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Wood is Good: A Way Forward for Climate Change Mitigation

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ABSTRACT

Wood is an important asset since time immemorial, nowadays there is scarcity of wood due to enormous population pressure and stringent law and regulations against felling of tree in India. Tree conservation is associated with multi-dimensional benefits but after attaining a physiological age (age of maturity) by the tree it starts natural decaying if the wood is not utilized properly in time. It is exiting fact that the natural decomposition of wood improves the fertility status and physical properties of soil but at the same time the increasing demand of wood need to be fulfilled. The demands of sustainable development rely on judicious use of resource like wood for mankind. This paper elucidates the significance of tree harvesting at maturity for better management of the forest resources over the natural death of tree provided the wood is used in such a way that carbon can be blocked in it for longer duration.

Introduction

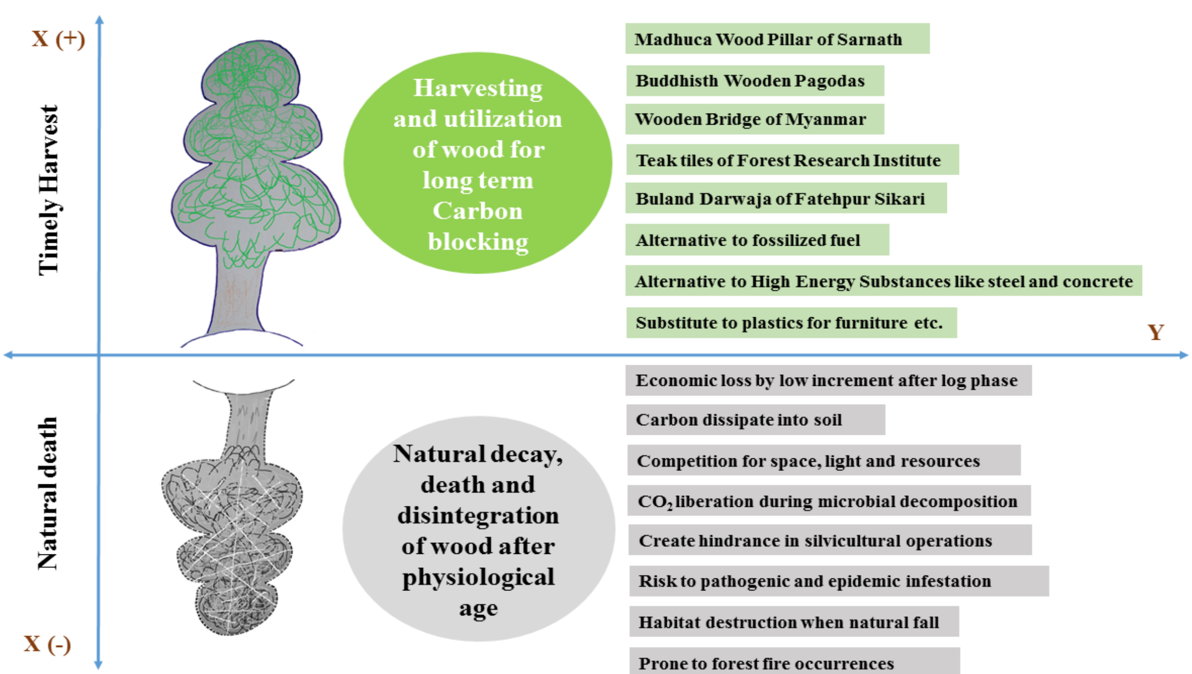
Utility and durability of wood made it an asset either cradle or coffin which is conventionally tested by graveyard test. The ancient Madhuca wood pillar of Sarnath and magnificent wooden doors of different palaces, Buddhist wooden pagodas, temples and other ancient religious buildings in India and wooden bridge of Myanmar etc. are few live examples to exemplified potential of locked carbon in wood. It offers a number of environmental benefits over other building material with less energy to produce and stores carbon. It owns the quality to be renewable, reusable, recyclable, durable and flexible. In last 50 year forests have absorbed about 30% of annual global anthropogenic CO_2 emissions. It produces wood as an option for fossil fuels and carbon-intensive high-energy materials such as concrete and steel (Borjsson and Gustavsson, 2000). In nutshell, for the sake of environmental concern, the *wood is good* as it is long-lasting retainer of carbon. The role of forest can be understood with the fact that the annual incremental carbon accumulation in India's forest estimated as 59.2 Mt which means an annual removal of 217.07 Mt CO_2 equivalents, thus the forests of India are playing a significant role in capturing of substantial amount of atmospheric CO_2 which is the major reason of global warming (IPCC, 2007). The growing stock of Indian forest is estimated to be 5768 million cubic meter comprising 4195 million cubic meter inside forest area and 1573 million cubic meter outside recorded forest area (TOF) (ISFR, 2011).

If we talk about India, the reserve forest, basically include those areas where harvesting, felling and any operation is strictly prohibited, this mostly includes the national parks, sanctuaries and biosphere reserve areas etc. In fact, trees are the sink (Pan *et al.,* 2011) and source (Uri *et al.,* 2017) of carbon, sink because trees capture the carbon when it is live and source because tree releases the carbon when it dies or after its natural death or destructive utilization for fuel wood, charcoal, biomass energy etc. The leaf litter from the tree is added the organic carbon to the soil which is helpful to the soil if in desirable C/N ration only (Monika *et al.,* 2017). Beyond the required C/N ratio addition the material to soil is not beneficial for soil fertility and productivity of soil as the system is input intensive (Jeet *et al.,* 2014). The regeneration, maturation and death of old tree are a common phenomenon in any of the natural forest. However, the trees which have completed its biological age, dead, standing dead, decay and degenerating are the source of carbon need to be handled in and processed in proper way rather lying as such in the forest and liberating the carbon to pollute the environment. The astounding capacity of wood to offset carbon emissions and natural properties, wood is the most promising material of the future with low carbon footprint and economic carbon disposal provided wood use should be responsibly sourced and genuine certified. The demand of wood like natural resource increased exponentially (Shankhwar and Srivastava, 2015), human interference and inadequate management results (Ingole *et al.,* 2015) resource scarcity ultimately leads to hindrance in sustainable development (Shankhwar *et al.,* 2015). The current demand of wood is mainly substituted by the plastics, high energy substances like cement, concrete and steel etc. that drive the world towards the unsustainability. Moreover, the land availability for forest is also lacking factor for regeneration and perpetuation of trees. So it is better to harvest the tree at the biological maturity for carbon sequestration, resource utilization *e.g.* building construction, furniture, and other valuable products mentioned in Figure 1. These products are the most suitable option for blocking of the carbon for long term storage and ecological benefits as well.

Forest also acts as source of carbon because when forests release more carbon compared to storage they act as a net carbon source and eventually lead to rise in CO_2 added to the atmosphere. The world-wide forest depository (ISFR, 2015) found to be more than 650 billion tonnes of carbon consisting of 44% as biomass, 11% in dead wood and litter, and 45% in the soil. When an old tree fells downs (dead wood) and decays, these trees emit more carbon than they store. Hence, they serve as a net carbon source after getting the maximum exploitable volume and ultimately convert towards source through an increase in CO_2 and other gases in the atmosphere during the process of decomposition of the wood. Therefore, dead wood biomass can be a considerable fraction of stored carbon in forest ecosystems, and coarse woody debris (CWD) decay rates may be sensitive to climate warming (Kueppers *et al.,* 2004). Brown and Schroeder (1999) estimated dead wood production for hardwood and softwood in the eastern USA, due to natural mortality on an average about 1 Mg ha^{-1} yr^{-1}. There is a substantial knowledge gaps exist concerning the carbon implications of various forest management activities, given the complex interaction between carbon emissions and carbon sequestration in forest environments (Russell *et al.*, 2015). During decomposition of organism major chunk get back to environment (Zeng, 2008). Hence, trees can be considered as only temporarily carbon sequesters and that by the time they start to rot they adds carbon back to the environment.

In the present assessment total carbon in Indian forest is estimated to be 7044 million tonnes. There is an increase of 103 million tonnes (1.48%) in the carbon stock of country as compared to the last assessment in 2013 (ISFR, 2015). The responsible use of wood is capable to fostering sustainable forest management and panacea for a number of organizations already working for the promotion of wood and proclaimed its benefits. As one of the premier places on earth to grow trees and produce wood, Oregon has an unparalleled opportunity to support and advance the responsible use of wood (OFRI, 2011). A study (Wihersaari, 2005), recommends that it's better to use comminuted forest residue before decay, if possible within one week. Moreover, it's good to lock the wood carbon by building wood products instead of left it for decomposing. Some research (Borjesson and Gustavsson, 2000) found net CO_2 emission to be lower for wood-framed buildings than for concrete buildings, when considering forest and sawmill residues as well as demolition waste as substitutes for fossil fuel. The fact is that Indian forest act 1927 has classified forest to different categories *viz.* Reserve forest, protected forest, un-classed forest and Village Forest (Civil swayam forest) on the basis of degree of protection and regulation of management activities. Natural forests are solely depending for restocking on natural regeneration especially in Reserve Forest (RF) and Protected Forest (PF) and in some cases they have assisted natural regeneration. There are series of silvicultural practices used to manage these forests but due to present conservation centric mindset, these silvicultural practices became redundant.

Fig.1 Comparative display of timely harvesting and natural death of tree



Sustainable forest management strategy has goal to perpetuate the stabilized carbon stocks for lengthier duration while producing forest products like timber, fiber or energy etc. for creating the mitigation advantage sustainably at maximum (IPCC, 2007). We are looking forward to cutting-edge strategy or revision of existing strategies in such a way that enable to sequester the carbon as much as its emission. This revolutionary strategy may be framed for carbon sequestration through the wood conversion to high-utility resources like wood-based sculpture, house architecture, furniture and other products. It is important that the carbon present in wood needs to be blocked and retains into wood itself for long-lasting period so that the wood-carbon may not release in the atmosphere. It would be desirably help to reduce the atmosphere CO_2 by inflow of excess CO_2 and other harmful gases, this phenomenon is kept under the tag line of *"Wood is Good"*. That means if we use wood instead of it substitute like plastic, iron and other metals etc, the more carbon can be blocked for a period till it is completely degenerated. Scientist (Pingoud and Perala, 2000) estimated the maximum wood substitution potential in new building construction in Finland.

It is a hard task to achieve the increment in carbon storage or sequestration in to the forest afterward attaining the maximum exploitable volume of tree. Today in the age of urbanization with declined per capita forest area (FAO, 2009) wood is a promising tool to mitigate the climate change discrepancies. This conversion should be subjected to the sustainable harvesting of forest produce; other-wise it will induce further problems. As it is an existing fact that if we harvest the trees, there will be a negative impact on the earth and environment. Large scale deforestation is an important factor in global climate change and other conjugated problems (Jiao *et al.*, 2017). Wood is among the top sustainable building materials in Japan with 80% commercial use for building construction unlike India non-existent of wood in buildings in urban area, as the almost 100% of natural forests as protected. In India wood used unsustainably as fuel-wood instead of building industry (Sriprakash, 2017). In addition to this, wooden buildings enable the resistance against the seismicity coupled with other environmental benefits like low carbon emission during construction and effective in energy conservation as well as CO_2 reduction (Naohito, 2011).

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