *American Railway Engineering and Maintenance of Way Association, Bulletin* 18 (March 1902): 8-9.

Pacific; and the Illinois Central. Active timber preservation plants in Chicago, Illinois; Beaumont, Texas; and Somerville, Texas; treated these ties using seven different preservative processes, and then, von Schrenk and his colleagues installed the crossties along the test track.[196] Nails in each tie marked the installation date, type of wood, and preservative process, a practice that many railroads experimenting with wood preservation already employed so they could keep accurate records about which ties deteriorated and which ties enjoyed a longer service life. In the interests of maintaining better records, specialists such as von Schrenk regularly checked the ties and provided updates about their status.[197]

This test marked "one of the first truly systematic tie testing experiments undertaken in America on a scale large enough to be definitive."[198] Although results would not occur overnight or even within a year, von Schrenk's experiment outside of Somerville demonstrated the importance of precise and accurate recordkeeping and reinforced his value to the railroads. While many lines conducted tie-treating experiments and produced voluminous records on their investigations long before von Schrenk's test, they did not organize or standardize their records and data-collection methods. The bias inherent in railroad-conducted tests raised doubts about the validity and accuracy of their results.[199] Von Schrenk's involvement and scientific approach addressed these limitations and soothed railroads. As his biographer explained: "here

[196] Cronin, *Herman von Schrenk*, 84.

[197] American Railway Engineering and Maintenance of Way Association, "Report of Committee No. III—On Ties," 9.

[198] Cronin, *Herman von Schrenk*, 84.

[199] Ibid., 83-84.

was a strong voice speaking with obvious knowledge and authority, offering them assurance that at last (although there was much to be studied) a systematic highly trained scientific mind was applying itself to the problem 'from the ground up.'"[200]

Just as von Schrenk brashly requested funding and assistance from the Pennsylvania Railroad, he continued to lobby railroads to provide the capital and aid necessary to further his wood-preservation experiments. In what now, as Cronin observes, appears to be "a remarkable combination of naivete and astuteness," von Schrenk actively solicited support for his research by inviting railroads and other large consumers of wood to pay a monthly subscription fee for updates about experiments such as the one outside of Somerville, Texas.[201] In addition to regular research updates, subscribers received answers to controversial questions about wood preservation and personalized advice about how to treat their timber to increase its service life. Von Schrenk also expected subscribers to provide test track for further experimentation, to use their status and connections to petition government officials for greater appropriations, and to raise additional funds as needed. While this subscription idea may seem farfetched to a modern audience, evidence suggests many railroads supported his scheme. The Atchison, Topeka, and Santa Fe Railroad; the Chicago, Burlington and Quincy; the Missouri Pacific; the Frisco System; and the American Telephone and Telegraph Company ranked among his monthly subscribers. While limited government appropriations might have hindered von Schrenk's research on timber decay, this novel subscription service netted him "about $25,000 a year as an

[200] Ibid., 83.

[201] Ibid., 77.

expense fund for carrying out his experiments, in addition to the share of the Bureau budget."[202]

Von Schrenk clearly had the attention of major players in the railroad industry, and he continued to court their favor. He agreed to set up a timber-treating laboratory to demonstrate the process and benefits of creosoted timber to live audiences at the 1904 World's Fair held in St. Louis.[203] Although he struggled to construct the laboratory and perfect the preservative treatment for the fair's opening in May 1901, he eventually succeeded in time for many railroad delegates and other consumers of wood to visit the timber-preserving station and explore exhibits on forestry and plant pathology. Von Schrenk's wood-preservation laboratory at the World's Fair proved to be a gathering point for wood-preservation advocates. While convening at the timber-treating laboratory, they agreed to establish their own association devoted to the cause of wood preservation—the AWPA. At the time, von Schrenk abstained from participating as an active member because of his position as a government agent. Nevertheless, the wood-preservation industry now had a prestigious spokesperson who railroads depended on and trusted for advice.[204]

With von Schrenk's leadership and the railroads' increasing acceptance of wood preservation, the AWPA's membership expanded rapidly. While 20 individuals formed the inaugural group at the 1904 World's Fair in St. Louis, membership ranks grew to

[202] Ibid.

[203] Forshey, "Interesting St. Louisans," 5.

[204] Cronin, *Herman von Schrenk*, 109.

104 individuals by 1911 and 299 individuals by 1916. [205] In a report at the 1919 annual convention, F. J. Angier, the secretary-treasurer, proudly noted that the organization's membership increased steadily since 1904, only showing a slight decline in 1917 and 1918, which he attributed "to the unprecedented times" caused by World War I.[206] "Corporate members" represented the bulk of the AWPA's membership—80 percent in 1919—and the organization's definition of this classification provided insight into the occupational backgrounds of its members.[207] These included executives, administrators, or any "operatives" in "a wood-preserving organization"; employees of public-utility companies that used treated wood; chemists or engineers in the employ of cities, counties, states, or nations; consulting chemical, civil, mechanical, forest, and electrical engineers; and professors or instructors at colleges and universities.[208]

Most AWPA members, however, represented railroads and commercial treating plants, which sprang up in response to the increased demand for longer-lasting timber. (Figure 4-1) Companies such as Eppinger & Russell, Republic Creosoting, and Ayer & Lord Tie, established treating plants in multiple locations, extending their reach across the United States. Eppinger and Russell opened a wood-preservation facility on Long Island, New York, in 1878, and later expanded to Jacksonville, Florida, by 1909. Republic Creosoting entered the wood-preserving business in 1896, building their first plant in Indianapolis, Indiana, and adding a second plant in Minneapolis, Minnesota, in

[205] F. J. Angier, "Report of the Secretary-Treasurer," in *Proceedings of the Fifteenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1919), 41. (hereafter cited as *AWPA Proceedings 1919*).

[206] Ibid., 42.

[207] Ibid., 7 and 41.

[208] Ibid., 7.

1903. In 1905, Republic Creosoting launched a southern location in Mobile, Alabama. Ayer & Lord Tie operated three major plants—one in Carbondale, Illinois, built in 1903; another in Grenada, Mississippi, constructed in 1904; and a third in Argenta, Arkansas, opened in 1908.[209] (Figure 4-2) To control costs and the treating process, railroads began constructing their own timber-treating plants instead of purchasing treated ties from third-parties. The Atlantic Coast Line Railroad, for example, built a creosoting facility in Gainesville, Florida, in 1912.[210] As their choice of locations reveals, timber-treating companies and railroads gravitated toward the American South because of its abundant timber resources, and they had already depleted much of the timber in the Northeast and Midwest.

From 1870 to 1892, the number of treating plants operating in the United States remained in the single digits and the industry exhibited slow or nonexistent growth. As the examples above illustrate, these figures drastically increased by the turn of the twentieth century. In 1904, the year of the AWPA's founding, 30 facilities preserved timber in the U.S. By 1910, the number of operating plants grew to 75, and surpassed 100 by 1915.[211] The growing percentage of railroads that relied on wood preservation for their crossties reinforced the industry's expansion. Although in 1900, wood preservers only treated about 1 percent of the 110 million crossties they consumed for their lines, this percentage increased to 11 percent of 150 million crossties 5 years later

[209] *Proceedings of the Seventh Annual Meeting of the American Wood Preservers' Association* (Chicago: Bazner Press, 1911), 213-214.

[210] "The Creosoting Plant of the Atlantic Coast Line," *Railway Age Gazette* 57, no. 3 (1914):125.

[211] American Wood Preservers' Association, *Handbook on Wood Preservation*, 20.

in 1906.[212] Creosoting became the preservative of choice at many of these plants and among railroads, which is illustrated by U.S. Forest Service calculations published in a 1916 AWPA *Handbook on Wood Preservation*. Each year during the period of 1909 to 1915, creosoted lumber comprised over 50 percent of the total cubic feet of material treated in the U. S, steadily outpacing zinc chloride and other preservative treatments.[213]

Although creosoting had gained ground in the United States, its acceptance as the preservative of choice did not result in a consensus about the precise process used to impregnate timber. This question consumed many AWPA members and caused contention in the industry as wood preservers and consumers of treated wood debated the technicalities and merits of seasoning the wood prior to treatment, the concentration and type of creosote employed, and whether preservative should totally saturate the wood's cell walls and cavities (full-cell creosoting) or merely the cell walls (empty-cell creosoting).[214] Because the empty-cell process employed less creosote and left the wood cells less fully saturated, it ultimately cost less, which intrigued many individuals and companies concerned with minimizing the expense of wood preservation. Many die-hard advocates of full-cell creosoting such as Chanute, regarded these newer, empty-cell processes with distrust, viewing them as "simply fraudulent and bad craftsmanship."[215]

[212] Charles A. Nelson, *History of the U.S. Forest Products Laboratory, 1910-1963* (Madison, Wisconsin: Forest Products Laboratory, 1971), 16.

[213] American Wood Preservers' Association, *Handbook on Wood Preservation*, 16.

[214] Oaks, *Date Nails and Railroad Tie Preservation: Volume 1*, 22.

[215] Short, *Locomotive to Aeromotive*, 167.

Promoters of empty-cell methods advertised their treatment as cheaper, and they secured "long-lasting, lucrative contracts" with railroads and other large consumers of wood.[216] If consumers chose not to buy their treated timber directly from these manufacturers, they could license the technology for a price, paying royalties on each piece of timber they preserved in their own plants. The lack of transparency about empty-cell methods, which many practitioners refused to divulge, frustrated full-cell advocates and escalated calls for more objective and centralized testing of wood preservatives and the establishment of industry standards.[217]

Von Schrenk reinforced the challenges and turmoil that plagued the industry in its early days. At a 1919 annual meeting of the AWPA, von Schrenk recalled how far the organization and the industry had progressed. He reminded his audience that when they first met in 1904, there had been "as many viewpoints expressed as to how ties should be treated" as members in attendance.[218] "There were no specifications, gentlemen," he lectured, "Nobody made any analyses. The plants were run according to the notion of the individual operator."[219] He also acknowledged the limitations of the industry's early efforts: "We did all kinds of experimental work on a large scale without any very good reason why we should do so."[220]

While von Schrenk and AWPA members depicted these early days as tumultuous and confusing ones, they clearly viewed their work as enlightened. One

[216] Ibid., 181.

[217] Ibid.

[218] *AWPA Proceedings 1919*, 154.

[219] Ibid, 155.

[220] Ibid., 158.

AWPA executive described the organization’s efforts as “true conservation.”[221] J. H. Waterman, vice president of the AWPA in 1913, spoke to the Canadian Forestry Association in Winnipeg, and proclaimed, AWPA members “are doing as much—I am going to say more—than any other one organization to conserve the forests of North America.”[222] They accomplished this Herculean task, he argued, “By making one stick of timber or one tie go as far as three.”[223]

While the AWPA played a vital role in promoting wood preservation, the organization did not achieve the true conservation that Waterman boasted about. Wood preservation conserved trees and made timber last longer, but the toxic preservatives degraded the environment and endangered public health. In addition, the credit for extending the life of timber did not belong to the AWPA alone. Instead, the establishment and work of the Forest Products Laboratory in 1910 legitimized and strengthened the wood-preservation industry. Although technical and professional organizations investigating the mechanics of wood preservation flourished in the late nineteenth and early twentieth centuries, the industry still lacked a centralized testing and research arm. Instead, many different railroads, technical and professional groups, and government agencies conducted tests independently of one another. While Fernow oversaw successful timber physics investigations from 1891 to 1896 under the auspices of the USDA’s Forestry Division, political pressures prompted the shutdown of this testing program in 1896 without much of an explanation. Historian Charles Nelson

221 Ibid., 39. J. H. Waterman, a past AWPA president, made this remark at the 1919 AWPA convention.

222 Waterman, “Wood Preservation and Forest Conservation,” 73.

223 Ibid.

reasoned, “Those who regarded forestry as an economic method of protecting and preserving American forests or as the practical art of forest culture apparently thought timber physics merely extraneous.”[224]

When Pinchot became chief of the Division of Forestry in 1898, he initially emphasized “forest management” rather than “forest products investigations.”[225] The work of von Schrenk, conducted under both the Bureau of Plant Industry and the Bureau of Forestry, reawakened interest in wood preservation among government officials. When railroads, which exerted significant political pressure, conveyed an interest in wood preservation, they provided renewed impetus for the creation of a government-affiliated testing agency that collaborated with industry. Although von Schrenk parted ways with government agencies after a major falling out with Pinchot, he established a precedent of “cooperation with private wood users” that his followers perpetuated.[226] Von Schrenk continued his wood-preservation research in a much more profitable venue—as a private consultant for railroads who paid him far more than the federal government for advice on how to treat their timber. Before leaving, he confidently told Pinchot that he had already secured positions as a technical expert for major railroads, and he declared, “From these sources I shall receive an annual salary of $15,000 on the present basis. Negotiations are in progress which will probably increase this amount by $5,000 or more.”[227] In addition, railroads and timber companies

[224] Nelson, *History of the U.S. Forest Products Laboratory*, 10.

[225] Ibid., 12.

[226] Ibid., 19.

[227] Cronin, *Herman von Schrenk*, 131.

paid von Schrenk handsomely—over $150 per day in addition to expenses—to testify as an expert witness in legal battles over creosote's occupational health risks.[228]

While railroads and timber companies built a corps of experts such as von Schrenk to serve as consultants, they remained open to working with government agencies. After von Schrenk left, the Bureau still conducted cooperative, wood-preservation research "with railroads, pole companies, and mining companies."[229] Often, they outsourced this work to forestry schools around the country or sent agents to the company because they lacked laboratory space, equipment, and personnel required to perform the research. Railroads and lumber companies paid for "the materials for the tests."[230] Evaluating the challenges of research under these circumstances, Nelson concluded, "Valid and comprehensive results were impossible under the arrangement."[231]

Researchers concurred with this sentiment. Howard Weiss, for example, one of the early government foresters assigned to help the Great Southern Lumber Company at Bogalusa, Louisiana, with their attempts at wood-preservation, communicated embarrassment over his plight and the "foolishness of the whole situation."[232] Weiss remembered that the only equipment he possessed for the venture "was two galvanized

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[228] Ibid., 163.

[229] Nelson, *History of the U.S. Forest Products Laboratory*, 20.

[230] Ibid., 22.

[231] Ibid., 22.

[232] United States Department of Agriculture, Forest Service, *Searching for Dollars in Wood: A Trip Through the Forest Products Industrial Laboratory* (Washington D. C. : Government Printing Office, July 23, 1920), 4.

iron tanks which I had had made at a cost of about $20 each."[233] "I felt like a very poor representative of the greatest government on earth in thus trying to demonstrate the art of preserving timber with a lack of funds for effective organization," he lamented.[234]

Frustrated with their predicament, Weiss and McGarvey Cline, another leading research engineer who assisted with timber-testing demonstrations of creosoted wood at the 1904 World's Fair, strategized about how to fund and create a dedicated forest products laboratory. Well aware of the lack of governmental funds available for such an undertaking, Cline made a brilliant suggestion—"to secure the cooperation of some university."[235] Pinchot approved the plan, and they reached out to major institutions including the University of Wisconsin, Purdue, the Carnegie Institute of Technology, the University of Illinois, Yale, Cornell, and the University of Michigan.[236]

Based on Cline's proposal, the university that won this contest consented to provide "approximately thirteen thousand square feet of floor space, special foundations for the testing machines, heat and utilities, and administrative offices."[237] The Forest Service, in turn, would be responsible for securing staff, equipment, and testing materials. Graduate students at the university would be able to make use of the facilities, laboratory staff would give lectures there, and the university would receive credit as a "cooperator" on any publications.[238] After a heated contest, the Forest

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[233] Ibid., 3.

[234] Ibid., 4.

[235] Ibid.

[236] Nelson, *History of the U.S. Forest Products Laboratory*, 25.

[237] Steen, *The U.S. Forest Service*, 133.

[238] Ibid.

Service selected the University of Wisconsin as the site of the new Forest Products Laboratory (FPL) on March 5, 1909.[239] The FPL opened in April 1910, and at the dedication ceremony in June 1910, Cline described it as a “laboratory of practical research,” that would investigate wood’s mechanical and physical properties, advance wood-preservation research, discover innovative uses for wood waste, and collaborate with industries.[240]

Despite the efforts of researchers and practitioners such as von Schrenk and the railroads commissioning his research, the wood-preservation industry, as Nelson observed, “lacked a truly scientific basis” before the FPL opened in 1910.[241] To professionalize and reform timber preserving, the FPL focused on investigating and standardizing processes and preservatives. Historically, this lack of standardization and consistency prevented many consumers from adopting and consistently employing wood treatment. As Nelson explained, a bewildering array of preservatives and methods confronted the consumer who “faced the perplexing problem of ascertaining just what preservative to use for his purpose and what process would yield the best results.”[242] Creosote, as it had for centuries, confounded buyers, sellers, and researchers, because of confusion over terminology, chemical composition, and its source. Although creosote ranked as the leading wood preservative in 1910, the term “was applied indiscriminately to oils from different material and in different methods.”[243]

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[239] Nelson, *History of the U.S. Forest Products Laboratory*, 25.

[240] Steen, *The U.S. Forest Service*, 134.

[241] Nelson, *History of the U.S. Forest Products Laboratory*, 54.

[242] Ibid.

[243] Ibid.

The FPL tackled this creosote conundrum, studying commercial creosotes and preservatives masquerading as creosote. To assist consumers, extend the life of timber, and repair the image of wood preservers, the FPL classed these preservatives based on quality. Researchers in the organization's wood preservation division also investigated the toxicity of existing preservatives available on the market. The question of toxicity, however, centered around how well these preservatives killed the organisms causing wood to deteriorate, not the environmental, occupational, or public-health risks associated with their widespread use.[244]

While the FPL made significant and specific contributions in the field of wood preservation with its classification of creosote and exploration of toxicity, "consumer education" ranked as its most important contribution.[245] Although conservation advocates such as Hough and Fernow worked for decades to persuade consumers that wood preservation would benefit them, many remained unsure. As Nelson observed, the FPL's "major problem lay in convincing wood users that preservative treatment would not only reduce the cost of wood in service but also reduce the drain on the forest supply."[246] The support of a research institution such as the University of Wisconsin, alliances with technical and professional organizations such as the AWPA, and backing from the federal government all positioned the FPL's staff to advance wood preservation in a way its predecessors had not. To persuade consumers, the FPL released a barrage of bulletins, circulars, and other government publications promoting wood preservation

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[244] Forest Products Laboratory, *Testing Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Dec. 1938), 2 and 3.

[245] Nelson, *History of the U.S. Forest Products Laboratory*, 55.

[246] Ibid.

and providing detailed instructions on the most effective ways to treat wood. Its researchers also published the results of their investigations in trade, technical, and scientific journals.[247] (Figure 4-3)

The most crucial component of the FPL's consumer education plan centered around collaboration with industry. In fact, industry ties existed from the FPL's very inception. As Aldrich notes, this new organization's establishment was "largely at the behest of timber interests."[248] In a 1920 decennial report detailing the FPL's accomplishments and mission, the author—presumably an FPL staff member—observed, "To a greater or less degree every wood-using industry of the country is a prospective user of the Forest Products Laboratory or the data available there."[249] The author characterized the FPL's relationship with wood-using industries as one of "cooperative service."[250] According to the FPL, its "cooperative service" helped industries "at minimum expense, in a larger way than would be possible by limiting activities exclusively to the work authorized by annual appropriations from Congress."[251]

A 1920 FPL publication, *Searching for Dollars in Wood*, detailed the ways in which the Laboratory aided industry by assisting in the planning, design, and specifications for the many wood-treating plants that spread throughout the country. More broadly, FPL staff also investigated and improved "the methods of private

[247] United States Department of Agriculture, Forest Service, *Searching for Dollars in Wood,* 14.

[248] Aldrich, "From Forest Conservation to Market Preservation," 321.

[249] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory: A Decennial Record, 1910-1920* (Madison, Wisconsin: Democrat Printing Company, 1921), 75.

[250] Ibid., 77.

[251] Ibid., 81.

concerns in handling forest products."[252] This publication outlined the Laboratory's guidelines for compensation, although the discussion of payment is abstract: "In cases of active cooperation there should be a remuneration to the Service equivalent to the total cost of the work done for the cooperator, including both the time and expense of the members of the laboratory detailed to the project."[253] When the research was more experimental, "of value chiefly to the Service rather than to the cooperator," or "of value chiefly to the general public" the FPL expected less compensation.[254] Before launching a research project with a company or industry, both parties signed a "written agreement" that stipulated the nature of the work and specified reimbursement.[255]

Through these arrangements, the FPL collaborated with railroad, mining, telegraph, telephone, and other companies to expand and refine wood-preservation in the United States. (Figure 4-4) Although the FPL formalized and extended a philosophy of cooperative service between a government agency and industry, its early leaders stressed earlier examples of this attitude. When an interviewer questioned McGarvey Cline, who helped establish the FPL and served as its first director, about initiating a "particularly friendly" relationship between government forestry research and private industry, he denied launching this policy.[256] Instead, Cline credited earlier individuals

[252] United States Department of Agriculture, Forest Service, *Searching for Dollars in Wood*, 14.

[253] Ibid., 15.

[254] Ibid., 14-15.

[255] Ibid., 15.

[256] McGarvey Cline and Donald G. Coleman, *An Oral History Interview with McGarvey Cline* (Madison, Wisconsin: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, in cooperation with the University of Wisconsin, 1962), 6, Forest Service Headquarters History Collection, Forest History Society, Durham, North Carolina.

such as von Schrenk for introducing a more collaborative spirit. “Oh no, I didn’t start the cooperation with industry. There had been cooperation in the wood preservation industry, and we were even cooperating with the railroads. . . . Oh no, I didn’t initiate cooperation,” Cline contended, “We only extended it.” [257]

Sensitive to the possible criticism that the FPL was “in the back pocket” of wood-using industries, the 1920 report defended the laboratory’s commissioned work: “It in no way commercializes the work of the laboratory, because all information available on any phase of wood utilization is furnished free upon request or through personal consultation.”[258] Although the FPL claimed that its research was not commercialized because it made the results freely available, commercial interests bought and paid for these results. While the cozy relationship between the FPL and wood-using industries might give contemporary audiences greater pause, it reflected the ideology of many foresters, wood-preservers, businessmen, and conservationists.

Ernest A. Sterling, a wood-preservation advocate, railroad consultant, and director of the American Forestry Association, articulated this philosophy in a June 1915 issue of *American Forestry*. He described forest conservation as a “purely economic problem,” and concluded that these conservation efforts “cannot be attained unless it is profitable, and up to the present. . . it has not been possible to make capital yield a reasonable return from conservative forestry.”[259] The work of the FPL and the other institutions backing the organization made it more likely that creosoting would yield

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[257] Ibid., 7.

[258] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory: A Decennial Record, 1910*, 81.

[259] E. A. Sterling, “One Portrait,” *American Forestry* (June 1915): 731.

dividends. As Sterling asserted, “The country needs economic, not sentimental forest conservation.”[260] To Sterling and many wood preservers economic forest conservation meant the management of natural resources for economic benefit rather than the preservation of nature for sentimental reasons. The FPL’s collaboration with wood-using industries reinforced this ethos, firmly placing the “dollar sign on decay” and promoting the expansion of wood preservation throughout the nation.[261]

The advent of railroad research laboratories as well as the proliferation of specialized scientific, professional, and technical organizations examining the problem of wood preservation underscored larger changes occurring in American society during the late 19th and early twentieth centuries. As historian Robert Wiebe concluded, this era marked a shift away from a “society of island communities” in which “weak communication” limited “specialization and discouraged the accumulation of knowledge.”[262] The pressures and anxieties of “urban-industrial life” disintegrated these island communities, creating a more “regulative,” and “bureaucratic” society in which members distinguished themselves “more by skill and occupation than by community,” and “they identified themselves more by their tasks in an urban-industrial society than by their reputations in a town or a city neighborhood.”[263]

During this period, according to Wiebe, a middle class that prided itself on “consciousness of unique skills and functions” expanded, establishing “increasingly

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[260] Ibid.

[261] Steer, “Putting the Dollar Sign on Decay,” 28.

[262] Robert Wiebe, *The Search for Order, 1877-1920* (New York: Hill and Wang, 1967), xiii.

[263] Ibid., xiv.

formal entry requirements," professional standards, and occupational associations.[264] He argues that this new middle class espoused a loyalty to "occupation, its values, and its policies," and an individual's involvement with a specific organization or professional society represented a "defining as well as an identifying act."[265] These individuals embraced "urban-industrial development" because it afforded them new economic and social opportunities; they gained access to profitable jobs and commanded respect among peers and neighbors as experts in increasingly specialized occupations such as railroad engineering, forestry, and wood preservation.[266]

Historian Samuel Hays supports Wiebe's conclusion that a rising middle class of technical and professional experts led the Progressive-era campaigns for reform in areas such as forestry, wood preservation, and natural resource management. Insisting that Americans discard the traditional narrative of conservation as simply a democratic crusade "against corporations," Hays asserts, "Conservation, above all, was a scientific movement" stemming from "the implications of science and technology in modern society."[267] Ultimately, he identifies the overarching goal of conservation as the "gospel of efficiency," or "rational planning to promote efficient development and use of all natural resources."[268]

Similar to Wiebe's theory that industrialization broke down the "island communities" distancing Americans from one another, Hays concludes that this

[264] Ibid., 112 and 113.

[265] Ibid., 129.

[266] Ibid., 112.

[267] Samuel P. Hays, *Conservation and the Gospel of Efficiency*, 1 and 2.

[268] Ibid., 265 and 2.

conservation movement transitioned the nation from “a decentralized, nontechnical, loosely organized society, where waste and inefficiency ran rampant, into a highly organized, technical, and centrally planned and directed social organization.”[269] In this new society, conservation advocates espoused a people-first approach rather than the nature-first stance that John Muir and other preservationists articulated. Conservationists asserted their expertise, claiming only those well versed in “technical and scientific methods” possessed the qualifications to determine how resources should be properly utilized and managed.[270] Professional and trade organizations as well as corporate and government laboratories, emerged to provide these experts with infrastructure, support, and the credibility necessary to advance new industries such as wood preservation, establish industry standards, and change how the American public viewed its use of wood.[271]

An even more basic “search for order” that Wiebe highlights underlay the “gospel of efficiency,” which conservationists and experts such as Fernow, Pinchot, Sterling, and others preached.[272] Amidst a “world of endless change” brought into sharp relief by industrialization, American reformers pursued “continuity and predictability.”[273] While Wiebe focuses on the social and political search for order during the late nineteenth and early twentieth centuries, historian Charles Haines argues that the push for timber conservation and wood-preservation technology reflected this undercurrent. “The wildly

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[269] Wiebe, *The Search for Order*, xiii; Hays, *Conservation and the Gospel of Efficiency*, 265.

[270] Hays, *Conservation and the Gospel of Efficiency*, 271.

[271] Haines, “The Industrialization of Wood,” 25.

[272] Hays, *Conservation and the Gospel of Efficiency*, 266; Wiebe, *The Search for Order*.

[273] Wiebe, *The Search for Order*, xiv.

fluctuating lumber industry, the unpredictability of wood, and, lurking in the background, the primitive and untamed image of the American forest itself became prime targets for reform for a rising middle class attempting to assert its view of social order and calm its own anxieties," Haines argues.[274]

In short, Americans sought to "reform wood," turning it into a more reliable, stable, and less rebellious material.[275] A 1920 decennial report commemorating the Forest Products Laboratory's research clearly reflected this desire for order and efficiency. The report celebrated technological innovations such as wood preservation that meant the forests no longer "dominated" humans. Instead, warding off decay, rot, and boring insects signified "man" successfully "reversing the order of his environment," "conquering the forests," and elevating "himself from a life of savage and nomadic wandering to the social and industrial modernism of today."[276]

While the American Society of Civil Engineers conveyed significant doubts about the future of creosoting timber in 1885, declaring that it "was cheaper to let it rot in the good old way," advancements in wood-preservation research and the legitimization of the field challenged this assertion within a few short decades.[277] Although creosoted railroad ties remained the industry's chief product, other applications helped expand the market for wood preservation. Telegraph and telphone poles, mining timbers, wood-block paving in cities, fence posts, docks and wharves, culverts, bridges, silos,

[274] Haines, "The Industrialization of Wood," 27.

[275] Ibid.

[276] Decennial Committee, Forest Products Laboratory, *The Forest Products Laboratory*, 1.

[277] American Society of Civil Engineers, "The Preservation of Timber," 249.

construction timber, and countless other products provided opportunities for creosote to demonstrate its worth. (Figure 4-5)

An increased demand for creosote in the United States accentuated one significant limitation—there was simply not enough of it. Because the nation's chemical industry lagged behind that of Germany and England, wood preservers depended primarily on foreign imports of coal-tar creosote. In 1912, for example, Americans consumed over 78,000,000 gallons, "of which about three-fourths was imported."[278] At the 1913 AWPA conference, Sterling addressed the challenge of securing sufficient coal-tar creosote in the United States. "Coal tar creosote is an anomaly among by-products because the demand is increasing faster than the output," he explained, "and, since creosote is not made for itself alone, but is a resultant, constituting a minor percentage of coal tar distillation carried on to recover other products, the production is not gauged to the requirements of the consumer."[279] Sterling predicted that "for some time to come," Germany would lead the world "in the ultra-refinement of coal tar products" because it possessed distinct advantages.[280] In addition to an established chemical industry, Germany enjoyed cheaper labor, skilled and low-salaried chemists, affordable material, and an advantage in patent laws and patented processes."[281] Importing the preservative significantly increased the cost and gave plants along the

[278] Sterling, "The Production and Supply of Coal-Tar Creosote," 64.

[279] Ibid.

[280] Ibid., 66.

[281] Ibid.

coast a major advantage, which resulted in uneven growth and squabbling among wood preservers.[282]

World War I only magnified these problems because the two primary manufacturers of creosote happened to be the two major opponents in this conflict. When war broke out in 1914, British and German governments promptly "placed an embargo on the exportation of creosote oil on the grounds that they needed it for their own purposes."[283] These two main suppliers of creosote stopped exporting or even manufacturing it because they needed to reserve all available stocks of coal and its byproducts for fuel, ammunition, and other essential wartime applications. Although Great Britain lifted the embargo during the war, creosote exports to the United States remained low because the government had commandeered all available "tank steamers" for the war effort. As a result, there were no ships available to transport creosote.[284] Elbridge Fulks, an executive with the American Tar Products Company, detailed the impact of wartime conditions in a discussion at the 1915 AWPA conference. He estimated the total creosote oil used in the United States to be "approximately 100,000,000 gallons a year, of which about 60 percent is imported."[285] Roughly 25 percent of the imported creosote (15,000,000 gallons) came from Germany," with the

[282] Ibid., 68.

[283] G. A. Lembcke, "The Foreign Creosote Oil Situation," in *Proceedings of the Twelfth Annual Meeting of the American Wood Preservers' Association* (Baltimore, Maryland: Peters Publishing and Printing Company, 1916), 104.

[284] Ibid.

[285] *Proceedings of the Eleventh Annual Meeting of the American Wood Preservers' Association* (Baltimore, Maryland: Peters Publishing and Printing Company, 1915), 137.

remainder from other European countries, particularly England.[286] As Fulks's calculations suggested, the war's turmoil removed over half of the creosote supply from circulation for American wood preservers. At the 1915 convention, AWPA President, George Rex, vented his frustration with the situation: "The handicap of the war, which has so disorganized the principal source of supply for the wherewithal to carry on our industry, has made it necessary for more than one-half of the industry to reverse its methods."[287]

As Rex's comment suggested, these constraints forced the wood-preservation industry to adapt. Some treating plants reverted to other preservatives such as zinc-chloride, which although less effective, remained available during the war. Other companies experimented with a combined creosote and zinc-chloride treatment that required less creosote overall. For example, a plant might only creosote the base of timber, an area often more vulnerable to rot and decay because it encountered the damp ground and water. Still other wood preservers or suppliers of creosote oil "adulterated" or diluted this preservative with other substances to stretch their limited reserves.[288]

At AWPA conferences throughout the war, representatives of chemical-manufacturing and creosote-import companies regularly addressed the "foreign creosote oil situation" and the difficulties of securing enough creosote to fulfill their

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[286] Ibid., 137.

[287] George E. Rex, "President's Address," *Proceedings of the Eleventh Annual Meeting of the American Wood Preservers' Association* (Baltimore, Maryland: Peters Publishing and Printing Company, 1915), 33.

[288] Clyde H. Teesdale, "Wood Preserving Industry May Suffer From War," *Railway Age Gazette* 57, no. 17 (October 23, 1914): 753.

contracts.[289] Ralph Esau, who represented the Barrett Company—a chemical manufacturing firm—reported a year's delay on satisfying orders. "A great many of the men here have been writing letters and wiring me, and some calling me on the long-distance phone, and some coming in personally, pleading, threatening, demanding all sorts of things," Esau stated plainly, "but you cannot get blood out of a turnip."[290]

While World War I created an immediate creosote crisis, it also underscored the perils of the wood-preservation industry's dependence on foreign creosote. Increasing the domestic production of creosote, many wood preservers concluded, offered the only viable solution to their shortage. Tar-distillation and chemical manufacturing companies such as the American Tar Products Company, the Barrett Company, Reilly Chemical Company, and the Koppers Company expanded throughout the United States to address this need.[291] The domestic production of creosote at these new plants depended on a recent technological innovation—a chemical recovery coke oven that captured coal-tar byproducts.[292]

Europeans had long dominated the creosote market because they had perfected the coal-distillation process to manufacture coal gas, which powered gaslights all over the nineteenth-century world. Over time, they learned that coal tar and its distillates

[289] Lembcke, "The Foreign Creosote Oil Situation," 104.

[290] *Proceedings of the Fourteenth Annual Meeting of the American Wood Preservers' Association* (Baltimore, Maryland: Peters Publishing and Printing Company, 1918), 93.

[291] Williams Haynes, *American Chemical Industry, Vol. 1: Background and Beginnings* (New York: Van Nostrand, 1945), 316.

[292] Allen W. Hatheway, *Remediation of Former Manufactured Gas Plants and Other Coal-Tar Sites* (Hoboken: CRC Press, 2011), 661; Kathryn Steen, *The American Synthetic Organic Chemicals Industry: War and Politics, 1910-1930* (Chapel Hill, North Carolina: University of North Carolina Press, 2014), 34.

such as creosote—the waste products of this manufacturing process—held considerable value as essential ingredients in products such as perfumes, dyes, explosives, and wood preservatives. These new applications transformed coal tar and its distillates from chemical refuse to prized commodities. In the United States, which industrialized later and was slower to develop a chemical industry that valued coal tar, many industrialists still regarded these distillates as refuse. When the American wood-preservation industry expanded in the late nineteenth and early twentieth century, its supporters clamored for increased domestic production of creosote, and they found their salvation in iron and steel.[293]

As the United States rapidly industrialized, its infrastructure demanded these metals for railways, locomotives, steamships, skyscrapers, guns, tools, and factories. While American manufacturers had long used charcoal, derived from wood, to produce iron and steel, this method was inefficient and costly as timber supplies dwindled and prices increased. To save time and money, American industrialists adapted European methods that used coke—a distillate of coal that burns hotter than charcoal—to smelt iron and steel. Similar to the European coal-gas industry, coke manufacture produced an excess of coal tar and its byproducts, but the traditional coke ovens used in the United States merely vented their waste into the atmosphere, preventing the efficient recovery of these coal-tar distillates. A German engineer, Heinrich Koppers, revolutionized the coke, iron, steel, and wood-preservation industries when he invented

[293] Frederick Accum, *Description of the Process of Manufacturing Coal Gas, for the lighting of Streets, Houses, and Public Buildings*. 2nd ed. (London: Thomas Boys, 1820), 36; Michael Fremantle, *The Chemists' War: 1914-1918* (Cambridge: The Royal Society of Chemistry, 2015), 65; George Lunge, *A Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor, and the Separation of Them From Valuable Products* (London: John Van Voorst, 1882), 4.

an oven that produced coke more efficiently, but also captured the distillates including creosote.[294]

Koppers, born in 1872 in Germany, specialized in metallurgy and began working with coke plants soon after he graduated from technical school in Duisburg, an industrial center with ties to major iron and steel manufacturers. After establishing his own firm, based in Essen, Germany, Koppers designed and constructed coke-production facilities for companies worldwide. These plants featured an innovative, Koppers-patented coke oven that "increased heating efficiency and economy" to produce "improved coke output per ton of coal," "coke of higher quality and uniformity," and "better recovery of coal gases, tar, and chemicals."[295] One of the first American companies Koppers collaborated with was U.S. Steel, which contracted him to "come to America and build a coke plant of 280 ovens at the then Illinois Steel Company's plant at Joliet, Illinois."[296] This 1907 venture was very successful and Koppers recognized that there was money to be made from American iron and steel corporations and the industries desperately seeking coal-tar byproducts. He incorporated the H. Koppers Company in 1912, with an office in Chicago, and continued constructing coke plants and tar-distilling plants.[297]

Despite the company's early successes, Koppers found it difficult to remotely oversee American operations once World War I broke out in 1914. He sold banker and

[294] Hatheway, *Remediation of Former Manufactured Gas Plants and Other Coal-Tar Sites*, 661; Thomas E. Bourne, "The History of Koppers Company: March, 1912-January, 1988," 2-3, Folder: Koppers Company History, Box 2, Koppers Company records, PSUA 548, Special Collections Library, Pennsylvania State University.

[295] Bourne, "The History of Koppers Company," 3.

[296] Ibid., 4.

[297] Ibid.

industrial tycoon Andrew Mellon eighty percent of H. Koppers Company stock and his patents, relinquishing a major role in the American firm. Mellon, born and raised in Pennsylvania, relocated the company's headquarters to Pittsburgh—often referred to as the "city of steel" because of its many iron and steel mills.[298] When the U.S. entered World War I in 1917, the government's Office of Alien Property Custodian seized and auctioned the remaining twenty percent of the shares that Heinrich Koppers still owned to Mellon.[299]

With Mellon's backing and Koppers's technology, the company expanded its scope to the chemical-recovery business because, as Koppers President Fred Foy told audiences in a 1958 presentation, they had "tar running out of their ears."[300] Allen Hatheway, an engineering scholar describes their transition to the coal-tar business as more intentional. Koppers, Hatheway observes, earned a reputation "as an aggressive gleaner of all and any coal tars."[301] As demand for coal-tar byproducts increased, Koppers vertically integrated, building chemical-recovery coke plants, tar-distilling plants, and tar-refining plants, but also investing in coal mines and railroads in Kentucky, West Virginia, and Pennsylvania. Koppers quickly emerged as a major

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[298] Ken Kobus, *City of Steel: How Pittsburgh Became the World's Steelmaking Capital During the Carnegie Era* (Lanham, Maryland: Rowman & Littlefield, 2015), xiii.

[299] Bourne, "The History of Koppers Company," 7; Steen, *The American Synthetic Organic Chemicals Industry*, 6-7; United States Government, Alien Property Custodian, *Alien Property Custodian Report* (Washington, D.C.: Government Printing Office, 1919), 219.

[300] Fred C. Foy, *Ovens, Chemicals, and Men! Koppers Company, Inc.* (New York: Newcomen Society in North America, 1958) 21.

[301] Hatheway, *Remediation of Former Manufactured Gas Plants and Other Coal-Tar Sites*, 661.

domestic producer of creosote oil, establishing a profitable relationship with wood-preservers, and alleviating the industry's dependence on foreign creosote.[302]

While World War I initially made it difficult for the industry to secure creosote and fulfill contracts for treated timber, the widespread destruction that the conflict wrought in Europe ultimately benefited American wood preservers. As Nelson Brown reported to his fellow wood preservers after visiting the European front, "The native forests have been very largely destroyed in all of those countries."[303] While he expressed regret for the violence inflicted on the people and the landscape, Brown predicted significant demand and markets for American treated timber to rebuild Europe.[304] Although, during the war, the American army "was not interested in wood that would last 20 years," the war's devastation provided new, global markets for American wood preservers.[305] Companies such as Koppers recognized that potential. They bought out wood-preserving companies such as the American Lumber and Treating Company, establishing a distinct wood-preserving division.[306] By May 1958, when Foy addressed the Newcomen Society in North America, Koppers owned thirty-four wood-preserving plants in the U.S. and additional plants in Central America, making it the "largest supplier of pressure-treated wood and wood products in the world."[307] "Enough facts

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[302] Foy, *Ovens, Chemicals, and Men!*, 23; Bourne, "The History of Koppers Company," 8-11.

[303] AWPA 1919, 263.

[304] Ibid., 261.

[305] Ibid., 189.

[306] Foy, *Ovens, Chemicals, and Men!*, 23.

[307] Ibid.

have been recorded," Foy insisted, to indicate that *the central theme* of The Koppers Story has been. . . ADVANCEMENT."[308]

While Foy boasted about his company's advancement, many wood preservers viewed the broader industry as a success story with creosote in the starring role. Creosoting, one proponent maintained, "is a sort of panacea for all the ills that affect structural timber."[309] As this quote suggested, treatment with this preservative had become a foregone conclusion, and people who used "untreated timber in any construction where the wood is exposed" committed an "economic crime."[310] By the close of World War I, technical and professional organizations, government agencies, and private companies all regarded creosote as an antidote to vanishing timber supplies, an economic godsend that saved companies' money, and an example of modern society's victory over nature's instability and disorder. They successfully placed the "dollar-sign on decay" that Steer spoke about and clearly endorsed creosote as an "economic, not sentimental" solution to forest conservation that Sterling believed companies required.[311] In their calculations and cost-benefit analyses, however, wood preservers and their advocates neglected or ignored the potential for hidden costs—the occupational, public, and environmental health risks associated with this toxic treatment.

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[308] Ibid., 33.

[309] Forshey, "Interesting St. Louisans," 9.

[310] Ibid.

[311] Steer, "Putting the Dollar Sign on Decay," 28; Sterling, "One Portrait," 731.

Figure 4-1. Albuquerque, New Mexico. At the Atchison, Topeka and Santa Fe Railroad tie treating plant. The steaming black ties on the left have just come out of the retorts after having been treated for eight hours. 1943. Albuquerque, New Mexico. Photograph by Jack Delano. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/2017848344/.

Figure 4-2. View in yards of Ayer-Lord tie plant, Carbondale, Ill. Ca. 1910-1920. Carbondale, Illinois. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/201264.

Figure 4-3. Forest Products Laboratory, Madison, Wisconsin. Laboratory has an extensive publications division. The results of experiments and findings of the laboratory are published and pamphlets and bulletins made available to the public. 1942. Madison, Wisconsin. Photograph by Jack Delano. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001003516/PP/.

Figure 4-4. Forest Products Laboratory, Madison, Wisconsin. Testing the fire-resistant qualities of various types of wood impregnations and coatings by the use of the firetube. Mr. Arthur Van Kleek, in charge of the work, is taking the readings. 1942. Madison, Wisconsin. Photograph by Jack Delano. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001003534/PP/.

Figure 4-5. Treated telephone poles stored in the yard at the International Creosoting Company. 1943. Beaumont, Texas. Photograph by John Vachon. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001030041/PP/.

CHAPTER 5
"A RESULT OF HIS OWN NEGLIGENCE": THE OCCUPATIONAL HAZARDS OF CREOSOTE

On February 23, 1928, the U. S. Fifth Circuit Court of Appeals met to reconsider the case of the *Eppinger and Russell Company*—a Jacksonville wood-treatment plant—vs. *J. H. Sheely*—its former employee. Sheely, who previously worked as a night engineer at the plant, fell into a 12-foot-deep creosote-filled waste pit. He sued the company for personal injuries, maintaining that he "suffered from burns," and that "he swallowed some of the creosote mixture," which soon led to "cirrhosis of the liver." The Eppinger and Russell Company argued that it bore no responsibility for these injuries, and contended the accident resulted from Sheely's own negligence. Although the details surrounding the accident and subsequent lawsuit are sparse, *Eppinger and Russell v. Sheely* emphasizes the hazardous nature of work in the wood-preservation industry.[1]

On the night of the accident, supervisors instructed Sheely to repair a creosote waste pit's clogged drain pipe. To retrieve the pipe from the sludge, Sheely had to cross a rickety wooden plank to pull the pipe up by a chain. His first attempt at recovering the pipe failed, and he called a plant fireman over for assistance. As the two men struggled to haul the pipe out of the pit, the plank busted, tumbling both men into the viscid waste below. The men could not even swim in the thick, toxic brew. Although Sheely somehow managed to get to safety, the fireman quickly drowned.[2]

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[1] *Eppinger and Russell Co. v. Sheely*, 24 F.2d 153; 1928 U.S. App. LEXIS 1977, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[2] Ibid.

Eppinger and Russell maintained that the company was not at fault since the plank only broke under the combined weight of Sheely and the fireman. Sheely, they claimed, should have inspected the plank carefully before venturing out on it. The company accused Sheely of “contributory negligence” since he chose an “unsafe” method of retrieving the pipe. During previous trials, the company claimed that Sheely could have raised the pipe by a rope in the engine room, although Sheely insisted there “was no other way provided at that time.” In spite of the fact that physicians representing both sides agreed that creosote was “poisonous,” the company dismissed Sheely’s health concerns, attributing them to “other causes.” Although the appeals court ultimately ruled in Sheely’s favor, he died from his condition before it ever convened. Without a full name, date of the accident, and date of his death, Sheely’s story is difficult to tell. Other than the appeals court ruling and later cases that reference *Eppinger and Russell v. Sheely*, he and the fireman who drowned remain—like many workers in the wood-preservation industry—largely invisible in the historical record.[3]

Existing research on this industry neglects the people employed at these facilities, although they—as Sheely and the fireman’s accident demonstrates—often faced the most direct, regular exposure to coal-tar creosote and other toxic treatments. The workers’ invisibility is due to a combination of factors. Wood-treatment plants changed ownership frequently, and companies seldom preserved documents. In the rare cases in which company records are accessible through public archives today, these collections offer limited insight into the employees’ perspective. Instead, financial accounts, minutes of stockholder meetings, and other business correspondence

[3] Ibid.

reinforce the perspective of company owners and operators. Research also suggests that the workers' invisibility results from a more deliberate effort on the part of companies and plant management to limit negative publicity and sanitize history by ignoring worker health concerns and neglecting worker safety.

In spite of these archival challenges, this chapter uses court cases, newspaper articles, studies in medical journals, and company records to piece together a portrait of the occupational hazards workers encountered at wood-treatment plants. Researchers of hazardous-waste sites often explore how pollution endangers nearby residential communities, but seldom consider the people laboring in "toxic workplaces." It is surprising that few scholars have focused on the workplace or what Karl Marx called "the point of production" because as environmental sociologists David Pellow and Lisa Park note, "factories and firms create pollution" and oftentimes workers are the first exposed to the pollution and the first to resist. The history of coal-tar creosote reinforces Gerald Markowitz and David Rosner's observation that "the same toxins that caused occupational disease also become environmental problems." Almost a century before the U.S. Environmental Protection Agency classified wood-preservation plants among the worst hazardous waste-sites in the nation, workers in this industry presented evidence that this substance threatened their health and safety.[4]

Although Sheely and the fireman's plunge into the toxic waste pit highlights the potential hazards of this work environment, the case does not provide a detailed picture

[4] David N. Pellow and Lisa Sun-Hee Park, *The Silicon Valley of Dreams: Environmental Injustice, Immigrant Workers, and the High-Tech Global Economy* (New York: New York University Press, 2002), 221, 3, 11, and 76; Gerald Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley: University of California Press, 2002), xii.

of what wood-treatment employees encountered when they went to work each day. This chapter introduces the "horrendous housekeeping problems" that, according to Nicholas P. Cheremisinoff and Paul E. Rosenfeld—chemical engineer and environmental chemist—distinguish this industry as historically "among the worst polluters." Understanding these conditions offers a window into the dirty environment in which workers labored.[5]

Images of wood-treatment plants often resemble scenes from dystopian science fiction. (Figure 5-1) Photographs depict a barren, pockmarked landscape dotted with machinery and stacks of timber. Closer examination reveals extensive soil staining, "pools of unexplained liquid," widespread vegetation damage, as well as drainage ditches, pits, and trenches full of standing liquid often topped with an oily "sheen."[6] Treating wood was clearly a messy business.

To prepare timber for treatment, employees peeled, trimmed, bored, and adzed the wood, generating significant amounts of waste wood in the form of bark, sawdust, and wood chips that coated workers, equipment, and plant grounds. Spills occurred frequently. Liquid chemicals regularly leaked out of preserving tanks and steadily dripped off treated timber left in the plant yards to dry. Excess preservative, or "kickback," collected on the ground in front of the treating cylinders, by the railroad

[5] Nicholas P. Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production Volume 2: Best Practices in the wood and Paper Industries* (Amsterdam: Elsevier, 2010), 1 and 46.

[6] M. A. Finkbeiner, *Aerial Photographic Analysis of Waste Study Sites: Texarkana and Southeast Texas* (U.S. Environmental Protection Agency, April 1985).

tracks, and near stacks of treated timber. Employees then walked and drove through the puddles, tracking the muck throughout the plant yard and buildings.[7]

The treatment process and rinsing of tanks and equipment resulted in considerable wastewater, which plants processed in "unlined earthen pits" or "evaporation ponds" to try and recover a portion of creosote coal tars and oils. In the storage tanks, treating cylinders, and wastewater pits like the one Sheely and the firemen fell into, a thick, "oily sludge" or "muck" accrued that necessitated collection and disposal. Typically, as Cheremisinoff and Rosenfeld concluded in their study of the industry, plants "buried, spilled, burned, stockpiled, and lagooned hundreds of millions of tons of toxic waste." In a May 25, 1933, letter, the superintendent of the Central of Georgia Railway's Creosoting Plant in Macon, Georgia, describes the plant's procedure for processing its industrial waste. Lamenting the "accumulation of slime and muck" in the "settling pit," the superintendent explained that plant employees removed the waste with a "locomotive crane and dipper" and then loaded it into a "suitable car" for transfer to the "dumping point" usually "an out of the way place at the other end of the yard."[8]

Other popular disposal methods included burning the toxic sludge—often under the cover of darkness—and depositing waste into nearby bodies of water. In Gainesville, Florida, for example, the superintendent of the Atlantic Coast Line Railroad's creosoting plant admitted in 1913 that the newly operational facility dumped roughly 75,000 gallons of waste per day into a drainage ditch that fed into nearby

[7] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention*, 53-54.

[8] Ibid., xii; Superintendent of Creosoting Plant to Master Car Builder, Mr. Adamson, May 25, 1933, Folder 1914-6, Box 211, Central of Georgia Railway Collection, Georgia Historical Society, Savannah (Hereafter cited as Central of Georgia Railway Collection).

Hogtown Creek. At the massive creosoting plant of the Atchison, Topeka and Santa Fe Railway Co. in Somerville, Texas, an employee testified that plant operators regularly performed what they dubbed the "Santa Fe Flush." When the sludge ponds became too full, plant managers would wait for a heavy rain and then instruct workers to simply "open valves," flushing the contaminants into nearby bodies of water.[9] "Air, land, and water," became—as environmental historian Joel Tarr describes—"ultimate sinks" for waste disposal.[10]

Amidst this polluted landscape, what one creosoting company in 1886 described as "the intensely acrid and pungent properties" of coal-tar creosote permeated the plant and its grounds.[11] Examining the "chemical, medicinal, and physiological properties of creosote" in 1836, Sir John Rose Cormack, a Scottish physician pronounced creosote's odor to be "peculiar, somewhat foetid, and ammoniacal."[12] In a 1922 U.S. Department of Agriculture Bulletin on creosote, Ernest A. Bateman—a chemist in Forest Products—noted that this "odor is rather difficult to describe" and he contended that it could "only be described as 'tarry.'"[13] Other individuals familiar with coal-tar creosote criticized its odor and taste more directly using adjectives such as "burning," "caustic," "smoky," and

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[9] Paul Sweeney, "Creosote Blues Revisited," *Texas Observer*, April 18, 2008.

[10] Florida, State Board of Health, *Twenty-Fifth Annual Report of the State Board of Health of Florida*, 1913 (Deland, Florida: The E. O. Painter Printing Company, 1914), 119; Joel A. Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Akron, Ohio: The University of Akron Press, 1996), 29.

[11] Old Dominion Creosoting Works, *The Preservation of Timber or How to Prevent Decay and Preserve Timber Against the Attacks of the Teredo Navalis or Ship-Worm* (Norfolk, Virginia: W.T. Barron & Co., 1886), 8

[12] John Rose Cormack, *A Treatise on the Chemical, Medicinal, and Physiological Properties of Creosote* (Edinburgh: John Carfare & Son, 1836), 41.

[13] Ernest Bateman, *Coal-Tar and Water-Gas Tar Creosotes: Their Properties and Methods of Testing* (Washington: Government Printing Office, 1922), 50.

"objectionable."[14] This unpleasant smell emerged as one of the main reasons the wood-preserving industry investigated alternatives to creosote. Workers experienced with handling coal-tar creosote or wood treated with it also commented on how difficult it was to remove the preservative when you worked around it regularly. It coated and even "filtered through clothing," worked itself under fingernails, and covered skin. One family member of a long-time worker employed at the Gainesville plant remarked that even after repeated washing and scrubbing at home the "dirt was permanently ingrained" and "there was always a lingering smell."[15]

As this comment suggests, wood-preservation employees often found it difficult to fully remove themselves from their work environment. Instead, wood preservation seemed, for many employees, to be an around-the-clock occupation. Plant superintendents often resided onsite "to be near the works at night in case of accidents or breakdowns," as J. H. Stewart, the Macon plant superintendent, explained in a 1912 letter to the Central of Georgia's Chief Engineer.[16] Many plants also housed workers on the premises to increase production and efficiency, but it also provided management with a way to supervise and control its labor force. The Central of Georgia Railway, for example, required laborers at its creosoting plant in Macon to request passes in

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[14] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention*, 10; U.S. Congress, Office of Technology Assessment, *Cleaning Up Contaminated Wood-Treating Sites* (Washington D.C.: U.S. Government Printing Office, 1995), 11; Forest Products Laboratory, *Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Nov. 1938), 2.

[15] Chris Carlsten, Stephen Hunt, and Joel Kaufman, "Squamous Cell Carcinoma of the Skin and Coal Tar Creosote Exposure in a Railroad Worker," *Environmental Health Perspectives* 113, no. 1 (Jan. 2005): 96; Don Felder, *Heaven and Hell: My Life With the Eagles, 1974-2001* (Hoboken, New Jersey: John Wiley & Sons, 2008), 6.

[16] J. H. Stewart to C. K. Lawrence, July 29, 1912, Folder 1254-8, Box 138, Central of Georgia Railway Collection.

advance from the superintendent if they wanted to "occasionally" travel "over the road." If the superintendent approved this request, he would then file a formal application with the Railway's administrative office, which ultimately distributed the pass.[17]

To maximize output, many plants also operated day and night. In correspondence from November 1912, management of the Central of Georgia Railway debated the merits of running its creosoting plant 24 hours per day as opposed to 10 to 12 hours. They concluded that the 24-hour option seemed the most "economical" since the plant already relied on a few night-shift employees because the cylinders had to be "hot by 3 o'clock in the morning, or earlier, in order to have everything in shape for the regular day force employees."[18]

Even if workers lived offsite, they often had to be on call at all times. Musician Don Felder, whose father Nolan toiled as a mechanic in Gainesville's wood-preservation plant for most of his life, recalled, "It was a twenty-four operation, and if there were any problems, night or day, he'd be summoned."[19] In addition to the long hours employees endured, machinery and equipment at plants frequently broke down, leading to work stoppages, repair headaches, and workplace injuries. Some plant owners blamed frequent machinery breakdowns and the need for expensive repairs on workers or "inefficient labor" and "pushing the plant to capacity." These factors, according to Edwin Fisher Conger, the Norfolk Creosoting Company's owner, "resulted in the plant

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[17] J. H. Stewart to C. K. Lawrence, July 27, 1912, Folder 1254-8, Box 138, Central of Georgia Railway Collection.

[18] T. S. Moise to C. K. Lawrence, November 13, 1912, Folder 1254-10, Box 138, Central of Georgia Railway Collection, Georgia Historical Society, Savannah; C. K. Lawrence to T. S. Moise, November 7, 1912, Folder 1254-10, Box 138, Central of Georgia Railway Collection.

[19] Felder, *Heaven and Hell*, 6.

equipment being left in very poor condition."[20] In a February 28, 1928, letter, Colonel William G. Atwood, the newly hired superintendent of the Norfolk Creosoting Plant, detailed the challenges of maintaining plant machinery and equipment. Atwood's inventory included "leaking storage tanks," old equipment "unsafe for a full load," "faulty treating tanks" that could not be repaired, and the potential for the leaking preservative to "flood the boiler room and burn up the plant." Increasingly frustrated with this malfunctioning equipment, Atwood informed his supervisors, "As I stated above, I thought we had our last heavy maintenance job done. Since these two things happened on two succeeding days, I am doubtful about everything."[21]

As Atwood warned, fires posed one of the greatest risks at wood-treatment plants because creosote is highly flammable. Comparing the wood preservative zinc chloride with coal-tar creosote for a January 25, 1913, issue of the *Electric Railway Journal*, Howard F. Weiss, at the time the assistant director of the Forest Products Laboratory in Madison, Wisconsin, considered the increased "combustibility" of creosote. Weiss explained to readers that "a zinc chloride plant presents a lower fire risk than a creosote plant."[22] Joseph G. Hubbell a fire inspector for insurance companies explained it even more succinctly: "there is no hazard attached to the use of zinc solutions" but "there is a decided hazard where creosote or similar materials are

[20] E.F. Conger to Lt. E. P. Noell, December 1, 1942, Folder 1942: Renegotiation Federal Contracts, Box 4, MS 5808 Norfolk Creosoting Company Records, University of Virginia, Charlottesville.

[21] William G. Atwood to Loomis Burrell, February 28, 1928, Folder: Loomis Burrell Correspondence 1 of 2, Box 1, MS 5507 Norfolk Creosoting Company Records, University of Virginia, Charlottesville.

[22] Howard F. Weiss, "A Comparison of Zinc Chloride With Coal-Tar Creosote For Preserving Cross-Ties," *Electric Railway Journal* 41, no. 4 (January 25, 1913): 153.

used."[23] In a November 1938 bulletin, the Forest Service Products Laboratory observed that timber freshly treated with this preservative could be "ignited easily, and will burn readily, producing a dense smoke."[24]

Despite its incendiary nature, creosote's effectiveness and affordability made it the preservative of choice in many plants, but the risk of fire was an ever-present danger since most plants had yards stacked with freshly creosoted timber and storage and treating tanks full of the preservative. A small spark from plant machinery or a locomotive could cause catastrophic damage to plants and threaten workers. When an 1892 fire broke out at the Galveston Wharf Company's creosoting works, "the combustible character of the works caused the flames to spread rapidly and by the time the fire department reached the scene, the entire works were enveloped in a mass of flames. In an hour's time the works were reduced to smoldering ashes." At the time of the disaster, the plant had been closed for repairs, and the cause of the fire remained a mystery.[25] Similarly, when a vat of hot coal-tar creosote filled with timber exploded in 1901 at the American Wood Preserving Company in Perth Amboy, New Jersey, reporters concluded the cause "is a mystery." Regardless of the explosion's source, the event had tragic consequences since a piece of the vat's door flew off in the explosion, cutting one workers' head "completely off" and gravely wounding three others."[26]

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[23] J. G. Hubbell, "Fire Protection As Applied to Wood-Preserving Plants," in *Proceedings of the Fourteenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1918), 85.

[24] Forest Products Laboratory, *Wood Preservatives*, 2

[25] "Fire's Work," *The Daily Picayune* (New Orleans), October 12, 1892.

[26] "Fatal Creosote Explosion," *New York Times*, August 8, 1901.

While many accounts of fires at creosoting plants, like those described above, cited unknown causes or freak events such as a "sparks from equipment" or a "piece of hot iron falling on the creosote," other accounts blamed employees' "carelessness."[27] In an analysis of "fire protection applied to wood-preserving plants, Hubbell, a fire inspector, warned that part of the risk of fire could be attributed to the "rather rough grade of employees" plants depended on, which suggests workers were incompetent and negligent.[28] This derogatory attitude is also conveyed in reports of an explosion at the Pennsylvania Railway's creosote plant in 1919 that killed one man immediately and likely "fatally burned" another two. The men, who lived onsite in houses provided by the company, had been tasked with cleaning a creosote boiler. Since it was too dark to see, one of the men "struck a match" igniting the creosote residue in the tanks and setting the men's "clothes on fire." The plant engineer reportedly "braved the dangers of other tanks in the vicinity exploding in giving aid to the blazing pile of humans." Witnesses reported that the fire wounded the men so badly their clothing "was completely burned from their bodies." While the account celebrated the heroic actions of the engineer, its author also stressed the injured workers' gross negligence in lighting the match.[29]

Employee negligence becomes less clear, however, when considering the lack of training many workers involved in wood-preservation reported receiving. Although

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[27] "Creosote Tank Erupts, 2 Hurt," *Washington Post*, October 16, 1972; "Creosote Works Burned," *Idaho Daily Statesman*; June 30, 1903; Hermann von Schrenk, "The Creosoting Industry with Relation to the Fire Hazard," *Quarterly of the National Fire Protection Association* 11, no. 4 (April 1918): 412-413.

[28] Hubbell, "Fire Protection As Applied to Wood-Preserving Plants," 83.

[29] "One Dead, Two Fatally Burned in Tank Blast," *Philadelphia Inquirer*, November 9, 1919.

workers' limited knowledge about safe handling of creosote is discussed in greater detail later in the chapter, it was a prevalent defense in many of the personal injury lawsuits employees filed. Injured workers repeatedly claimed they had no training working with coal-tar creosote, and that their employers routinely failed to educate them about safe-handling practices.[30]

The long history of fires at creosoting plants in Norfolk, Virginia, illustrates how common these disasters were in this industry. Edmund Andrews established a creosoting plant on the Elizabeth River near Norfolk in 1882 and named it the Old Dominion Creosoting Plant. A promotional tract on the plant noted that "the very success he attained may be attributed the misfortune which befell him" since his numerous orders "compelled Andrews to press his operations continuously day and night." One night in October 1883, "some cause" resulted in a massive fire that "consumed" Andrews's "entire works."[31] Baltimore's *Sun* offered more details about the blaze in a November 1 article, attributing the fire to a boiler exploding and igniting "1,000 barrels of oil" along with all of the treated timber. According to the reporter, "The explosion shook the houses of this city. Parts of ten-ton cast-iron cylinders were hurled a quarter of a mile."[32] Although the Old Dominion Creosoting Company dismissed the fire, instead promoting how Andrews "rebuilt the works on a much larger and more

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[30] Ibid..

[31] Old Dominion Creosoting Works, *The Preservation of Timber*, 5;

[32] "Creosoting Works Destroyed," *Sun* (Baltimore), November 1, 1883.

complete scale" so that they could double the plant's previous capacity, the *Sun's* account depicted the fires as dangerous and destructive.[33]

Fires continued to trouble creosoting facilities in Norfolk. On January 21, 1907, the *Washington Post* reported that a "spectacular fire" destroyed the Atlantic Creosoting Company's plant when a "spark from a locomotive of the Norfolk and Western Railway set fire to grass near the plant." A "forty-mile wind" fueled the conflagration, igniting "several hundred thousand feet of creosoted timber and piling," and "2,500 barrels" of creosote oil along with "seventy-five thousand gallons of creosoting fluid in the tanks" that exploded. According to the article, "the smoke from the fire reached a height estimated at 1,000 feet" and "three acres of property were covered in blazing oil." Miraculously, the fire only critically injured one sailor assisting the fire fighters, who, according to the report, was "expected to die."[34] In September 1921, a fire at the Chesapeake Manufacturing and Creosoting Company resulted in $500,000 damage and "destroyed the entire storage yards."[35] Fires again devastated Norfolk's creosoting facilities into the 1930s. A credit report on the Norfolk Creosoting Company, previously the Old Dominion Creosoting Company, listed the plant's fire record under owner Edmund F. Conger. Two fires spread to the Norfolk plant in 1935 from a pine kindler facility operating on the property by a separate company. The fires caused enough damage that company payroll records from September 1935 include a note that suggests much of the work completed at the plant during this month was "cleaning up

[33] Old Dominion Creosoting Works, *The Preservation of Timber*, 5;

[34] "Acres of Blazing Oil," *Washington Post*, January 21, 1907.

[35] "Fire Causes $500,000 Loss," *Macon Daily Telegraph*, September 18, 1921.

after fire."[36] Additional fires likely occurred at Norfolk's creosoting plants, but these disasters did not make headlines or went unreported. Historical accounts, for example, suggested that some plants and the industry worked carefully to control the flow of information about these fires so that the blazes did not negatively impact business.

On June 2, 1910, the *Dallas Morning News* reported that the International Lumber and Creosoting Company in Texarkana suffered an estimated $750,000 loss when its plant along with 125,000 gallons of creosote, 28-carloads of creosoted cross ties and a large quantity of raw material" went up in flames. A few days later, the paper released a special report correcting "erroneous data obtained about the fire" that "caused a much greater account of their damage and loss to be furnished to the press than was the case." According to the article, since the plant was outside of the city, accurate information about the fire was slow to arrive and "the burning oil gave a very bright light, which threw an illumination into the city" giving the firestorm an appearance of being worse than it actually was. Although the first report claimed the fire occurred at the International Lumber and Creosoting Company, the second article referred to the National Lumber and Creosoting Company. The damage estimate also significantly dropped from $750,000 to $2,000. While the updated report suggests the press sensationalized the initial account, the second article acknowledged that the company "had the misfortune of losing very heavily by fire some months ago, but have since rebuilt." This reference to a recent fire suggests these events were not isolated incidents at this particular creosoting plant. According to the end of the revised article, the plant's

[36] Folder Payroll and Distribution, Box 3, MS 5802, Norfolk Creosoting Company Records, University of Virginia Library, Charlottesville.

“present structure is a magnificent fireproof and up-to-date establishment” and it is “considered one of the best of its kind in the country.” Clearly, the plant’s owners wanted to promote its safety and stability. A second fire occurring months after the first blaze, however, casts doubt on how “fireproof” the rebuilt, modernized plant was.[37]

The wood-preservation industry touted itself as having the most up-to-date fire protection, but research suggests even this often proved inadequate. Hermann von Schrenk, an expert on wood preservation and a member of the National Fire Protection Association, published an article in this organization’s quarterly journal in April 1918 on fire hazards associated with the creosoting industry. Von Schrenk noted that at the time, 141 wood-treating plants operated in the U.S., “practically all of which use creosote.” Considering the “present extensive nature of the industry,” von Schrenk contended, “the number of fires which have occurred at creosoting plants is remarkably small.” The fires that had occurred, he explained, “took place in plants of more or less ancient design.” Von Schrenk also submitted a list of six fires at creosoting plants reported to the National Fire Protection Association since 1909, but acknowledged it was only a “partial list.” By 1918, he credited the industry with a “very high system of fire protection,” particularly the practice of organizing employees into “fire companies who drill at frequent intervals.” Von Schrenk concluded that “it is probably due to the great care used in this respect that there have been so few fires at creosoting plants in late years.”[38] This comment suggests that while the frequency of fires at plants had declined, it was once much higher.

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[37] “750,000 Fire at Texarkana,” *Dallas Morning News*, June 2, 1910; “First Estimates Incorrect,” *Dallas Morning News*, June 4, 1910.

[38] von Schrenk, “The Creosoting Industry with Relation to the Fire Hazard,” 400, 412, 402.

The number of articles in historical U.S. newspapers reporting fires at creosoting plants suggests that von Schrenk's "partial" list minimized the number of fires. Likely, not all plants reported their fires to the National Fire Protection Association, and it was in both the plants' and the industry's best interests to downplay the fire risk. This is further evidenced by the fact that von Schrenk admitted at the subsequent annual meeting of the American Wood Preservers' Association in 1918, that the original paper to be published in the National Fire Protection Association quarterly was "practically devoted to a discussion of fires which had occurred at creosoting plants in the last twenty-five years." The piece disturbed von Schrenk because it "gave the impression that the creosoting plant was about the worst kind of fire hazard there was anywhere in the United States." Indignant about this negative publicity, von Schrenk set about revising the article so that it did not cast creosoting in such a damaging light. Similar to von Schrenk, other members of the industry espoused concerns about its hazardous reputation; at the annual meeting of the AWPA in 1918, the organization's president worried that "misunderstanding" and "misconception" about the fire risk associated with creosoting "incline consumers to be prejudiced against it."[39]

Despite the industry's protestations that "creosoting materials are not extremely risky if care is taken," the danger of fire proved enough of a concern that the American Wood Preservers' Association frequently investigated how to reduce the risk and prevent blazes.[40] At the 1910 annual meeting of the organization held in Chicago, Lowry Smith presented a paper on "precautions to be observed for prevention of fire in

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[39] These comments are published in the *Proceedings of the Fourteenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1918), 91-92.

[40] Ibid., 92.

creosoting plants." Smith's authority on the subject came from practical experience; he managed a creosoting plant owned by the M. K. & T. Railway Company, at Greenville, Texas, which burned on the night of February 8, 1909. Although Smith believed the plant "was well equipped for fire protection," he acknowledged some of the reasons the plant went up in flames. Since the fire pump was located in the same room the fire started, employees had no water pressure to fight the fire. The plant also located the tanks containing creosote oil close to the buildings, increasing the risk that the fire would spread if the tanks exploded and the preservative ignited. According to Smith, the plant had also been laid out with its buildings too close together; while this increased the plant's efficiency, it also raised the chance that a fire would subsume the other buildings. Perhaps one of the most grievous errors, Smith warned, was that the plant buildings were all wooden structures. In a wood-treating plant, when preservatives spilled, leaked or dripped, the creosote soaked into the wood, ready to burst into flames from a stray spark, faulty wiring, a lamp, etc.[41]

To prevent these disasters, Smith issued recommendations to his colleagues in the AWPA. The key to reducing fire risk, according to Smith, involved "fireproof construction and good ventilation." He insisted plants should be built using steel and concrete, not wood. Concrete floors should be "thoroughly flushed with hot water at least once a week, and washed off with the hose once a day" to keep the oil from collecting. In spite of his claim that concrete construction would render the building "fireproof," he admitted that "oil-soaked concrete will burn like coal once started." Smith

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[41] Lowry Smith, "Precautions to Be Observed For Prevention of Fire in Creosoting Plants," in *Proceedings of the Sixth Annual Meeting of the Wood Preservers' Association* (American Wood Preservers' Association, 1910), 52.

also advised attendees of the importance of chemical fire extinguishers since "water is almost less than worthless in fighting an oil fire of any size." Plant managers should also endeavor to repair leaks quickly; clear the yard of grass, weeds, and bark; keep open lights away from the plant, and have adequate fire hoses and hydrants. In response to this lecture, one of the attendees and the AWPA's secretary, F. J. Angier, boasted that the main building of the tie-treatment plant he supervised in Galesburg, Illinois "is absolutely fireproof." Angier's comment suggests overconfidence since many plants pronounced their facilities "fireproof" only to later watch them reduced to a pile of ashes. While plant managers and operators like Smith who had experience with fires in wood-treating plants considered practical ways to better improve fire safety, others arrogantly assumed fire posed no threat. Perhaps acknowledging the significant risk fires posed and the likelihood they would occur, Smith ultimately argued that "the last and best precaution is: DON'T HAVE ANY FIRES."[42]

In contrast to infernos, which captured public and media attention while costing plants significant monetary losses, the greatest risks to worker safety initially appeared more innocuous—the coal-tar creosote used to preserve timber. This preservative soaked, splashed, and dripped onto workers constantly. (Figure 5-2) A British physician investigating the correlation between cancer and coal-tar workers in 1920, noted, "The men who attend this process are generally bespattered with evidence of their calling." As he attested, it was virtually impossible to work with or near creosoted material and not come in contact with the preservative. Personal injury claims and medical reports

[42] Ibid., 49, 50, 53.

also convincingly demonstrate that contact with what some workers described as "Black Jack" or "Hot Stuff" posed a major health risk to workers.[43]

Workers often developed "tar acne" as a result of working with creosote, and by the late 1800s, dermatologists recognized this as a specific type of "acne artificialis," or acne caused by exposure to chemicals or external irritants. In an 1885 "handbook of diseases of the skin," for example, German physician Ernst Veiel included "tar acne" in his discussion of "acne artificialis." Patients developed tar acne, Veil explained, as a result of inhaling tar vapor or directly applying tar, creosote, or similar substances to the skin.[44] Philip Ross, a British physician investigating "occupational skin lesions due to pitch and tar," concluded that tar acne was "quite common among these workers," and older employees often had visible "pitted scars" from chronic bouts of this condition. Creosote and similar tar products also produced other types of skin lesions on workers' bodies, often referred to as "tar warts."[45] In addition to these skin conditions, longtime creosote workers sometimes developed "tar melanosis," which caused a "deep tanning of the exposed parts, especially the face, neck, and forearms."[46] British physicians researching the health risks of coal-tar products noted that workers were often easily recognized since "their faces and hands" were "browned by long exposure."[47] French

[43] W. J. O'Donovan, "Epitheliomatous Ulceration Among Tar Workers," *British Journal of Dermatology and Syphilis* 32, no. 6 (July 1920): 216; *Samuel A. Pinkley v. The Chicago and Eastern Illinois Railroad Company*, 246 Ill. 370; 92 N.E. 896; 1910 Ill. LEXIS 2073.

[44] Ernst Veiel, "Anomalies of the Sebaceous Glands and Their Function," in *Handbook of Diseases of the Skin* ed. Hugo Ziemssew (New York: William Wood & Company, 1885), 469.

[45] Philip Ross, "Occupational Skin Lesions Due to Pitch and Tar," *British Medical Journal* 2, no. 4572 (Aug. 21, 1948): 370-371.

[46] Ibid., 370.

[47] O'Donovan, "Epitheliomatous Ulceration Among Tar Workers," 216.

and American physicians also documented cases of melanosis in railroad “plate-layers” or “trackmen” who inspected and maintained creosoted railroad ties and construction workers who came in contact with creosote.[48]

Although tar acne, tar warts, and tar melanosis were bothersome and unsightly, they did not result in any real “disability,” as one physician noted.[49] In contrast, workers were much more concerned about the severe burns and skin irritation even brief contact with creosote caused, and they filed lawsuits as a result of their exposure. In August 1907, Samuel A. Pinkley, a laborer for the Chicago and Eastern Illinois Railroad Company, handled creosoted timbers during the course of his work. After experiencing what he described as a “severe allergic reaction,” Pinkley sued the railroad company for his injuries. In addition to his personal experience, Pinkley claimed that other employees “blistered and burned from working with creosote, and skin peeled off arms, faces, and hands.” The fumes, according to Pinkley, also caused a “burning sensation.”[50] In a similar case, an employee of the Norfolk & Western Railway Company, sued the railroad when ties soaked in creosote “burned and irritated his arms and other portions of his body.” The employee, who is identified only by his last name—Robinette—encountered creosote in August 1930 while loading treated ties into a railcar.[51]

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[48] Robert Prosser White, *The Dermatergoses or Occupational Affections of the Skin* 4th ed. (London: H. K. Lewis & Co. Ltd., 1934), 226; J. McCafferty, “Melanodermia,” *Archives of Dermatology and Syphilology* 16, no. 6 (Dec. 1927):

[49] Ross, “Occupational Skin Lesions Due to Pitch and Tar,” 370.

[50] *Samuel A. Pinkley v. The Chicago and Eastern Illinois Railroad Company*.

[51] *Robinette v. Norfolk & W. Ry. Company*, 249 Ky. 93; 60 S.W.2d 344; 1933 Ky. LEXIS 482, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015); *Norfolk & W. Ry. Co. v. Robinette*, 257 Ky. 558; 78 S.W.2d 802; 1935 Ky. LEXIS 67, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

Another railroad employee, James Lloyd Underwood, who worked for the Cincinnati, New Orleans, and Texas Pacific Railroad Company from 1928 to 1955, sued for personal injuries after exposure to burning, creosoted railroad ties. Underwood maintained that the burning ties caused severe "eruptions," "skin irritation" and "swelling over his body, especially his eyes," and a doctor diagnosed the employee's malady as "contact dermatitis due to creosote." Other workers also testified on his behalf, supporting Underwood's claims about injuries resulting from creosote with their own personal experiences. Chester Galloway, one laborer for the railroad, admitted that creosote burned his face and hands "sufficiently to cause the skin to peel off a number of times." Additional laborers experienced in handling ties admitted knowing "lots of workers to be affected with burning by creosote," further validating Underwood's injuries.[52] In a 1943 personal injury suit against the Missouri Pacific Railroad Company, a company foreman testified that creosoted bridge pilings blistered members of his crew "from their waists down."[53]

Based on the descriptions provided in court documents, these workers appeared to suffer from tar burns and tar erythema, which physicians long documented as occupational hazards of working with coal-tar creosote. In his 1946 study, Ross described tar erythema—also known more commonly as "tar smarts"—as "severe smarting of the exposed parts of the body." While this condition usually "resembles ordinary sunburn," Ross noted that it "may vary from a slight redness of the skin to a

[52] *Cincinnati, New Orleans & Texas Pacific Railroad Company v. James Lloyd Underwood*, 262 F.2d 375; 1958 U.S. App. LEXIS 5149; 74 A.L.R.2d 1025, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[53] *Missouri Pacific Railroad Company, Thompson, Trustee, v. McKamey*, 205 Ark. 907; 171 S.W.2d 932; 1943 Ark. LEXIS 254.

severe dermatitis." Tar erythema also affected the eyes, as some of the injured workers discussed above reported, causing severe burning and an extreme sensitivity to light.[54]

Workers handling treated wood also blamed creosote for more debilitating injuries. In 1904, Herschell Palmore, sued the Atchison, Topeka, & Santa Fe Railway for personal injuries sustained when he unloaded creosoted railroad ties from a box car. Palmore insisted creosote was "a virulent poison, the natural effect of which is to destroy the tissues of the human body with which it may come in contact." When he handled the creosoted ties, "a fine, light dust which had accumulated upon them and which had become impregnated with the creosote was disseminated in the air and into his eyes, by means of which they were badly burned and his vision was permanently impaired."[55] Two years later, Charles Gill, a manual laborer for the Illinois Central Railroad Company suffered a fate similar to Palmore. The railroad's section foreman ordered Gill to assist with the unloading of creosoted bridge timbers. Creosote dripped into Gill's eye and, he alleged, "it became so injured and inflamed that he lost the eye."[56]

In addition to creosote exposure causing skin irritation, blistering, and eye damage, some employees reported even more grievous afflictions. After unloading creosoted ties in July of 1916, Winford Wright, a section hand for the Louisville and Nashville Railroad Company, became very ill. Although the railroad and its medical representatives alleged that Wright suffered from tuberculosis, he insisted his condition

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[54] Ross, "Occupational Skin Lesions Due to Pitch and Tar," 370.

[55] *The Atchison, Topeka & Santa Fe Railway Company v. Herschell Palmore*, 68 Kan. 545; 75 P. 509; 1904 Kan. LEXIS 142, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[56] *Illinois Central Railroad Company v. Charles Gill*, 88 Miss. 417; 40 So. 865; 1906 Miss. LEXIS 142, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

was the result of acute “creosote poisoning that impacted liver, muscles, nerves, and eyes.”[57] Similar to Wright, Robert Collins who handled creosoted ties for the Northern Texas Railway Company in 1912, reported suffering from “systemic” creosote poisoning, but the railroad alleged he was simply afflicted with pellagra.[58] In July of 1922, Joseph Cheek pursued compensation from the Chicago, R. I., & Pacific Railway Company, after creosote dripping from ties soaked through his clothing, burning and scarring his skin. According to Cheek and the doctors from whom he sought medical treatment, the creosote caused “permanent injuries to his genitals” and he “will never recover completely.”[59]

These examples of court cases illustrate some of the common health concerns employees raised about coal-tar creosote, but they also highlight the lack of safety equipment and instruction employees received. When the railroad ordered Pinkley and other laborers to unload creosoted timbers, they provided limited handspikes and cant hooks, tools for handling lumber. Pinkley pointed out, however, that the workers had to use their bare hands to “roll the timbers up skids to get them out of the car,” thereby increasing workers’ exposure to creosote.[60] In Cheek’s case, he noted that the company offered only one hook to section laborers “forcing many to use their hands” to load

[57] *Louisville & Nashville Railroad Company v. Wright*; *Louisville & Nashville Railroad Company v. Barr, Administrator Winford Wright*, 183 Ky. 634; 210 S.W. 184; 1919 Ky. LEXIS 547; 4 A.L.R. 478, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[58] *Robert Collins v. Pecos & Northern Texas Railway Company*, 110 Tex. 577; 212 S.W. 477; 1919 Tex. LEXIS 124, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[59] *Chicago, R. I. & P. Ry. Co. v. Cheek*, 105 Okla. 91; 231 P. 1078; 1924 Okla. LEXIS 476, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

[60] *Pinkley v. The Chicago and Eastern Illinois Railroad Company*.

creosoted pine ties onto flat cars.[61] The limited supply of tools was not always an oversight. Wood-treatment plants and the companies purchasing treated wood discouraged the use of cant hooks or tongs because they did not want the wood gouged or damaged. Using these tools might “leave deep stab holes where water collects and rot starts,” rendering the expensive creosoting process futile.[62] When the Virginia Public Service Company, for example, requisitioned creosoted pine poles from the Norfolk Creosoting Company in 1936, the order specified that “pole tongs, cant-hooks, and other pointed tools capable of producing penetrations of more than 1 inch in depth shall not be used.”[63] This desire to protect the integrity of the preservative treatment put workers at a greater risk of coming in contact with coal-tar creosote and other harmful preservatives.

In addition to a lack of tools, employers seldom supplied workers with any protective clothing. Testifying on Underwood’s behalf—Levi Kreis, a Cincinnati, New Orleans, and Texas Pacific Railroad Company employee who had over 28 years’ experience handling creosoted ties—noted that “he had never been furnished by the railroad company with any particular type of gloves or any kind of ointment.”[64] Without any safety equipment, workers handling creosoted timber sometimes resorted to desperate measures to minimize contact with the caustic preservative. Court documents on Pinkley’s case suggest one foreman “furnished a can of vaseline and advised the

[61] *Chicago, R. I. & P. Ry. Co. v. Cheek*.

[62] Advertisement for Multipoint Cant Hook in *Wood Preserving News* (September 1941), 11, Folder Older Information Pertaining to Purchase of Boiler, Box 1 MS 5802, UVA Library.

[63] E. H. Crews to E. F. Conger, May 28, 1936, Folder NPS Yards, Box 3, MS 5802, UVA Library, Charlottesville.

[64] *Cincinnati, New Orleans & Texas Pacific Railroad Company v. James Lloyd Underwood*.

men to use the vaseline on their faces" to "prevent the preparation hurting them."[65] In another case where workers rebuilt a bridge with timbers heavily saturated with creosote, they used mud in an effort to cover the wood to prevent the fluid from dripping on them from such timber."[66] Photographs of workers at wood-preservation plants reinforce these workers' accounts. Although a few are shown with gloves, many of the employees handling treated wood wore no protective equipment.[67] Some workers took initiative and attempted to fashion their own protective equipment. Workers at the Escambia Wood Treating Company in Pensacola, for example, placed burlap bags around their feet before climbing in tanks filled with creosote and "spinning the poles" with their feet to ensure the creosote fully saturated the wood. The creosote, however, would soak through the burlap quickly, minimizing the effectiveness. [68]

Providing protective equipment to workers would have undermined the claims that handling coal-tar creosote in no way threatened workers. Both the industry and the companies that purchased treated wood employed a variety of strategies in their resolute endorsement of creosote. Many railroads and wood-treatment companies not only flat-out denied employees' claims that creosote caused injuries or made them sick, but they argued the preservative was "healthful" and "harmless." In 1929, supervisors of the Republic Creosoting Company in Indiana instructed employee Earl C. Hiatt to handle creosoted-wood-paving blocks, although Hiatt's standard job for the plant

[65] *Pinkley v. The Chicago and Eastern Illinois Railroad Company*.

[66] *Missouri Pacific Railroad Company, Thompson, Trustee, v. McKamey*.

[67] See, for example, the photographs of workers in the "Forest to Field" scrapbook located in Folder 57, Box 2 of the Edwin Fisher Conger Papers at the Virginia Historical Society in Richmond.

[68] Steve Lerner, *Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States* (Cambridge, Massachusetts: MIT Press, 2010), 42.

involved planing the blocks prior to treatment. Because the job was outside “the scope of his employment,” Hiatt protested. His supervisors insisted “the work was beneficial to his health” and necessary if he wanted to keep his position at the plant. Hiatt, who noted that he was not furnished with any safety equipment, became sick from “breathing and inhaling said creosoting preparation, said fumes, vapors and gases,” which left “his body and system” totally “saturated with said creosoting preparation.”[69]

Similar to the Republic Creosoting Company’s claim that creosote was “beneficial” to workers’ health, the Missouri Pacific Railroad Company contended that the creosote preparation, which permanently impaired a former employee’s vision, was not “injurious” and could be used “with safety as an antiseptic.”[70] In another approach that dismissed the health concerns workers raised, the Louisville & Nashville Railroad Company attributed one worker’s injuries to “some idiosyncrasy or peculiar susceptibility possessed by him and which does not exist in the ordinary run of men.”[71] This approach not only absolved both the treatment and the company of any potential guilt, it also suggested the sick employee was abnormal or deficient in some way that made him unusually susceptible to injury.

Railroads possessed the resources and allies to defend their practices; they could afford to appeal cases until judges arrived at the desired verdict—that the company was not liable for workers’ injuries. In a 1999 study, Historian William G. Thomas demonstrates the power railroads wielded in these personal injury disputes

[69] *Republic Creosoting Company v. Hiatt*, 212 Ind. 432; 8 N.E.2d 981; 1937 Ind. LEXIS 329.

[70] *Missouri Pacific Railroad Company, Thompson, Trustee, v. McKamey*.

[71] *Louisville & Nashville Railroad Company v. Wright*; *Louisville & Nashville Railroad Company v. Barr, Administrator Winford Wright*.

since they employed “nearly as many people as the U.S. government” and operated with “budgets nearly as large.”[72] Railroad companies presided over legal departments with experienced counsel, but also retained specialized personal injury agents and company surgeons who could investigate injury claims and testify on the railroads' behalf.[73] Perhaps even more instrumental to their success in the courtroom, Thomas, noted, was that railroads possessed “the advantage of economy of scale over individuals” because “no one case carried the importance for the railroad company that it did for the individual plaintiff.”[74]

Cases in which workers sued railroads after alleging injury due to creosote highlighted these challenges. According to one researcher who was dismissive of workers' claims and familiar with these proceedings, “the railroads had little difficulty in showing that the ‘creosote burns' and scars were the result of syphilis; in other instances, they lost to juries who were something less than sympathetic to logic and medical testimony when a poor man was fighting a big railroad.” Oftentimes, lawsuits dragged on for years, with injured workers' dying before courts reached an ultimate decision. To sway the courts in their favor, railroad companies often hired expert witnesses such as Hermann von Schrenk, a renowned specialist and consultant in wood preservation, whom they paid as much as “$150 per day plus expenses” to convince juries that creosote was of no threat to workers. In one such case, von Schrenk made a theatrical demonstration. “He rose from the witness chair, dramatically

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[72] William G. Thomas, *Lawyering for the Railroad: Business, Law, and Power in the New South* (Baton Rouge: Louisiana State University Press, 1999), 113.

[73] Ibid., 62, 115, and 157.

[74] Ibid., 62.

pulled off his coat, high stiff collar and tie, rolled up his cuffs and bathed himself in creosote in a dishpan resting on a table before the bench." As his biographer later noted, "it was an heroic device" that made the jury seriously question the workers' reported injuries, and, ultimately, von Schrenk's "client won." Unlike most of the injured workers or those employed at wood-preservation plants, von Schrenk did not make a regular habit of "bathing himself" in creosote and he likely did not leave the preservative on his body long before scrubbing it off.[75]

While some companies claimed coal-tar creosote posed no threat to workers, others insisted that employees willingly "assumed these risks." If companies could show that workers knew of the hazard, they could not receive compensation.[76] Because this legal defense acknowledged that risks were present, it directly conflicted with the assertion that creosote was harmless. In the Pinkley case, the Chicago and Eastern Illinois Railroad Company pointed to Pinkley's experience working for railroads to justify that he assumed the risk.[77] Even if he had no previous hands-on experience handling creosote prior to working for this specific railroad, the company claimed he had enough common knowledge to anticipate that creosote might be dangerous. Similarly, the Illinois Central Railroad Company cast doubt on its employee Charles Gill's claim that he had no previous experience with creosote and was unaware of the dangers of this preservative.

> In this case the plaintiff is a man thirty-two years old, who had been at work for the company for over three years in the state of Louisiana, when

[75] James E. Cronin, *Hermann von Schrenk A Biography* (Chicago: Kuehn, 1959), 164 and 163.

[76] Christopher C. Sellers, Hazards of the Job: From Industrial Disease to Environmental Health Science (Chapel Hill: University of North Carolina Press, 1997), 35.

[77] *Pinkley v. The Chicago and Eastern Illinois Railroad Company*.

> all the world knows that in its swamps and over its waterways creosoted timbers are used. Indeed, they are in such demand by the railroad company and telegraph and telephone companies that they attract attention of all classes of people, and a ten-year-old boy almost at any place on the Illinois Central Railroad system can tell why they are so black and why they are used. Thousands of men handle them every day.[78]

This argument suggested that even a ten-year-old boy—let alone a seasoned railroad employee—would be able to recognize the risks of creosote because it was in no way "hid from him." Thus, at the same time the railroad's legal counsel questioned the plausibility that creosote caused Gill's injury—as they alleged creosote was "harmless"—the attorneys also insisted that "if there was danger it was obvious and required no warning."[79]

In addition to employing this contradictory logic, railroads and companies using creosote alleged their workers' injuries occurred as a result of their own negligence or "contributory negligence." Many hazardous industries relied on this legal principle to defend against compensation lawsuits. If a company could demonstrate that the injured worker "shared the slightest responsibility" or acted negligently in any way, the employee could not recover damages.[80] In 1924, the Chicago, Rock Island and Pacific Railway Company questioned whether creosote actually posed any threat to workers, but the railroad's legal counsel also alleged the injured employee, Cheek, was to blame. Appealing the decision of a district court in Oklahoma, which ruled in favor Cheek, the railroad's legal counsel denied Cheek's claim. The railroad's legal representation declared, the "injury was caused by the plaintiff's own lack of care, and negligence" but

[78] *Illinois Central Railroad Company v. Charles Gill*.

[79] Ibid.

[80] Sellers, *Hazards of the Job*, 35.

also maintained that Cheek "knew of the danger in handling the ties, if any existed, and assumed the risk." Judges even remarked on the convoluted nature of these arguments, casting serious doubt that employers failed to recognize the risks of working with creosote. In the *Cheek* case, the Supreme Court of Oklahoma questioned, "Can it be said that the dangers of handling the creosoted ties could not be deemed to have been foreseen by the employer?" The judges concluded, "The defendant, employer, knew this fact, or should have known it."[81]

This ruling by the Supreme Court of Oklahoma in Cheek's favor was unusual. Of the eleven court cases discussed in this chapter, only three concluded in the employees' favor—*Chicago, Rock Island, and Pacific Railway Company v. Cheek*; *Eppinger and Russell v. Sheely*; and *Cincinnati, New Orleans & Texas Pacific Railroad Company v. Underwood*. Even these appellate rulings in employees' favor were hollow victories. Cheek claimed creosote led to injuries from which he would never recover. Sheely died before the appellate court even reached its decision. After twenty-eight years working for the railroad, Underwood's injuries from creosote forced him out of work. Verdicts in the remaining eight cases affirmed rulings in favor of employers or reversed previous rulings that held companies responsible for employees' injuries. Although Hermann von Schrenk and his biographer expressed frustration with juries' tendency to side with a "poor man" rather than a "big railroad," the verdicts in the cases involving creosote exposure suggest appellate courts frequently supported railroads, creosoting

[81] *Chicago, R. I. & P. Ry. Co. v. Cheek*.

companies, and other consumers of treated wood rather than the “poor men” coming in contact with this preservative.[82]

In spite of the numerous creosote-related lawsuits, the Forest Products Laboratory (FPL) argued that health risks associated with wood preservatives were negligible and could be deduced relatively easily because “long experience in the industrial use of chemicals of various kinds has furnished much information of this character.”[83] Although the American wood-preservation industry vehemently challenged the idea that coal-tar creosote posed health risks to workers or consumers, the FPL was correct in its claim that the extensive use of this preservative, especially in Europe, had already produced a mountain of data documenting the danger to workers. Reports suggesting creosote’s toxicity date back to the mid-eighteenth century. Although John Bethell did not patent the use of coal-tar creosote as a wood preservative until 1838, medical professionals in Europe had already established convincing links between coal by-products and cancer.[84]

In 1775, Sir Percivall Pott, a renowned English surgeon at St. Bartholomew’s Hospital, published his findings on a specific occupational disease or a “disease as peculiar to a certain set of people, which has not, at least to my knowledge, been publicly noticed; I mean the chimney sweepers’ cancer.” Pott detailed how chimney

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[82] Cronin, *Hermann von Schrenk*, 164.

[83] Forest Products Laboratory, *Testing Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Dec. 1938), 11.

[84] George M. Hunt and George A. Garratt, *Wood Preservation* (New York: McGraw-Hill Book Company, Inc. 1938), 10;

Paul Blanc, *How Everyday Products Make People Sick: Toxins at Home and in the Workplace* (Berkeley: University of California Press, 2007), 227.

sweeps commonly developed what he described as “soot warts” on their scrotums. Just as the railroads later dismissed many workers’ creosote-related injuries as the result of syphilis, Pott noted that his contemporaries often misdiagnosed chimney sweepers’ cancer as “venereal.” Although these physicians treated patients with “mercurials,” Pott noted, their conditions often worsened and resulted in a very “painful death.” While many physicians of the period ignored the chimney sweeps and their “peculiar” affliction, Pott empathized with their plight:

> The fate of these people seems singularly hard: in their early infancy, they are most frequently treated with great brutality, and almost starved with cold and hunger; they are thrust up narrow, and sometimes hot chimneys, where they are bruised, burned, and almost suffocated; and when they get to puberty, become peculiarly liable to a most noisome, painful, and fatal disease.[85]

His research is recognized as groundbreaking because Pott clearly connected the chimney sweeps’ exposure to soot with their subsequent cancer, and he produced the “earliest account” linking an occupational and environmental pollutant with a “specific type of cancer” thus laying the foundation for “occupational epidemiology.”[86]

Pott’s son-in-law and medical colleague, Sir James Earle, continued researching the association between chimney sweeps and cancer after Pott’s death in 1788. In 1808, Earle republished Pott’s *Chirurgical Works,* supplementing the research with his own notes and observations. In addition to “soot warts” developing on the scrotums of

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[85] Percivall Pott and James Earle, *The Chirurgical Works of Percivall Pott: With His Last Corrections : to Which Are Added, a Short Account of the Life of the Author, a Method of Curing the Hydrocele by Injection, and Occasional Notes and Observations (*Philadelphia: James Webster, 1819), 291-292.

[86] Dona Schneider and David E. Lilienfeld, “Chapter 5: Percival Pott,” in *Public Health: The Development of a Discipline, Volume 1* (New Brunswick, New Jersey: Rutgers University Press, 2008), 100.

chimney sweeps, Earle also found growths on patients' faces.[87] More importantly, Earle noted that while chimney sweeps, in particular, seemed afflicted with this type of cancer, he had also identified cases among individuals who simply came in contact with soot. Searching for a possible connection to chimney sweeps, Earle repeatedly interviewed one man "who was attacked with this dreadful disease to a most lamentable degree." Although the patient assured Earle he had never "had any thing to do with sweeping chimneys," he later "recollected" that not long before his condition emerged, he "had lodged at the house of a chimney-sweeper, in the apartments of which soot-bags and soot were deposited." Earle also documented another case where a gardener, developed a "large cancerous sore"—similar to the warts seen among chimney sweeps—after regularly "strewing" soot on the ground among his plants each spring to keep slugs away. These and other medical cases led Earle to conclude that "soot in substance, or perhaps the volatile parts of it, have the power of producing the disease."[88]

Although scientists might today minimize Pott's and Earle's research as anecdotal, it nevertheless established a compelling link between "some peculiar acrimonious quality in soot" and cancer.[89] Creosote, as Paul Blanc, a specialist in environmental and occupational medicine explained, is "simply essence of chimney soot," and subsequent physicians built on this early work, investigating related

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[87] Pott and Earle, *The Chirurgical Works of Percivall Pott*, 291.

[88] Ibid., 294.

[89] Ibid., 293. Dan Fagin discusses Pott's contribution in *Toms River: A Story of Science and Salvation* (New York: Bantam Books, 2013).

occupations that rendered workers susceptible to cancer.[90] Charles B. Ball, an Irish surgeon, published a report in 1885 on two similar cases of “tar cancer” he treated. The first patient, who Ball identified as “Curley,” worked for years at “Messrs. Bethell’s tar works” near Dublin when scrotal warts prompted him to seek medical help. In 1881, Ball removed “a large epithelium” from Curley’s scrotum. Convinced the man’s occupation might have led to this malady, Ball recommended he change employment. Curley shrugged off Ball’s warning and returned to the tar works. Two years later, Curley had returned to Ball with new growths, which Ball again excised. Ball identified a second case of tar cancer in an approximately 80 year-old tar worker employed for 15 years at “Kurtz’s,” another tar factory in Dublin. This man experienced warts on his hands for years, but only sought medical help in April 1884, when one of the growths on the back of his left hand “ulcerated” and continued to swell. Upon examination, Ball also identified “numerous blackish horny warts” on the patient’s face, the backs of both hands, and his forearms. The patient refused to undergo any operation at the time, but he returned a few months later in September 1884 when the ulcer mushroomed and “the pain was so excessive that the patient was anxious for any operation that would given him relief.” Ball “amputated the forearm,” and after “microscopic examination” he pronounced the ulcer to be a “typical epithelioma.”[91]

Ball summarized the parallels between these two cases: “The occupation of both patients was the same, and the disease commenced in both with warts, upon which hard epithelial horns were attached.” He also insisted, “The analogy between these

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[90] Blanc, *How Everyday Products Make People Sick*, 228;

[91] Charles B. Ball, “Tar Cancer,” *Transactions of the Academy of Medicine in Ireland* 3 (1885): 319.

cases and the chimney sweeper's cancer so ably described by Pott, is at once obvious." Although Ball admitted he had previously "not met with any recorded cases where the disease has occurred to persons engaged in the distillation of tar," he reasoned that the lack of existing cases was due to the relatively "recent" growth of the industry. Determined to find answers, he toured Bethell's tar works and interviewed the manager. The manager explained that the factory manufactured "three principal products": a "crude naphtha," "what is called creosote oil," and "pitch." According to the manager, the creosote "is used for creosoting timber to prevent it rotting." In Dublin at the time, Ball estimated that 17 men labored in this industry—15 working at Bethell's plant and 2 at Kurtz's. Upon investigation, Ball also identified other cases of tar cancer among these 17 men. In addition to the two patients he treated, Ball also referenced a third case cited by a different physician. The first patient, Curley, informed Ball that another of Bethell's employees "some years ago" sought treatment at a hospital in Dublin "to have a sore, which had originated in a horny wart on his face, cut out." No one, however, knew "what subsequently became of him." Bethell's manager also shared with Ball that the factory foreman had a similar type of wart "recently" removed from his nose.[92]

These probable cases of tar cancer led Ball to a groundbreaking conclusion: "I think there cannot be any doubt that the direct exciting cause of these two examples of epithelioma was the occupation, especially when we consider their close resemblance to the soot wart." Frustrated by "the difficulties of obtaining reliable information," Ball

[92] Ibid., 319 and 320.

maintained that the “subject is one which requires fuller investigation.” He predicted that “possibly ten years hence we may know more about the matter.[93]

It did not even take that long for other physicians to reaffirm Ball’s research on the occupational health risks of coal-tar distilling and the manufacture of creosote. During the summer of 1892, Henry Butlin, a professor of pathology and surgery at the Royal College of Surgeons of England, delivered a series of lectures in which he summarized the existing research on the “chimney-sweeps’ cancer.”[94] In his final lecture, Butlin also outlined new research that explored the occurrence of scrotal cancer among “persons engaged in wholly different employments to that of sweeping chimneys.” Citing the 1875 research of German surgeon Richard von Volkmann, Butlin examined the “liability of the workers in tar and paraffin.” He documented several cases of scrotal cancer among barge and boat builders who coated wood with mixtures of gas-tars. During the course of his investigation, Butlin also visited a tar factory and interviewed the owner who admitted that many workers involved in distilling gas-coal-tar to produce products including creosote “became affected with warts, often very badly.” Butlin suspected these growths might be due to the fact that although the laborers wore an apron over their trousers, during their work, the apron and trousers became soaked with the distilled liquids.[95]

[93] Ibid., 320.

[94] The *British Medical Journal* published Butlin’s lectures in the July 25, July 2, and July 9 issues of the journal.

[95] Henry T. Butlin, “Lecture III: Tar and Paraffin Cancer,” *British Medical Journal* (July 9, 1892): 68 and 69.

British physicians continued gathering more persuasive proof that occupations involving coal-tar—especially wood preserving—posed serious health risks to workers. In the *British Journal of Dermatology* in 1898, Dr. Stephen Mackenzie "exhibited" what the journal described as a "case of tar eruption" in a 60-year-old patient. This patient, according to Mackenzie, "had been employed for thirty years in dipping railway sleepers in liquid creosote, in an air-tight chamber." As he dipped the railroad ties in the creosote, the man's hands and arms regularly came in contact with "the dripping planks." When Mackenzie shared the case with his colleagues, he noted that the patient's "forearms, front and back, and the backs of the hands and fingers, have the mouths of the hair-follicles plugged by a black crust. In several places elevations of the skin of a warty character, of the size of a split pea, are to be seen." The patient told Mackenzie that his arms had "been in their present condition for years." Mackenzie also detailed "swellings from the size of a pea to that of a nut, rather soft, but covered with a horny crust" on the patient's scrotum. Based on his experience with similar cases, Mackenzie predicted these growths might be cancerous.[96]

French researchers in 1903 verified Mackenzie's concerns about the risks coal-tar creosote posed to wood preservers. In a study of Occupational Diseases published by France's Industrial Hygiene Commission, doctors Le Roy Des Barres and Courtois-Suffit described the painful wart-like growths discovered on the hands, fingers, and

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[96] Stephen Mackenzie, "A Case of Tar Eruption," *British Journal of Dermatology* 10 (January-December 1898): 417.

scrotums of railroad workers. These men had been employed creosoting railroad ties. The doctors anticipated that these tumors would likely develop into cancer.[97]

While coal-tar creosote threatened wood preservers, this was not the only hazardous occupation that brought workers in contact with this toxic substance. Coal miners often experienced the same symptoms as wood preservers and railroad workers when they handled creosoted mine timbers. The "pickled props" produced a "pustular eczema" that irritated the hands, face, and neck of workers and some also reported "a conjunctivitis" after inadvertently rubbing creosote in their eyes. Similar to coal miners, physicians deduced that laborers at brickworks also developed severe skin irritation and even cancerous growths after coming in regular contact with creosote oil, which they often used to lubricate brick molds.[98]

Although only a handful of physicians focused exclusively on coal-tar creosote as a distinct hazard, by the early 1900s doctors accumulated sufficient data on the health risks of coal-tar to "make out a case," as one doctor noted, "for a definite industrial tar etiology of malignant disease."[99] Doctors, especially those in Britain, who documented numerous cases of cancer caused by coal tar began describing it is a specific occupational disease. Thomas Oliver, a physician at the Royal Victoria Infirmary and a professor of physiology at Durham University, included a section on "coal-tar, pitch, and allied products" in his 1908 treatise *Diseases of Occupation*. Oliver explained:

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[97] Le Roy Des Barres and Courtois-Suffit, "Les Dermatoses D'Origine Professionnelle," in *Maladies Professionnelles* (Paris: Imprimerie Nationale, 1903), 103.

[98] White, *The Dermatergoses*, 153; J. Wishart, "In Coal-Miners: B. Chemical Causes Division," *Encyclopedia Medica* 3 (1916): 429.

[99] O'Donovan, "Epitheliomatous Ulceration Among Tar Workers," 219.

> During the distillation of tar, such gases and products as ammonia, carbonic acid, sulphuric acid, sulfurous acid, and creasote (sic) are given off. Persons brought into contact with these products occasionally suffer from inflammation of the eyes, running at the nose, bronchial catarrh, dyspepsia, headache and vertigo. Frequently the skin becomes dirty looking and cyanosed.[100]

In addition to these common side effects, Oliver also researched the "question as to whether manipulation of tar products or exposure to the fumes given off by coal-oil and tar is capable of giving rise to cancer." He cited cases of men who "manipulated" coal-oil and frequently developed "wart-like growths" on their hands and forearms as well as "hard nodules in the skin which ulcerate" and potentially require "amputation of the arm." Although physicians often removed these ulcers, Oliver noted that "a return to the work lays the person open to fresh developments."[101]

The existing research and the growing number of cases had already convinced Great Britain's Departmental Committee on Compensation for Industrial Disease to recommend this "malady should be made the subject of compensation."[102] Between July 1907—when this legislation went into effect—and August 1911, one physician contended that "thirty cases are known to have been reported for compensation by certifying surgeons," and "sixteen other cases of epithelium or of dangerous warts came to the knowledge of the Home Office in various ways." From 1914 to 1918, factory surgeons in South Wales reported an estimated 64 cases of ulceration tied to coal, pitch, or similar products.[103]

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[100] Thomas Oliver, *Diseases of Occupation: From the Legislative, Social, and Medical Points of View,* 2nd edition (London: Methuen & Co. 1908), 383 and 384.

[101] Ibid.

[102] Ibid., 385.

[103] O'Donovan, "Epitheliomatous Ulceration Among Tar Workers," 218.

Many of the doctors and researchers investigating the occupational hazards of creosote and other coal-tar products focused on determining the cancer-causing agent of these substances and describing the diseases' appearance. Few considered preventive measures. Robert Prosser White, an early British pioneer in occupational dermatology and an associate editor of the *Journal of Industrial Hygiene*, was one of the first physicians to propose safety measures for workers coming in contact with coal-tar products. In 1915, White first published *Occupational Diseases of the Skin*, a landmark guide that long served as "the definitive reference for occupational skin diseases."[104] In this text, which White regularly updated and re-released, he carefully documented the "trade dermatoses" of the coal-tar industry, but also insisted that "preventive measures are required." White recommended properly maintaining equipment that might expose employees to leaks, dust, and fumes. He contended "it is also necessary that the men's clothes and skin should be protected by suitable overalls" and also "goggles."[105]

Even more importantly, according to White, employers should provide exposed workers with access to facilities where they could remove the coal-tar products from their skin. "It stands to reason," White assessed, "that a skin freed from these agents, during the hours spent at home, must diminish the risks by more than one-half." He pointed out that workers should apply some sort of barrier cream or "bland, insoluble ointment" to the "exposed surfaces" before working to block pores from absorbing the

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[104] Derek R. Smith, "Historical Development of the Archives of Environmental & Occupational Health and Predecessor Journals, 1919-2009," *Archives of Environmental & Occupational Health* 64 (2009): 21.

[105] White, *The Dermatergoses*, 149 and 161.

hazardous substances.[106] Perhaps most critical to employees' health, White cautioned, medical professionals should "regularly" examine "all employees working with petroleum and tar residues" in order to "promptly" identify and treat "any tendency to malignancy."[107] With regard to creosote, White also concluded employees' maladies might be a result of "the quality" of the company or industry's choice of creosote oil. According to White, "the heavier and less refined, and incidentally the cheapest" creosote oils seemed to cause more severe symptoms among workers.[108] White's conclusion suggests that companies attempting to save money by purchasing cheaper creosote threatened the safety of their workers.

Increasingly concerned about the prevalence of cancer among tar workers, the British government added a new provision to the Factory and Workshop Act on November 28, 1919. This addendum required employers notify the Chief Inspector of Factories if cases of "epitheliomatous ulceration due to tar, pitch, bitumen, mineral oil, or paraffin, or any compound, product or residue of any of these substances" occurred.[109] William James O'Donovan, first assistant in the Department of Dermatology and Syphilology at London Hospital, published an extensive two-part study of cancer among tar workers in 1920 issues of the *British Journal of Dermatology and Syphilis.* He concluded that workers involved in wood preservation or who encountered coal-tar creosote as barge hands and railway workers "are exposed to skin hazards."[110]

[106] Ibid., 161 and 162.

[107] Ibid., 162.

[108] Ibid., 154.

[109] O'Donovan, "Epitheliomatous Ulceration Among Tar Workers," 215.

[110] Ibid., 216.

O'Donovan documented many cases of "epitheliomatous ulceration" among these laborers. His research uncovers not only the health risks associated with coal-tar creosote, but also the nature of work in the industry. At creosoting plants, O'Donovan explained, the men often handle the treated material by hand and "are generally bespattered with evidence of their calling, their clothes are soaked and their faces and hands browned by long exposure."[111] O'Donovan focused on 16 clinical cases, and of these patients, 4 worked directly in wood preservation, listing their occupations as "pickles wood in creosote," "pickles telegraph poles," or "creosotes timber." Many of the remaining 12 men labored in tar distilleries producing creosote and other distillates. The wood preservers O'Donovan examined were all age 55 or older, and had been employed in the industry for 20 to 40 years. When O'Donovan asked one 55-year-old patient, W. P., who creosoted timber, how long he had been employed in this occupation, W. P. responded, "Always." Another wood preserver revealed that he had been creosoting timber since he was 14 years old.[112] These cases reinforce the idea that many men working in wood preserving started at an early age and often remained in the industry for decades. Also, while the patients' carcinomas had developed more recently (in most cases less than a year), the laborers all acknowledged they had been afflicted with warts much earlier. The case of J. R., age 64, who creosoted timber for forty years, underscored the hazards of working with this preservative. O'Donovan noted that "For seven years warts have appeared on the hands and legs and behind the ears, which have fallen off and left scars behind them." Unfortunately J. R.'s condition

[111] Ibid., 216.

[112] Ibid., 221.

worsened and he developed scrotal warts that “never healed, but steadily enlarged.” O’Donovan admitted J.R. to the hospital in June 1909, but O’Donovan concluded “the case was considered inoperable.”[113]

Although J. R.’s fate seemed grim, O’Donovan argued that on the whole the patients’ prognosis “happily is good” as long as doctors detected and excised the growths early.[114] The future of the other wood preservers, however, appeared less optimistic when O’Donovan admitted that many of the individuals returned to their work and the creosote that made them sick in the first place. O’Donovan, for example, discussed the case of W. P., who physicians treated in 1903 for numerous warts on the face and forearms, and a “large left scrotal ulcer.” As of 1920, at age 72, W. P. “still did odd jobs in the factory yard,” and O’Donovan noted that tar acne and new growths continued to plague him.[115] In the second part of O’Donovan’s study, he appeared less confident about the fate of workers employed in this industry and those already afflicted with tar cancer. He confessed, “This is by no means an easy problem; we have a definite type of skin carcinoma following a definite form of industrial activity.”[116]

One possible explanation for the pervasiveness of cancer among these laborers, O’Donovan concluded, was the “uncleanliness of the older type of worker in this industry,” which he described as “notorious.”[117] In addition to blaming workers for their

[113] Ibid., 223.

[114] Ibid., 228.

[115] Ibid.

[116] W. J. O’Donovan, “Epitheliomatous Ulceration Among Tar Workers” *British Journal of Dermatology and Syphilis* 32, no. 7 (Aug-Sept. 1920): 251.

[117] O’Donovan, “Epitheliomatous Ulceration Among Tar Workers,” *British Journal of Dermatology and Syphilis* 32 (July 1920): 223.

occupational diseases, this rationale offered no criticism of the industry for failing to provide workers with safety equipment, sanitation facilities, or guidance as to best-handling practices. Not a single worker O'Donovan interviewed indicated he used gloves, safety glasses, or even aprons, which reinforces the testimony of injured American workers who sued railroads and wood-preserving companies. In fact, O'Donovan admitted it was virtually impossible for these workers to avoid contact with the preservative." R. R., a 61-year old man who had "pickled" timber in creosote for over 30 years, explained that his "face frequently became splashed by this fluid."[118] The physicians' claim that workers' "notorious" lack of cleanliness led to their afflictions echoed the wood-preservation industry's refrain that workers' injuries resulted from "their own negligence" rather than any fault of the plant or industry.

Despite allegations that these maladies resulted from workers' negligence rather than occupational hazards, physicians grew more convinced that exposure to creosote could result in occupational cancer. H.A. Cookson, a pathologist at the Royal Infirmary in Sunderland, presented a case in the *British Medical Journal* in March 1924 of a worker who after 33 years of laboring in a creosoting plant, developed an "epithelium of the skin of the right hand." The 66-year-old patient told Cookson that he regularly handled treated wood, and "he stated that he was 'up to the eyes in creosote.'" After about 15 years of work, the man noticed a "small swelling" on the "back of his right hand" that continued to grow until it became a "large fungating ulcer." Cookson included a disturbing photograph of this ulcer on the man's hand, demonstrating that although tar acne, tar smarts, and tar warts might seem relatively harmless, they could develop into

[118] Ibid., 225.

virulent cancers. After examination, Cookson recommended a "circular amputation above the elbow." Approximately 7 to 8 weeks after the amputation the patient died. Post-mortem examination revealed warts on the man's left forearm and "secondary epitheliomatous deposits in both lungs, in the liver, and in both kidneys." Cookson summarized the significance of the creosote worker's case this way: "The case is put on record because it appears fairly certain that creosote was the cause of the malignant growth and subsequent death of the worker."[119]

From 1920 when Great Britain added "epitheliomatous ulceration" to the list of notifiable diseases to 1943, 3,333 cases had been reported to the Chief Inspector of Factories. One former medical inspector of factories, S. A. Henry, cataloged these cases in 1946 and attributed 56.7 percent of them (1,892) to tar and pitch.[120] According to Henry, 767 cases occurred among tar distillers, who produced products including creosote, and Henry attributed 15 cases of "epitheliomatous ulceration" directly to workers engaged in preserving railroad ties and other timber. Seven additional cases occurred among "creosote handlers," including "men who pumped, loaded, or unloaded creosote oil in a tar distillery or storage works" and 1 additional laborer who manufactured a creosote-based disinfectant.[121] Henry linked creosote to 13 more cases of skin cancer among workers in industries such as brick making where they employed creosote as a lubricating oil. As a result of the 36 cases that clearly connected creosote

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[119] H. A. Cookson, "Epithelioma of the Skin After Prolonged Exposure to Creosote," *British Medical Journal* 1, No. 3296 (March 1, 1924): 368.

[120] S.A. Henry, *Cancer of the Scrotum in Relation to Occupation* (London: Humphrey Milford Oxford University Press, 1946), 16.

[121] Ibid., 16, and 22-23.

with occupational skin cancer, Henry concluded “there appears to be no doubt as to the carcinogenic properties of creosote.”[122] Henry also reminded readers that these numbers were low because they represented only the cases brought to the attention of the Chief Inspector of Factories. As Henry lamented, since the disease occurred in “others than chimney sweeps even in Pott’s time, it is unfortunate that its extent and the occupations of the men affected and any medicinal treatment given to them, were not recorded.” Henry wished “that we had an opportunity of traveling back some 200 years on a magic carpet to see what then was the extent of the disease and in whom it occurred.”[123]

Ernest Laurence Kennaway, an eminent British pathologist who spent decades investigating the cancer-causing agents in coal-tar, supported Henry’s assessment that the estimated number of cases was low and misleading. “When a new cancer-producing substance comes into industrial use on a large scale, no danger will be detected during the long latent period, which in man is probably of many years’ duration,” Kennaway explained in a 1924 *British Medical Journal* article.[124] Kennaway was correct that this latent period was a long one. Dr. Wilhelm Hueper, a German-born physician who authored the first textbook on environmental and occupational cancer in 1942, estimated 25 years as the average latent period of cancer caused by creosote, with a range between 15 to 40 years.[125]

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[122] Ibid., 22-23.

[123] Ibid., 99.

[124] E. L. Kennaway, “On the Cancer: Producing Factor in Tar,” *British Medical Journal* 1, no. 3300 (March 29, 1924): 564.

[125] Wilhelm Hueper, “Environmental Cancers: A Review,” *Cancer Research* 12, no. 10 (October 1952): 694.

Although many cases of skin cancer among workers handling creosote in Great Britain likely went unreported, other physicians noted that the increase of skin cancer among tar workers was a "steady" one.[126] Physician, Philip Ross, attributed this increase to several factors. After cancer associated with tar exposure became a "notifiable" disease in Great Britain, doctors and those involved in the tar industry were more aware of "this particular hazard." Although they might have previously dismissed these cases as "natural visitations," Ross contended that medical professionals were now considering them "correctly in the light of occupational environment." He also agreed with Kennaway and Hueper that more workers had "passed the 'latent' period" and were "liable to develop this lesion." Perhaps more importantly, medical professionals also increasingly biopsied growths, discovering that tumors they once regarded as "innocent" were in fact malignant.[127]

The extensive research performed by European physicians—especially those in Great Britain—clearly emphasized the potential health risks coal-tar creosote posed to workers, but how aware were American doctors and the wood-preservation industry of this existing research? Historian Christopher Sellers documented how Britain and Germany developed "national and international literatures about occupational disease" earlier than the U.S. He also concluded that—as compared with European countries—American medical training focused less on "workplace-induced diseases."[128] In spite of these limitations, American medical journals sporadically addressed the risk of coal-tar

[126] Ross, "Occupational Skin Lesions Due to Pitch and Tar," 372.

[127] Ibid., 372.

[128] Sellers, *Hazards of the Job*, 19 and 33.

products. In 1910, for example, American dermatologist Jay Frank Schamberg published an article in the *Journal of Cutaneous Diseases* on cancer in workers who produced tarpaper. Schamberg cited much of the European research on the dangers of coal tar and presented his study to colleagues at the 1910 American Dermatological Association meeting in Washington, D.C. Based on the comments published in the article, Schamberg's colleagues listened to his findings with interest, and also shared their own experiences of treating tar workers afflicted with dermatological issues.[129] This conversation suggests some U.S. doctors were aware of and in conversation with each other about the occupational hazards of coal-tar and its byproducts.

While American medical journals published few articles on this topic, railroads and other companies continued to expand wood-preservation operations throughout the United States. Simultaneously, a growing movement for general occupational safety and health also emerged during the Progressive era. The nation had shifted from a "fourth-rate industrial power to the leading industrial producer of the world," but many Americans realized this economic growth came at what historians Gerald Markowitz and David Rosner described "an inordinate social cost" to workers.[130] Disturbed by the growing number of industrial accidents, crippling poverty, and rising numbers of sick workers, one turn-of-the-century writer urged Americans to "face the situation and understand how cheap human life has become under American conditions." As a result,

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[129] Jay Frank Schamberg, "Cancer in Tar Workers," *Journal of Cutaneous Diseases* (December 1910): 644.

[130] Gerald Markowitz and David Rosner, "The Early Movement for Occupational Safety and Health, 1900-1917," in *Sickness and Health in America: Readings in the History of Medicine and Public Health, e*d. Judith Walzer Leavitt and Ronald L. Numbers, 3rd ed. (Madison: The University of Wisconsin Press, 1997), 468.

he argued, “It is becoming as perilous to live in the United States as to participate in actual warfare.”[131]

Muckraking journalists and writers, politicians, workers, social activists, doctors, academics, and other professionals heeded this call. They publicized and investigated working conditions and lobbied for reform, although the “heterogeneity” of this “broad-based coalition” proved divisive and hindered reformers’ ability to resolve these pervasive problems.[132] Progressives founded organizations such as the American Association for Labor Legislation, the National Commission on Industrial Hygiene, and the National Safety Council, which succeeded in “making occupational safety and health a national issue” and increased public awareness against workplace hazards “to a level that was not to be reached again until the 1970s.”[133]

Although Progressive reformers waged war on industries such as lead and phosphorus for poisoning workers, the wood-preservation industry drew little attention. Companies often located the plants in rural areas, close to the timber they extracted and treated, but also far from the urban centers where Progressive reformers lobbied. Since the U.S. embraced wood preservation more reluctantly than Europe, many workers might develop cancer later, but this risk had not manifested in large numbers by the early twentieth century. This contributed to what pioneer occupational health investigator Alice Hamilton described as “few American observations” in this field. In her 1925 study *Industrial Poisons in the United States*, Hamilton noted that although skin

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[131] “Slaughter by Accident,” *The Outlook* (October 8, 1904): 359.

[132] Markowitz and Rosner, “The Early Movement for Occupational Safety and Health,” 469 and 467.

[133] Ibid., 478.

cancer caused by coal-tar, pitch, and paraffin products “excited the liveliest discussion” in Europe, there existed limited knowledge of this “so-called ‘paraffin or tar cancer.’” Hamilton attributed the limited knowledge to the “confusing” research that made it challenging to identify “just what substances” caused problems in workers. Hamilton’s analysis also demonstrates that studies often focused on tar products broadly, obscuring creosote within the larger literature.[134]

A study published in the *Journal of Industrial Hygiene* in 1930 reinforced this “confusion” about the risks of “cancer caused by coal tar and coal tar products.” Although Imre Heller, the physician who wrote the article, acknowledged that “statistics from foreign countries show a more or less high incidence” of skin cancer among workers handling tar and its byproducts, he focused more specifically on workers in the United States. Heller classified creosote oil among tar products “proved to be carcinogenic either experimentally or by industrial evidence,” but he did not identify any cases of cancer among wood preservers and few among tar distillers. As the following chapter demonstrates, however, Heller’s rationale for a lack of cases in the U.S. centered around the belief that certain workers were immune to creosote’s carcinogenic properties.[135]

Heller’s research documenting skin cancer among tar workers in the U.S. circulated widely enough that the 1931 U.S. Bureau of Labor’s Handbook of Labor Statistics cited it and included a section on “Cancer Caused by Coal Tars and Coal-Tar

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[134] Alice Hamilton, *Industrial Poisons in the United States* (New York: The Macmillan Company, 1925), 414, 413, and 410.

[135] Imre Heller, “Occupational Cancers,” *Journal of Industrial Hygiene* 12, no. 5 (May 1930): 175, 179, and 180.

Products and Mineral Oils” in its summary of recent studies of industrial diseases and poisons. According to the handbook, “previous studies and experimental work have shown without question tar and tar-distillation products will cause epithelium among workers handling these substances.”[136] The U.S. Department of Labor also classified wood preservation as a “hazardous occupation” in a 1933 bulletin designed to help physicians, safety engineers, and industrial hygienists recognize the “diagnostic signs” of occupational diseases. This bulletin categorized tar as a “poison” and a “dermatosis” or disease of the skin, identifying “creosoting-plant workers,” “wood preservers,” and “tar workers” among the at-risk occupations for exposure. In addition to “epitheliomatous cancer,” “tar itch,” “acne,” “eczema,” “psoriasis,” and ulcers of the skin and cornea,” the bulletin warned afflicted workers might experience “loss of appetite,” “headache,” “vertigo,” “conjunctivitis,” as well as kidney, bladder, and respiratory problems.[137]

In spite of the U.S. Department of Labor’s acknowledgement of creosote’s risks, years passed with few additional U.S. medical publications on creosote’s occupational hazards. In the 1940s, wartime demand for factories, transportation, housing, and temporary structures resulted in the increased use of creosote-treated wood. Louis Schwartz, the Medical Director of the U.S. Public Health Service in 1942, published reports of dermatitis outbreaks at “new factories erected for the manufacture of war materials” that used creosote-treated wood for the floors. Employees developed the same itching, burning, and lesions characteristic of the “tar smarts” that wood

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[136] United States Bureau of Labor Statistics, *Handbook of Labor Statistics, 1931 Edition* (Washington, D.C.: United States Government Printing Office, 1931), 326.

[137] United States Department of Labor, Bureau of Labor Statistics, *Occupation Hazards and Diagnostic Signs No. 582* (Washington: United States Government Printing Office, 1933), 12, 26, 47.

preservers and railroad workers experienced. Schwartz suggested the condition occurred when the freshly treated blocks came in contact with clothes, which then transferred creosote to the workers' skin.[138]

In a similar case, Adolph Jonas a physician in New York published a report in 1943 of widespread creosote burns that occurred among workers constructing temporary barracks at a U.S. Navy camp. Cutting creosoted timber injured many of the workers when it scattered the "fine wood-dust" resulting in "burns wherever it came into contact with unprotected skins." Jonas also pointed out the hazards of "creosoted roof paper" that burned workmen when they fastened the paper to the roof with nails. Over 450 workers required medical treatment for creosote burns, but Jonas claimed that the majority of cases "were mild" with workers experiencing symptoms reminiscent of a sunburn. In 30 percent of cases, the creosote produced "more severe" itching, burning, peeling, and even altered the pigmentation of the skin to a deep bronze. Some workers suffered permanent vision damage when the creosoted sawdust landed in their eyes. Upon realizing the dangers of creosote, camp officials tried to institute preventive measures such as masks, safety glasses, and ointments, but Jonas concluded "none were entirely satisfactory." After treating afflicted workers, he warned that creosote presented "an important industrial hazard" that "very often seriously interferes with the progress of the project."[139]

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[138] Louis Schwartz, "Dermatitis From Creosote-Treated Wooden Floors," *Industrial Medicine* 11, no. 8 (1942): 387.

[139] Adolph D. Jonas, "Creosote Burns," *Journal of Industrial Hygiene and Toxicology* 25, no. 9 (November 1943): 418-420.

Both Schwartz and Jonas focused on immediate symptoms, and failed to address the potentially deadly long-term effects of creosote exposure. They also indicated these medical issues had been well established among wood preservers and other handlers of treated wood, but this does not appear to have been the case in the United States. In the 1950s, for example, Peyton Rous, a Nobel-Prize winning cancer researcher made an accidental discovery during the course of another experiment. Curiously, the mice in his study developed cancerous tumors after being "raised in boxes impregnated with a commercial wood preservative."[140] Rous's surprise at these results, which he presented at the annual meeting of the American Association for Cancer Research, highlights the American medical community's ignorance of creosote's dangers.[141] The wood-preservation industry also continued to remain silent on the occupational hazards of this toxic treatment. Medical reports, although scattered, reinforce that American doctors and even the federal government started acknowledging the threat these substances posed to workers.

Harry R. Foerster, a specialist in industrial dermatology, and Wilhelm Hueper, an occupational cancer researcher, articulated concerns that the United States severely underestimated the pervasiveness of this threat. In 1936, the *Journal of the American Medical Association* published Harry R. Foerster's "observations on industrial dermatology," which he also presented at the organization's annual meeting. Foerster argued that "complete and accurate figures on industrial skin diseases are not available,

[140] Peyton Rous, "Influence of Hereditary Malformations on Carcinogenesis in 'Crew' Mice and Deer Mice of Hairless Strains," *Proceedings of the American Association for Cancer Research* 2 (April 1956): 143.

[141] Ibid.

because few states record them and then only when five or more days of disability for work has occurred." Records, according to Foerster, proved even more misleading because many dermatoses were dismissed as "non disabling" even though they encompassed a significant group. Companies, including wood-preservation plants, encouraged injured or sick employees to return to work quickly, so they did not have to file official reports. It is also not clear how states or industries classified skin diseases as "non disabling" when cases of cancer often did not emerge for decades. Foerster also noted that "Workmen's compensation legislation in this country applied originally to occupational injuries only," excluding occupational diseases altogether. According to Foerster, in 1936, this restriction remained in over 24 states, although some states had "broadened their interpretation of the word 'injury.'"[142] The knowledge that many of the skin diseases they experienced would not be considered eligible for compensation likely discouraged many employees from reporting them. It also allowed companies and industries to neglect or ignore their workers' health.

Hueper, the leading occupational cancer researcher in the U.S., agreed with Foerster that the number of industrial skin disease cases, and more specifically occupational cancer cases, was "astonishingly small." "Needless to say," Hueper commented in a 1948 Public Health Service Report published by the National Institutes of Health, "the majority of tar and oil cancers have not been reported."[143] While he classified creosote as an "established" occupational carcinogenic agent, Hueper

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[142] Harry R. Foerster, "Observations on Industrial Dermatology," *Journal of the American Medical Association* 107, no. 4 (July 25, 1936): 247 and 248.

[143] W. C. Hueper, "Environmental and Occupational Cancer," *Public Health Reports: Supplement 209* (Washington, D.C.: United States Government Printing Office, 1948), 45.

lamented that occupational cancer generally "attracted relatively little attention from industry, labor, public health bodies, or the medical profession."[144] As a physician, Hueper leveled criticism at the medical community, which he claimed "had been slow in the past to appreciate" the role of "chemical agents" in contributing to disease. Unfortunately, most doctors lacked "specialized information" on working conditions and occupational cancer risks. Medical professionals seldom gathered the detailed occupational data necessary to trace the relationship between cancer and industries in which patients might have labored. Perhaps, most importantly, physicians needed to take into account the long, latent period of many occupational cancers, which might not manifest for decades.[145]

In addition to criticizing the medical profession for its lack of awareness about occupational cancer, Hueper expressed grave concerns about relying on industries to look after their employees' welfare. As a pathologist working for chemical giant Du Pont, Hueper experienced firsthand the chemical industry's neglect of its workers' health. He doggedly warned company officials about the cancer risks associated with the production of aniline dye—another coal-tar product. In response to his warnings, Du Pont fired Hueper and actively sought to discredit and censor his work. In spite of these influential and well-funded adversaries, Hueper became the first director of the Environmental Cancer Section of the U.S. National Cancer Institute in 1938. Relentlessly publicizing the risk of occupational cancer, Hueper described "the willful

[144] Ibid., 48.

[145] Ibid. 51.

and undue exposure" of workers to occupational carcinogens such as creosote as "equivalent to an attack with a deadly weapon with a delayed action mechanism."[146]

Industrial interests, Hueper explained, were not well-informed about the etiology of cancer, and doubted that their products might be the source of such diseases. Companies also "feared" compensation lawsuits, increased government regulation, the expense of preventive measures, bad publicity, and losing their workforce and consumers. These concerns often contributed to the production of "misleading statistical evidence" minimizing the number of occupational cancer cases.[147] In calculating the prevalence of cancer among employees, for example, industries often included office workers never exposed to carcinogens or excluded short-term employees altogether even if they performed the most hazardous jobs. These strategies "diluted" the cancer risk, giving the impression that carcinogens such as creosote only harmed a small fraction of employees.[148] Because many occupational cancers—"the products of modern industrialization"—emerged relatively recently, Hueper conceded that these diseases had not yet "become the subject of established and intelligent legislative procedures." He contended that this was no excuse for sustaining inadequate regulations, and the United States had resoundingly failed to provide "reasonably safe working conditions."[149]

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[146] Fagin, *Toms River*, 180-182 and 202; Hueper, "Environmental and Occupational Cancer," 50.

[147] Hueper, "Environmental and Occupational Cancer," 49 and 48.

[148] Hueper, "Environmental Cancers: A Review," 695.

[149] Hueper, "Environmental and Occupational Cancer," 50.

The wood-preservation industry's stance on creosote reinforced Hueper's criticisms. Although many publications addressed how admirably wood preservatives such as creosote performed in toxicity tests, since "toxicity is required in all wood preservatives," these tests examined the treatment's toxicity to "wood-destroying organisms" not people who might come in contact with the preservatives. While wood preservers refuted workers' concerns, the poison symbol emblazoned on a wood-treating tank underscored the risks creosote posed to human life. (Figure 5-3) Even when the industry acknowledged the possibility that these treatments posed health risks, it provided vague information about those risks. In a December 1938 Forest Products Laboratory bulletin on "testing wood preservatives," the authors noted that "health risk cannot be determined quickly or easily," but "any preservative, if taken internally in sufficient quantity would probably cause death, but that is true of most of the chemicals in daily domestic or industrial use and is not a valid objection."[150] According to the industry, the economic benefit far outweighed what it depicted as an abstract and very unlikely health risk. Researchers, however, had long demonstrated the threat was very real.

Other publications expressed even more confidence in coal-tar-creosote's safety for workers and the general public at the same time authors acknowledged worker concerns. In their 1938 textbook on wood preservation, George M. Hunt—head of the wood preservation division of the Forest Products Laboratory—and George A. Garratt a professor specializing in wood products at Yale's School of Forestry—noted that

[150] Forest Products Laboratory, *Testing Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Dec. 1938), 2 and 3.

"workmen sometimes object to handling the treated wood, as the preservative soils their clothes and, in some cases, may burn the skin of the face and hands, causing an injury similar to sunburn." Hunt and Garratt quickly pointed out "creosoted timber has no other apparent effect on the health of people working with or near it, nor is it in any way injurious to the occupants of buildings in which such treated material has been used."[151] This discussion entirely ignored the possibility that workers might experience long-term, cancerous consequences. In their effort to promote creosote's safety, Hunt and Garratt also failed to consider any measures workers might take to prevent injuries or health problems. Just as the industry endeavored to minimize public knowledge about fire risks, it also sought to suppress awareness of the health risks associated with creosote exposure.

Ross, the British physician researching "occupational skin lesions" caused by exposure to tar and pitch, offered an explanation for the silence of industry leaders. "Most industrial concerns are loath to broadcast indiscriminately the hazards obtaining in the use of these compounds," Ross explained, because "these measures are likely to deter men from working in these processes." Instead of disseminating "leaflets" or displaying "warning notices," companies preferred to leave "individual education and training" in the hands of the "medical officer and to the foremen and charge hands." This, according to Ross, ensured "adequate welfare supervision," but avoided "creating unnecessary alarm." Ross, who served as a company doctor for an engineering firm that manufactured coal-tar and pitch products, took the threat these products presented very seriously. He advocated, for example, "frequent and regular inspection of

[151] Hunt and Garratt, *Wood Preservation*, 105 and 106.

employees" at three-month intervals. Ross, however, seems to be an exception. Wood-treatment plants seldom had medical officers in charge of employees' welfare. Even if a plant had a regular "company doctor," it was in the doctor's and the company's best interest to treat workers without causing what Ross described as "unnecessary alarm."[152]

At locations where workers handled treated wood, companies blamed their laborers for fires, injuries, and diseases. In many cases, they insisted these incidents resulted from workers' "own negligence." The lawsuits that workers filed and the medical reports physicians published emphasize the lack of education workers received about the dangers of coal-tar creosote and how to safely handle it. The fact that wood-preservation treatises, manuals, and pamphlets are silent on the subject of worker safety speaks volumes. If the wood-preservation industry and its consumers refused to acknowledge that creosote posed any threat, then how could it ensure adequate welfare supervision, especially among a group of laborers they regarded as less than human?

[152] Ross, "Occupational Skin Lesions Due to Pitch and Tar," 373.

Figure 5-1. Treated telephone poles stored in the yard at the International Creosoting Company. 1943. Beaumont, Texas. Photograph by John Vachon. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001030039/PP/.

Figure 5-2. Tie-treating plant loading. Forest History Society Photograph Collection, Forest History Society, Durham, N.C.

Figure 5-3. Detail of a poison sign on the north end of a wood treating tank in the timber yard - Butte Mineyards, Anselmo Mine. Butte, Montana. Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/mt0095.photos.101143p/.

CHAPTER 6
"THE BEST DEVICE I EVER SAW TO HANDLE TIES IS A NEGRO": ENVIRONMENTAL INEQUALITIES IN THE WOOD-PRESERVATION INDUSTRY

On January 22, 1918, the American Wood Preservers Association held a special session at its annual meeting in Chicago, Illinois, at the Hotel Sherman to address the "extreme" turnover in labor at wood-preserving plants.[1] Although Elmer T. Howson, an associate editor of *Railway Age* and the editor of *Railway Maintenance Engineer*, gave the main lecture, his talk led to a spirited debate among attendees about securing a reliable labor force for the industry. Howson emphasized how immigration restrictions in the midst of World War I depleted the industry's supply of unskilled labor from Europe. He also argued that the "Mexican supply of labor has been overestimated" and categorized it as "insignificant."[2] Howson noted that "Asiatic labor" might provide some "relief" since "we all know that there are large numbers of men, coolies and others, that we could get in China."[3] U.S. immigration restrictions and what Howson described as a "strong sentiment" on the West coast against "labor of that kind," however, limited the possibility of bolstering the industry's workforce with Asian immigrants.[4] The labor shortage appeared so severe that Howson and AWPA members contemplated desperate measures such as recruiting "hoboes" off the streets or even hiring women, although Howson questioned "the advisability of putting them out in a tie yard to stack

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[1] *Proceedings of the Fourteenth Annual Meeting of the Wood Preservers' Association* (American Wood Preservers' Association, 1918), 44 (Hereafter cited as *AWPA 1918*).

[2] Ibid., 45.

[3] Ibid., 46.

[4] Ibid., 46.

ties” because “work of that kind is entirely out of their class.”[5] Although the outlook appeared bleak, some members warned against turning to African American workers to alleviate the shortage.

C. M. Taylor, the superintendent of a creosoting plant in Port Reading, New Jersey, advised members: “As one who has worked in the South and lived in the North, I hope that the railroads will all discourage the importation of the negroes to the North.”[6] Some members supported Taylor’s exhortation, but others dismissed him outright. Joseph H. Waterman, who managed timber preserving operations for the Chicago, Burlington, and Quincy Railroad, protested: “Mr. President, if you would take away the colored fellows that I have handling ties I would not have anybody left.” Waterman argued that he not only depended on African American laborers, but insisted, “The best device I ever saw to handle ties. . . is a negro. We are not going to let the fellows down South have all them. We are going to have some North if we can get them.”[7] AWPA members attending the session applauded Waterman’s conclusion.[8]

Although this debate illustrated tensions over the most suitable labor force for the wood-preservation industry, it also highlighted the industry’s dependence on and exploitation of African American workers, especially in the southern United States where wood preservers established plants. Waterman and many wood-preserving managers viewed black workers not as people, but as “devices” or tools, more efficient and

[5] Ibid., 48.

[6] Ibid., 50.

[7] Ibid., 50 .

[8] Ibid.

affordable than any labor-saving machinery or other group of workers. In an industry plagued with the problem of "high-priced labor" and "high-priced labor-saving devices," Waterman and many other wood-preservers embraced cheap "negro" labor as the solution.[9] In the midst of the debate, the AWPA's president called on Harry S. Valentine, who supervised treating operations at the Eppinger & Russell Company's plant in Jacksonville, Florida, to share the perspective of a member representing a Southern plant. Valentine asserted, "We use nothing but negro labor."[10] Southern wood-preservation plants, in particular, relied on black workers to perform some of the most grueling and hazardous jobs in wood-preservation. They consigned black laborers to the lowest-paid, unskilled positions such as handling and loading creosoted wood, which ensured that they faced regular, direct exposure to toxic chemicals and ultimately bore a disproportionate share of the pollution associated with this industry.

Activists, scholars, and policymakers have carefully documented how race and social class influence access to a livable environment in the United States. In the landmark 1987 report *Toxic Wastes and Race in the United States*, the United Church of Christ's Commission for Racial Justice investigated the locations of hazardous-waste facilities, and researchers identified an "inordinate concentration of uncontrolled toxic waste sites in Black and Hispanic communities."[11]As environmental historian Andrew

[9] Ibid., 51.

[10] Ibid., 54.

[11] The United Church of Christ's Commission for Racial Justice, an organization originally founded in response to events in 1963 including Medgar Evers's assassination and the church bombings in Birmingham, became involved in the EJ struggle when Warren County, North Carolina residents asked for assistance in their battle against a toxic dump. United Church of Christ, *Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites* (New York, N.Y.: Public Data Access, 1987), 23.

Hurley contends, “The domination of nature involves and necessitates the control of human beings,” and oftentimes marginalized groups lower in the social and economic hierarchies have limited power to advance their environmental agenda and typically face greater environmental inequalities.[12] Responding to criticisms that environmental historians traditionally minimized social divisions, highlighting the treatment of nature but neglecting our treatment of each other, this chapter explores how African American workers in the southern United States came to face an unequal share of environmental hazards generated by wood-treatment facilities. While I reference other groups of workers or use their accounts to provide context, this study focuses more exclusively on black workers, who comprised the bulk of the labor force for wood preservation plants, faced the greatest discrimination and pollution in the industry, and have been virtually excluded from traditional research on wood preservation.[13]

Cheap land and labor, lax governmental regulations, and abundant southern pine timber drew the wood-preservation industry to the American South. At the same time, the South’s “permissive regulatory culture,” “substantial poverty,” and significant minority populations contributed to what environmental historian Paul Sutter describes as a regional culture of environmental injustice.[14] This culture emerged because many of the

[12] Andrew Hurley, *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill: University of North Carolina Press, 1995), 182.

[13] Christopher Sellers, “Environmental Justice as a Way of Seeing,” *Environmental Justice* 1, no. 4 (December 2008): 177-178.

[14] Paul S. Sutter, introduction to *Environmental History and the American South: A Reader*, ed. Paul S. Sutter and Christopher J. Manganiello (Athens: the University of Georgia Press, 2009), 15. Many EJ scholars such as Robert Bullard have focused on the South, arguing that this region is a center for the EJ movement because mainstream environmentalism has been weak in the South. Dumping in Dixie, Bullard’s pioneering study, also helped establish this region’s significance, and subsequent work by both Bullard and McGurty emphasize how southern residents’ experience with the civil rights movement provided a foundation for environmental justice activism in this region.

late-nineteenth and early twentieth-century industries in the South that abused the environment, such as timber, turpentining, and phosphate mining, also exploited African American labor.

Scholars have designated these industries as "purely extractive" because their leaders regarded both natural resources and even the workers forced to extract them as expendable rather than renewable.[15] The southern forest industry, gained a brutal reputation for treating its workers—especially African Americans—as "prisoners of the pines."[16] White operators and supervisors frequently secured labor through debt peonage and convict leasing, and they maintained this labor force by violently repressing workers. The Jim Crow laws passed in the post-Reconstruction era also severely limited black workers' ability to escape their situations.[17] When Gloria Jahoda, a Chicago writer and anthropologist, began traveling throughout Florida in the 1960s to document what she described as "the Other Florida," she interviewed a "ragged half-toothless old man," who worked in the black turpentine camps during the 1920s and 1930s. She asked him, "How did you get into turpentining?" His response illustrates black laborers' awareness that they were casualties of the environmental inequalities to

[15] Cassandra Y. Johnson and Josh McDaniel, "Turpentine Negro," in *"To Love the Wind and the Rain": African Americans and Environmental History*, ed. Dianne D. Glave and Mark Stoll, 51-62 (Pittsburgh: University of Pittsburgh Press, 2006), 55; William P. Jones, *The Tribe of Black Ulysses: African American Lumber Workers in the Jim Crow South* (Urbana: University of Illinois Press, 2005); Robert B. Outland, *Tapping the Pines: The Naval Stores Industry in the American South* (Baton Rouge: Louisiana State University Press, 2004); Michael David Tegeder, "Prisoners of the Pines: Debt Peonage in the Southern Turpentine Industry" (Ph.D. dissertation., University of Florida, 1996)

[16] Tegeder, "Prisoners of the Pines," viii.

[17] Alex Lichtenstein, *Twice the Work of Free Labor: The Political Economy of Convict Labor in the New South* (London: Verso, 1996); Pete Daniel, *The Shadow of Slavery: Peonage in the South, 1901–1969* (Urbana: University of Illinois Press, 1972); Jacqueline Jones, *The Dispossessed: America's Underclasses from the Civil War to the Present* (New York: Basic Books, 1992); Douglas A. Blackmon, *Slavery by Another Name: The Re-Enslavement of Black Americans from the Civil War to World War II* (New York: Double Day, 2008).

which whites had subjected them: “Sugar…you is born into the teppentime. Ain’t nothing you go into. Something you get out of.”[18]

On the surface, wood preservation seemed to be a less extractive operation than turpentine, phosphate, or other southern industries because it extended the life of timber. As discussed in previous chapters, however, railroads and other large-timber users embraced wood preservation not because this process saved trees and the larger forests of the United States, but because it saved money. These savings also came at a high cost to the environment and the workers laboring in that environment because creosote and other toxic wood preservatives threatened worker and public health and generated long-lasting pollution problems. Although there is no evidence southern wood preservation plants relied on the convict-leasing or debt-peonage practices that made the timber and turpentine industries so notorious, the supervisors managing the plants viewed black workers as a disposable source of labor. Thus, similar to other contemporary southern industries, the wood-preservation industry was not an exception. It degraded the environment and exploited black laborers. Even if workers managed to “get out” of wood preservation and move on to less hazardous occupations, creosote’s toxic effects might haunt them for the rest of their lives.[19]

Understanding how these environmental inequalities manifested in the wood-preservation industry requires juxtaposing disparate accounts on the nature of this work. Wood preservers described their treating processes as scientific and precise, but individuals within the industry rarely agreed on standard operating procedures. They

[18] Gloria Jahoda, *The Other Florida* (Port Salerno, Florida: Florida Classics Library, 1967), 231.

[19] Jahoda, *The Other Florida*, 231.

seemed to debate everything—the most effective preservative, the best choice of wood, how to season it properly before treatment, how much pressure should be applied to impregnate wood, and how to store the creosoted timber. The only point on which they definitely agreed was wood preservation's value. This lack of consensus meant that plant operations varied considerably, and the practice of treating wood was as much an art as a science. Regardless, the technology, complexity, and efficiency inspired awe in visitors and observers. Musician Don Felder, whose father worked as a mechanic at Gainesville's plant since the age of 12, recalled in his autobiography that "It was an incredibly slick operation."[20] The workers themselves often articulated a very different perspective. Red Joe, employed at the Chicago and Northwestern Railroad's creosoting plant in Escanaba, Michigan, since age 16 declared in an interview, "If'n you never pulled a shift in a tie mill, you'd never know what miserable work it is. It shortened a lot of lives. Not usually by killing outright."[21] Similarly, Ben Brown, who began working at the Republic Creosoting plant in St. Louis Park, Minnesota, in 1936 succinctly described the nature of his labor there: "The work was brutal and dirty."[22]

To reconcile these divergent perspectives, one must retrace the process of production at these plants and consider how it impacted workers. This, however, is challenging because wood preservers seldom published step-by-step details about their operations. Supervisors and industry officials extolled the virtues of their facilities and

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[20] Don Felder, *Heaven and Hell: My Life With the Eagles, 1974-2001* (Hoboken, New Jersey: John Wiley & Sons, 2008), 5.

[21] Dennis Boyer, *Prairie Whistles: Tales of Midwest Railroading* (Black Earth, Wisconsin: Trails Books, 2001), 43.

[22] St. Louis Park Historical Society, "Republic Creosoting Inc." St. Louis Park Historical Society, http://www.slphistory.org/history/creosote.asp (accessed October 20, 2016).

state-of-the-art equipment, but their discussions of the wood-treatment process are devoid of any real discussion of the laborers who toiled in the plants. The industry's tendency to minimize the role of workers reinforced J. H. Waterman's comment, quoted in the opening of this chapter, in which he compared black workers to "devices."[23] If the industry acknowledged them at all, they depicted them as tools—or a static part of the plant's landscape—less essential than the machinery and equipment.

While wood-preservation operations shared limited information about workers, companies maintained detailed records about the timber they processed. The wood that arrived at plants came from a variety of sources—the plant's own landholdings, large private suppliers, or individual landowners. Railroad-operated plants often cut the timber along their routes or had specific tracts from which they extracted timber. In a 1920 letter, C. E. Weaver, the Maintenance of Way Engineer, for the Central of Georgia Railway explained how efficiently the railroad secured the timber supply for its Macon creosoting plant:

> All of the ties which we consume are produced along our line. They are allowed to season on the right-of-way before shipment to the Plant. When they are properly seasoned, they are picked up by work train and shipped to the Plant and are handled directly from cars to trams and, after treatment, they are again handled from trams to cars for distribution along line of road.[24]

Although Edwin Fisher Conger's Norfolk Creosoting plant did not have the ease of access that railroad-operated plants such as the Central enjoyed, the Virginia plant received timber from property Conger owned in Florida, but also from its direct supplier

[23] *AWPA 1918,* 50.

[24] Letter from C. E. Weaver to R. C. Falconer, December 3, 1920, Folder 1914-15, Box 212, Central of Georgia Railway Records, Georgia Historical Society, Savannah (Hereafter Cited as Central of Georgia Railway Collection).

company, the Tidewater Piling and Timber Corporation, which Conger also controlled.[25] Tidewater employees maintained detailed daily reports of potential and current timber suppliers throughout North Carolina and Virginia. Tidewater's suppliers included both sawmills and individual landowners with access to quality timber for ties, poles, and piling.[26]

If plants did not have their own timber to draw from, they worked with private lumber companies. Memos exchanged between Conger—who owned several southern creosoting plants—and his plant supervisor in September 1936 indicated they purchased poles from the Jackson Lumber Company.[27] This extensive timber operation, logging in Alabama's southern pine forests, had a long history of debt peonage and coercive labor practices.[28] The company and the cruel bosses supervising their labor, as workers testified, treated African Americans and European immigrants "like cattle," beating, whipping, and forcing workers at gunpoint and in the intense Alabama heat to fell trees and handle the heavy railroad ties.[29] Along with these disturbing accounts from Jackson Lumber Company workers, the research of scholars on the southern timber industry suggests that long before the timber arrived at creosoting plants, many workers

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[25] W. A. Ilgenfritz to K. G. McDonald, May 31, 1938, Folder: Bidding Information Western Electric Contract, Box 1 MSS 5507a, Norfolk Creosoting Company Records, University of Virginia, Charlottesville (Hereafter Cited as Norfolk Creosoting Company Records).

[26] Folder: Tidewater, Box 2, MS 5802 Norfolk Creosoting Company Records.

[27] Folder 42: Jackson Lumber Company Accounts, Box 1 of the Edwin Fisher Conger Papers at the Virginia Historical Society, Richmond (Hereafter Cited as EFC Papers). In addition to the Norfolk Creosoting Company, Conger also owned the Piedmont Wood Preserving Company.

[28] Aaron Reynolds, "Inside the Jackson Tract: The Battle Over Peonage Labor Camps in Southern Alabama, 1906," *Southern Spaces* (January 21, 2013). http://www.southernspaces.org/2013/inside-jackson-tract-battle-over-peonage-labor-camps-southern-alabama-1906#footnote19_cdwql01.

[29] Ibid.

had been abused to produce it.[30] Thus, although wood preservers focused more on the quality of the timber rather than the means by which logging companies and sawmills extracted it, the wood-preservation industry benefited from and operated in tandem with the exploitative timber industry.

Once the timber arrived at the wood-preservation plant, workers first had to unload and stack it. Depending on the plant or customer's preferences, the timber might be stored in the yard for several months to properly season or dry out. Some facilities also used an industrial process to quickly season wood and draw out excess moisture. Plants had to be careful not to wait too long to preserve wood, because it might start to decay or rot, rendering the creosoting process futile. After seasoning, employees often peeled, planed, adzed, and machined the timber to create a straighter, smoother, and more even surface that would readily absorb the creosote treatment. Although innovative labor-saving technology eventually made this process much easier, workers often had to complete these steps by hand at early wood-treatment plants. They also inspected the timber, looking for defects such as large knots or signs of decay that would necessitate discarding it before creosoting. Once they peeled and prepared the timber, workers also branded it with symbols—recording specific information such as the type of wood, the preservative used, and the plant that preserved the piece. Thorough record-keeping allowed producers and consumers of treated wood to gauge its longevity and effectiveness.[31]

[30] See, for example, Jones, *The Tribe of Black* Ulysses; Outland, *Tapping the Pines*; Tegeder, "Prisoners of the Pines"; James E. Fickle, *Green Gold: Alabama's Forests and Forest Industries* (University of Alabama Press, 2014).

[31] See "Chapter 5: Preparation of Material for Treatment," in George M. Hunt and George A. Garratt, *Wood Preservation* (New York: McGraw-Hill Book Company, Inc. 1938); *Forest to Field*

After once again inspecting the branded timber, workers—usually with the aid of locomotive cranes at more sophisticated operations—loaded the timber ready for treatment onto tram cars that slid along tracks directly into treating cylinders. (Figure 6-1) While most larger, commercial plants preferred to harness the “motive power” of smaller railroad switch engines or locomotives to haul the timber around the plant grounds and into the cylinders, some plants relied on horses or tractors.[32] These massive treating cylinders—usually over 100 feet in length and over 9 feet in diameter at large commercial plants—resembled horizontal tanks with one end permanently closed.[33] Steam pipes or steam coils lined the bottom of the cylinders to heat the creosote during treatment so the oils in the mixture did not settle at the bottom of the cylinder.[34] Depending on the size of the plant’s treating cylinders and trams, and also the type of timber being preserved—poles, piling, or ties—multiple cars fit into the cylinder at the same time. In a November 10, 1915, article published in *Lumber World Review*, F. J. Angier who supervised wood preservation at the Baltimore and Ohio Railroad’s plant in Green Spring, West Virginia, explained that one “charge” or batch of timber included 675 total ties spread out over fifteen trams.[35]

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scrapbook (hereafter cited as *Forest to Field*) located in Folder 57, Box 2 of the EFC Papers, also outlined timber preparation prior to creosoting.

[32] See section “The Treating Cylinder” in *Forest to Field*, EFC Papers; Hunt and Garratt, *Wood Preservation*, 354.

[33] Hunt and Garratt, *Wood Preservation*, 338 and 342.

[34] Hunt and Garratt, *Wood Preservation*, 343; John C. Oakes, *Creosotes and Creosoting* (Chicago: John Crerar Library, 1909), 16.

[35] F. J. Angier, “Wood Preservation: Its Past, Present, and Future,” *Lumber World Review* (November 10, 1915): 43.

Hydraulic pumps drew the creosote from a steel "working tank" to the cylinders for treatment. Steam coils also kept the preservative hot so the oils did not settle at the bottom while in the working tank, and many plants fastened "perforated air pipes" in this tank to "agitate the preservative and keep it uniformly mixed."[36] Other storage tanks filled with creosote loomed above the treating cylinders, ensuring a steady supply but also because it was much cheaper to purchase the preservative in large quantities, and shipping delays could shut down a plant. Coastal wood-treatment plants even built pipelines to funnel creosote directly from ships to plant storage tanks; the Atchison, Topeka, and Santa Fe Railway, for example, constructed an elaborate four-mile pipeline that conveyed creosote from ship directly to the storage tanks of its National City treating plant in California. Many facilities that received shipments of creosote via railroads constructed underground storage tanks or "receiving tanks" so the tank cars carrying creosote could easily unload the preservative.[37]

After positioning the timber-laden tram cars inside the treating cylinders, workers sealed the "heavy hinged door," which weighed close to half a ton, carefully tightening the large bolts around the cylinder's rim to secure it while the contents were under extreme pressure.[38] Meanwhile, in what some plants referred to as the "control room," a treating engineer (almost always a white man) oversaw what one observer described as a "mase (sic) of valves, pipes, and recording meters" where only this engineer

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[36] Hunt and Garratt, *Wood Preservation*, 345.

[37] Ibid., 347.

[38] See section "The Treating Cylinder" in *Forest to Field*, EFC Papers; Angier, "Wood Preservation: Its Past, Present, and Future," 43; Hunt and Garratt, *Wood Preservation*, 340.

possessed “a complete understanding of their individual functions.”[39] It was in this “control room” that the treating engineer and his assistants carefully monitored temperature, pressure, and timing. (Figure 6-2)

The treating process itself took considerable time and varied depending on the specific process employed at the plant, the type of wood treated, and the desired level of absorption. In a 1903 *American Lumberman* article on the “science of wood preservation,” the writer estimated that preserving railroad ties required 12 to 15 hours while treating larger pieces of timber such as piling might take 24 to 48 hours.[40] A scrapbook detailing the workings of the Piedmont Creosoting Company in Augusta, Georgia, calculated the “total time” for treatment of one load of 66 telephone poles as 17 hours and 10 minutes. If plants seasoned the wood by machine prior to treatment, this might add an additional twelve hours to the process.[41] In a 1909 report on creosoting, Captain John C. Oakes, an engineer in Galveston, compiled the treatment time of batches of wood at plants in Texas. According to his report, the process ranged from 7 hours to 69.5 hours.[42] Workers could not leave machinery unattended while the wood absorbed creosote in the cylinders because a stray spark anywhere onsite might result in a devastating fire or explosion since creosote was very flammable and plants housed so much wood.[43]

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[39] See section “The Control Room” in *Forest to Field*, EFC Papers.

[40] “The Science of Wood Preservation,” *American Lumberman* (October 31, 1903): 45-46.

[41] See section “The Treating Sequence” in *Forest to Field*, EFC Papers.

[42] Oakes, *Creosotes and Creosoting*, 30.

[43] Lowry Smith, “Precautions to Be Observed For Prevention of Fire in Creosoting Plants,” in *Proceedings of the Sixth Annual Meeting of the Wood Preservers’ Association* (American Wood Preservers’ Association, 1910), 52.

In addition to fire hazards, the creosoting process required constant supervision to make sure the timber absorbed the required amount of creosote under the right level of pressure. Many consumers of treated wood insisted the plant meet their unique specifications, such as the pounds per cubic foot of creosote they demanded should be injected into the timber.[44] Large commercial operations built laboratories onsite so that a chemist (again, typically a white man) could assess whether each batch of creosoted wood met the appropriate conditions.[45] Before treatment, the chemist analyzed the creosote's content to ensure the preservative would be toxic enough to kill fungi and stave off decay. Since creosote is comprised of several different oil groups obtained when coal tar is distilled, the chemist needed to keep the different fractions of each oil within the guidelines of the consumer, the industry, or the plant—a challenging process since there was considerable debate over what constituted the "proper fractions."[46]

After the treatment process was complete, the most dangerous and onerous work that brought laborers into such close contact with creosote began. Workers had to unseal the bolts encircling the cylinder with hand wrenches—a challenging task since the bolts became extremely tight during the "sealing process."[47] Photographs indicate workers, often African Americans, had to climb on top of the still-hot cylinders to reach the uppermost bolts. When they opened the massive door, steam from the timber and

[44] Hunt and Garratt, *Wood Preservation*, 266-267.

[45] Ibid., 364.

[46] See section "Distillation Fractions" in *Forest to Field*, EFC Papers. Oakes also discusses this debate on page 6-9 of *Creosotes and Creosoting*.

[47] Hunt and Garratt, *Wood Preservation*, 342.

creosote poured out of the cylinder, enveloping them in a hot, pungent cloud.[48] Before these workers unloaded the tram of freshly creosoted timber, they had to ensure the preservative penetrated the wood to the desired depth. A worker might use an "increment borer" to extract a sample the chemist could then test. Wooden dowels plugged the holes left by increment boring. If the preservative had not reached the proper depth, workers had to start the labor-intensive process over again and re-treat the batch of timber.[49]

Once assured all specifications had been met, workers could finally unload the tram cars of creosoted wood in the storage yard to drip dry, where it also contaminated the soil.[50] Handling the heavy wood, saturated with what workers referred to as "Black Jack" or "Hot Stuff" was one of the most miserable tasks at a wood-treatment facility.[51] As described in the previous chapter, the creosote frequently resulted in severe skin irritation, burns, and potentially cancer among those exposed to the preservative. Exposure to creosote also caused headaches, vertigo, conjunctivitis, as well as kidney, bladder, and respiratory problems, and workers responsible for handling the treated wood would have been in extended contact with the toxic preservative.[52] Most workers also handled creosoted wood outside with no shade or cover in the hot southern

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[48] See section on "The Pole Has Been Treated" and "The Door is Opened" in *Forest to Field*, EFC Papers.

[49] "Scenes in a Modern Wood Preserving Plant," *The Timberman* 35, no. 4 (February 1933): 11. See also section on "Taking the Increment" and "Plugging the Hole" in *Forest to Field*, EFC Papers.

[50] U.S. Congress, Office of Technology Assessment, *Cleaning Up Contaminated Wood-Treating Sites* (Washington D.C.: U.S. Government Printing Office, 1995), 10.

[51] *Samuel A. Pinkley v. The Chicago and Eastern Illinois Railroad Company*, 246 Ill. 370; 92 N.E. 896; 1910 Ill. LEXIS 2073;

[52] United States Department of Labor, Bureau of Labor Statistics, *Occupation Hazards and Diagnostic Signs No. 582* (Washington: United States Government Printing Office, 1933), 12, 26, 47.

sunshine, which increased the likelihood they would develop severe skin conditions because coal-tar products including creosote also heightened photosensitivity.[53] The warm climate caused creosote to “bleed” or leach out of treated wood, although this also occurred if the wood had been too heavily saturated with the preservative during treatment.[54] These factors made the wood slippery, wet, and messy to work with, but also increased the risk that workers would come in contact with the preservative.

The smell of treated wood was also distinctly unpleasant. If citizens nearby a plant found the odor “nauseating” and “disagreeable” as one resident complained about Republic Creosoting’s plant in St. Louis Park in 1918, workers likely found it even more objectionable.[55] Photographs of workers at plants often depicted them handling treated wood barehanded and only occasionally with gloves. Images do not suggest they wore any other protective gear on face or limbs.[56] (Figure 6-3) Injured workers who sued railroads and creosoting plants frequently attested that they had no access to this sort of equipment.[57] Companies also discouraged the use of tongs and hooks that might aid employees in hefting or shifting treated wood for fear it might gouge or scar the product.[58] (Figure 6-4) The American Wood Preservers’ Association, cautioned in

[53] U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Wood Creosote, Coal Tar Creosote, Coal Tar, Coal Tar Pitch, and other Volatiles* (Agency for Toxic Substances and Disease Registry: Atlanta, September 2002), 301.

[54] Hunt and Garratt, *Wood Preservation*, 317-318.

[55] St. Louis Park Historical Society, “Republic Creosoting Inc.”

[56] See *Forest to Field*, EFC Papers.

[57] See, for example, *Samuel A. Pinkley v. The Chicago and Eastern Illinois Railroad Company*, 246 Ill. 370; 92 N.E. 896; 1910 Ill. LEXIS 2073.

[58] Hunt and Garratt, *Wood Preservation*, 360; Advertisement for Multipoint Cant Hook in *Wood Preserving News* (September 1941), 11, Folder: Older Information Pertaining to Purchase of Boiler, Box 1, MS 5802, Norfolk Creosoting Company Records.

specifications drafted at its 1922 annual meeting that "extreme care should be used" when "handling creosoted material," and the organization forbade workers from employing "sharp pointed tools, such as cant hooks, peavies, pickaroons, and crowbars" except on the "ends" or "three feet" from the ends of creosoted piling.[59] While guidelines such as this one protected the product consumers purchased, they prevented workers from using tools that might protect them from exposure to toxic treatments.

In addition to increasing the potential health hazards caused by close contact with creosote, handling treated wood required tremendous strength. Untreated railroad ties measured about eight feet long and weighed "up to 250 pounds each," although the weight increased after creosoting and varied depending on the railroad's specifications.[60] Men who handled these ties, known as "tie buckers," often singlehandedly hoisted and carried the ties on their shoulders. George A. Corrigan, a logger who published his autobiography, explained, "Average men could not buck ties; it really took supermen."[61] Veteran tie buckers could often be recognized even "from a distance," Corrigan noted, because the shoulder they favored for carrying ties "was a lot lower than the other one."[62] These skilled tie buckers, often immigrants and African Americans, acquired legendary status at wood-treating plants. Laurence L. "Dutch" Reider, an immigrant from Bavaria, who worked for Republic Creosoting in St. Louis

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[59] *Proceedings of the Eighteenth Annual Meeting of the Wood Preservers' Association* (American Wood Preservers' Association, 1922), 408 (Hereafter Cited as *AWPA 1922*).

[60] George A. Corrigan, *Calked Boots and Cant Hooks*, ed. L. G. Sorden 2nd ed. (Ashland, Wisconsin: Northword Inc. 1986); 164.

[61] Ibid., 163.

[62] Ibid., 164.

Park, could supposedly haul two massive railroad ties at the same time.[63] In a 1915 newspaper article about the Argenta Tie Plant close to Little Rock, Arkansas, the writer praised the strength of black tie handlers. "It is worth while to see the husky negroes handle these ties," he admired, "A treated tie will weigh 210 pounds, and the negroes shoulder the ties, a tie to a man, and walk off with it into a car as though it were child's play."[64] In the American South, in particular, plant owners and supervisors regarded black men as ideally suited to tie bucking and handling because of their presumed strength and alleged racial immunity to creosote.[65]

Even plant managers readily acknowledged the physical exertion required to perform the strenuous task of hefting treated wood. As one supervisor conceded at a 1913 conference of wood preservers, "When you wrestle with ties on a piece-work basis they require a great deal of energy, and seven to eight hours gives about all the time they will work."[66] Although the industry celebrated the capabilities of labor-saving devices such as cranes and hoists, Alfred L. Kuehn—superintendent of the American Tar Products Company in Chicago—acknowledged that creosoting operations depended on a "good, husky tie loader."[67] Fear of being replaced by technology also motivated workers, and wood preservers deployed this concern to their advantage. A

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[63] St. Louis Park Historical Society, "Republic Creosoting Inc."

[64] "Tie Plant a Big Local Industry," *Arkansas Gazette* (Little Rock), December 12, 1915.

[65] E. E. Pershall, "Factors Affecting the Cost of Cross Ties," in the *Proceedings of the Eighteenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1922), 160.

[66] *Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1913), 215 (Hereafter cited as *AWPA 1913*).

[67] Kuehn's comment is published in *AWPA 1918*, 53.

Republic Creosoting plant manager joked that simply parking the Hilkie tie-stacking machine in the plant yard “has been the best insurance that we could possibly get at our plant to keep costs down” because it motivated laborers to “get the work done cheaper.”[68]

While handling treated wood called for brawn, it was also a skill acquired through considerable experience and careful observation. Many plants paid workers by the piece to move both treated and untreated timber, so the more ties or pieces of timber they handled, the more money they made. A piecework inspector for the creosoting plant of the Chicago, Burlington, & Quincy Railroad, boasted to AWPA members about the skills of an exceptional worker, who loaded an average of 16 trams per day while other employees scrambled to fill half that many. Eldridge attributed this man’s adept performance not just to his “superior strength,” but because “he has studied out all the short cuts and knows just how to pick up a tie, how to shoulder it, and how to land it on the tram where it will require the least possible shifting to properly load the tram.”[69] Similarly, when a colleague asked Amos Smith to observe how the workers at his plant handled ties, he insisted they study a team of black workers who had become so efficient they could load and unload trams very quickly:

> I told them to go on the platform and find a long, tall nigger, and to watch him and his partner, and if they did not put a tram load of ties into a car in

[68] *Proceedings of the Sixteenth Annual Meeting of the American Wood Preservers’ Association* (American Wood Preservers’ Association, 1920), 208.

[69] *Proceedings of the Ninth Annual Meeting of the American Wood Preservers’ Association* (American Wood Preservers’ Association, 1913), 209 (Hereafter cited as *AWPA 1913*).

a minute and a half to come back and tell me and I would buy them a hat. In a few minutes they came back and told me I did not owe them a hat.[70]

As these supervisors noted, laborers learned how to pace themselves, working quickly to load and unload trams so that they had time to recover before the next batch arrived.

Although many large commercial plants eventually purchased locomotive cranes to transfer large pieces of treated wood, such as poles, piles, and bridge timbers, workers still came in regular contact with the preservative as they positioned the wood in slings for the crane to pick up or removed it once the crane dropped it in the desired location.[71] At a 1914 American Wood Preservers Association conference, Carl G. Crawford, the general manager of the American Creosoting Company in Louisville, Kentucky, justified plants' dependence on hand labor despite technological innovations: "I think it is very difficult to find any mechanical means whereby you can do that work without again handling them by hand. You drop them down on to a pile in quantities, and then you must have someone to place them."[72] (Figure 6-5)

As Crawford alluded, treated wood had to be painstakingly stacked and balanced to maximize shipping effectiveness and keep piles from toppling, a precise process that a large, unwieldy crane could not perform easily without laborers standing by to make adjustments.[73] Equipment that reduced hand labor was also very expensive, and the

[70] *Proceedings of the Tenth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1914), 371. (Hereafter cited as *AWPA 1914*).

[71] Hunt and Garratt, *Wood Preservation*, 357 and 363.

[72] *AWPA 1914*, 373.

[73] See "Forest to Field" scrapbook located in Folder 57, Box 2 of the Edwin Fisher Conger Papers at the Virginia Historical Society in Richmond.

price discouraged plants from adopting this technology, especially when they paid workers so little. Waterman noted at the American Wood Preservers' Association meeting in 1918, a new crane cost $20,000, while plants often paid laborers 1 to 1.5 cents per tie they handled.[74] To justify its cost, the crane would have to move two million more ties than workers. Plants would also have to find, train, and pay reliable crane operators.

Preserving wood with creosote also produced significant treating waste, which workers regularly encountered when cleaning equipment or when plants attempted to recover valuable chemicals. (Figure 6-6) The pressure process left some creosote behind in the cylinders following treatment and also sucked moisture out of wood, generating wastewater that plants channeled into unlined evaporation ponds or settling pits so that they could skim and reuse coal tars and oils. These ponds, however, frequently overflowed.[75]

After treating repeated charges of timber, the cylinders built up a sludge that workers would have to scrape out and dump into these evaporation ponds, nearby bodies of water, or as one creosoting plant supervisor instructed, "an out of the way place at the other end of the yard."[76] Some plants even had workers use this gunk to fill

[74] Waterman's discussion is in *AWPA 1918*, 50-51; Letter from C. E. Weaver to R. C. Falconer, December 3, 1920, Folder 1914-15, Box 212, Central of Georgia Railway Collection.

[75] Nicholas P. Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production Volume 2: Best Practices in the Wood and Paper Industries* (Amsterdam: Elsevier, 2010), 51; U.S. Congress, Office of Technology Assessment, *Cleaning Up Contaminated Wood-Treating Sites*, 10.

[76] Superintendent of Creosoting Plant to Master Car Builder, Mr. Adamson, May 25, 1933, Folder 1914-6, Box 211, Central of Georgia Railway Collection.

in potholes.[77] Once an operation had recycled as many chemicals as they could from the ponds and evaporation pits, workers also had to transfer the toxic muck left behind in the pits to a prescribed dumping point. In addition to being “very crude and inefficient” “recovery systems” as Nicholas P. Cheremisinoff and Paul E. Rosenfeld demonstrated in their study of pollution problems at wood-preservation plants, these disposal methods also brought workers into contact with high concentrations of hazardous chemicals.[78]

Both workers and the industry recognized that handling creosoted timber was, as laborer Red Joe, recalled “miserable.”[79] Virgil Neitzel, whose father John spent over fifty years working at Republic Creosoting’s plant in St. Louis Park, remembered that “the typical creosote worker claimed that ‘it took a little alcohol to thin out that creosote.’”[80] Some members of the American Wood Preservers’ Association also admitted that “labor objects to handling freshly creosoted timber.”[81] As a result, plant supervisors struggled to find workers willing or desperate enough to tackle the disagreeable work. The superintendent at a railroad creosoting plant in Bradford, Pennsylvania, recommended that plants in different regions rely on the most marginalized workers available in their area. “Most advantageous productivity is derived from a one-man group, i.e. a nigger in the South, an Old-Mexico Mexican in the West, a Swede in the North, an Austrian in the

[77] Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention*, 45.

[78] Ibid., 51; U.S. Congress, Office of Technology Assessment, *Cleaning Up Contaminated Wood-Treating Sites*, 10.

[79] Boyer, *Prairie Whistles*, 43.

[80] Virgil Neitzel, “Oak Hill and the Republic Creosoting Co.,” in *Something in the Water: The Village of St. Louis Park, Minnesota 1945 and earlier*, ed. Don Swenson (St. Louis Park, Minnesota: St. Louis Park Historical Society, 2001), 47.

[81] *Proceedings of the Fifteenth Annual Meeting of the American Wood Preservers’ Association* (American Wood Preservers’ Association, 1919), 166.

East," he argued. "On the Pacific Coast, the Jap hardly reaches the size of a one-man tie carrier, even with a 130-pound tie."[82] While this comment emphasized the racism rampant within the industry, it also demonstrated the reliance of southern wood preservers on African American workers.

In the South, the wood-preservation industry celebrated its region's steady, cheap, and exploitable labor supply, but it also made an important distinction where these workers were concerned. When Franklin J. Angier, the superintendent of timber preservation for the Baltimore and Ohio Railroad, referred to black workers at the Atchison, Topeka and Santa Fe Railway's plant in Somerville, Texas, as "colored gentlemen" during a meeting of wood preservers, Amos Smith took offense.[83] Smith, who supervised an Ayer & Lord tie plant in Argenta, Arkansas, proudly proclaimed, "We have not got any colored gentlemen in the South. We call them niggers there."[84] Smith continued his racist rant, bragging to his colleagues: "Now, the nigger is supposed to be the poorest laborer in the world, but he is one of the best and just as good as a mule. He does all he is forced to do, and does it as easily and quickly as he can."[85]

As Smith's comment revealed, southern wood preservers did not regard their African American employees as people or even workers, but as "niggers" and "mules" they could "force" to do their bidding. When referring to the African American workforce at a southern wood-treating plant, one wood preserver referred to another colleague

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[82] *Proceedings of the Eighth Annual Meeting of the American Wood Preservers' Association* (American Wood Preservers' Association, 1912), 76.

[83] *AWPA 1914*, 371.

[84] Ibid.

[85] Ibid.

and “his darkeys” as if the supervisor owned the black workers.[86] They also further dehumanized black workers by comparing them directly to machinery, regularly referring to them as “devices.”[87] While the difficulties of securing workers to handle treated timber prompted many wood preservers to consider purchasing equipment and machines that might reduce hand-labor at plants, southern supervisors and managers remained steadfast in their belief that black workers presented the most economical and efficient solution, especially for the handling of treated wood. Estes Pershall, vice president of the T. J. Moss Tie Company in St. Louis, maintained, “In a large majority of instances. . . a negro tie handler is economically superior to any mechanical devices now in common use.”[88] Similarly, in 1920, after a presentation by the AWPA’s Committee on Plant Operation that discussed machines for “the mechanical handling of material,” Waterman challenged the committee’s claims about the Hilkie tie stacker’s efficiency: “You know a nigger will beat that about four times.”[89] Will H. Grady, the chairman of the commission and the superintendent of the American Creosoting Company’s Louisville plant, conceded Waterman’s point: “Yes, he will. This is just given here for information. I don’t advocate this machine.”[90]

Southern wood preservers’ views of African Americans as tools they extracted labor from resulted in these workers occupying the most dangerous positions at

[86] *AWPA 1914*, 371.

[87] *AWPA 1918*, 50.

[88] Pershall, “Factors Affecting the Cost of Cross Ties,” in *AWPA 1922*, 160.

[89] *Proceedings of the Sixteenth Annual Meeting of the American Wood Preservers’ Association* (American Wood Preservers’ Association, 1920), 207.

[90] Ibid.

creosoting plants where they encountered an uneven share of the toxic preservative. As the above comments from supervisors indicated, plants relied on African Americans to handle treated wood. Photographs of plant operations and company payroll records also support this evidence. A scrapbook detailing the operations of Piedmont Wood Preserving Company workers preparing an order of creosoted southern yellow pine poles featured images of African Americans performing the hard, manual labor involved in pressure-treating wood with creosote. The images showed black workers prepping timber for treatment, manning the cylinder doors, handling the freshly creosoted wood, and also recovering usable chemicals after the process was complete. White employees, such as the chemist and yard superintendent, clearly occupied the white-collar and supervisory positions in this Georgia plant. The photographs show them overseeing the African American employees, standing behind them or at a distance while monitoring black labor. While the African American workers wore stained coveralls, signaling the dirty nature of their jobs, many of the white employees dressed in button-down shirts and slacks. Although the narrative in the scrapbook credited specific white workers, such as the treating engineer, chemist, and yard superintendent, by name, it portrayed black workers as a fixed part of the landscape. The scrapbook featured African Americans in most of the photographs, but it did not mention any by name. Instead, the equipment and tools received more attention than the men operating them.[91]

Payroll records from the Norfolk Creosoting Company, which designated employees as “W” or “C” (white and colored), also offer insight into the types of jobs

[91] *Forest to Field*, EFC Papers.

African American workers held. While white men—in the minority of the plant's labor force—dominated more skilled positions such as "chief engineer," "foreman," "machinist," and "inspector," most African American workers toiled in jobs as lumber laborers and crane laborers where they could not escape creosote. Black men also exclusively operated the cylinder doors, a dangerous, hot, and messy job. In addition, they served as firemen for the plant, stoking the flames that powered the entire operation. In many positions that involved running expensive equipment, such as the cranes, these records classified a white man as the "crane operator" and supervisor over a crew of African American workers.[92]

While it is not surprising that wood preservers in the segregated Jim Crow South pushed African Americans into the least desirable and most dangerous positions at wood-treatment facilities, racialized conceptions of disease also provided a justification for endangering these black workers. In the late nineteenth and early twentieth centuries, when creosoting facilities expanded rapidly throughout the United States, Americans increasingly applied Charles Darwin's biological arguments about evolution, natural selection, and survival of the fittest to the social and political realm, wielding these theories to justify slavery, racism, and eugenics. In a study of medical racism, historian John Hoberman explored how whites manipulated Darwinian logic to the detriment of African Americans, crafting a myth of black physical "hardiness."[93] This "doctrine" of "physical," including "dermatological hardiness," Hoberman explained, contributed to "a willingness among whites to expose black workers to a variety of

[92] Box 3 and 4 MS 5802, Norfolk Creosoting Company Records.

[93] John Hoberman, *Black and Blue: The Origins and Consequences of Medical Racism* (Berkeley, University of California Press, 2012), 120.

physical traumas, including the extreme heat of a cotton field or a blast furnace, industrial chemicals, or exposure to invasive insects."[94] Eugenicist Charles Davenport declared black skin resistant to "skin diseases," "dermatitis from traumatisms," and "venomous bites and stings."[95] Esteemed dermatologist Henry Hazen supported this claim in his 1915 treatise on *Diseases of the Skin*, concluding that "the negro's skin is more resistant to external irritants than the white man's." Hazen also contended that the darker or more "full-blooded" a "negro" was, the more resistant they were to skin diseases.[96]

The view Hazen articulated was prevalent among anthropologists and physicians who espoused what Hoberman characterized as "simpleminded pseudo-Darwinian reasoning" that "equated black human beings with darker kinds of animals."[97] This logic is apparent in a 1928 article published in the *American Journal of Physical Anthropology*. Zoologist and eugenicist Samuel J. Holmes explored why "the negro" possessed such a "resistant ectoderm" or outer layer of skin, and deduced, "It is natural to associate the low death rate of negroes from skin diseases and skin cancer with the presence of large amounts of pigment. Among animals there are many cases in which darker varieties are relatively immune to various diseases."[98] Holmes went on to cite Charles Darwin's observation that certain types of "dark-colored swine" could consume

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[94] Ibid., 110.

[95] A. G. Love and C. B. Davenport, "A Comparison of White and Colored Troops in Respect to Incidence of Disease," *Proceedings of the National Academy of Sciences* 5 (1919): 59.

[96] Henry H. Hazen, *Diseases of the Skin* (St. Louis: C. V. Mosby Company, 1915), 34.

[97] Hoberman, *Black and Blue*, 67.

[98] S. J. Holmes, "The Resistant Ectoderm of the Negro," *American Journal of Physical Anthropology* 12, no. 1 (1928): 149.

plants that would be poisonous to light-colored swine. Thus, similar to the wood preservers who regarded their workers as “devices” and “mules,” Holmes viewed blacks as less than human, only worthy for their muscle.[99]

White perceptions about the imperviousness of black skin, especially from cancer, continued to predominate among scholars and medical professionals. Throughout the early twentieth century, Americans regarded cancer as a disease of civilization. Because they viewed African Americans as animalistic, savage, and uncivilized, they reasoned that blacks were less susceptible to diseases that afflicted more “advanced” cultural groups.[100] Holmes reflected this prevailing view in his article, and he remarked, “In general, the primitive races have the reputation for being less afflicted with cancer than more highly civilized man.”[101] In a study of how “cancer crossed the color line,” historian Keith Wailoo notes, “Statisticians, physicians, biologists, and surgeons imagined African Americans not as individuals but as a homogeneous group that was carefree and protected from cancer, living as they did in ‘primitive,’ stress-free environments that made them less vulnerable to the modern scourge.”[102]

Applying this perceived relationship between cancer and civilization, “theorists” and “self-styled experts” as Wailoo pointed out, also believed that cancer rates would be much lower in the rural and more primitive South than the culturally and industrially

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[99] Ibid.

[100] Keith Wailoo, *How Cancer Crossed the Color Line* (New York: Oxford University Press, 2011), 42.

[101] Holmes, “The Resistant Ectoderm of the Negro,” 147.

[102] Wailoo, *How Cancer Crossed the Color Line*, 9.

advanced North.[103] Much of the cancer data they relied on came from insurance statistics, and while the insured number of African Americans was generally lower than whites, this disparity was even more marked in the South. Even Louis Dublin, a statistician and executive at Metropolitan Life Insurance Company, which insured “close to two and a half million Negroes” by 1928 admitted, “The conditions which prevail in the rural South, where a great proportion of the Negroes still live, are therefore not closely reflected by the insurance experience.”[104] This “notoriously sparse and unreliable” data, as Wailoo characterized it, raised questions about how much researchers really knew about “health and disease” in the South, especially the rate of cancer among African Americans living and working there.[105]

Nevertheless, these prejudiced views influenced both industry leaders and researchers examining the health risks of coal-tar creosote. In a February 1917 issue, the editors of *Railway Maintenance Engineer* featured a story on the quality of “the negro” as a railroad maintenance laborer and offered advice on how to extract the best level of work from black employees. The editors explained, “The southern negro has strong racial characteristics and these must be recognized by those who would secure the greatest amount of work from him.”[106] According to the article, immunity to creosote ranked among the unique racial characteristics that made “the negro” ideally suited for

[103] Ibid., 44.

[104] Louis Dublin, “The Health of the Negro,” *Annals of the American Academy of Political and Social Science* 140 (November 1928): 77. The article was also revised and updated in 1937. Louis Dublin, “The Problem of Negro Health as Revealed by Vital Statistics,” *Journal of Negro Education* 6 (July 1937): 268-75.

[105] Wailoo, *How Cancer Crossed the Color Line*, 44.

[106] “The Negro as a Maintenance Laborer: Two Discussions of Employes of This Type Who are Moving North in Large Numbers,” *Railway Maintenance Engineer* 13, no. 2 (February 1917): 37.

work as maintenance laborers who frequently encountered creosote when they replaced and repaired treated railroad ties and bridge timbers. Contributing to this article, Kenneth H. Hanger, an engineer in El Dorado, Arkansas, for the Chicago, Rock Island & Pacific observed, "They are far less susceptible to the burning effect of creosote in hot weather than is a white man; in fact, they pay but little attention to it unless some spatters in their eyes as the hammer strikes a pile head."[107]

Similarly, at the annual convention of the American Railway Bridge and Building Association in 1918, Hermann von Schrenk, a botanist and wood preserving specialist, praised African Americans' resistance to the dermatological effects of creosote.

> There has been a good deal of complaint from time to time as to the injuries received by workmen as a result of working with creosoted material. We have had a number of lawsuits connected with that problem and I found that the injury complained of was confined principally to light-skinned and fair-haired people. Swedes are more affected than the so-called Americans with dark skin and dark hair. In the south, the negro is never influenced by it at all but a man with light skin is liable to have his hands and face blistered if he is not careful.[108]

Von Schrenk's comment is interesting since railroads and creosoting companies frequently hired him to serve as an expert witness and support their claims that creosote was harmless. He routinely testified against workers filing personal injury lawsuits after exposure to creosote.[109] When among his peers at the conference, however, von Schrenk revealed that creosote did, in fact, cause many injuries among workers, but he claimed African Americans did not experience any of these afflictions. Thus, just like the

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[107] Kenneth H. Hanger, "Characteristics of the Negro" *Railway Maintenance Engineer* 13, no. 2 (February 1917): 38.

[108] *Proceedings of the Twenty-Eighth Annual Convention of the American Railway Bridge and Building Association October 15-17, 1918* (Elgin, Illinois: Brethren Publishing House, 1918), 84.

[109] James E. Cronin, *Herman von Schrenk: A Biography* (Chicago: Kuehn, 1959), 164 and 163.

editors of the *Railway Maintenance Engineer*, he encouraged the employ of African American workers in jobs that would bring them in contact with creosote because they seemed less prone to its adverse effects.

Medical research also reinforced the views held by consumers and producers of treated wood that African Americans were physically hardy and resistant to creosote. In a 1930 study published in the *Journal of Industrial Hygiene*, physician Imre Heller investigated the cancer risks associated with coal tar and coal-tar products. Although he did not identify any cases of cancer among wood preservers and few cases among tar distillers, Heller attributed this low incidence to the prevalence of "negroes" in these plants who he claimed possessed a "racial immunity." "It is a well-known fact," Heller asserted, "that negroes are less susceptible to skin diseases than white men."[110]

Similar to Imre Heller a decade earlier, Adolph Jonas, a physician in New York, advised that "colored" or "dark-skinned" workers exclusively should handle treated wood because they showed a "remarkable resistance" to its effects.[111] Jonas arrived at this conclusion after treating over 400 injured workers engaged in the construction of a temporary U.S. Navy camp. These workers came in contact with creosote from preserved timber and creosoted roof paper during camp construction. Jonas did not seem to base his conclusion that African American workers possessed a resistance to creosote on medical data, but simply his observation that supervisors "never received

[110] Imre Heller, "Occupational Cancers," *Journal of Industrial Hygiene* 12, no. 5 (May 1930): 175, 179, and 180.

[111] Adolph D. Jonas, "Creosote Burns," *Journal of Industrial Hygiene and Toxicology* 25, no. 9 (November 1943): 420 and 418.

complaints" from African American crews, although they occupied the "maximum exposure" jobs such as hand-dipping wood into vats of creosote.[112]

As Wailoo argues, "It is impossible to rewind the clock and uncover the statistical truth of who actually experienced what kind of cancer in earlier decades when the standards of diagnosis were so different."[113] Nevertheless, the belief that African Americans enjoyed racial immunity to skin cancer and other dermatological conditions likely ensured that supervisors, companies, and medical professionals did not take black workers' health concerns seriously. The workers themselves might have also underestimated the risk and dismissed symptoms since the industry and medical community insisted they were immune to creosote.[114]

Regardless, these beliefs justified the industry's exploitation of its workers, providing a medical rationale to assign African Americans to work in the jobs where they faced greater exposure to creosote and other toxic wood preservatives. Even Heller noted the tendency of tar-distillation plants manufacturing creosote to employ "mostly negroes" in the "most dangerous occupations" such as tank cleaning.[115] While men dominated the wood-preservation industry's workforce, photographs taken during World War II reveal that plant operators turned to women, like many other industries, to cope with the wartime labor shortage. Assumptions about racial immunity from creosote,

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[112] Ibid., 418.

[113] Wailoo, How Cancer Crossed the Color Line, 4.

[114] Hoberman, *Black and Blue*, 124.

[115] Heller, "Occupational Cancers," 180. These misperceptions also persist today; many Americans still regard skin cancer as a white person's disease.

however, led them to rely on African American women—at least temporarily—to take over this unpleasant and dangerous work. (Figure 6-7)

In addition to endangering black workers, company documents also reveal that management concealed these workers' injuries and even bribed black laborers to discourage them from seeking redress. While few creosoting companies seem to have preserved records pertaining to workers, correspondence and official injury reports from the Central of Georgia Railroad's creosoting plant near Macon offer insight into management's attitude toward workplace injuries among African Americans.

To preserve the railroad ties and bridge timbers used along its line, the Central built a creosoting plant in 1912 near the outskirts of Macon, appropriately dubbing the area "Creosote, Georgia."[116] The plant's first superintendent, Frank H. Stewart, earned a reputation among employees and railroad supervisors for his volatile, erratic behavior. Stewart battled with his supervisors for years to secure what he felt was adequate company housing because he argued there was "nothing available fit for a white man to live" in the area.[117] Stewart also had frequent, violent marital disputes with his wife onsite. Although Stewart lived on the property with his family in company housing, their altercations often occurred inside plant offices while employees looked on and sometimes even had to intervene when his wife beseeched them.[118] One employee, identified in records as "C. O. Speer," alleged that Stewart denied him water for hours at

[116] Folder 1254-9, Box 138, Central of Georgia Railway Collection.

[117] July 29, 1912 Letter from F. H. Stewart to C. K. Lawrence. Folder 1254-8, Box 138, Central of Georgia Railway Collection.

[118] Folder 1914-3, Box 210, Central of Georgia Railway Collection.

a time, was verbally abusive, and dismissed him without cause.[119] In correspondence to railroad officials, Stewart plotted how to dismiss Speer, challenging his supervisors' idea that "Speer cannot be gotten rid of so easily, that we must show some cause for dismissing him."[120] Other workers also claimed that Stewart fired employees for no apparent reason. After years of dealing with Stewart's antics, one incident in which he physically abused his wife at the plant finally prompted the Central of Georgia's Chief of Police to launch an official investigation in June 1919, and ultimately the railroad pressured Stewart to resign. As part of the investigation, the Central's Chief of Police interviewed workers about some of these disturbing incidents, and their testimony sheds light on Stewart's management tactics, particularly with regard to concealing injuries at the plant and coercing a black worker to serve as Stewart's handyman and personal attendant.[121]

Although Otis Wallace, a timekeeper at the plant, had only been employed for six months when railroad police began investigating Stewart, he reported one occasion when Stewart instructed him to keep Ed Mapp, an injured "negro," on the payroll for over a week although no accident report was made out. Stewart, according to Wallace, claimed the injured man was "a good worker and a good negro and that he got hurt serving the Company and to carry his time of 10 hours per day until he came back."[122]

[119] May 10, 1914, Letter from C.O. Speer to Mr. J.L. Fickling, Folder 1914-4, Box 211, Central of Georgia Railway Collection.

[120] October 19, 1914 Letter from F. H. Stewart to C. K. Lawrence, Folder 1914-4, Box 211, Central of Georgia Railway Collection.

[121] Folder 1914-3, Box 210, Central of Georgia Railway Collection.

[122] "Statement of Mr. Otis Wallace," Folder 1914-3, Box 210, Central of Georgia Railway Collection.

Although there is no mention of the type of injury the black worker sustained, Stewart's actions violated official rules that required the completion of an injury report if an employee would miss work for more than 3 days. Although Stewart justified his actions to Wallace as in the injured employee's best interests and as a reward for good work, his decision also kept the railroad from investigating the cause and nature of the accident and likely kept the injured employee from pursuing compensation or accusing the plant and its managers of negligence.[123]

The Central's chief of police also questioned Wallace about Robert Barnes, another black worker. Although the plant paid Barnes to work under Wallace for ten hours per day, repairing track, cleaning around the plant, and working in the boiler room, Wallace reported that Stewart pressed Barnes into personal service. Instead of his regular duties, Barnes spent most of his time serving at Stewart's beck and call, tending his garden, working in his house, and running his errands. This example illustrates that Stewart had no qualms about exploiting black workers for his own personal benefit.[124] This practice was also common in other southern industries, especially timber and naval stores, which exerted control over its workforce through convict leasing and debt peonage.[125]

Personal drama declined after Stewart resigned, but later evidence points to larger flaws in the system of reporting injuries. An April 1925 issue of *The Right Way*

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[123] Ibid.

[124] Ibid.

[125] Outland, *Tapping the Pines*, 206; Tegeder, "Prisoners of the Pines," 155 and 156; Talitha L. LeFlouria, *Chained in Silence: Black Women and Convict Labor in the New South* (Chapel Hill: The University of North Carolina Press, 2015), 113 and 159; David M. Oshinsky, *Worse Than Slavery: Parchman Farm and the Ordeal of Jim Crow Justice* (New York: Free Press, 1996), 139.

Magazine, a Central of Georgia Railway publication, eulogized the efforts of L. H. Harper the creosoting plant's new superintendent who "made an excellent record in accident prevention during 1924."[126] The annual number of personal injuries at the plant decreased from 68 in 1923 to 31 in 1924.[127] While railroad officials lauded Harper for improving the plant's safety record, the article reveals little about the nature of these injuries and what ultimately happened to the workers. It also raised questions about why the Central did not preserve these injury reports in its files.

Although Harper and the Central continued to try and reduce the frequency of "reportable" injuries at the creosoting plant, correspondence from May 1926 suggests this proved challenging. In a May 18 letter from Harper to the assistant general manager of the Central, Harper again expressed his displeasure at injuries threatening the plant's "record." "I, too, regretted to see our record marred by having a personal injury. Then, right on top of it, we had the misfortune to have another one; that of Claude Foster, May 15," Harper complained. "This injury, while not fatal, was bad enough, and more serious that (sic) any we have had in a long time."[128] While Harper's comments indicated Claude Foster's injury was quite serious, there are no records addressing what actually happened to Foster or the other worker hurt on the job.

Only a few sporadic injury reports are available, and these seem to have been preserved because they were attached to official correspondence. Harper, the plant

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[126] "Good Safety Record," *The Right Way Magazine* (April 1925): 44, Folder April-May 1925, Box 1, Central of Georgia Railway Collection.

[127] Ibid.

[128] May 18, 1926 Letter from L. H. Harper to G. L. Candler, Folder 1914-18, Box 213, Central of Georgia Railway Collection.

superintendent, and Robert R. Cummins, the Central's Superintendent Maintenance of Way, for example, exchanged letters in May and June 1933 about Stewart Moore, a "colored laborer" whose thumb was mashed in the tie adzing and boring machine on May 31, 1933. Although "the injury was not at all serious," Harper decided to notify Cummins before completing the official paperwork, lamenting, "We have had a perfect personal injury record for 1933 up until this time, and it is very disappointing to me to have it spoiled." Acknowledging this incident, Cummins replied, "I regret to see this report, but hope that you can get him back to work before three days' time is lost, in order that it will not be a reportable injury."[129] This interchange demonstrates how plant managers and railroad officials responded to news of employee injuries. Harper expressed frustration that Moore jeopardized the plant's safety record, and Cummins reminded him that if Moore was back to work quickly, the incident was not "reportable" and not officially on record.

This accident and other injury reports also shed light on the Central of Georgia's process for reporting workplace injuries. The railroad had an official injury report form that asked detailed questions about the cause of the accident, whether the incident was avoidable or not, the nature and extent of the injury, the prescribed medical treatment, eyewitnesses, the employee's level of experience at the plant, and the task the worker had been engaged in when hurt. The plant superintendent completed this paperwork, exerting considerable control over the narrative of the injury, and he designated whether it was "unavoidable" or "avoidable." If the superintendent determined the accident "avoidable," he had to assess whether the injury occurred as a result of the

[129] See correspondence in Folder 1914-6, Box 211, Central of Georgia Railway Collection.

“carelessness of injured employe,” the “carelessness of other employes,” the “carelessness of foreman or superior,” or “defective tools, track or machinery.” Supplementary statements from the injured employee and witnesses accompanied the superintendent’s report, but employees did not write these statements by hand. Instead, the statements appeared typed, with a place for the employee and a witness to sign. In the few injury reports available, the superintendent stressed the employee’s negligence, including statements that explained the injured worker had “nobody but himself” to blame. The accompanying typed statements signed by injured workers also articulated a clear admission of guilt that absolved the plant of any negligence: “I do not blame any one for the accident” and “I do not blame any one.”[130] Southern creosoting plants relied heavily on African American workers and many plants in other U.S. regions depended on immigrant laborers, and it is likely that not all workers were literate and able to verify the accuracy of the typed statement they signed. In a 1934 lawsuit filed by the widow of an injured black creosote employee, court records indicate his fellow black laborers submitted their affidavits not with signatures but with a “mark” because they “could not sign.”[131]

While some injuries at plants might appear to be the result of employee negligence, management often failed to provide any safety equipment and training to workers. As the previous chapter documented, “a result of their own negligence” became a common industry refrain and defense, especially in the courtroom when

[130] These examples are from Stewart Moore’s injury form in Folder 1914-6, Box 211 and Felton Foster’s injury form, Folder 1914-19, Box 213 in the Central of Georgia Railway Collection.

[131] *Maryland Casualty Co. v. Dawson*, 75 F.2d 431; 1935 U.S. App. Lexis 2953, www.lexisnexis.com/hottopics/lnacademic (accessed May 8, 2015).

employees sought to recover damages for creosote-related injuries. Although white laborers filed many lawsuits against railroads and creosoting companies, evidence suggests employers seldom had to confront injured black laborers or their families in the courtroom.

One of the few cases involving an African American plaintiff—*Maryland Casualty Co. v. Dawson*—illustrated the challenges black workers faced when pursuing recompense through official channels. In 1930 Will Dawson, a black employee of the National Lumber and Creosoting Company in Texarkana, Texas, died mysteriously. Dawson worked for the company for over twenty years, performing the hard labor of loading treated ties into tramcars. His widow, Fannie Dawson, contended that a workplace injury led to his death, but the National Lumber and Creosoting Company and the Maryland Casualty Company—which provided fire and casualty insurance for the plant—denied that Will Dawson, a "good careful worker" and a "strong healthy man" ever sustained an injury. Company officials refused to pay more than $50—the standard sum they paid to any deceased worker for funeral expenses. Fannie Dawson sued over the dispute, and after a four-year legal battle, the court awarded her $11.75 per week for 360 weeks. The insurance company, however, appealed this verdict demanding a new trial and insisting that Dawson's widow and fellow black laborers falsified testimony and lied about his injuries. Although the appellate court ultimately ruled in Dawson's favor, these proceedings delayed her compensation until five years after her husband's death.[132]

[132] Ibid.

The *Dawson* case also illustrated the uneven power relationships between white management and the black workers who labored under dangerous conditions. Dawson alleged that the creosoting plant and the insurance company intimidated several of her husband's coworkers into changing their testimonies during the court proceedings. Cat Harris, a black worker who served on a "gang" with Will Dawson, admitted in the appeals process that he previously withheld information about Dawson's injury because "he was scared."[133] While Dawson eventually received compensation for her husband's death at the plant, this seems to have been an exceptional outcome. A dearth of similar court records suggests black workers rarely sought or were prevented from pursuing legal redress. The industry's and medical community's misconception that African Americans possessed a racial immunity to creosote likely suppressed lawsuits from black employees. The perception, especially in the American South, of African American workers as tools, devices, or animals also reinforced a general disregard for their health and safety. Southern states slowly and reluctantly adopted workers' compensation legislation in comparison to other regions of the United States. During a discussion of workmen's compensation at the 1934 National Conference for Labor Legislation, a representative from Florida, a major timbering and creosoting region, admitted that he represented a state with "no compensation law" and explained that southern states did not accept ideas about workers' compensation because of both "the predominance of very cheap colored labor" and the "determined opposition" of southern industries.[134]

[133] Ibid.

[134] United States Department of Labor, "Workmen's Compensation," *Proceedings of the National Conference for Labor Legislation* (Washington D. C.: United States Government Printing Office, 1934), 12.

In addition to these social and labor hurdles, injured black workers also had to contend with the power of company doctors. Creosoting facilities, especially larger operations run by railroads, often hired a company doctor or company surgeon to treat workers. In *Lawyering for the Railroad*, William G. Thomas addressed the influence these physicians had: "Company surgeons, as they were called, provided expert testimony on the severity of injuries, helped the lawyers judge the strength of their defense, and often used their contacts with injured employees to prevent the evolution of a lawsuit."[135] Company doctors served as the first line of defense to stave off personal injury lawsuits, but they also played an important role in the event an employee filed suit. Injury forms in the Central's records identify Allen Rozar as the company doctor supervising medical treatment for the Macon creosoting plant but also the Central's larger railroad system.[136] Doctors such as Rozar wielded great influence over workers and the handling of workplace injuries, and black creosoting laborers lacked even the limited resources white employees enjoyed if they chose to challenge the power of company doctors or plant managers.

When white creosoting employees at railroad-operated plants had concerns about injuries, wages, overtime, or seniority, many filed official complaints with railroad "brotherhoods" such as the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers or the United Brotherhood of Locomotive Engineers.[137] These organizations—founded in the 1860s and 1870s—functioned as trade unions and

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[135] William G. Thomas, *Lawyering for the Railroad: Business, Law, and Power in the New South* (Baton Rouge: Louisiana State University Press, 1999), 117.

[136] Folder, 1914-19, Box 213, Central of Georgia Railway Collection.

[137] See correspondence in Folder 1914-15, Box 212, Central of Georgia Railway Collection.

benevolent associations for railroad employees, but actively excluded black workers from membership. Exploring this discriminatory stance, historian Eric Arnesen explains, “From their inception, race was written into the very definition of their unions’ membership” and the brotherhoods represented a strictly “white, native-born male constituency.”[138] Southern members of the brotherhoods demanded that these organizations keep African Americans out. Economist and labor specialist Herbert Northrup testified on the position of black workers in railway unions before the Fair Employment Practices Committee in Washington in November 1943, and addressed southerners’ views: “To admit Negroes, the Southern members declared, would be tantamount to admitting that the Negro is the ‘social equal’ of the white man. This they refused to countenance.”[139] As a result, according to Northrup, even by the 1940s, “The Negro railroad worker is in an anomalous position. He is denied a voice in nearly all railroad labor organizations.”[140] The brotherhoods’ exclusionary restrictions remained in place until the 1950s and 1960s when federal and state courts challenged these policies. Even if the “brotherhoods” permitted black members, these organizations would probably not have viewed the manual labor African Americans performed at creosoting plants as skilled work deserving of the brotherhoods’ protection.[141]

The piecework system that southern wood preservers implemented further alienated and endangered African American workers. Instead of paying employees a

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[138] Eric Arnesen, *Brotherhoods of Color: Black Railroad Workers and the Struggle for Equality* (Cambridge, Massachusetts: Harvard University Press, 2001), 28.

[139] Herbert Northrup, “The Negro in the Railway Unions,” *Phylon* 5, no. 2 (2nd Qtr. 1944): 160.

[140] Ibid., 159.

[141] Arnesen, *Brotherhoods of Color*, 3.

day rate or an hourly wage based on the amount of time they worked, creosoting plant owners and managers compensated workers by the "piece" or by the number of pieces or trams of creosoted lumber they processed.[142] This system pushed workers to increase their productivity, but it also elevated their exposure to toxic chemicals and compromised their safety. Piecework had long been used in the textile and garment industries, but it was also common in the turpentine industry.[143] Before considering the impact of piecework on African American workers, it is important to examine how wood preservers viewed the system and advertised it to their employees.

Supervisors touted piecework as of great benefit to workers because they could potentially exceed what they would earn at an hourly or day rate. According to proponents of piecework, laborers also worked at their own pace, controlling their own productivity and receiving rewards for hard work. The money they earned, advocates claimed, directly correlated with their effort. At the 1913 American Wood Preservers' Association annual meeting, W. W. Eldridge prepared a presentation on the utility of this system for handling ties and timber. Eldridge, who served as a piecework inspector for the Chicago, Burlington, & Quincy Railroad, encouraged his fellow wood preservers to adopt this method and contended that employees would thank them for implementing a piece rate:

> It places each individual workman in business for himself. It enables him to secure pay for what he does. . . Knowing that he is getting paid for what he does, and that in proportion as his efforts are increased his earnings are increased, he is able to make better wages than his fellow-workmen in

[142] For a general discussion of piecework in the wood-preserving industry see: W. W. Eldridge, "The Piecework or Unit System of Handling Ties and Timber," *AWPA 1913*, 203-213.

[143] David A. Zonderman, *Aspirations and Anxieties: New England Workers and the Mechanized Factory System, 1815-1850* (New York: Oxford University Press, 1992), 173; Outland, *Tapping the Pines*, 171.

> other lines of business on a day rate system, hence he is satisfied and contented with his job at all times.[144]

Although Eldridge argued that this system rewarded workers, it also rewarded companies. When employers paid workers an hourly or daily wage, Eldridge explained, "there was no incentive for the man to do other than plod along from morn till night, day in and day out, doing as little as he can and hold his job" and often "his highest ambition is to see that he does no more than his fellow workman."[145] In contrast, Eldridge underscored the appeal of the piece rate to employers and management: "The object of piecework. . . is to get the largest possible output at the least cost."[146] Piecework, he attested, also "enables you to get the 'cream' of the laborers to do your work" because "there is no place for the 'drone' in the piecework system, as he will be pushed aside and eventually crowded out."[147] Why should "the poorest man in the gang" who struggled to load eight to ten trams receive the same pay as the "best man"?[148] In a day-rate system, the top workers, Eldridge explained, would soon decrease their pace to match the slower workers because there was little motivation to work harder if everyone made the same rate. In time, companies would lose money and plants would run less efficiently.

In contrast to Eldridge's enthusiastic endorsement, Karl Marx recognized how the piecework system privileged employers and exploited workers. In *Capital*, he

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[144] Eldridge, "The Piecework or Unit System of Handling Ties and Timber," 204.

[145] Ibid., 209.

[146] Ibid., 203.

[147] Ibid., 204.

[148] Ibid., 209.

pronounced it “the form of wages most in harmony with the capitalist mode of production.”[149] This system, Marx maintained, gave a worker the illusion that it was in their “personal interest” to “strain his labor power as intensely as possible,” ultimately prompting “the capitalist to raise more easily the normal degree of the intensity of labor” and pushing the worker to “lengthen the working day.”[150] Piecework, Marx assessed, was rife with “capitalistic cheating” because an overseer, inspector, or company official judged how much a worker should be paid based on the amount produced.[151] Owners and managers—the “capitalists” Marx critiqued—could also slash piece rates if they found that workers earned too much or they needed to cut costs.

Researchers studying the implementation of the piecework system in specific industries echoed Marx’s concerns. Investigating how mechanization affected the labor environment in the New England textile industry, historian David Zonderman demonstrates that “there was a disturbing sense of uncertainty with piece rates” because workers did not have “an assured or even a constantly predictable wage.”[152] This often led to divisiveness in the workplace, and Zonderman concluded, “Piece rates often did more to discipline and push a work force than any single machine or regulation.”[153] The fierce competition among workers also discouraged collaboration and labor organization, thus offering additional benefits to plant owners and supervisors.

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[149] Karl Marx, *Capital: A Critique of Political Economy, Volume 1* (Chicago: Charles H. Kerr & Company, 1912), 608.

[150] Ibid., 606.

[151] Ibid., 605.

[152] Zonderman, *Aspirations and Anxieties,* 175.

[153] Ibid.

Wood preservers certainly recognized the control and power this system afforded them and they argued there was no better approach for this industry and specifically for southern plants with an African American workforce. C. W. Berry, a founding member of the American Wood Preservers' Association, confidently expressed his faith in the piecework system: "It is not a question with me of believing, but a question of knowing that the piece work is cheaper, better, and more satisfactory."[154] Similarly, the manager of the Atchsion, Topeka & Santa Fe Railway's wood-treating plants, George E. Rex, proclaimed: "We, of course, do piece work, always have done piece work, always expect to do piece work."[155] Southern wood preservers such as Amos Smith, the superintendent of an Arkansas treating plant, were even blunter in their appraisal of piecework: "You cannot make a nigger do much paying him day wages except you stay with him all the time. You can pay him on a piece-work basis and get very good results."[156] Smith's assessment reflected longtime stereotypes of African Americans as lazy workers who needed the careful supervision and oversight of whites to complete their jobs. Piecework, however, offered an alternate approach because it deluded a worker into believing he was, as Eldridge declared, "in business for himself."[157]

William Fisher, who managed the Atlantic Coast Line Railroad's creosoting plant in Gainesville, Florida, heartily agreed with Smith, pronouncing piecework a "very satisfactory way of working negroes" that also proved cost effective.[158] Due to

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[154] *AWPA 1913*, 213.

[155] Ibid., 214.

[156] *AWPA 1914*, 371.

[157] Eldridge, "The Piecework or Unit System of Handling Ties and Timber," 204.

[158] *AWPA 1913*, 213.

piecework, Fisher announced, "We have actually cut our costs in two, to just about half the cost incurred working on the day basis."[159] Perhaps even more significant than the savings, Fisher explained, was the psychological impact of the system on "the negro" who "likes to think that he is beating you."[160] Fisher and Smith's comments, however, indicated that black workers who believed this labored under a serious misconception, reinforcing Marx's critical evaluation of the piecework system.

An article in the *Railway Age Gazette*, detailing the capabilities of the Gainesville plant that Fisher managed, provided additional details on the suitability of the piecework system for the "negro labor" employed there. Piecework, the author explained, offered "great stimulation to the negro," which made even this type of laborer "a fairly satisfactory hand."[161] This perceived need for "stimulation" among black employees echoed the racist ideas that Smith and Fisher articulated, and evidence suggests this attitude was widespread. In a 1917 issue of *Railway Maintenance Engineer*, J. T. Bowser—identified as an experienced "handler" of black railroad track laborers in Kentucky—appraised the qualities and characteristics of "the negro" as a laborer.[162] Although he insisted black workers should be "properly handled," Bowser commended virtues that were in reality stereotypes: "He is a born imitator and readily acquires a very considerable skill at almost any kind of ordinary work, if he is intelligently directed." He also characterized black workers as exhibiting "an almost childlike pride in his skill" and

[159] Ibid.

[160] Ibid.

[161] "The Creosoting Plant of the Atlantic Coast Line," *Railway Age Gazette* 57, no. 3 (1914): 126.

[162] J. T. Bowser, "The Stayer and the Drifter," *Railway Maintenance Engineer* 13, no. 2 (February 1917): 38-40.

found that they reacted “quite readily to the stimulation of rivalry or pride of achievement.”[163] It was this “childlike pride” and response “to stimulation of rivalry or pride of achievement” that southern wood preservers believed they could exploit using the piecework system.[164]

In addition to these allegedly “innate” racial characteristics, white supervisors implied that African Americans’ history and experience living and working in the tightly regulated and stratified slave and then Jim Crow society made them ideally suited to piecework. Kenneth Hanger, a veteran overseer of black railroad track laborers in Arkansas, explained how this history worked to whites’ advantage. “For supervision, the negro does not need constant nagging, watching, teaching and checking up,” he recommended, “but one must remember that his training of a lifetime has been that, when a white man in authority spoke to him, he was to do as he was told, and that his boss really meant what he said.”[165] This “lifetime” of “training,” Hanger claimed, made African Americans exemplary workers who asked for “fewer special privileges than any class of foreign labor.”[166] Hanger encouraged white supervisors to continue reinforcing this “training” by providing “intelligent supervision” and demonstrating their authority over black workers with “firm, sometimes stern” discipline. If you “make as much allowance for his racial traits as you would for south Europeans and Mexicans,” Hanger concluded, “the negro will do more work and cause less trouble than any of the lot.”[167]

[163] Ibid., 38.

[164] Ibid.

[165] Hanger, “Characteristics of the Negro,” 38.

[166] Ibid.

[167] Ibid.

Bowser, also a white manager, supported Hanger's assessment, calling for a unique "method of handling" African Americans with "discipline of a peculiar sort."[168] "Good-natured firmness with an occasional indulgence," according to Bowser, met the needs of "negro" workers who had "something childlike in his makeup" that necessitated this sort of treatment.[169] Employing similar language, a writer for the *Railway Age Gazette* argued, "No class of laborer is so dependent upon intelligent and experienced supervision as the negro."[170] Other white supervisors and railroad engineers provided even more unvarnished and disparaging assessments of black workers and the treatment they deemed appropriate from white foremen. F. E. Lawrence, listed as a supervisor of the Central of Georgia Railway which operated the railroad's creosoting plant near Macon, candidly shared his views in a feature article also published in the same trade publication. Lawrence regarded black workers' "absolute improvidence" as an "established fact," maintained they had "no initiative," and insisted they possessed "the intellect of a child and must be treated accordingly."[171] He endorsed several strategies to manage what he referred to as these "elemental characteristics." Of paramount importance, he counseled his colleagues, "The foreman must be a despot in that his word is absolute law. If a foreman allows a negro to argue a point or to hesitate in carrying out an order the foreman's value to the company is gone."[172] This comment

[168] Bowser, "The Stayer and the Drifter," 40.

[169] Ibid.

[170] *Railway Age Gazette* 53, no. 3 (July 19, 1912), 106.

[171] F. E. Lawrence, "Methods of Handling Negro Track Labor," *Railway Age Gazette* 53, no. 3 (July 19, 1912), 121.

[172] Ibid.

underscored the pressure that plant owners and management placed on white supervisors to preserve the racial hierarchy. In addition, Lawrence seemed to recommend that supervisors delay pay day or push black workers to buy items on credit from a monthly “commissary train.” This would help keep the African American workforce from walking off the job because “he does not miss the money that he has never received.”[173] “To work the negro successfully,” Lawrence concluded, “he must be well fed and kept contented” and “keep him laughing and singing” and “he will give in return the most efficient service that is possible with so inefficient a machine.”[174]

While Lawrence clearly had little respect for the black workers he dismissed as “inefficient machines,” a white railroad supervisor in Alabama described this labor force’s appeal. Black workers represented, he argued, the “best labor we can get in the south, because they can stand more heat, cold and hardships of all kinds than the white men.”[175] These hardships included exposure to industrial poisons and pollution such as creosote. To continue extracting the level of labor they demanded from African Americans, however, whites also needed to reinforce a superior position. As A. O. Wilson, a railroad engineer for the Seaboard Air Line in Hamlet, North Carolina, admitted, it was “essential” that “a negro be kept impressed with the fact that he is a negro.”[176] In these articles, white supervisors cast themselves in the paternal role of firm but also wise and magnanimous overseers tasked with directing inferior and

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[173] Ibid.

[174] Ibid.

[175] W. J. Edwards, “The Importance of a Good Foreman for Negro Track Laborers,” *Railway Age Gazette* 53, no. 3 (July 19, 1912), 122.

[176] A. O. Wilson, “Strict Discipline Necessary with the Negro Track Laborer,” *Railway Age Gazette* 53, no. 3 (July 19, 1912), 122.

“childlike” African Americans. These insulting evaluations of black laborers highlight the racist tropes white supervisors subscribed to, but they also show how these perspectives further dehumanized and distanced black workers from management and their white counterparts. The “logic” that whites employed also legitimized their decision to isolate black workers to jobs in which they risked their health and safety for meager pay.

While these racist stereotypes clearly influenced managers’ perceptions and treatment of African American workers, the fact that some blacks occupied temporary or seasonal positions at creosoting plants likely also contributed to the idea that these workers were expendable. Historians have documented how African Americans, especially in the early twentieth century, supplemented agricultural work with off-season labor in fertilizer plants, cotton gins, cottonseed presses, lumber mills, and turpentine camps.[177] Evidence suggests they also sought opportunities in the wood-preserving industry. American Wood Preservers’ Association members complained about the high labor turnover at their plants, especially in areas with “an agricultural community.”[178] Apparently, in the American South, this was a particular concern with a black labor force that relied heavily on seasonal agricultural work or sought to supplement sharecropping and tenant farming with work at creosoting plants. George E. Rex, a superintendent of the Atchsion, Topeka & Santa Fe Railway’s creosoting operation, worried about this problem and shared his concerns at a 1918 AWPA meeting: “I am afraid when spring comes and the negro finds 30-cent cotton very inviting we will not have sufficient

[177] Peter Gottlieb, *Making Their Own Way: Southern Blacks' Migration to Pittsburgh, 1916-30* (Urbana: University of Illinois Press, 1996), 23; Jones, *The Tribe of Black Ulysses*, 1-2.

[178] *AWPA 1918*, 59.

labor."[179] Frustrated with seasonal turnovers, another wood preserver bemoaned the fact that "By the time you get them efficient they are gone."[180] E. T. Howson an AWPA member and editor for railway trade publications compared the turnover at timber-treating plants with that of railroads, which "shipped 10 men out to keep one man in the gang."[181]

While some wood preservers such as Rex grew frustrated that agricultural employment pulled workers away from jobs at creosoting plants, others found temporary or seasonal labor schedules beneficial because they could pick up additional workers when plant capacity or orders necessitated a larger labor force. Discussing conditions at the Central of Georgia Railway's creosoting plant, C. K. Lawrence—the railroad's chief engineer— seemed optimistic about the labor prospects in the area. In a November 7, 1912, letter, he reported to the Central's general manager, T. S. Moise, "We seem to have secured some labor at $1.25 per day, and as the cotton season is about ending, it is possible he may be able to secure as many as he will need at that rate until he can work them into the piece rate."[182] Perhaps hinting at the plant's preference for a cheaper and more productive piece rate, Lawrence's comment indicated the plant initially recruited African American workers with the promise of a day wage, before pushing workers into the piece-rate system.

[179] Ibid., 52.

[180] Ibid., 59.

[181] Ibid.

[182] Folder 1254-10, Box 138, Central of Georgia Railway Collection.

Other African Americans sought temporary jobs in creosoting plants as they slowly worked their way out of the South in search of better opportunities. Researching the twentieth-century migration patterns of African Americans, historian Peter Gottlieb profiled one black man, identified as Jasper A., who left his home in Albany, Georgia, before making his way to "the lumber and creosote industries of Florida."[183] While painting oil storage tanks in Jacksonville, Florida, Jasper A. signed up with a labor agent for railroad work in Pennsylvania, and then finally made his way North. As Gottlieb noted, "Each temporary job along these routes led the emigrants to the next leg of their journeys, though they seldom conceived the larger stepwise pattern in advance."[184] Although Jasper A. did not remain in the wood-preserving industry, other African Americans probably moved from one treating plant to another. The AWPA President in 1918 observed, "Many laborers at wood-preserving plants have become wedded to their work, and go from one plant to another." "Every once in a while we get men who tell us of a dozen plants they have worked at," he explained, "They stay several months at one place and then go on to another."[185]

From white supervisors' perspective, black workers' position as seasonal or temporary employees reinforced the prevailing stereotypes about African Americans having a "nomadic instinct" and being unreliable.[186] They did not consider why African Americans might have wanted to escape the hazardous conditions of the wood-

[183] Gottlieb, *Making Their Own Way*, 45.

[184] Ibid.

[185] *AWPA 1918*, 55.

[186] Lawrence, "Methods of Handling Negro Track Labor," 121.

treatment plant or the oppressive racial environment and limited economic opportunities available to them in the Jim Crow South. Just as Jasper A. worked his way northward, over six million other African Americans migrated out of the rural South to more urban areas in the North, Midwest, and West from 1916 to 1970 in search of better living and working conditions.[187]

To combat the wood-preservation industry's high labor turnover and coerce workers into remaining at their plants, some supervisors instituted bonus systems designed to reward workers who stayed in service longer. Plant managers, however, reported that the bonuses did not yield "altogether satisfactory" results.[188] At one plant, employees received an end-of-year bonus based on a percentage of their wage and the length of time employed for the company. To supervisors' dismay, "out of 250 men employed at that plant only 65 showed up for work during the week after they had received this extra money." The Santa Fe Tie and Lumber Preserving Company offered a bonus at six-month intervals to employees, which managers pronounced successful to a degree. As the plant supervisor explained, "There is no question but that the prospect of this bonus has helped us to hold men for six months, but when it is paid we did not have a negro on the job for four days."[189] It is unclear from this comment if the speaker insinuated that African American workers went on benders after receiving their bonus and then failed to report for work, or if he meant they quit altogether after receiving the bonus. Regardless, wood preservers' discussion of the bonus system reinforces the

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[187] Isabel Wilkerson, *The Warmth of Other Suns: The Epic Story of America's Great Migration* (New York, NY: Random House, 2010).

[188] *AWPA 1918*, 57.

[189] Ibid.

challenges of finding and maintaining a creosoting plant's labor supply. Apparently, bonuses did not offer sufficient incentive to keep many men employed for longer than six months at a time.

To aid in their efforts to attract workers but also harness as much of their labor as possible, companies in the American South often housed workers onsite. While this strategy increased production and efficiency at creosoting plants, it also provided management with a way to supervise and control its labor force, especially black workers. Although archival information on housing at plants is limited, it seems to have ranged from more temporary camps and shacks on plant property to well-established company towns. The quality of the housing also seems to have varied greatly depending on the location of the plant and the workforce performing the labor, with African American workers segregated in the least developed and desirable areas.

At the 1918 American Wood Preservers' meeting, members discussed the need to "provide proper living and working conditions for the men," including "shower baths" which they thought might "make the work attractive," especially for those "handling 'black' ties" or creosoted ties, a job they recognized as particularly messy and unpleasant.[190] This job was one they reserved for African Americans, but members did not address whether they would have access to these facilities. Another attendee at the 1918 convention who supervised timber treating operations for a railroad, recommended modified box cars as housing for the plant's black labor force.[191] For railroad-operated plants in more remote locations, box cars likely provided a cheap

[190] Ibid., 49

[191] Ibid., 58.

living option, especially for the black workers they typically viewed as less than human, but the box cars also served a marked contrast to the housing that plants offered white supervisors and employees. During negotiations with the Central of Georgia Railway, for example, Stewart, the white plant supervisor demanded the railroad build him a house with "a buffet in dining room, kitchen cabinet, seats and cozy corners, cupboards and various things" because "there is nothing available fit for a white man to live in in this section."[192] Although Stewart did not address whether the plant provided housing for black workers, it was clear from his correspondence that he did not find the available accommodations up to white standards.

In other cases, the silence on housing available to black employees speaks volumes. The International Creosoting and Construction Company in Galveston published a promotional tract on their wood-preservation facilities in 1903, which featured a photograph of the plant's modern-looking "quarters for white employees."[193] The housing for black employees was apparently not a selling point in these advertisements although the company's plants in Galveston, Beaumont, and Texarkana relied on a significant African American workforce.[194] Similarly, the writer of a 1915 newspaper article promoted the "pretty" housing options available for certain workers at the Argenta Tie Plant, an extensive creosoting plant that operated on 84 acres outside

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[192] August 15, 1917 Letter from C. K. Lawrence to F. H. Stewart, Folder 1254-12, Box 139, Central of Georgia Railway Collection; July 29, 1912 Letter from F. H. Stewart to C. K. Lawrence, Folder 1254-8, Box 138, Central of Georgia Railway Collection.

[193] This is the caption on a photo at the beginning of this publication. No page number is given. International Creosoting and Construction Company, *A Treatise on Wood Preservation* (Galveston, Texas: Engraving and Print by American Lumberman, 1903).

[194] See photos of workers in International Creosoting and Construction Company, *A Treatise on Wood Preservation*.

of Little Rock, Arkansas. Some workers enjoyed “handsome four and five-room cottages” that featured porches, climbing vines, electricity, indoor plumbing, and natural-wood interiors. A “nine-room boarding house” provided another option, perhaps more suitable for workers without families. Almost as an afterthought, the writer admitted the existence of housing for the plant’s African American workers, but also reassured white audiences that these were not within close proximity to white housing: “In the rear of these, but some distance removed, are the negro quarters.”[195]

While the silence on the subject of black accommodations is striking in the above cases, records of the Norfolk Creosoting Company offer a clearer portrait of the housing inequalities African American employees experienced. Owners of the Norfolk plant collected an unspecified rent from its employees residing onsite, but they built very different residences for their white and black workers. An inventory of property in 1930 detailed the segregated housing options that had been in use for over thirty years. Plant owners spent $12,500 to build the “very large” residence of the white superintendent, which had “14 rooms,” and also spent another $12,500 to build five houses occupied by white employees.[196] In contrast, the plant only expended $8,000 to construct “16 houses,” or “negro shacks” as they are referred to in other correspondence.[197] This cost difference demonstrates that black employees’ quarters were considerably less spacious and grand than housing available for the superintendent or white workers. The

[195] “Tie Plant a Big Local Industry,” *Arkansas Gazette* (Little Rock), December 12, 1915.

[196] “Memorandum on Plant Inventory,” Folder 1922 to 1944 1956 and nd, UVA MSS 5707; “Property Schedule: November 1, 1930, Buildings,” Folder financial analyses, Box 1, MSS 5507, Norfolk Creosoting Company Records.

[197] Ibid; July 14, 1928 Letter from William Atwood to Loomis Burrell, Folder Loomis Burrell Correspondence 2 of 2, Box 1, MSS 5507, Norfolk Creosoting Company Records.

larger number of houses available to black employees at the Norfolk plant suggests much of the plant's labor force was African American, but also that there might have been more limited housing options offsite for African Americans.

The Norfolk plant did not even provide "sanitary toilets" for the African American residences until 1930 when the state's Sanitary Commission ordered it to do so. In response to this edict, the plant managers spent $759 to add creosoted toilets "at the colored houses."[198] The company's attempt at compliance underscores long-term inequalities in living conditions, but it also further demonstrates that African American workers continued to confront creosote when they clocked out of work each day.

Although employees at the Norfolk plant might have enjoyed alternate housing options in Norfolk—a more urban area—these options were scarce or nonexistent in rural or remote areas with creosoting plants. In these cases, some enterprising wood preservers constructed company towns similar to those developed around textile factories, mines, lumber mills, and turpentine operations. In the early 1920s, James Graham Brown, a real estate developer and lumberman, launched the Brown Wood Preserving Company in Tuscaloosa County, Alabama, which specialized in creosoting utility poles. Brown also operated another plant in Louisville, Kentucky.[199] With the Alabama business expanding and the number of employees increasing, he soon carved out a community—Brownville—around the plant. As a *Tuscaloosa News* article explained in 1965, Brown Wood Preserving Company owned "all the houses, the only

[198] "Memorandum on Plant Inventory," Folder 1922 to 1944 1956 and nd, MSS 5707; "Property Schedule: November 1, 1930, Buildings," Folder financial analyses, Box 1, MSS 5507, Norfolk Creosoting Company Records

[199] John E. Kleber, "James Graham Brown," in *The Kentucky Encyclopedia* (Lexington: University Press of Kentucky, 2015), 128.

store, the only industry, the train and even the railroad line."[200] A post office, segregated schools, a church, and a theater also met the needs of employees of the plant and their families. As former Brownville resident Buford Miller recalled in a 2001 interview, "Everybody who lived there at that time worked for Brown Wood Preserving Co."[201]

Articles about Brownville suggest that at its zenith, about 300 to 400 people called the town home. Former residents remembered that "all of the company buildings, including the houses, were treated with the creosote preservative used on the poles, giving them a dark brown hue."[202] Families lived in segregated quarters with whites residing in "four-room houses mostly to the east of the plant" while black workers and their families "lived in smaller, shotgun shacks on the west side of the pole yard.[203]" Some white managers enjoyed more modern amenities in their homes, but most employees did not have indoor plumbing or heat.[204] The Brown Wood Preserving Company also recouped money on its properties, renting them to employees and their families for $1 per room each month, as one resident reminisced.[205] This description of life in Brownville also illustrates the extent to which employees and their families came in contact with creosote. They worked around the toxic preservative all day and tromped over plant grounds soaked in the substance whenever they walked around the property.

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[200] Delbert Reed, "Brownville," *Tuscaloosa News*, May 2, 1965.

[201] Robert DeWitt, "Just Memories Remain," *Tuscaloosa News*, July 11, 2001.

[202] Ibid.

[203] Ibid.

[204] Ibid.

[205] Ibid.

Then, when they came home to rest, sat in church, or shopped in a store, they remained surrounded by creosote-coated buildings.

While many former white residents looked back at Brownville nostalgically, reflecting on the town's self-sufficiency and the sense of community among residents, the silence on the subject of race relations is striking. Company towns like Brownville represent what geographer Andrew Herod describes as "spatial engineering" or the "deliberate manipulation of the landscape—for purposes of social engineering."[206] Isolating African American workers in shacks separate from nicer white houses reinforced racial divisions, but it also conveyed the company's control over its residents and workers.

Similar to many lumber and mining companies, Brown's creosoting enterprise exerted further control over workers by refusing to pay them with legal tender. Instead, the company compensated them with company scrip or "joogaloo" as Brownville residents referred to it.[207] This scrip could only be redeemed at the company store, which gave Brown Wood Preserving an economic monopoly and left workers at the company's mercy. Employees possessed no leverage to protest prices or choose where they wanted to spend their hard-earned money because there was no other option in the rural outpost. Even if they had other stores to patronize, they possessed no legal tender. While company stores such as the one in Brownville often allowed residents to purchase items on credit, which offered a measure of flexibility to impoverished families,

[206] Andrew Herod "Social Engineering through Spatial Engineering: Company Towns and the Geographical Imagination," in *Company Towns in the Americas: Landscape, Power, and Working-Class Communities* edited by Oliver J. Dinius, Angela Vergara (Athens: University of Georgia Press, 2011), 210.

[207] Robert DeWitt, "In A Company Town, There's Only One Way," *Tuscaloosa News*, July 11, 2001.

this practice could also lead to debt bondage. As singer Merle Travis lamented, employees often found they "owed their soul to the company store."[208] Some former residents' also hinted at this potential for exploitation in their accounts. Reflecting on the power structure in Brownville, one former community member described the company and its community as a "benevolent dictatorship" because "in a company town, there's only one way."[209] While Brown Wood Preserving Company remains open today under different ownership, the houses and other remnants of the company town have been abandoned, torn down, and "reclaimed" by nature.[210] Brownville, like many once thriving company boomtowns is now a ghost town, leaving behind many unanswered questions about life and work in the community, especially from the perspective of African American workers and their families. Eugene Tucker's memories of life in another company town centered around a wood-treatment facility, however, help fill in these critical gaps.

Tucker, an African American whose ancestors "had arrived chained in the bowels of slave ships," was born in 1935 in a Mississippi company town built around a tie plant and aptly referred to as "Tie Plant."[211] Tucker's father worked at this creosoting facility—located in the woods near Grenada—which Tucker recalled, "provided cross ties for the railroads and poles for electric companies" and served as "an employer of many

[208] Ibid.; Merle Travis, "Sixteen Tons," *Folk Songs of the Hills*, Capital Records, 1947.

[209] DeWitt, "In A Company Town, There's Only One Way," July 11, 2001.

[210] John L. Hunt and Hoyt B. Ming, "People Move Out; Nature Takes Over," *Tuscaloosa News*, May 27, 1999.

[211] Eugene Tucker, *Democracy As We Lived It* (First Library Writing Group: 2005), viii.

Negroes in Mississippi."[212] Tucker described his father's limited pay for the "long hours of hardship" spent hefting treated timber and "working on the cranes."[213] As he observed, creosoting fit with the typical, limited employment opportunities available to African Americans in Mississippi and the broader region.

> Working in hot creosote, logging, railroads, highways, saw mills and the fields were employment opportunities of Negroes here in Mississippi. Strength and endurance were important attributes. They were in no position to bargain for wages and benefits. Business owners could get the work done for only a few dollars per week. Jobs requiring the intellect were not available to Negroes in this town. This was our town.[214]

While Tucker vividly recalled the "smell of hot creosote" and how a stream near the plant would "bring the overflow of creosote from the plant with it," his descriptions of racial tension and violence at the plant are even more revealing.[215] Tucker matter-of-factly explained how his father's name had to be changed "because one of the White men had the same name" at the plant.[216] Placing the two workers—one white and one black—on the same level was unconscionable to whites. Forcing a black man to go by a different name demeaned African American employees and reinforced their inferior position in the racial and social hierarchies. Tucker also remembered, "One day one of the foremen brought and exhibited the leg of a Negro man who had been lynched the night before. The leg was later thrown into the fire that heated creosote for processing

[212] Ibid., 43.

[213] Ibid., 181.

[214] Ibid., 43.

[215] Ibid., 163.

[216] Ibid., 43.

the cross ties."[217] Although it is unclear from Tucker's account if the lynching victim worked at the plant, the foreman's macabre display illustrated the violent behavior of the white men supervising black workers, and it also served as a graphic reminder of what might happen to African Americans living and working at the plant.

Harsh conditions at Tie Plant, Mississippi, according to Tucker, prompted some African Americans to strike out in search of better opportunities. Unfortunately, they often did not get very far and found themselves still toiling in creosoting plants, perhaps even for the very same company. Tucker noted that his family relocated from Tie Plant in Grenada, Mississippi, to "an extension of the plant" in Louisville, Kentucky in the 1940s. "Many of the men who left Mississippi in search of a better opportunity found employment here," he recalled.[218] Tucker's family experience provides evidence that African American laborers frequently remained "wedded" to this industry even if they migrated from plant to plant.[219] Thus, their exposure to creosote was often not temporary or seasonal, but rather consistent, and long term. This also meant that even if they escaped the racial violence Tucker observed firsthand in Mississippi, African Americans still had to contend with dangerous working conditions and the enduring impact of creosote.

While Tucker offers an invaluable glimpse into African American life at wood-treatment facilities, this account is an exception in both the historical record and the traditional narrative of the wood-preservation industry, which omits and obscures the

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[217] Ibid., 43.

[218] Ibid., 163.

[219] *AWPA 1918*, 55.

role of African American workers. In spite of archival limitations, however, the industry's attitude toward and treatment of its labor force is visible. An article by James O. Bradney in a 1917 issue of *Wood* Preserving intended to drum up interest in the "labor saving equipment" his company produced, precisely conveyed the industry's longstanding neglect of its employees.

> The cheapest machine on earth is the machine we call man. We employ him at the least wage he will consent to accept, and, as we do not have to oil him or stoke him, we take him as a matter of course, pay him at regular intervals, and when he is worn out we pass him on without concern as to what becomes of him after he leaves the shadow of our roof.[220]

For decades, he confessed, "many of us were careless and entirely indifferent as to how soon our man-machine wore out or what became of him thereafter."[221] This indifference, he implied, had been especially acute in wood-treatment, which he characterized as a "field of hard and killing labor" where many workers' "only stock in trade is brawn."[222] Bradney's article underscored the divide separating industry leaders and workers, or "man machines" as he referred to them, but there was no group of workers regarded less like men than African American laborers, especially those in the Jim Crow South.

Wood-preservers consistently argued and sought to demonstrate that these workers were not men—but rather "devices," "niggers," and "mules." This attitude, bolstered with pseudoscience and racist stereotypes, justified placing African Americans in the most hazardous occupations at wood-treatment plants, and ensured they

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[220] J. O. Bradney, "The Machine Called Man," *Wood Preserving* 4, no. 2 (April-June 1917): 35.

[221] Ibid.

[222] Ibid., 35 and 36.

sustained an unequal proportion of toxic chemicals during the course of their labor. Since the industry regarded African Americans as both inferior and immune to creosote's deleterious effects, their health and safety were not taken seriously. Instead, many black workers at plants labored without the benefit of protective equipment or even the recognition that the substances they worked with were hazardous to their health. This could not be classified merely as "indifference" or carelessness," but rather the "willful and undue exposure" that pathologist Wilhelm Hueper denounced in his exposés on occupational cancer.[223]

Unfortunately for African American workers employed in the wood-treating industry, the environmental inequalities continued even when the industry embraced new preservative treatments in the 1930s and 1940s. Wood preservers promised that creosote's emerging competition—pentachlorophenol (PCP) and copper chromated arsenate (CCA)—offered a "clean" treatment for wood compared with dark, tarry, creosote. Just like their predecessor, however, these preservatives also posed a significant threat, raising the question of whether we should view Bradney's characterization of wood preservation as "hard and killing work" even more literally.

[223] W.C. Hueper, "Environmental and Occupational Cancer*," Public Health Reports: Supplement 209* (Washington, D.C.: United States Government Printing Office, 1948), 50.

Figure 6-1. Pressure-treating fence posts. Forest History Society Photograph Collection, Forest History Society, Durham, N.C.

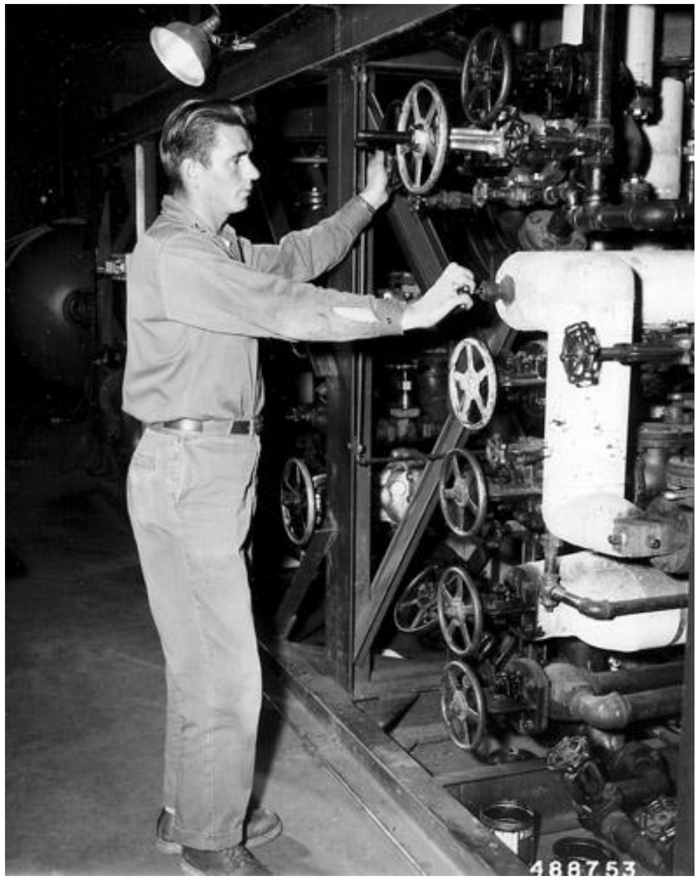

Figure 6-2. Control room of creosote impregnation plant. 1958. Photograph by Bluford Muir. Forest History Society Photograph Collection, Forest History Society, Durham, N.C.

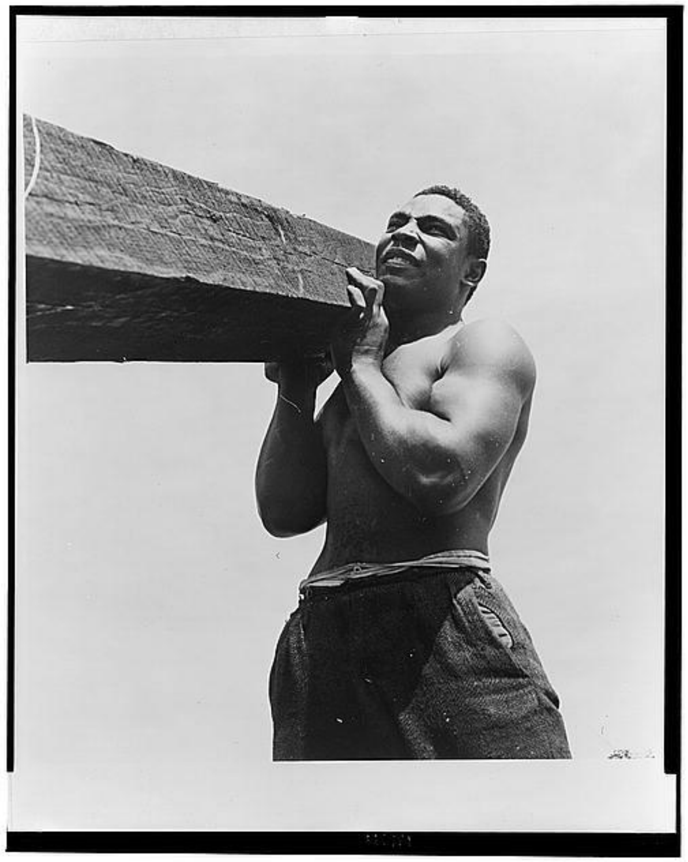

Figure 6-3. Laborer lifting creosoted railroad tie. 1942. Photograph by Howard Liberman. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001041646/PP/.

Figure 6-4. Negro laborers carrying and laying railroad ties for a spur line into a coal storage space for the federal government. 1942. Photograph by Howard Liberman. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001041649/PP/.

Figure 6-5. Loading creosoted utility poles onto railcars. 1936. Photograph by H.E. Whitehead. State Archives of Florida, Florida Memory. https://www.floridamemory.com/items/show/62752.

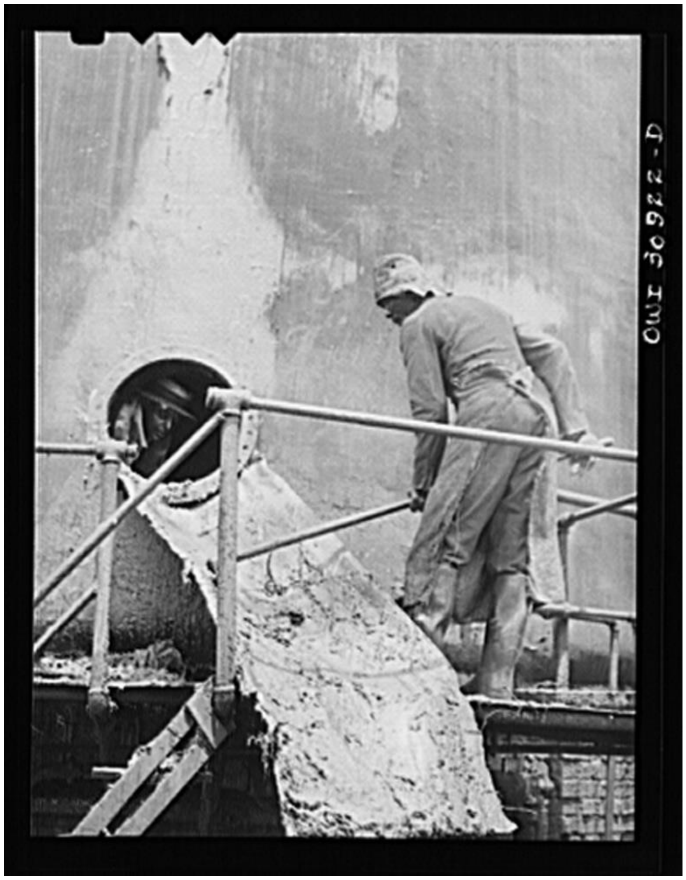

Figure 6-6. Cleaning out a vat in which creosote is stored at the International Creosoting Company. Beaumont, Texas, 1943. Photograph by John Vachon. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001030037/PP/.

Figure 6-7. Woman worker at the International Creosoting plant. This work was formerly done by men. 1943. Beaumont, Texas. Photograph by John Vachon. Farm Security Administration - Office of War Information Photograph Collection, Library of Congress Prints and Photographs Division Washington, D.C. http://www.loc.gov/pictures/item/owi2001030023/PP/.

CHAPTER 7
CONCLUSION: A “CLEAN” TREATMENT FOR WOOD?

A May 1954 advertisement in *Popular Mechanics* depicts a smiling, suburban, homeowner brushing a “clean” wood preservative on his picket fence and lawn furniture to “get extra years of use and satisfaction.”[1] In contrast to the smelly, sticky, black residue coal-tar creosote left behind, a new “modern preservative” known as PENTA—short for pentachlorophenol—was colorless and odorless when applied, but still promised to increase the longevity of “*any* wood article you can build.”[2] Although German chemists first synthesized pentachlorophenol in 1841, the chemical industry did not begin its commercial production until the mid-1930s. In addition to its application as a wood preservative, pentachlorophenol also found use as an essential ingredient in broad-spectrum herbicides, fungicides, mildewcides, and pesticides, which became popular during and after World War II as the United States declared war on enemies—both human and non-human. Dow, Monsanto, and other large chemical companies manufactured a host of pentachlorophenol-based products for Americans’ arsenals at home and abroad.[3]

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[1] “PENTA: The Clean Wood Preservative,” *Popular Mechanics* (May 1954): 262.

[2] Ibid.

[3] Ronald Eisler, “Pentachlorophenol: Chapter 24,” in *Eisler’s Encylopedia of Environmentally Hazardous Priority Chemicals*, 589-606 (Amsterdam: Elsevier, 2007), 589-592; Edmund Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge: Cambridge University Press, 2001), 14; T. S. Carswell and H. K. Nason, “Properties of Pentachlorophenol,” *Industrial and Engineering Chemistry* (June 1938): 622; Karen Summers, *Management Practices for Used Treated Wood* (Palo Alto, California: Electric Power Research Institute, 1995), 1-4 and 2-10.

Unlike creosote, PENTA "leaves a natural appearance, but does not interfere with finishing" and "leaves wood pleasant to handle and work."[4] Although pressure-treating wood remained the most effective technique, this preservative could also be applied in your own backyard without commercial equipment—another selling point for suburban homeowners maintaining their American dream.[5] "Simply flood clean PENTA on with a broad brush, or dip individual pieces before assembling," advertisers recommended.[6] The Dow Chemical Company, which sponsored the advertisement, invited readers to sign up for a free "Handyman's Guide to Home Wood Preservation," which touted PENTA's many uses. Cleanliness emerged as the new preservative's defining characteristic, an assertion that the manufacturer repeated four times in the advertisement.[7]

Novel synthetic treatments such as PENTA captured the attention and interest of post-World War II manufacturers and consumers who shared a fascination with laboratory-created agrochemicals and a devout belief that science and industry could triumph over nature.[8] Throughout the 1950s, Dow Chemical and Monsanto marketed pentachlorophenol products in popular magazines, suggesting that creosote had finally fallen out of favor among wood preservers. These successful marketing campaigns, as

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[4] "PENTA: The Clean Wood Preservative," 262.

[5] Carswell and Nason, "Properties of Pentachlorophenol," 625; Adam Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism* (Cambridge: Cambridge University Press, 2001).

[6] "PENTA: The Clean Wood Preservative," 262.

[7] Ibid.

[8] Paul D. Blanc, *How Everyday Products Make People Sick: Toxins at Home and in the Workplace* (Berkeley: University of California Press, 2007), 231; Christopher J. Bosso, *Pesticides and Politics: The Life Cycle of a Public Issue* (Pittsburgh, Pennsylvania: University of Pittsburgh Press, 1987), 63.

the advertisement described above exemplifies, pushed creosote out of the spotlight. Almost paradoxically, however, the increased popularity and widespread use of synthetic wood preservatives allowed creosote and its dangers to linger out of sight.[9]

The motivating factor behind this transition in the wood-preservation industry did not stem from creosote's environmental, occupational, and public health risks—although researchers had thoroughly documented them by this time.[10] Aesthetics, rather than safety, drove the industry's search for alternatives. In a 1939 article published in the *Journal of Industrial and Engineering Chemistry*, Thomas Carswell and Ira Hatfield, chemists working for Monsanto, justified the industry's embrace of pentachlorophenol and other "clean" wood preservatives:

> Much of the future for wood in certain industrial applications is dependent upon the development of effective and permanent "clean" treatments which, while protecting the wood against degradation, will not alter its characteristic feel or appearance nor interfere with subsequent fabrication or application of surface coatings.[11]

According to the industry, for a new generation of consumers particularly concerned with aesthetics, creosote and other "older treatments are inadequate either

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[9] For other examples of pentachlorophenol advertisements see "Monsanto Chemicals in Action," *Life* (March 21, 1955): 18-19 and "Clean Penta-Treated Wood Won't Rot," *Popular Mechanics* (November 1955): 265.

[10] See, for example, United States Bureau of Labor Statistics, *Handbook of Labor Statistics, 1931 Edition* (Washington, D.C.: United States Government Printing Office, 1931), 326; United States Department of Labor, Bureau of Labor Statistics, *Occupation Hazards and Diagnostic Signs No. 582* (Washington: United States Government Printing Office, 1933), 12, 26, 47. Paul Blanc also provides a broad overview of research on creosote's dangers in *How Everyday Products Make People Sick: Toxins at Home and in the Workplace*.

[11] T. S. Carswell and Ira Hatfield, "Pentachlorophenol for Wood Preservation," *Industrial and Engineering Chemistry* (November 1939): 1431.

because of their color, odor, or lack of permanence, or because of adverse effects upon the appearance of the treated products."[12]

Instead of a dark, tarry substance that seeped from treated timber and appeared anything but healthful, PENTA seemed innocuous because it was virtually undetectable once applied, a characteristic that significantly enhanced the appeal of treated timber among Americans who desired to protect the symbols of their increased material wealth and leisure.[13] The perceived invisibility of PENTA, and the new generation of wood preservatives it represented, brought these toxic chemicals even closer to home as consumers purchased treated timber for playground equipment, lawn furniture, decks, fences, landscaping material, and countless other home-improvement projects.[14] While PENTA and this new class of wood treatments left timber looking more natural, these chemical preservatives were decidedly unnatural. Similar to coal-tar creosote and the wood preservatives that preceded it, these synthetic treatments also proved incredibly toxic—to wood-destroying organisms, but also to people and the natural environment.[15]

The most significant health risk associated with pentachlorophenol is that chlorinated dioxins, a compound similar in chemical structure to the infamous tactical herbicide Agent Orange, are a byproduct of its manufacturing process. When wood

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[12] Ibid.

[13] Mechanical Wood Products Branch, Forest Industries, *Wood Preservation Manual* (Rome: Food and Agriculture Organization of the United Nations, 1986), 33; Barry A. Richardson, *Wood Preservation* 2nd ed. (London: E & FN Spon, 1993), 162. For a discussion of consumer culture in America in the post-WWII period, see Lizabeth Cohen, *A Consumers' Republic: The Politics of Mass Consumption in Postwar America* (New York: Knopf, 2003).

[14] Carolyn M. Goldstein, *Do It Yourself: Home Improvement in 20th-Century America* (New York: Princeton Architectural Press, 1998), 11 and 31;

[15] Blanc, *How Everyday Products Make People Sick*, 219.

preservers treated timber with PENTA and released dioxins into the environment, they exposed workers, nearby residents, and consumers to these chemicals, which researchers have linked to “cancer, immune system abnormalities, and birth defects” as well as skin conditions such as “chloracne,” a sort of “industrial leprosy.”[16] Another popular post-World War II wood preservative, chromated copper arsenate (CCA), releases dioxins when burned, but the arsenic it is built from also poses a serious risk because of its carcinogenic nature. Like pentachlorophenol, CCA is related in chemical composition to another renowned, hazardous herbicide—Agent Blue. [17]

At the same time that wood preservers increasingly turned to PENTA and CCA to treat timber, the nation confronted a growing concern about its wholesale application of toxic chemicals. In *Silent Spring* (1962), Rachel Carson, a marine biologist, documented how the chemical industry’s unrestrained use of toxic insecticides such as DDT “silenced the voices of spring in countless towns in America.”[18] She clearly outlined how blanketing the earth with “biocides,” a term she used instead of insecticides, threatened all forms of life, not just the intended targets.[19] Carson provided readers with powerful images of the effects of DDT as vegetation “withered,” streams became “lifeless,” and “a

[16] Blanc, *How Everyday Products Make People Sick*, 237 and 232; Brett Fisher, “Pentachlorophenol: Toxicology and Environmental Fate,” *Journal of Pesticide Reform* 11, no. 1 (Spring 1991): 5.

[17] William R. Cullen, *Is Arsenic an Aphrodisiac?: The Sociochemistry of an Element* (Cambridge: Royal Society of Chemistry, 2008), 257-258; Blanc, *How Everyday Products Make People Sick*, 237-238. Alvin L Young provides a detailed history of these tactical herbicides in *The History, Use, Disposition and Environmental Fate of Agent Orange* (New York: Springer, 2009).

[18] Rachel Carson, *Silent Spring* (1962; repr., Boston: Houghton Mifflin Company, 2002), 3. For a discussion of Rachel Carson’s life and legacy, see William Souder, *On a Farther Shore: The Life and Legacy of Rachel Carson* (New York: Crown Publishers, 2012) and Linda Lear, *Rachel Carson: Witness for Nature* (New York: H. Holt, 1997).

[19] Carson, *Silent Spring*, 8.

shadow of death" descended.[20] These visible changes, Carson explained, "reflect the web of life—or death—that scientists know as ecology." But "there is also an ecology of the world within our bodies," Carson innovatively argued, and pesticides disrupted this ecology.[21] While Carson's exposé directed considerable attention at DDT, she included the popular wood preservative, pentachlorophenol, and arsenical-based biocides, such as CCA, in her discussion of other "elixirs of death."[22] Marshalling evidence from countless case studies and correspondence with citizens and researchers throughout the world, she warned, "It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth."[23]

Although the diverse and complicated history of the environmental movement resists simplified timelines and interpretations, Carson's chilling exposé on pesticides, as one scholar argues, "lit the fuse" on the "powder keg" of U.S. environmentalism.[24] *Silent Spring* convinced many Americans to be vigilant about their environmental health, many of them, as environmental journalist Philip Shabecoff notes, "out of fear—fear of cancer or other disease caused by toxic substances, fear for the future of their children."[25] Although Carson forced Americans to consider the consequences of

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[20] Ibid., 2-3.

[21] Ibid., 189.

[22] Ibid., 36 and 17.

[23] Ibid., 297.

[24] Philip Shabecoff, *A Fierce Green Fire: The American Environmental Movement* (New York, Island Press, 1993), 102. For a discussion of the origins and complicated trajectory of the modern environmental movement, see Robert Gottlieb, "Reconstructing Environmentalism: Complex Movements, Diverse Roots," *Environmental History Review* 17, no. 4 (Winter 1993): 1-19.

[25] Shabecoff, *A Fierce Green Fire*, 109.

deploying toxic chemicals, wood-preservation's link to the conservation of natural resources shielded it from the regulatory oversight and backlash that other toxic industries faced. Deceptive terminology also deepened this misunderstanding. While the wood-preserving industry referred to the chemicals it applied as "preservatives," Carson's label is a more accurate one because it was biocidal toxicity that made creosote, pentachlorophenol, and CCA effective at thwarting rot, decay, and wood-destroying organisms.[26]

Nevertheless, when tabulating pesticide production and consumption, researchers often excluded wood preservatives from their calculations.[27] Omitting these biocides seriously misrepresented the hazards of this industry. In 1982, the U.S. Environmental Protection Agency (EPA)—established in 1970—reported that creosote, pentachlorophenol, and CCA "comprised roughly one third of the 2.7 billion pounds of pesticides produced for both agricultural and industrial uses."[28] Consumer advocacy groups such as Beyond Pesticides reinforce these figures. Jay Feldman and Terry Shistar, scholars and activists, authored a 1997 report, "Poison Poles," in which they contended wood preservatives accounted for "the single largest pesticide use in the United States."[29] These conclusions are even more alarming when one considers the

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[26] Forest Products Laboratory, *Testing Wood Preservatives* (Madison, Wisconsin: United States Department of Agriculture, Forest Service, Dec. 1938).

[27] Shirley A. Briggs, *Basic Guide to Pesticides: Their Characteristics and Hazards* (Washington, D.C.: Taylor & Francis, 1992), xii; Jennifer Curtis, Tim Profeta, and Lawrie Mott, *After Silent Spring: The Unsolved Problems of Pesticide Use in the United States* (New York: Natural Resources Defense Council, 1993), 51.

[28] United States Environmental Protection Agency, *EPA Pesticide Fact Sheet: Wood Preservatives* (Washington, D.C.: Office of Pesticides and Toxic Substances, 1984), 1.

[29] Jay Feldman and Terry Shistar, "Poison Poles: A Report About Their Toxic Trail and Safer Alternatives," (Washington, D.C., National Coalition Against the Misuse of Pesticides, 1997),

sheer number of wood-treating facilities—795, according to Feldman and Shistar—that once spread across the nation.[30] (Figure 7-1) While not all of these locations are formally recognized as "Superfund" sites eligible for federally funded cleanup, they all share a similarly hazardous history.[31]

Although the conflation of wood preservation and environmental stewardship misled many consumers and regulatory officials, even early wood preservers recognized their treatments required "a poisonous character."[32] It took much longer, however, for agencies to act against the threat. In 1984, as part of an update to the Federal Insecticide, Rodenticide, and Fungicide Act (FIFRA), the EPA launched a review of what one researcher describes as the "trinity of toxic wood preservatives"—creosote, pentachlorophenol, and CCA.[33]

Under FIFRA, the EPA reviews wood preservatives and other biocides approximately every 15 years and then decides whether to re-register or restrict how they are sold and distributed. Although wood preservers employed creosote long before the federal government enacted this legislation, this preservative, as its proponents

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http://www.beyondpesticides.org/programs/wood-preservatives/publications/poison-poles (accessed September 10, 2017).

[30] Ibid.

[31] Harold C. Barnett, *Toxic Debts and the Superfund Dilemma* (Chapel Hill: University of North Carolina Press, 1994).

[32] W. F. Goltra, "History of Wood Preservation," *Proceedings of the Ninth Annual Meeting of the American Wood Preservers' Association* (Baltimore: The Peters Publishing and Printing Company, 1913), 178.

[33] Philip Shabecoff, "E.P.A. TO LIMIT THE SALE OF 3 WOOD PRESERVATIVES," *New York Times*, July 12, 1984; Blanc, *How Everyday Products Make People Sick*, 238.

have proudly noted, “has been continuously registered under FIFRA since 1948.”[34] While the EPA decided to restrict creosote, pentachlorophenol, and CCA biocides to use by “certified applicators” in 1986, it did not limit the sale of products treated with these chemicals, only the method of application.[35] The potential “economic impact of cancelling each use,” determined with input from the wood-preservation industry and other major consumers of treated wood, played a key role in the EPA’s decision not to ban any of these major preservatives.[36]

Creosote has benefited from a determined and powerful interest group, the Creosote Council, which has been instrumental in ensuring that the EPA continues to re-register this biocide. Formed in 1986 when the EPA attempted to crack down on wood preservatives, this lobbying group is made up of creosote producers and pressure treaters, including some of the largest manufacturers of treated wood products and their resulting pollution. The Creosote Council defines its mission as underwriting “all of the creosote health, safety, environmental, and other studies required by the Environmental Protection Agency to support coal-tar creosote’s re-registration as a pesticide.”[37] As two members of the Creosote Council stated in a 2008 article for the Railway Transportation Association, this special-interest group spent more than $27 million over a period of

[34] David A. Webb and Lawrence S. Ebner, “U.S. EPA Approves Continued Registration of Creosote,” *Crossties* (January/February 2009): 19.

[35] Ibid.

[36] United States Environmental Protection Agency, *Wood Preservative Pesticides: Creosote, Pentachlorophenol, and Inorganic Arsenicals, Position Document 4* (Washington, D.C.: Office of Pesticides and Toxic Substances, July 1984), 27.

[37] Creosote Council, “Research,” Creosote Council, http://www.creosotecouncil.org/creosote-research/ (accessed September 10, 2017).

twenty years “to support continued registration of creosote.”[38] This close relationship between creosote’s advocates and the EPA lend credence to some critics’ claims that the organization has become a “polluter’s protection agency” rather than an environmental protection agency.[39]

Even today, the Council conducts its own research on the benefits and risks, writes position papers supporting creosote, challenges consumer and environmental groups, and collaborates with the EPA to ensure creosote’s endurance.[40] With the Creosote Council in its corner, American railroads installed an estimated 20 million creosote-treated wood ties in 2012 alone.[41] During the EPA’s re-registration of creosote in 2008, agency officials found that “99% of the US market of wood treated railroad crossties, bridge, and switch ties are treated with creosote.”[42] Ultimately, the EPA consistently determines that creosote’s effectiveness and economic value still made it the toxic treatment of choice, and it justifies, “Economic considerations are particularly relevant to railroads and other public works uses because increased costs are frequently passed on to the public.”[43]

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[38] Webb and Ebner, “U.S. EPA Approves Continued Registration of Creosote,” 19.

[39] E. G. Vallianatos and McKay Jenkins, *Poison Spring: The Secret History of Pollution and the EPA* (New York: Bloomsbury Press, 2014), 1. The authors address the wood preservation industry on page 145.

[40] Ibid.

[41] Creosote Council, “History,” Creosote Council, http://www.creosotecouncil.org/creosote-research/.

[42] United States Environmental Protection Agency, *Reregistration Eligibility Decision for Creosote (Case 0139)* (Washington, D.C: United States Environmental Protection Agency, 2008), 34.

[43] Ibid., 35.

As the previous chapters demonstrate, the wood-preservation industry's concern with cost-savings is not a new focus, but it is a dangerous one. Public health historians, including Gerald Markowitz and David Rosner, have documented how various industries such as lead and vinyl concealed information about the dangers of their products while manufacturing and controlling scientific evidence to support their continued operations. As they observe, "Industry has always taken the position that there is no reason to hold up production of useful products if no danger has been proven," even when safety cannot be assured.[44] The histories of lead, vinyl, asbestos, and radium, which industries unwaveringly defended, demonstrate the perils of this position.[45] Despite a consensus among scientists, medical professionals, and government agencies about the toxicity of preservative biocides, wood preservers continue to claim that following industry-approved guidelines successfully minimizes any risks the treatments pose to consumers, workers, and the environment.[46] The Creosote Council makes an even more confident, brazen statement on its website: "In all of this research, no evidence of any significant risk has emerged, either to the general public or to workers at creosote treatment facilities or in the field where creosote treated wood is used."[47]

The experiences of Patsy Ruth Oliver and other citizens living in communities plagued with pollution or workers sickened after prolonged exposure demonstrate the

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[44] Gerald Markowitz and David Rosner, *Deceit and Denial: The Deadly Politics of Industrial Pollution* (Berkeley: University of California Press, 2002), 4.

[45] Ibid., 4.

[46] Nicholas P. Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production Volume 2: Best Practices in the Wood and Paper Industries* (Amsterdam: Elsevier, 2010), xii.

[47] Creosote Council, "Research," Creosote Council.

failures of an industry-knows-best approach to research and regulation. Trusting companies to protect our homes, workplaces, and communities is difficult when wood preservers have a long history of exposing certain groups, particularly African American workers, to a disproportionate share of the toxic chemicals the industry manufactured.[48] Lois Gibbs, the famed activist who challenged pollution in her community of Love Canal, in Niagara Falls, New York, and who now serves as the executive director of the Center for Health, Environment, and Justice, casts doubt on the industry's ability to protect people and the environment. "Wood preservatives are the culprit chemicals in contaminating hundreds of communities across the country," she concludes. "There is no good reason to allow the poisoning to continue."[49]

In contrast to the United States, many countries including Canada and the member states of the European Union severely restricted and even banned the use of creosote, pentachlorophenol, and CCA years earlier. The U.S. "almost stands as an island unto itself with the industry's continued dependence on creosote coal tars, pentachlorophenol, and arsenicals," argue Nicholas P. Cheremisinoff, a chemical engineer, and Paul E. Rosenfeld, an environmental chemist.[50] Curiously, American wood preservers' reliance on creosote has been the hardest to break. Once American railroads finally embraced it, creosote paved the way for the wood-preservation industry

[48] For a discussion of environmental inequalities in the wood-preservation industry, see Chapter 6 of this dissertation.

[49] Gibbs's comment appears in the press release to Feldman and Terry Shistar, "Poison Poles: A Report About Their Toxic Trail and Safer Alternatives," http://www.beyondpesticides.org/programs/wood-preservatives/publications/poison-poles/no-title98.

[50] Cheremisinoff and Paul E. Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production*, 1.

in the U.S., and it has remained the longest-running preservative of choice. After almost two centuries of applying this toxic treatment, journalist Alan Zagier emphasizes, "the wood treatment industry is in no hurry to abandon the horse it came in on."[51]

Although the industry increasingly employed PENTA and CCA preservative treatments, creosote never disappeared entirely from use. Even Carswell and Hatfield, the Monsanto chemists touting pentachlorophenol, admitted that creosote would still have specific applications for railway ties, piling, and more industrial projects.[52] Adapting to the changing times, most plants embraced these new preservatives, but also continued to preserve timber with creosote. Using all the chemicals at their disposal, wood preservers even began combining creosote with these more modern treatments to increase effectiveness, creating a toxic cocktail of wood preservatives. Some facilities, for example, pressure treated telephone poles with a solution of creosote, petroleum, and pentachlorophenol.[53] Similarly, a dual treatment of creosote and CCA proved particularly effective at resisting the teredo's advances.[54] While it faded from public view, creosote still made up the bulk of preservative used in the United States.[55]

Plants' application of multiple preservative treatments complicates the pollution problems and cleanup attempts because different contaminants typically require

[51] Alan Scher Zagier, "Creosote: 'Witch's Brew,'" *Naples Daily News*, May 24, 2004.

[52] Carswell and Ira Hatfield, "Pentachlorophenol for Wood Preservation," 1431.

[53] Henry B. Steer, *Wood Preservation Statistics: 1949* (n.p.: United States Department of Agriculture, Forest Service, 1950), 17.

[54] Paul E. Rosenfeld and Lydia Feng, *Risks of Hazardous Wastes* (Burlington, MA: Elsevier, Inc., 2011), 98.

[55] United States Environmental Protection Agency, *EPA Pesticide Fact Sheet: Wood Preservatives*, 1.

different methods of remediation. Cleanup efforts often take decades, leaving communities with a sense of hopelessness and despair.[56] "At this rate," one frustrated Gainesville, Florida, resident predicted, "I think nature will clean it up before people do."[57] The industry's long history, which is often underestimated and poorly documented, further exacerbates these problems. "There are wood-treating facilities in the USA that have been operating for 100 years and have eight or more decades of cumulative spills to property," Cheremisinoff and Rosenfeld reflect.[58] Limited records and knowledge of facilities' early histories contribute to a focus on post-World War II operations, pollution failures, and preservatives—particularly pentachlorophenol and CCA.

As Americans grew more aware of the hazards of synthetic agrochemicals such as DDT, pentachlorophenol and CCA garnered more immediate, negative attention. Publicized ecological disasters in the 1970s and early 1980s such as the dioxin contamination of an entire town—Times Beach, Missouri—sensitized Americans to the dangers of dioxins that lurked in pentachlorophenol.[59] Vietnam veterans and their families also filed lawsuits and shared their tragic stories of health afflictions due to

[56] For a firsthand account of these struggles, see Patsy Ruth Oliver, "Living on a Superfund Site in Texarkana," in *Unequal Protection: Environmental Justice and Communities of Color*, ed. Robert D. Bullard (San Francisco: Sierra Club Books, 1994). Many journalists have also written stories in affected communities such as Gainesville, Florida, and Somerville, Texas. See, for example, Molly Larmie, "Down Stream: Life Goes on In the Shadow of a Toxic Waste Site," *Our Town* 2, no. 1 (Spring 2011): 114-120. Paul Sweeney, a journalist for the *Texas Observer*, has written articles on "Creosote Blues" and the Somerville, Texas, wood-treating site in 1980 and 2008.

[57] "Saving Superfund," *Gainesville Sun*, May 4, 2002.

[58] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production*, xii.

[59] Robert Reinhold, "Missouri Dioxin Cleanup: A Decade of Little Action," *New York Times*, February 20, 1983.

Agent Orange exposure, which contributed to a growing concern about dioxin hazards.[60]

Similarly, in the late 1990s and early 2000s, many Americans learned about what Florida journalist Julie Hauserman described as "the poison in your back yard."[61] Cities across the United States experienced "arsenic scares" when soil tests revealed elevated levels of the poison at children's playgrounds. Arsenic leached out of the CCA-treated timber that municipalities and homeowners installed as safer alternatives to traditional metal playground equipment, which also prompted a reconsideration of CCA-treated timber for decks, boardwalks, gazebos, and other structures.[62] Under increasing pressure from the U.S. Consumer Product Safety Commission and the EPA, many manufacturers of CCA-treated timber agreed to voluntarily cancel most residential uses, effective December 31, 2003. Existing structures treated with CCA, however, did not fall under these agreements, and CCA-treated timber remained available for industrial use and for residential products such as shakes, shingles, posts, and structural timbers.[63]

When the EPA proposed a more stringent labeling requirement, the industry instead negotiated a voluntary consumer awareness program. The result, many concerned citizens, activists, and scholars argue, is woefully inadequate. Blanc, for

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[60] Lois Marie Gibbs, *Dying from Dioxin: A Citizen's Guide to Reclaiming Our Health and Rebuilding Democracy* (Boston, MA: South End Press, 1995); Aaron B. Wildavsky, *But Is It True?: A Citizen's Guide to Environmental Health and Safety Issues* (Cambridge, Mass: Harvard University Press, 1995).

[61] Julie Hauserman, "The poison in your back yard," *St. Petersburg Times*, March 11, 2001.

[62] Blanc, *How Everyday Products Make People Sick*, 237; Cullen, *Is Arsenic an Aphrodisiac*, 70.

[63] U.S. Consumer Product Safety Commission, "CCA-Pressure Treated Wood Chromated Copper Arsenate: What You Should Know," U.S. Consumer Product Safety Commission, https://www.cpsc.gov/PageFiles/122137/270.pdf (accessed August 12, 2017).

example ridicules these attempts, maintaining that they do not “guarantee that every hapless Bob Villa wannabe can’t convert ‘this old house’ into a split-level toxic waste dump.”[64] With pentachlorophenol and CCA under fire, creosote, as one concerned Florida citizen disparaged, remained “under the rug” even though it has been in widespread use for centuries, and its resulting cumulative impact is more extensive.[65] Coal tar creosote has, once again, as wood preserver Samuel Boulton proclaimed in 1884, “entirely extinguished its rivals” and “took the place of the others by a species of 'survival of the fittest.’”[66]

How did creosote escape closer scrutiny for so long? The answer lies in its elusive, contested identity. Scientists, regulators, wood preservers, and citizens continue to confront the same dilemma that creosote has long presented—it resists easy categorization and is based on confusing terminology. Unlike its laboratory-made competitors, creosote’s precise composition and potential risks are nearly impossible to pinpoint because any given sample is made up of at least 300 chemicals, and a standard mixture often contains up to 10,000.[67] Further misunderstandings derive from the existence of creosote sourced from wood tar and coal tar. Nineteenth and early

[64] Blanc, *How Everyday Products Make People Sick*, 240.

[65] Protect Gainesville’s Citizens, “Protect Gainesville’s Citizens: Improving the flow and accuracy of information regarding the Cabot Koppers Superfund site,” Protect Gainesville’s Citizens, http://protectgainesville.org/ (accessed March 4, 2012). The comments discussed above occurred at an October 6, 2010 meeting and activists distributed the lyrics to a protest song, “Under the Rug.”

[66] Samuel Bagster Boulton, *The Preservation of Timber By the Use of Antiseptics* (New York: D. Van Nostrand, 1885), 27.

[67] Cheremisinoff and Rosenfeld, *Handbook of Pollution Prevention and Cleaner Production*, 10.

twentieth-century pharmacists and medical professionals realized—often through tragic accident—that the two creosotes were not interchangeable.[68]

As a product distilled from coal, creosote reflects society's complicated relationship with the bituminous ore that fueled industrial and chemical revolutions, but poisoned environments.[69] Compared with synthetic wood preservatives, creosote may be perceived as more "natural" because it derives from a naturally occurring resource. Additionally, creosote's synthetic competitors did not enjoy the protection of a specialized and dedicated lobbying and research organization such as the Creosote Council, which effectively re-branded this preservative in the 1980s as an industrial-use-only biocide. Ultimately, pentachlorophenol and CCA's visibility in the residential consumer marketplace contributed to the downfall of these toxic treatments. Driven by effective marketing, Americans purchased and inundated their homes, yards, and neighborhoods with these products. Consequently, when the EPA began reviewing wood preservatives, pentachlorophenol and CCA appeared to present a greater menace because of their ubiquity and proximity in our everyday lives. Although creosote was once as omnipresent as these contemporary chemicals, now, railroad ties, telephone poles, and marine pilings seemed more removed and less threatening to a modern audience. Furthermore, evidence of creosote's toxicity and carcinogenicity has been slow to erode its reputation as a medicinal agent, a disinfectant, and an industrial

[68] "On Creosote" in *The Proceedings of the American Pharmaceutical Association at the Forty-Ninth Annual Meeting* (Baltimore: American Pharmaceutical Association, 1901), 278.

[69] Barbara Freese, *Coal: A Human History* (Cambridge, Massachusetts: Perseus Publishing, 2003).

panacea that conserved forests and extended the longevity of an essential material—wood.

Ultimately, creosote's volatile history and continued use underscore a larger issue. Is a "clean," non-toxic treatment for wood possible when its effectiveness depends on its very toxicity?[70] Wood preservers, manufacturers, and retailers have adapted to the increased concern about sustainability and environmental and public health, "greenwashing" a new generation of chemical preservatives whose names and descriptions include terms such as "green," "eco," and "natural."[71] The wood-preservation industry's long history of employing toxic treatments, however, should caution us against believing that "clean" treatments for wood are free from consequences—for the workers who produce these products, for our homes and communities, and for our environment.[72]

[70] "PENTA: The Clean Wood Preservative," 262.

[71] Jeremy L. Caradonna, *Sustainability: A History* (New York: Oxford University Press, 2014), 248; Blanc, *How Everyday Products Make People Sick*, 240-241.

[72] "PENTA: The Clean Wood Preservative," 262.

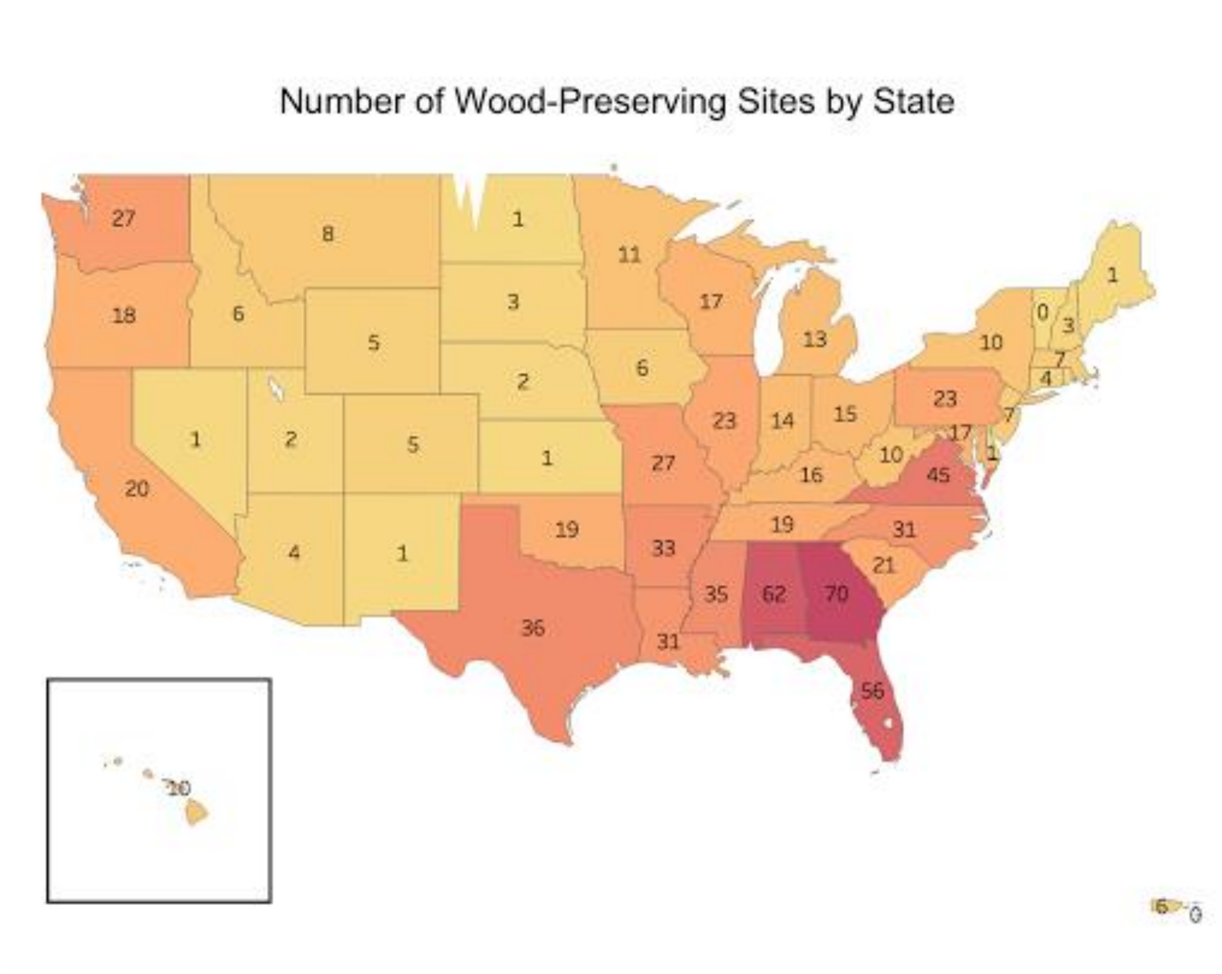

Figure 7-1. Number of wood-preservation sites by state. Data: Jay Feldman and Terry Shistar, “Poison Poles: A Report About Their Toxic Trail and Safer Alternatives,” (Washington, D.C., National Coalition Against the Misuse of Pesticides, 1997), http://www.beyondpesticides.org/programs/wood-preservatives/publications/poison-poles.

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BIOGRAPHICAL SKETCH

Nicole C. Cox grew up in Panama City, Florida. She completed her B.A. in history with a minor in American studies at the University of South Florida, in Tampa. After graduating summa cum laude in 2007, Nicole earned an M.A. in history at USF in 2009. She worked under the direction of Dr. Lu Ann Jones and Dr. Joanna Dyl, focusing on oral history and environmental history. While studying at USF, Nicole had the opportunity to work in the Special Collections Department and served as a graduate coordinator of the Oral History Program in the Florida Studies Center at the USF Library. Her combined interest in oral history and environmental history brought her to the University of Florida, where she received her Ph.D. in history in 2017 with Dr. Jack Davis as her adviser. In addition to undergraduate teaching and research at UF, Nicole worked with Dr. Paul Ortiz and the Samuel Proctor Oral History Program for several years as a transcriber, editor, and graduate coordinator.