Benefits of Creosote-Preserved Wood

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Purpose

The purpose of the paper is to discuss why and how the United States continues to benefit from the availability of creosote-preserved wood. The benefits are economic, environmental, and societal.

Creosote-Preserved Wood Market

Creosote-preserved wood includes lumber, timber, and poles that are treated with creosote to prolong their service lives by protecting the wood from environmental hazards of decay and insect attack. Predominant uses include railroad crossties; utility; marine piling and construction lumber; and foundation piling.

The volumes of creosote-preserved wood used for these markets annually were estimated in 2010[2]. Total typical annual production of creosote-treated wood was estimated to be approximately 93 million cubic feet. Approximately 84% or 78 million cubic feet is used in the railroad market (approximately 21 million ties/yr), 10% or 9 million cubic feet is used in the utilities market (approximately 352,000 poles/yr), and 4% or approximately 4 million cubic feet is used in the marine and foundation piling markets.

Economic Benefits

Economic benefits include lower installed cost of ties, piles, and poles compared to non-wood products, reliable delivery of services, such as rail freight, transportation, and power, employment of U.S. workers in areas including forestry, wood preserving, transportation, and utilities, and taxes on forest derived production.

The Hardwood Federation[3] reported that 17,087 jobs existed in the U.S. in 2016 related directly to wood preservation of railroad ties. Assuming each job is worth $70,000 per year, including salary and benefits, this equates to approximately $1.2 billion per year in direct jobs alone. The Hardwood Federation study further estimated that wood preservation of railroad ties is responsible for $1.9 billion contribution to the U.S. Gross Domestic Product and $4.8 billion contribution to U.S. economic output, defined as the sum of business revenues associated with railroad ties.

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[2] Smith, S. Managing Treated Wood in Aquatic Environments, Chapter 4 Economics of Treated Wood in Aquatic Environments. Edited by J. Morrell, K. Brooks, and C. Davis. Forest Products Society, USA. 2011
[3] Agribusiness Consulting, Economic Contribution of Hardwood Products: United States. Produced for the Hardwood Federation. 2019. Website: https://www.decorativehardwoods.org/sites/default/files/2019-02/Hardwood%20-%20Combined%20Report.pdf.

The users of creosote treated wood purchase the products because they prefer them over other products. Information from Smith[4].is used to estimate savings to end users due to being able to use creosote-preserved wood instead of non-wood products. Approximately 91 million cubic feet of creosote-preserved wood are sold annually for a value of approximately $920 million. These preserved wood products are used in projects worth approximately $2.6 billion. If non-wood alternative products had been used instead, the projects would have cost approximately $4.5 billion. Thus, the availability of preserved wood resulted in savings to users of approximately $2 billion per year.

Through most of the evolution of the U.S. infrastructure of railroads, power distribution, and ports, preserved wood has been the only viable product available. Prior to World War II, creosote was the accepted preservative for such products. Only recently have concrete, steel, and plastic composite materials become potential alternatives in specific limited circumstances. Development of infrastructure has truly been transformational to our nation. The availability of creosote-preserved wood, in particular, was necessary for this construction. It is impossible to know what the U.S. infrastructure and our resulting economy would be now if preserved wood had not been available, but it is very likely that the U.S. would now be much less productive and provision of basic commodities, such as food, building materials, power, and communications, would be less efficient and more costly.

Looking forward in time, alternative materials to maintain and build to this infrastructure exist, but at higher cost and potentially less reliability. A recent survey by the Association of American Railroads revealed that U.S. Class I freight railroads have actually reduced their use of non-wood crossties, such as concrete and plastic, in favor of more use of creosote-preserved wood crossties from 2013 to 2017[5]. Consequential costs to society of forcing use of alternative materials would be high, such as increased railroad derailments and more storm damage to utilities and ports.

Production of railroad crossties from hardwood logs helps to maximize the value of such logs. By co-producing both the higher and lower value products from hardwood logs, sawmills, loggers, and forest landowners all realize higher income than if the hardwood cores could only be used for even lower value pulp or firewood.

Poles and piles, in contrast to ties, are generally made from pine and Douglas fir trees. Trees suitable for such uses generally are higher in value than trees for pulp or softwood lumber.

When forest landowners are able to make a profit from careful management and harvest operations, they are more likely to manage the forest resource in a responsible and renewable manner. The broad economic impact of forestry in the US is estimated by Forests2Market to include 2.8 million jobs, $102 billion in payroll, $262 billion in sales together representing 6.68 percent of the manufacturing base within the 32 states studied[6].

The U.S. and state governments benefit directly from taxes levied on wages paid to employees and on profits of businesses that manufacture forest products, preserved wood, and the infrastructure projects. Indirect benefits accrue to governments from efficiency of transportation and communications systems that rely on use of creosote-preserved wood products.

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[4] Smith, S. 2011.

[5] Smith, S. 2018 Railroad Ties Survey. For the Association of American Railroads. March, 2019.

[6] Wan, Yang and Fiery, Mike. The Economic Impact of Privately-Owned Forests in the United States. June 2013.

The cost effectiveness of products, especially those used for long-lasting infrastructure, depends on those products having long service lives. Creosote-preserved wood products have proven long service lives that compare well to, and often exceed, the service lives of competing non-wood alternatives.

Creosote-preserved railroad ties' typical service life compared to service lives of concrete, steel, and plastic-composite ties were studied by Zarembski[7]. Generally, the wooden tie performed more cost effectively than other materials, except where high decay hazard or track curvature and high loading combined made concrete the preferred material. Railroads have, over the last decade, been transitioning to ties dual treated with creosote and borate for the severe decay hazard areas as studies confirm that such dual treatment significantly extends service lives of the ties[8]. Thus, creosote-preserved wood railroad ties provide cost-effective service of 35 years or more.

Creosote-preserved wood utility poles have been proven to provide service for up to 80 or more years with regular inspections and maintenance[9]. Similarly, creosote-preserved wood marine and foundation piles have proven service records over many decades.

Creosote-preserved wood products provide good service life that results in cost effective installations. End users would not specify this material if that was not the case. Railroads, utilities, foundation designers, and marine facilities owners continue to specify creosote-preserved wood for projects where it provides the most cost-effective performance.

Environmental Benefits

Environmental benefits include use of products with lower greenhouse gas (GHG) and other life-cycle impacts than non-wood products, encouragement of forest growth to provide the raw materials, and use of renewable materials for primary functions as well as secondary use as renewable biomass fuel.

Wood products are unique among building products in that the raw material, wood, is "manufactured" as trees grow in forests. The growth process uses the natural biological process of photosynthesis to combine the sun's energy with carbon dioxide (CO_2) from the air to produce wood. Thus, wood products embody CO_2 that has been removed from the atmosphere. CO_2 is a greenhouse gas (GHG) of which emissions, primarily from fossil fuel combustion and other human (anthropogenic) activities, are thought to be a cause of climate change. Wood production counteracts such CO_2 emissions. So, while the production of all other building products, such as steel, concrete, and plastics, results in emissions of CO_2 and promote climate change, production of wood products result in the opposite, the absorption, or negative emission, of CO_2.

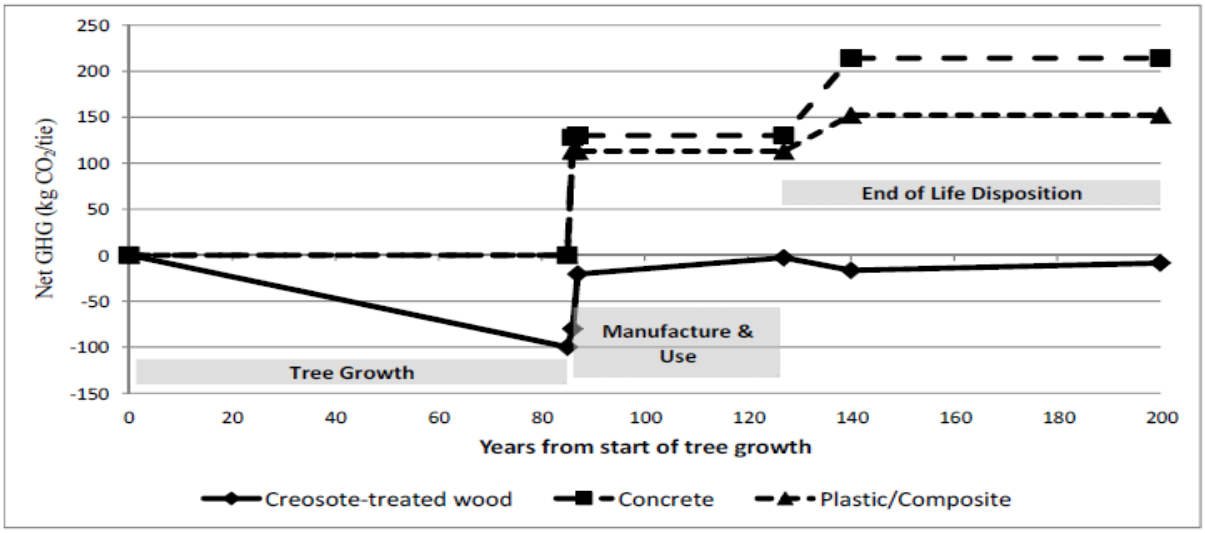
[7] Zarembski, Allen and Kondapalli, Sunil. Development of Comparative Crosstie Unit Costs and Values. Crossties. Jan-Feb 2007. Pp 17-18.

[8] Ambergy, Terry and Sanders, Michael. Tie Dual Treatments of TimBor and Creosote or Copper Naphthenate, 20 Years of Exposure in AWPA Hazard Zone 4. Crossties. Nov-Dec 2009. Pp 20-22.

[9] Morrell, Jeffrey. Estimated Service Life of Wood Poles. North American Wood Pole Council Technical Bulletin. 2008.

This characteristic of wood products removing CO_2 from the atmosphere in contrast to other products is illustrated clearly in a Life Cycle Assessment of creosote-preserved railroad ties.[10] A graph showing uptake and emission of CO_2 through the life cycles of products from that report is shown here as Figure 1. As wood grows, it incorporates carbon from the atmosphere, in use carbon is sequestered in the products for 30 to 100 years, after service it may be used as a replacement for fossil fuel, or may be buried in a landfill where the wood carbon is further sequestered for many more decades. Meanwhile, a new tree has grown to replace the harvested one.

Figure 1



The railroad ties LCA[11] also documented other environmental advantages of creosote-preserved wood. Creosote-preserved wood crossties, in addition to much lower GHG emission, had lower environmental impact in all six categories than concrete and in five of six categories than plastic composite.

Following its service life as a structural component, creosote-preserved wood can be recycled as a renewable fuel that offsets use of fossil fuel. In this way, the GHG benefit of using wooden materials instead of non-wood, mined materials are further enhanced.

The increased value and demand for forest products resulting, in part, from creosote wood preservation of forest products, provides incentive for forest owners and managers to take care of and improve the quality of their forests. Further, it is mostly larger, more mature trees that are used for structural members that are preserved with creosote, so longer harvest rotations and more mature forests are further rewarded.

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[10] Bolin, C. and Smith, S. Life Cycle assessment of Creosote-Treated Wooden Railroad Crossties in the US with Comparisons to Concrete and Plastic Composite Railroad Crossties. *Journal of Transportation Technologies*, 2013, 3, 149-161. http://dx.doi.org/10.4236/jtts.2013.32015.
Published Online April 2013.

[11] Bolin and Smith.

Forests have been shown to help control GHG levels in the atmosphere and otherwise help to stabilize global climate. A recent report by Ohio State University[12], for example, notes that forests not only remove CO_2, but also regulate temperatures.

Societal Benefits

Societal benefits accrue from using home-grown raw materials rather than imported ones, beneficial use and support of forest lands, self-sufficient production, and reliable services.

Wood used in products treated with creosote at U.S. pressure-treatment plants is grown and milled primarily in the United States. Our economy is more stable because of this self-reliance. U.S. citizens benefit from the aesthetic and environmental values of having forest lands.

Forest lands are important to air quality, water quality and quantity, biological diversity, protection of endangered species, recreational opportunities, and our overall quality of life. Creosote-preserved wood, as an important component of forest products, plays an important role in the U.S. economy and environment.

Conclusion

The United States has benefited from use of creosote-preserved wood that has supported infrastructure of transportation, power, communications, and construction for over 100 years. U.S. continues to accrue economic, environmental, and societal benefits due to the availability of creosote-preserved wood products. Clearly, the economic, environmental, and societal advantages of creosote-preserved wood continue to benefit United States.

[12] Ohio State University. "Forests fight global warming in ways more important than previously understood: Trees' role extends beyond carbon consumption, study finds." ScienceDaily. ScienceDaily, 28 March 2017. Web site: www.sciencedaily.com/releases/2017/03/170328120234.htm.