CONTRIBUTION OF WOOD PRESERVATION TO THE CONSERVATION OF GLOBAL ECOSYSTEMS

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Summary

Significance and importance of wood preservation has been documented, although its role is not well realized by the public. Increased concern about the environmental issues leads us to reconsider the problems from various viewpoints.

Strategy to prevent global warming through stabilization of greenhouse gases in the atmosphere and to develop a new energy source should be seriously discussed for the future generations. Because we are now sitting in front of the predictable human-inducing crisis of environmental destruction, species extinction, and other related detrimental things. Along with the concept, a couple of subjects are reviewed. Role of forests, sustainability and utilization of forest resources, reforestation and deforestation, potential of a new energy technology, and wood preservation in terms of its economy and contribution to the conservation of global ecosystems with a special emphasis on a balance of carbon in the atmosphere are discussed. Further investigations are needed to reduce environmental pollution caused by wood preservation industry, as we are supposed to establish the industry as an environmentally friendly one. Role of wood preservation should be highly appreciated in relation to retaining of our living standards in the future because it seems to make it possible to sustainably supply enough raw materials from forests and to protect the earth from warming by a reduced deforestation through an efficient use of forest resources.

Keywords: global ecosystems, environmental pollution, global warming, sustainability of forest resources, wood preservation.

1. Introduction

Wood preservation started many years ago to afford timber and cellulosic materials a longer service life by protecting those from deteriorating agents (Hunt and Garratt, 1953; Graham, 1973; Wilkinson, 1979; Hosli, 1982), although modern wood preservation technologies have been developing since mid 1800's (Goltra, 1913).

Wood preservation definitely contributes to forest savings when service life of the treated products is compared to that of untreated products and the costs of treatments are taken into account (Roche, 1965). A workshop of Wood Preservers' Association of Japan (WPAJ) reported that approximately two million m^3 of forest resources is saved every fifty years through wood preservation in the country (WPAJ, 1992). However, their calculation did not include any expense in dealing with the disposal of treated waste materials. In addition, very little attention has been paid to environmental impacts induced by wood preservation industry. We, therefore, can not always admire inherent advantages of wood preservation any more. We need to take environmental costs for reexamining the value and role of wood preservation.

2. Problems

There are a few series problems in the world to be solved such an environmental pollution, global warming and energy alternatives to fossil sources.

Environmental pollution: As far as wood preservation depends on chemicals (fungicides and insecticides), it is possible to contaminate soil, water and air in the manufacture, use and disposal of preservative-treated forest products (Forest Products Society, 1994), although its proportional account is rather small.

Global warming: Combustion of fossil fuels (e.g. coal, oil and natural gas) is a major cause of this global scale headache due to emissions of carbon dioxide that is more abundant and important than any other greenhouse gases (e.g. chlorofluorocarbons, methane, nitrous oxide and ozone). Unplanned deforestation is also responsible for the increased concentrations of atmospheric carbon dioxide. Because carbon stored in trees and soils is oxidized during the processes of clearing (Houghton, 1991). The resultant effects could impose loss of species and forest area, cause a rise of mean sea levels and an increased demand of electricity for air conditioning (Cline, 1992).

Energy alternatives: It has been reported that supply of fossil resources is not everlasting but sufficient for the next few decades. We are urged to develop environmentally friendly energy technologies and fuels to retain present standard of our life in the future.

3. Possible solutions and proposals

Today forest resources are often regarded as environmental and/or ecological raw materials because of their relatively low energy requirements in production, process, use, recycle and disposal and sustainability of supply. That is, forest resources are less environmental impacts in comparison with other material sources (Koch, 1992; Sutton, 1994). Therefore, It seems reasonable to utilize more wood instead of non-wood, nonrenewable materials such as metals, plastics, cement and so on. Concurrently, population increasing trend in the world (Clouser and Libby, 1992) strongly suggests that we need to expand our forest area by either natural reforestation or plantation to afford sufficient raw materials for our living (Williams, 1990). On the other hand, the trend has been imposing conversion of forestlands to agricultural lands to produce more food (Richards, 1990). This means that an efficient use of forest resources plays an important role to keep a good balance of forest and agricultural lands so that the growing population can be supported in terms of the supply of raw materials and food.

Material research efforts have been focusing to develop wood-based composite products made of smaller elements to provide those with multi-functional properties (Kawai, 1996). State of log harvest and forest management suggests that we can not expect the supply of good quality solid wood for a long period of time from now on because plantation strategy tends to extensively cultivate low quality fast-growing trees. These perspectives appear to demand an increased use of composite products which consist of small elements from plants, agro-residues, wood residues and low quality logs including thinnings.

3-1. What we can do for the reduction of environmental pollution

As environmental pollution problems relating to wood preservation industry were already well documented elsewhere (Forest Product Society, 1994), some proposals are listed below.

1. Shift to low toxicity preservatives.
2. Treatment process to enhance fixation of preservatives in wood.
3. Closed treatment system to recover solvent and preservatives separately for reuse and to allow no emissions of any matter from the treating plants.
4. Chemical modification.
5. Incorporation of preservatives into composite product.
6. Plant and waste disposal management and control.
7. Life cycle assessment: More case studies should be conducted to demonstrate superiority of preservative-treated wood and other related products.

3-2. Is global warming underway?

Studies of global climate models and the correlation between atmospheric greenhouse gases and the earth's temperature in the past tell us that increased temperature cause further releases of gases. This is well accepted among scientists in the world today (Houghton, 1991) .

It is believed that most important and effective way to stabilize global warming is to largely reduce the use of fossil fuels. That requires alternatives to conventional energy sources to meet predictable shortage of energy supply.

Although afforestation and/or reforestation is a temporary measure to withdraw carbon from the air, forests can effectively contribute to decrease carbon concentrations in the atmosphere as far as the trees grow. Sutton (1994) indicated that investment in fast-growing plantations could be advantageous due to very high capital intensity of forestry, discussing future wood demand and supply in the world. He also suggested that wood is still the primary energy source for the majority of the global population and it is not realistic to replace wood with substitutes such as steel, plastic, cement, ceramics and others without a major breakthrough on energy production. Industrial plantations are approximately 100 million ha which is equal to less than 5 % of the world's total exploitable forest area and the fact seems to suggest that a significant reserve of wood will meet future needs. However, we can not be optimistic because actual economic accessibility to the forest areas is not easy in general (Bazett, 1993). Subsequently, we need to utilize forest products with a desired service life to maintain sustainable production from forest lands. That is, every supply of forest resources should be dependent on sustainable forest management.

On the other hand, there is a good example for a drastic change in use of forest resources. That is an Asian country, China. Once they got an alternative energy source to wood, a rapid growth of wood composite industry has been underway (Zhang, et al., 1997). Global demand of industrial wood will increase with population growth and will exceed that of fuelwood within the next two decades (Sutton, 1994), while the latter accounts for more than a half of the present global wood demand (Bazett, 1993). Such

changes and massive reforestation and plantations are likely to fill up deficiency of wood supply in the future to some extent.

3-3. Energy alternatives

As we have experienced during early 1970's, short supplies of oil may be anticipated and that will result in higher prices of energy, if some countries or regional groups control world energy market. Other energy sources such as coal, natural gas, hydro, wind and nuclear power have some potential as oil substitutes, although they will cause another serious problems which we will have to deal with (Clouser and Libby, 1992). Biomass including forest residues might account for some proportion of future energy supply.

Energy alternatives should desirably be common to every country and everybody. There are some developments in generating electricity from water using environmentally friendly sources (solar, biomass and geothermal energy). That is hydrogen energy, fuel from water (Peavey, 1995), and one of the more developed countries will take the initiative in commercialization of the new energy technology (Cashman, 1995).

4. Conclusions

Increased concern about forest resources as materials and energy sources respects their advantageous features: renewable, sustainable, relatively low energy requirement in manufacturing, biodegradable, high specific strength and others.

Future energy technologies are likely to enable us to utilize wood substitutes, while our resources are not present universally and we need to use them more efficiently until resource and environmental problems are fully solved. Only case studies might be able to answer whether wood and related products are superior to other materials by life cycle assessment program. Wood preservation plays important roles not only in providing high quality materials but also in conserving forests and the related ecosystems through reduced harvest of trees. Thus, service life of treated forest products should precisely meet requirement of end-users to maintain our present living standard.

We must realize that all the difficult problems have arisen from a rapid population growth. Global and/or regional linkage on population control and conservation of resources will be more serious and important. Developed countries will have to help developing countries follow international guideposts for environmental conservation under the same standards. International standardization scheme has been becoming very realistic for a wide range of products including preservative-treated wood. Future problems seem to need various international discussions before political decisions will be drawn out. However, we will have to do that to avoid catastrophic disaster.

5. Literature

Bazett, M.D. (1993) Industrial wood - Analyses the need for industrial wood plantations. Shell/WWF Tree Plantation Review Study No. 3, Shell International Petroleum Company Limited and World Wide Fund for Nature, 112pp.

Cashman, T. (1995) Fuel from water . Whole Earth Review, Spring 1995, 50-53.

Cline, W.R. (1992) The economics of global warming. Institute for International Economic, Washington, DC, 399pp.

Clouser, R. L. and Libby, L. W.(1992) World population growth in the 21st century and implications for resource use. [In] Proc. of the Conference on Wood Product Demand and Environment, November 13-15, 1991, Vancouver, Canada, Forest Products Society, 13-20.

Forest Products Society (1994) Environmental considerations in the manufacture, use and disposal of preservative-treated wood. 107pp.

Goltra, W.F.(1913) History of wood preservation. Proc. of the 9th Ann. Meeting Amer. Wood Preserv. Assn., 178-203.

Graham, R.D. (1973) History of wood preservation. [In] Wood deterioration and its preservative treatments (ed. by D.D. Nicholas), Syracuse University Press, Syracuse, New York, 1-30.

Hosli, J. H. (1982) Wood preservation in the pre-industrial period. The Intern. Jour. Wood Preservation, 2(1), 29-36.

Houghton, R. A. (1991) The role of forests in affecting the greenhouse gas composition of the atmosphere. In Global climate change and life on earth (ed. by R. L. Wyman), Chapman and Hall, New York, 43-55.

Hunt, G. M. and Garratt, G. A. (1953) Wood preservation. McGraw-Hill, New York, 417 pp.

Kawai, S. (1996) Towards the new generation of bio-based composite products. In Proc. of Third Pacific Rim Bio-Based Composites Symposium (compiled by H. Kajita and K. Tsunoda), December 2-5, 1996, Kyoto, Japan, 1-4.

Koch, P. (1992) Wood versus nonwood materials in U. S. residental construction: some energy-related global implications. Forest Prod. Jour. 42(5), 31-42.

Peavey, M. A. (1995) Fuel from water (6th ed.). Merit, Inc., Lousiville, Kentucky, 251 pp.

Richards, J. F. (1990) Land transformation. In The earth as transformed by human action Global and regional changes in the biosphere over the past 300 years (ed. by B. L. Turner II and others), Cambridge University Press, Cambridge, UK, 163-178.

Sutton, W. R. J. (1994) The world's need for wood. In Proc. of the Conference on The Globalization of Wood: Supply, Process, Products and Markets, November 1-3, 1993, Portland, USA, Forest Products Society Proceedings No. 7319, 21-28.

Wilkinson, J. G. (1979) Industrial timber preservation. Associated Business Press, London, 532 pp.

Williams, M. E. (1990) Forest. In The earth as transformed by human action Global and regional changes in the biosphere over the past 300 years (ed. by B. L. Turner II and others), Cambridge University Press, Cambridge, UK, 179-201.

Wood Preservers' Association of Japan (1992) Wood preservation and environmental conservation. 11 pp.

Zhang, Y., Buongiorno, J. and Zhand, D. (1997) China's economic and demographic growth, forest products consumption, and wood requirements: 1949 to 2010. Forest Prod. Jour., 47 (4), 27-35.