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Vol. 2, Issue 4, January - March 2022

INSTITUTE OF WOOD SCIENCE AND TECHNOLOGY, BENGALURU

Indian Council of Forestry Research and Education

(An Autonomous Body Under Ministry of Environment, Forest & Climate Change)



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Indian Council of Forestry Research and Education

New Initiatives

- ☞ Transparent wood- a flexible and biodegradable transparent wood has been fabricated using poplar wood veneer and water soluble polymer- polyvinyl alcohol. The transparent wood exhibited high optical transmittance, high haze and light diffusing property.



Natural wood (Left most), Lignin modified wood (middle) and Transparent wood (right most) placed on a paper with letters "IWST"

Heat storage based modified Solar Kiln

- ☞ Solar heat storage system based solar kiln has been developed by Forest Research Institute, Dehradun for timber drying. The solar heat is trapped using suitable phase change material (PCM). The New solar kiln is able to trap 39 % more heat in winters as compared to traditional green-house based traditional FRI solar kiln developed during 1970.



Head based storage Solar Kiln

Xylarium

- ☞ Collection of authentic wood samples both from India and other countries, depicting wood biodiversity of the country like lightest, heaviest, sweet-smelling, foul smelling, smoothest, streaked, variegated wood and wood of different colours, etc. The collection of wood cross sectional discs depicting variation in sapwood and heartwood colour is a unique feature of the xylarium.
- ☞ Wood identification services.



Xylarium- Collection of Authentic wood samples

Tree hollowness detection technique based on ultrasonic waves

- ☞ Forest Research Institute, Dehradun has developed ultrasonic techniques (Non-destructive testing) to detect the location and magnitude of the hollowness of the standing tree. This will help to remove the potential human hazards by way of falling down of such trees during a high wind regime in Urban Forestry.



Measurement of hollowness in a tree using ultrasonic detector

Agroforestry models

- ☞ Various agroforestry models (Poplar, Eucalyptus, Melia, Casuarina and Babool) have been developed to improve green cover, enhance farmers income and to mitigate climate change .



Poplar based agroforestry model with wheat

Innovative Bamboo Bottles

- ☞ Techniques for making bamboo bottles by using Bamboo Treatment Technologies of ICFRE. Most suitable bamboo species for making bottles are Shil Barak (*Bambusa salarkhanii*) & Barak (*Bambusa balcooa*). One full bamboo is sufficient for making 21 full size bottles and 12 small bottles.



Bamboo bottles

For further details please contact :

Assistant Director General, Media & Extension Division,
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सत्यमेव जयते



FOREWORD

सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
SECRETARY
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Wood, with its varied forms, has historically been a part of all societies and cultures. Being a natural, renewable resource, it is a sustainable material and has multiple uses ranging from furniture to modern utilities like modular kitchens. Possessing a lighter carbon footprint, wood is a greener alternative as compared to steel and concrete. Enhanced use of wood has, therefore, been advocated globally as one of the effective strategies in climate change mitigation. This gives impetus for the expansion of area under tree cover which would be beneficial for farmers and also boost economic growth through wood-based enterprises.

Agroforestry is a key intervention for the country's transition to a carbon neutral economy. In this endeavour, the Institute of Wood Science and Technology (IWST), Bangalore under the aegis of Indian Council of Forestry Research and Education, has been working on emerging technologies to promote sustainable use of wood. The Institute has been publishing "Wood is Good: Grow more, Use more", a quarterly magazine covering various issues related to promotion of wood and wood products. The aim of this publication is to share scientific knowledge and best practices amongst various stakeholders.

The previous issues of the magazine published during the last two years have covered important sectors such as handicraft and bamboo products, along with policy inputs for promotion of Tree Outside Forests. The last quarterly (October – December 2021) issue highlighted the status of wood-based industries in India, particularly of primary wood processing industries engaged in milling, seasoning, preservation, and processing, with special reference to their technological status, constraints and requirements. The most important constraint in the wood industry sector is unavailability of the required quantity of raw material, possessing the desired quality.

An effort has been made by IWST to present a vivid picture of the "Wood Sector in India" to various stakeholders in order to prepare a roadmap. Insights and feedback for promoting agroforestry, including quality and certification aspects of wood, would be very useful for coming up with a clear action plan.

I hope that the current issue of 'Wood is Good: Grow more, Use more' magazine, which is focusing on various dimensions pertaining to the production of certified wood and promotion of wood based industries, would give a boost to the sector and make a significant contribution to the export of wood products from India.

[Leena Nandan]

New Delhi, the 13th April, 2022



इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110 003 फोन : (011)-2081-9408, 2081-9308, फैक्स : (011)-2081-9238
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD, NEW DELHI-110 003, PH. : 011-2081-9408, 2081-9308, FAX : 011-2081-9238
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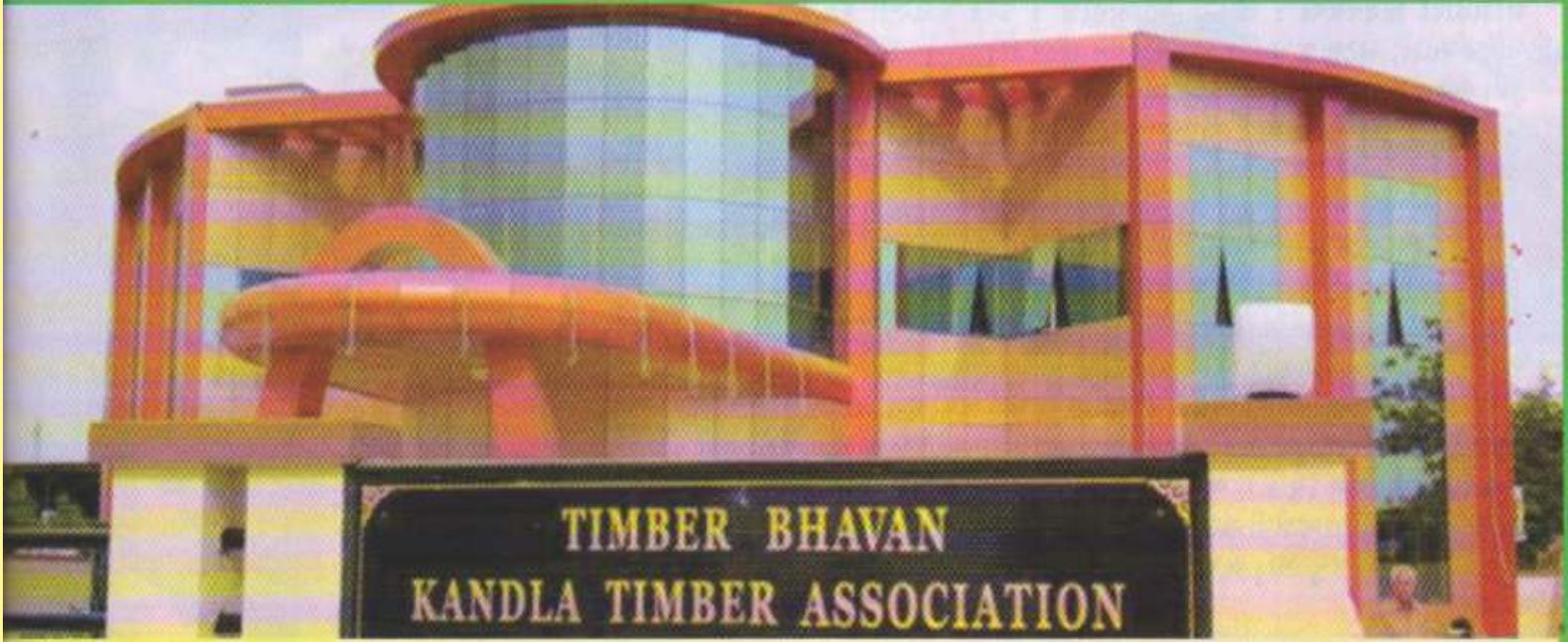
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Telefax: 02836-222337, E-mail: kata.gdm@gmail.com

Web: www.kandlatimber.org

IWST activities during January–March, 2022

Webinar on Electric Resistance Tomograph (ERT): A Technology in deciphering the interiors of standing trees

As part of Azadi ka Amrit Mahotsav celebration, Institute of Wood Science and Technology (IWST) conducted webinar on **Electric Resistance Tomograph: A Technology in deciphering the interiors of standing trees** on 04th January 2022. The topics covered in the webinar included differentiating properties of heartwood and sapwood in few commercially important timber species, wood quality parameters such as moisture content, density, grain direction and chemical constituents on electrical properties of wood, ERT in understanding the inner structure to estimate heartwood, sapwood and decay in the standing trees by taking example of sandalwood (*Santalum album*) and redsanders (*Pterocarpussantalinus*). About 70 participants attended the program.



Webinar on Sustainability, Certification and Legality in wood products

Under the Azadi ka Amrit Mahotsav initiative of Govt. of India, IWST conducted webinar on **Sustainability, Certification and Legality** in wood products on 21 January 2022 to perceive the views of panelists, invited speakers and representatives from Wood Based Industries, Academia and Practitioners of forest certification. About 250 participants from across the country participated. The webinar included five renowned panelists and four distinguished speakers.



PANELISTS

Dr. M.P. Singh, Director, IWST, Bangalore, welcomed the panelists and speakers. He highlighted the importance of Sustainability and Certification of forests, wood and wood products in India. He also briefed the fellow panelists and participants about the various certification schemes across the globe, and stressed upon coming up with chain of custody certification for agri-wood produced from agroforestry plantations.

Sri. Sajjan Bhajanka, President, FIPPI, observed that there is a need to develop Indian framework for certification of forests and Agri-wood in India and also to provide certified wood to the industries. Further, he complemented IWST for organizing this webinar highlighting its importance to the stakeholders from wood based industries.



Dr. Manmohan Yadav, Professor, IIFM, Bhopal, opined that, to ease forest certification process in India, already IIFM (Indian Institute of Forest Management), Bhopal has come up with 8 criteria and 37 indicators (C&I) for SFM through Bhopal India Process. The C&I thus developed by IIFM have been adopted in the National Working Plan Code, 2014 and they are being implemented in most of the forest divisions across the country. Hence, it would be desirable to come up with Indian framework of forest certification that is simple, economical, implementable and acceptable.



Dr. Suneesh Buxy, Inspector General, MoEF & CC, Govt. of India briefed about various initiatives taken by the MoEF & CC in respect of promotion of agro-forestry in the country. He also informed that the recommendations of this webinar should be sent to ministry for further necessary action in respect of certification of forests and Agri-wood in India.



Sh. Jikesh Thakkar, Executive Director, All India Plywood Manufacturers Association, also emphasized the need of developing Indian framework of certification for certification of forests and Chain of Custody certification for the Agri-wood produced from farm lands. He opined that certification of wood and wood products helps boosting exports from India.

INVITED SPEAKERS



Dr. H.R. Prabuddha, IFS, IWST, Bengaluru, presented on Sustainability, Certification and Legality in Wood Products: World and Indian Scenario. In his presentation he highlighted about various certification systems practiced across the globe and challenges associated with certification in India. He quoted instances of FSC certification scheme which consists of 10 principles, 55 criterias and 200 indicators related to SFM. Similarly, Network for Certification and Conservation of Forests (NCCF), a NGO from India has come up with 59 criteria and 239 indicators for SFM, which is endorsed by the PEFC. Thus, he underlined that adhering to too many Criteria and Indicators (C&I) makes certification a very complex process and difficult to implement in Indian conditions.



Dr. H.D. Kulkarni, Vice President Plantation (Retd.), ITC Ltd., made a detailed presentation on Relevance of Sustainability Certification for Agri-wood in India and shared his first hand experience in dealing with certification agencies when he was working in ITC ltd. He also stressed upon creation of Indian system of certification especially for wood produced from agricultural lands and plantations.



Ms. Shilpa Naryal, Head Sustainability-South East Asia, Intertek, presented on Sustainable Development for Greener Supply Chain in the Global Value Chain. She talked about the complexity associated with the concept of sustainability and existing certification systems like FSC and PEFC. She also urged for creation of Indian system of certification for the benefit of farmers and wood based industries.



Dr. Shiv S. Panse, Forest Governance Expert & Technical Advisor Sustainable Forest and Natural Resource Management, gave a detailed presentation on Sustainability and Legality Assurance Standard for Wood Products in India. In his presentation he gave a framework for creation of Indian certification system.

All the panelists unanimously agreed that a simple and cost effective Indian framework for certification of forests and Agri-wood is the need of the hour and adoption of such a certification system will benefit farmers and industry at large in India.

Webinar on Wood and Bamboo Polymer Composite

As part of Azadi ka Amrit Mahotsav celebration, IWST conducted webinar on Wood and Bamboo Polymer Composite on 04th February, 2022. Wood Polymer Composite (WPC) is a crucial and potential engineering wood product which is extensively employed in the fields of landscape, automobiles, transportation, municipal engineering, building construction etc. Hence, it is very important to develop suitable standards which will ensure the quality of product and for benefits of consumer. The topics covered in the webinar included innovative fractional geometry technology for natural composite, Wood Polymer Composite as a support to India's ambition for carbon neutrality considering its environment friendliness, sustainable natural fiber based bio-composite for packaging applications and sustainable natural fiber based bio-composite for packaging applications. The session also comprised of experience sharing on manufacturing of environment friendly products from recycled polymer waste and generating value out of waste like food grade packaging waste (tooth paste tube, face cream tubes, juice, milk, oil etc. packs) which are collected, sorted and shredded for preparing high quality products which are even used in coaches of Indian railways. About 160 stakeholders who included wood researchers, students, industrialists and academicians participated in the webinar.



Creation of Awareness on Biofertilizers to Attivatta Farmers



Under the Azadi ka Amrit Mahotsav initiative of Govt. of India, IWST conducted demonstration to create awareness on Biofertilizers to Attivatta Farmers on 08th February, 2022. Training program was conducted at Government Primary School, Attivatta Village, Bangalore Rural District for the farmers in local language namely Kannada. About 23 farmers participated in the program. They were told about the importance and necessity of biofertilizers, types of biofertilizers and plant growth promoting rhizobacteria. Future scope of biofertilizers, usage in agriculture and forestry tree species, commercial production of Mycorrhiza and Biofertilizer, application and precautionary methods were also highlighted in the training. A demonstration was conducted on seed treatment of biofertilizers.

Webinar on Problems and its solution strategies for wooden handicraft sector in India

As part of Azadi ka Amrit Mahotsav celebration, IWST conducted webinar on Problems and its Solution Strategies for Wooden Handicraft Sector in India on 11th February, 2022. The topics covered in the webinar included overview of wooden handicraft sector in India, role of LUB in promoting handicraft sector in India, support mechanism being provided by MSME for the development of wooden handicraft sector, quality parameters namely timber seasoning and preservation



technique for wooden handicrafts and also problems faced in handicraft sector with respect to design and product quality together with common hindrances in the wooden handicraft sector in India. The lectures were followed by fruitful experience sharing and discussion wherein issues like developing dyeing skill among artisans, employment generation, women empowerment, effort to create child artisans, raw material bank, digital marketing, gap between GI tag and non GI tag handicraft products etc. were discussed by stakeholders like artisans and handicrafts traders who participated in the webinar. Dr. Nagesh Prabhu, IFS (Retd.), PCCF, HoFF, Kerala Forest Department also shared his experience and stated that majority of timber species are not grown by the farmers because of their long gestation period. But they may be grown by forest departments because the departments have huge area of land. At least 5% of it should be reserved for species plantation required for wooden handicrafts and that IWST-ICFRE can take a lead regarding handicraft species and make a case to Government of India for bringing a policy decision and prepare a plan for 2047.

VVK - KVK Networking training on Sandalwood Cultivation and its prospects at Bhadravathi



IWST conducted a training on Sandalwood Cultivation and its prospects on 21st February, 2022 for Sandalwood growers and field staff of Karnataka Forest Department, Bhadravathi Division under VVK-KVK networking activity. The training focused on aspects such as sandalwood seed & nursery technology, guidelines for establishment & management of plantations with emphasis on agroforestry systems, benefits & host plant with suitable spacing and estimation of heartwood in standing trees with the application of Electric

Resistance Tomograph (ERT). A field demonstration of heartwood estimation in standing teak tree was conducted and analysis of the images obtained was explained to the participants.

Vigyan Sarvathra Pujyate

IWST participated in Vigyan Sarvathra Pujyate - A Mega Exposition, showcasing various achievements in Science and Technology held at New Delhi during 22-28 Feb 2022. Posters, artifacts and models related to thermal modification of wood, chemical modification of wood, transparent wood, wood polymer composite, bamboo lumber, cross laminated timber, use of alternative species for handicrafts, palmyra palm etc were displayed at the exhibition.



International Women's Day



IWST, Bangalore celebrated International Women's Day on 8th March 2022. On this occasion, Smt. Meenakshi Negi, IFS, APCCF (CAMPA), Karnataka Forest Department delivered a talk on "Gender equality today for sustainable tomorrow". In her address she highlighted about the presence of gender discrimination at all levels in workplace and society and need for women empowerment to overcome the gender discrimination. She opined that women enjoyed equal status in the society during ancient period and it is prevalent in many tribal societies in India. Further, it was felt that celebration of women's day should not be restricted to only 8th March every

year and IWST should keep series of lectures related to gender issues on regular basis.

Training on Wood seasoning, preservation and composite wood

Training on Wood seasoning, preservation and composite wood under HRD program of ICFRE was organized by IWST during 7 -11 March 2022. About 12 scientists from various ICFRE institutes attended the training program.

Dr. M. P. Singh, IFS, Director, IWST, Bengaluru, during the inaugural address stressed upon the need for selection of appropriate processing technologies for better utilization of wood. The presentation on wood structure with relevance to seasoning, preservation, wood properties and utilization was followed by visit to xylarium, where trainees saw the collection of standard reference samples for identification of different wood species. The training also touched upon fungal degradation of wood and wood deteriorating insects and their management. Wood processing with emphasis on wood preservation technologies was followed by demonstration of various treatment methods of preservation like pressure method, sap displacement method and Boucherie method at the wood processing workshop.

The trainees were introduced to new concepts like wood modification both thermal and chemical



modification methods, Wood based composites and demonstrated methods of preparation of products like Bamboo lumber, Cross laminated timber and Wood polymer Composites at IWST workshop.

Field visit was organized for the trainees to know about industrial scale seasoning and preservative treatment plant at Karnataka State Forest Industries Corporation, Bengaluru; toy cluster at handicraft unit of Channapattana; different stages of sandalwood oil extraction at Karnataka Soaps and Detergents Limited, Mysore and plywood and other wood based products at Indian Plywood Industries Research and Training Institute, Bengaluru. The visits were appreciated by all the participants.

Training for IFS officers on Advances in Wood Production and Utilization



IWST organized MoEF&CC sponsored one week compulsory training (through physical mode) for IFS officers on Advances in Wood Production and Utilization. A total of 11 in-service IFS officers nominated by MoEF&CC from different states attended the training from 14-18 March, 2022. Dr. Jagmohan Sharma, IFS and Director General, Environmental Management & Policy Research Institute (EMPRI), Bangalore was the guest of honour for the inaugural session of the training. The training was broadly classified into five sessions namely

Industrial wood production, wood technology, wood sector scenario, wood products design & innovation and wood as a building material. Apart from visit to IWST laboratories, xylarium, museum and woodworking centre it also included field trip to Chennapatna Craft Park, Hunsur Plywood Works Ltd. and Karnataka Soaps and Detergents Limited, Mysore. Eminent wood based industry representatives, researchers and experts in the field of design and wooden building technologists addressed the participants.

National Webinar on Augmenting Teak Timber in India: Way Forward

As part of celebration of Azadi ka Amrit Mahotsav and also on the occasion of Aluminum Jubilee of the International the Day of Forests, the Institute conducted a webinar on "Augmenting Teak Timber in India: A Way forward" on 21-22 March, 2022. This webinar was attended by Forest officers from several state Forest Departments, scientists from ICFRE organizations and research institutes, universities and representatives from wood industries, all the Heads of Divisions, Scientists, Officers, Technical Staff and Scholars of IWST, State Forest Departments, Agricultural Universities and Forestry Colleges through online or offline mode. The premise was to arrive at suitable strategies and options in determining the reduction of importing teak timber to India and augmenting the internal production so as to achieve self-sufficiency in the next 25 years.

Dr. M.P. Singh, IFS, Director, IWST addressed with a brief presentation explaining that teak is indigenous to India and has the second largest teak forests after Myanmar. He mentioned that import of teak wood has been increasing from 2003-04 and the recent decrease was due to increased import of other timbers. Dr. Singh, opined that revisiting the forests and planning augmentation of teak within India is the need of the hour to make changes in the current scenario of teak import and hoped that this webinar will result in strategies for planning augmentation from natural forests and Trees outside Forests (ToFs).

The Guest of Honour, Shri.K.P.Singh, IFS Deputy Director General of Forests (C), MoEF&CC, IRO, Bengaluru shared his experiences in Maharashtra,

where teak seed collection and raising of saplings was well managed and plantations were raised scientifically. However, he viewed that in spite of teak growing stocks being available, presently focus has shifted from production forestry to conservation forestry. Therefore, he urged young foresters to make our forests more productive and sustainable.

The Chief Guest of the day Mr. Tasneem Ahmad, IFS (Retd.), Former PCCF of Maharashtra Forest Department, in his inaugural address said that this webinar on a very important contemporary topic is crucial for the moment. He explained the importance of canopy manipulation, regeneration and yield enhancement concept which is necessary to enhance the productivity of teak plantations. The Current Annual Increment (CAI) growth can be increased to 5 cu.ft/ha/year if properly managed. Mr. Ahmad explained the importance of tree felling which is necessary to raise subsequent plantations and timber to obtain as by-product for revenue generation. On the other hand, conservation forestry has led to lesser felling and not enough carbon is captured as forest increments become insufficient. He emphasized that forestry should not be split as conservation or production forestry and that forest service was created for the silviculture and management of forests rather than leaving them unmanaged. Mr. Ahmad ended his speech with a note to promote the use of wood instead of alternative materials like steel. The inauguration was followed by the technical session during which speakers presented scientific aspects or the state-wise perspectives on augmenting teak timber in India.

Technical Session: Day - 1 (21.03.2022)

Dr. B. Gurudev Singh, Scientist-G (Retd), IFGTB, Coimbatore, made detailed presentation on the topic 'Utilization of genetic resources of teak in India for higher productivity and increased farm income'. Dr.



Dr. Singh, explained the journey of teak improvement from 1970s which led to the availability of selected clones being multiplied through tissue culture and planted. He also outlined a road map for 2047 by

creating and making use of a national register of teak seed sources and a consortium of research institutes, farmers, artisans and woodbased industries, so that teak timber as well as finished products can be exported by India.

Dr. Chiranjiv Chaudhury, IFS, PCCF, Andhra Pradesh Forest Department, provided perspectives of A.P. forest department for



augmenting teak timber in India and highlighted the regional variations in teak wood while citing the teak of Western Ghats and central India. Mentioning the constraints for non-availability of indigenous teak and large imports, he suggested a way forward for changing the scenario by creating a national database of teak growers, inventory of plantations, strengthening of institutes for R & D and supply of Quality Planting Material (QPM), uniform grading system and certification, commercial forestry in degraded forest area, revisiting existing policies, lack of farmers' friendly agri-silviculture, agri-silviculture models etc.

Sri. Dipak Sarmah IFS (Retd), Former PCCF (HoFF), Karnataka Forest Department, highlighted the perspectives of Karnataka Forest Department for augmenting teak timber. Though teak extraction has



been reported as early as 1800 in North Canara, in the absence of clear policy decisions, neither clear felling for raising plantations nor thinning in the existing plantations have occurred after 1983. Mr. Sarmah further viewed that thinning was not done as per the prescriptions of working plans, which has resulted in the growth of miscellaneous species causing reduction in teak growth. As regeneration in teak plantations is nil, promoting plantations and maintaining teak areas as teak forests with proper thinning is important. He opined that it is necessary to make changes in the policy to create awareness among young forest officers and subordinates about the actual composition of existing forest types in Karnataka for better management. He emphasized that crown thinning intervention and maintaining 40% and 20% of teak growing stocks in moist and dry forest will help in improving productivity. He opined that teak performs well in open forest areas and ANR and enrichment planting would help to improve teak productivity.

Sri. Ravishankar R, CCF (Research), Karnataka Forest Department raised the query to Sri. Dipak Sarmah about the future of teak if it is promoted. The speaker replied that teak productivity in forests will improve if proper thinning is done on



time. The 25 years rotation period is fairly good enough in agroforestry system which has good scope to expand teak base. Shri. Ajay Mishra, KFD clarified that KFD could not do thinning due to some reasons and further he added that Teli-teak variety performs well in dry areas with 60-90 years rotation but it has failed in moist areas.

Sri. Aseem Srivastava, IFS, PCCF, Madhya Pradesh Forest Department, while presenting on the status of augmenting teak in Madhya Pradesh mentioned that currently teak is being imported from Africa



and outlined their future strategy to tackle the issue through JFM Sankalp and Vriksharopan Protsahan Adhiniyam. He informed that teak plantations are being promoted by the forest department by using certified seeds and by allotting more area to Forest Development Corporation. Sri. Srivastava briefly explained about the various research initiatives undertaken at SFRI, Jabalpur for augmenting indigenous teak production. He opined that imported teak wood is 60-70% cheaper in India due to its easy and ready availability.

Sri. N. Sateesh, IFS, CCF, Tamil Nadu Forest Department, presented on the perspectives of Tamil Nadu Forest Department for augmenting teak timber and elaborated on Padugai teak plantations (canal teak) and its growth habit in Tamil Nadu. He



explained about the various technologies such as Acoustic Tomography for detecting hollowness of teak wood and SMART forest being used for teak cultivation in Tamil Nadu and also cited the success of smart forest system in Brazil.

Dr. S. Sandeep, TEAKNET, Coordinator and Senior Scientist, Kerala Forest Research Institute, in his presentation on 'Global and Regional perspectives', mentioned that teak is being naturally distributed in 4 countries including India and is now introduced in 70



other countries. He covered various aspects viz., region-wise area of planted teak in the world, global teak import of round and sawn wood, teak log dimensions, rotation age in different countries and also highlighted the critical activities during various stages of management for teak plantations. Dr. Sandeep informed that teak productivity in India is about 1.41 to 2.83m³/ ha/year whereas in African countries, productivity is 15m³/ha/year. He urged that timber certification is needed to access global markets and small holder plantations should be promoted. He stressed that we need to focus on TPM (Target Planting Material) instead of QPM for enhancing productivity as TPM has been successful in Ghana and Tanzania.

Sri. U.D. Singh, IFS, APCCF, Gujarat Forest Department, presented an overview of Teak augmentation in Gujarat and explained the efforts of Gujarat Forest Department for augmenting teak production and mentioned that teak is the fifth top-most species in TOF in the state. While outlining the ways for popularizing teak plantations, he informed that research activities of Gujarat Forest Department are carried out along with Navsari Agricultural University. He informed that they are also working on obtaining GI tag for 'Valsad Teak' as it has unique qualities. He highlighted that teak production can be



Technical Session: Day - 2 (22.03.2022)

The second day of the webinar began with the opening remarks by the following guests/ experts:

Dr. P.J. Dilip Kumar, IFS (Rtd.), Former, DGF & Special Secretary, MoEF&CC.

In his initial remarks, Dr. Dilip Kumar mentioned that though a lot of work has been done on teak in 1990s, data on actual growth pattern of teak is not available and even volume table needs to be re-looked and updated. He opined that ICFRE has to play a major role in dissemination of information on teak cultivation & yield and suggested that market availability needs to be thoroughly analyzed and



increased through rehabilitation of degraded lands with teak, development of teak based bund planting in farm lands and reduction of rotation age. He ended the talk with a suggestion to create a WhatsApp group for teak to discuss crucial matters and flag important issues to the Government of India.

Discussions of the sessions are summarized below

Though the quality of plantation grown teak being imported is less compared to indigenous material, there is no limit on imports and it is cheaper. There is a need for quality timber and only aged teak trees are capable of producing the highly durable class I timber and plantation grown timber of lesser rotation period falls under class II category. Research has shown that teak from agro forestry models has lesser extractives and strength is also compromised as compared to naturally grown teak from forests. When research is focused on decreasing the rotation period, results must be drawn from yearly observations made till the actual rotation period of teak, as heartwood is much more in aged trees compared to mature young trees. It was suggested that teak can be grown with miscellaneous species with proper thinning and regeneration is almost nil in teak monoculture. Conservation efforts/ ecosystem services should be monetized and the government should be made aware of the financial loss due to depriving the society of the material from thinning/felling and that policy changes should happen only with the input of foresters.

proposed to avoid teak monoculture. He suggested that IWST has to develop a method to distinguish the immature and mature teak wood as people are easily cheated in the market with *Acacia Auriculiformis* wood in the name of teak. He also emphasized that agroforestry needs quality improved planting material for high productivity and cautioned that teak is not a good species in high rainfall areas.

Sri. Bivash Ranjan IFS, Additional Director General of Forest, MoEF&CC, Government of India.

Sri. Bivash Ranjan elaborated on how production of teak can be increased, if certification and chain of custody are



made available for forest products and TOF, which are necessary to qualify for export of timber. He also pointed out shortcomings in working plans due to lack of best practices for raising QPM and suggested to rope in CAMPA and state forest corporations for QPM production. He emphasized that organization like IWSST must be recognized as certifying agencies for timber species and also urged to develop benchmarks for sustainability. He stressed that capacity building, promotion of TOFs and certification play a key role in promotion of timber export in the future. He advocated identifying tree species having local demand and export prospects for promotion of TOFs. He assured assistance from the Ministry for implementation of policy changes, when a task force is constituted by the ministry to review and suggest changes.

The following speakers then presented on various scientific aspects or the states perspectives for augmenting teak timber in India:

Dr. Rekha Warriar, Scientist-F, IFGTB, Coimbatore, in her talk titled 'small holder teak agro forestry plantations: scope and prospects in India', she mentioned the challenges for sustainable wood production and presented wood import status since 1990. About 95% teak wood is imported from 30 countries by India, a forested nation (ITTO, 2022). She explained the strategies for growing our own wood by promoting smallholder systems for commercial production through integrated/block system, agro-forestry (AGF) and subsistent systems for increasing teak productivity. Dr. Rekha also highlighted the research contribution in achieving this through the All India Coordinated Research Program on teak carried out at various ICFRE institutes. She presented the challenges/ impediments to smallholder teak in India and suggested to strengthen seed supply by certification and geo-tagging. She also mentioned the outcome of the research at IFGTB to overcome wind as a delimiting factor for growth by intercropping with casuarina and also cautioned against transport of



seeds across population limits (genecological zones). She informed that the IFGTB has supplied QPM and clones of teak to Chhattisgarh farmers and the Forest Departments of Maharashtra and Kerala which are performing well.

Sri. Pramod Krishnan, CCF, Kerala Forest Department, deliberated on the status of augmenting teak in Kerala and mentioned that teak productivity has decreased in plantations due to site quality deterioration and about 86% of teak timber production is met from homesteads. He informed that farmers prefer short-rotation teak varieties and a technical committee has evaluated the quality of all teak plantations in Kerala. Mr. Pramod suggested that teak productivity can be increased by 3-4 m³/ha/year through intensive management and also pointed that every panchayat would be carbon neutral by increasing tree cover in farmlands. He further highlighted that forests in Kerala are managed for multi-functional purposes.



Sri. Ashok Kumar Sinha, IFS, APCCF, Telangana Forest Department, presented the perspectives of Telangana in augmenting teak timber. He described the factors contributing to the dwindling productivity of teak and suggested various strategies such as planting in natural forests, use of improved planting materials/clones (APSBC-1, APNDG -1, APNMR-1 and APNMP-1), site quality improvement, applying best silvicultural practices and total protection for augmenting teak yield through assisted natural regeneration and artificial regeneration. While tabulating the supply and demand, he opined that captive plantation will be the strategy for the future.



Dr. Kuruvilla Thomas, IFS, PCCF & Director, SFRI, Kanpur, in his presentation on the perspectives of Uttar Pradesh state forest in augmenting teak timber, he



described the scenario of teak in U.P., a non-teak area. He emphasized the need for augmentation since the requirement for teak and teak saplings has increased in U.P. He listed the prospects and challenges of teak plantations and mentioned that there are no new wood based industries in U.P. ever since the ban in 1997. He concluded that UP Forest Department has proposed new Draft U.P. TOF/Agroforestry Policy - 2022.

Sri. Kalyan Kumar, IFS, APCCF, Maharashtra Forest Department, made a presentation on the perspectives of Maharashtra in augmenting teak timber. Mentioning that tree cover in Maharashtra has increased in 2021, he presented the availability of teak timber in the state. However, he stressed that the imports are more, and listed potential ways for going forward for augmenting teak in Maharashtra. He concluded that teak import can be reduced if farmer-centric approach is promoted.



Sri. Rajesh S. Kallaje, IFS, CCF, Chhattisgarh, Forest Department, made a presentation on the perspectives of Chhattisgarh in augmenting teak timber. He listed year wise teak timber production from 2001 to 2021 and mentioned that teak supply in Chhattisgarh timber market is less. He elucidated their targets for the next six months and mentioned that tissue culture teak plants from IFGTB, Coimbatore will be used for raising plantations for high productivity and listed out several strategies for way forward viz., ease of felling and transit rules, promotion of teak based AGF under MGNREGA schemes, linkage between WBI and producers, re-look on teak harvesting prescriptions in WPs, provide digital platform to the farmers to sell AGF woods and sharing of market information. He finally advocated the “ease of doing business principle” and “wood is good” to public.



Sri. O.P. Singh, IFS, APCCF, Odisha Forest Department, gave a perspectives of Odisha Forest Department in augmenting teak, detailed about their

teak resources, management issues and rotation period. He mentioned that they have teak plantations in ten districts apart from seed production area, clonal seed orchards, clonal multiplication gardens and in situ conservation teak plots. He opined that the royal status of teak is the main cause for its ruin, and protection from biotic factors and illicit felling is a major issue. Detailing other difficulties for the way forward for teak augmentation, he suggested that 80% of mature trees should be harvested and rest 20% retained as future crop; thereby productivity would be enhanced.



Sri. Subhash K. Malkede, IFS, APCCF, Karnataka Forest Department, presented perspectives of Karnataka in augmenting teak timber. Highlighting that the first teak plantation was raised in 1865 in Chikmagalur, he described about teak forests, production and sale in Karnataka's depots. However, despite increasing demands, there has been no regular extraction since 1983, due to ban on green felling in Karnataka. He opined on the need to convert natural forests to increase productivity and described how confusions have occurred in Karnataka regarding teak forests. He suggested ways to augment teak productivity by assessing productivity of teak forests, segregating teak forests as productive and non-productive (conservation) natural teak forests, introduction of teak in TOFs and at least 5% forest area to be brought under teak and ended by emphasizing the need for policy changes in utilizing of teak from forest areas.



Dr. E.V. Anoop, Dean (Forestry), College of Forestry, KAU, Thrissur made a presentation on ‘GI tagging of Nilambur teak - the success story’, elucidating about the Nilambur teak, its superior attributes and uses and the reasons for its unique properties. He described the journey of obtaining its GI tag and its benefits to the stake holders.



There were several discussions and suggestions by participants after each talk /presentation. While

considering the aspect of intensive farming of teak leading to soil deterioration, Dr. P.J. Dilip Kumar, IFS (Retd.) suggested not to commit the same mistakes done in the past of raising teak as a monoculture. Describing the preamble on green felling ban, Mr. Dipak Sarmah, IFS (Retd) suggested revisiting and revising future working plans for taking up degraded and encroached areas for planting teak with miscellaneous species, since there is no blanket ban on clear felling and it is based on basal area changes. Mr. Tasneem Ahmad, IFS (Retd) detailed how canopy manipulation and proper management by thinning while following yield tables, can result in increased growth and productivity of teak by presenting the

normal growing stock curve profiles from the past.

Dr. M. P. Singh, Director, IWST in

his concluding talk assured that IWST is willing to work on timber certification with MoEF & CC, and informed that IWST has already submitted a proposal to MoEF & CC in this aspect. He stressed that development of Task Force on Teak will not only help in promotion of teak at a large level, but also in augmenting teak farming in TOFs and requested all the senior forest officers for guidance in this matter.



Webinar on Sandalwood farming and management of its health

IWST organized a webinar on Sandalwood farming and management of its health under Azadi ka Amrit Mahotsav on 25th March, 2022. Sandalwood seed handling and nursery techniques detailing processing of sandal wood fruits and seed quality testing, plantation technology in sandalwood based agroforestry systems, heartwood estimation and economics of growing sandalwood, good silvicultural practices for the best health of sandal wood was discussed during the webinar. The harmful effects of injudicious pruning was also highlighted during the program. About 150 participants including students, researchers, academicians, farmers and individuals from various backgrounds attended the program.

Webinar on Need an act to revive agro wood based sector in India

IWST organized a webinar on Need an act to revive agro wood based sector in India under Azadi ka Amrit Mahotsav on 28th March, 2022. In this webinar, five panelists namely, Shri. Bivash Ranjan, IFS, ADG (Wild Life), MOEF & CC, Shri. Ritwik Dutta, Environmental Lawyer, New Delhi, Shri. Sajjan Bhajanka, Chairman, Century Plyboards India Ltd., Dr. M.P. Singh, IFS, Director, IWST, Bangalore and Dr. H.R. Prabuddha, IFS, Dy. Conservator of Forests, IWST, Bangalore spoke on promotion of Trees outside Forests (ToF) and Agro-wood based sector in India. More than 100 stakeholders representing wood based industries, tree growers, scientists, officers from State Forest Departments participated.

The salient points discussed in the webinar are presented below-

Shri. Bivash Ranjan, IFS., ADG (Wild Life), MoEF&CC in his opening remarks as Chairman of the 2nd Joint Working Group for promotion and Expansion of Tree Outside Forest (ToF) constituted by the MoEF&CC to promote ToF in the country mentioned that to promote the cultivation of Rosewood, Sandalwood, Agarwood and Red Sanders on farmland, MoEF&CC has recently released package of practice in the Farm Bulletin for wide distribution. He also observed that, there is a need to come up with pamphlets/bulletins covering package of practice for other Agroforestry species to promote ToF in the country. He advised ICFRE institutes and State Forest Departments to work towards supplying certified quality planting material for production of certified wood to boost export. Further, he stressed upon improving infrastructure to promote marketing of wood and wood products in the country.





Shri. Sajjan Bhajanka, Chairman, Century Plyboards India Ltd., emphasized that the proposed legislation to promote ToF and wood based industries in the country should facilitate the establishment of more and more wood based industries in the country and it should not be regulatory in nature. He narrated the success story of China, where liberalized policy to promote Wood Based Industry and Agroforestry in the country helped China to boost production of wood and wood products by 10 times. Now, China contributes 50% of world's total exports in wood products. Considering China's success story, he stressed

upon coming up with a policy which facilitates ease of doing business and urged that establishment of Wood Based Industry in any state should be decided by market forces like demand and supply of wood rather than any Act or Policy. Banking institutions should provide credit facility to farmers to grow more wood. He also opined that ICFRE institutes should work on supply of quality planting material for the farmers to promote ToF. He expressed satisfaction over the recent initiatives taken by the Government to promote ToF and Wood Based industries in the country.

Dr. H.R. Prabuddha, IFS., Dy. Conservator of Forests, IWST, made a presentation on draft legislation on "Growing Trees outside Forests (Promotion and Facilitation) Act" prepared by IWST in consultation with various stakeholders. In his presentation, he explained the salient features of the new draft legislation highlighting on important definitions used in the new act, supply of quality planting material, certificate of origin, use of IT solutions to handle certification of wood and registration of Wood Based Industries, constitution and powers of national, State and District level Wood Councils and their role in promotion of Wood Based Industries; use of electronic trading and transaction platform.



Shri. Ritwik Dutta, Environmental Lawyer, New Delhi, in his address highlighted on some of the existing policy obstacles for promotion of ToF in India, like para 3.2 of National Forest Policy, 1988 which discourages the diversion of productive agricultural land to forestry purpose and in some of the instances, Hon'ble Supreme Court of India also observed that provisions of National Forest Policy should be influenced like any other legislations passed in the Parliament. So he emphasized that instead of going for any act, we need to have policy in place to promote ToF in the country. Further, he opined that we should not go for

monoculture of plantations rather, we need to have mixed plantation models for each agro-climatic zone in the country. He also stressed upon taking up studies on socio-economic impact of agro-forestry on livelihood of farmers in comparison with pure agriculture. He suggested to work on promotion of wood products in construction industry as "Wood is Good" for climate change mitigation. He also opined that management of wood based industries is a State subject, so we need to address this issue carefully without interfering much in the federal structure of Governments in India.

Dr. M.P. Singh, Director, IWST, Bangalore gave brief background about the new draft act prepared by IWST. He appraised all the panelists and participants about the consultative process adopted by IWST in drafting this legislation. He opined that the laws applicable for forests and forest products cannot be applied to wood produced from ToF. Liberalized policy for ToF helps in expansion of area under ToF which in turn will help in boosting wood based industries in India. He stressed upon the importance of certification of wood to maintain chain of custody of wood produced from ToF to boost the export of wood products from India. Many Western countries like USA and EU have legislation in place to ensure legality of wood and due diligence, whereas in India we do not have any law to ensure due diligence in wood production. So, it is high time for India to come up with new legislation to promote ToF and certified wood that can help in promotion of



export of wood products from India. As many participants suggested to promote use of wood in construction, he opined that there is a need to incorporate some legal provision in the draft legislation to promote wood for various purposes.

Growing Trees Outside Forests (Promotion and Facilitation): A draft Act™

PREAMBLE

An Act to promote and facilitate growing of trees outside forests (henceforth, “farm wood”); to promote availability of certified/accredited quality planting stock; to provide a framework for electronic Certificate of Origin and Ownership and establish a standard for legality of farm wood; to promote efficient, transparent, and barrier-free inter-state and intra-state trade and commerce of farm wood; to establish a national framework on agreements for farm wood; to facilitate establishment and promotion of farm wood-based enterprises and matters connected therewith or incidental thereto.

WHEREAS increasing tree cover is an effective mechanism to fight the climate change crisis arising out of increased greenhouse gases in the atmosphere;

AND WHEREAS the agricultural lands in India provide an opportunity to supply wood along with food, while simultaneously meeting the objective of creating carbon sinks, which is also in line with India's commitment to the Paris Climate Agreement;

AND WHEREAS forests in India, although seemingly adequate in area, are primarily committed to demands such as fuel, fodder and timber for indigenous people, and are required to be maintained and improved for various

ecosystem services and conservation of biological diversity, hence limiting the production of wood;

AND WHEREAS growing of trees on private lands outside forests has played an important role in catering to domestic timber demand in India and stabilizing the forest and tree cover of the country, by not only adding to area under tree cover but also providing a substitute to the timber harvested from forests and hence, conserving the forests for ecological functions;

AND, it is necessary to transcend the boundaries of the forests in order to meet India's wood requirements from within the country (Atmanirbharta), to reduce pressure on the forests, and consequently, to increase carbon sequestration by various landscapes to fight global warming;

AND, it is necessary to have a standard for the legality and chain of custody of farm wood that is accepted worldwide (Vocal for Local);

NOW, THEREFORE, it is expedient to enact a legal framework for hassle-free transportation, marketing and utilization of wood grown on non-forest lands in order to promote the growing of trees outside forests and double the income of farmers.



Policy and Legislative Interventions to Strengthen Wood-Based Sector in India

Representations were made by Federation of Indian Chambers of Commerce and Industry (FICCI) Furniture Committee about limited availability of certified raw material for furniture sector. FICCI advocated for a Timber Policy focusing on certification, providing incentives for farmers to grow more wood to meet the industry requirements, intensive scientific management of forest plantations, and encouraging tea, coffee and rubber planters to produce seasoned wood along with other policy suggestions. Similarly, Federation of Indian Plywood and Panel Industries (FIPPI) made a representation regarding small policy shifts to promote agroforestry and license free wood based industrial establishments in the country. Considering the industry demand, Government of India announced required policy and legislative changes to promote agro-forestry and private forestry in its annual budget following which a budget webinar was organized to initiate discussion on aforementioned issues. Further, the Ministry of Environment, Forests and Climate Change (MoEF&CC) has constituted two joint working groups to dwell on the aforementioned issues. In this article, I plan to summarize the current scenario and suggest some policy and legislative interventions to augment raw material supply for wood-based industries.

Previously, I made an attempt to bring out the key concerns regarding the revival of Wood Based Industries in the first issue (April-June 2020) of this magazine. In the second issue (July-September 2020) of this magazine, I wrote an article on the journey of raw materials from forest produce to agri-wood for Indian plywood and panel industries. In this issue, I mainly emphasize on how forest-based industries metamorphosed to become wood-based industries after the adoption of National Forest Policy 1988 and various judicial orders of the Hon'ble Supreme Court of India in Writ Petition (Civil) No. 202 of 1995 in the matter of *T.N GodavarmanThirumulpas v Union of India*.

M.P. Singh, IFS

Director, Institute of Wood Science and Technology,
Bengaluru.

Email: mpsinghifs1989@gmail.com

In India, about 90% raw material consumed by Wood Based Industries is produced by the Trees Outside Forest (ToF) areas, which are mainly in the form of agroforestry plantations. Forests contribute only 3.0 % of raw material consumed by the Wood Based Industries and the remaining 7.0% of raw materials requirement is met by imports. Approximately 10 lakh farmers are engaged in raising ToF plantations who are currently the main driving force behind Wood Based Industries in India. However, ToF/ agroforestry sector is facing several problems which require separate mechanism to handle, resolve and facilitate the growth of ToFs / agroforestry in India. Absence of dedicated and focused national policy and associated issues were demotivating the farming communities from further expansion. Moreover, restrictions were being imposed by the Central and State Governments on harvesting and transportation of ToF produce, especially those species which are found growing in the nearby forests.

In February 2014, India became the world's first country to adopt a comprehensive National Agroforestry Policy (2014) with an objective to encourage and expand tree plantation in a complementary and integrated manner with crops and livestock. This sought to improve productivity and livelihoods of farmers while also meeting the raw material requirements of wood-based industries and to further reduce reliance on imports from foreign countries. The policy document identified various factors responsible for agroforestry not gaining the desired importance as a resource development tool. These factors include: 1) restrictive legal provisions for harvesting and transportation of trees planted on farm lands 2) inadequate attempts at liberalization of restrictive regulations 3) near non-existent extension mechanisms 4) lack of institutional support

mechanisms 5) lack of quality planting materials 6) inadequate research on agroforestry models and species suitable across various ecological regions of the country 7) inadequate marketing infrastructure and price discovery mechanisms 8) lack of post-harvest processing technologies 9) industry operations at a sub-optimal level etc. Consequently, two pronged strategies were undertaken. First one entailed creation of *Submission on Agroforestry* as part of sustainable agriculture to support the states in implementing the scheme on agroforestry. The second strategy emphasised on liberalizing the production and movement of such timber sourced from agroforestry farms without jeopardising the safety of the forests. The regulatory provisions in *Indian Forest Act, 1927* that apply to a number of tree species are ambiguous with respect to treatment of timber harvested from forest and agroforestry, as both come under the purview of forest produce as defined by the Act. To remedy this, states were encouraged to exempt tree species grown under agroforestry systems from all restrictions related to harvesting, transportation and marketing. Furthermore in 2016, the *Wood Based Industries (Establishment and Regulation) Guidelines (2016)* of Government of India made special provision for industries based on round log/timber from species declared as agroforestry/agricultural crops by making them exempt from having to procure a license. Since these categories of industries don't need licensing, they can be established without regard to the assessment of availability of timber.

However, legal and policy framework has not changed much in most of the states/UTs. Furthermore, the perspective of Hon'ble Courts and tribunals in India has not adapted with the changing scenario in which wood is being supplied mainly from agroforestry. In the present-day scenario, the precautionary principle of forest conservation that has been applied on wood-based industries in the past irrespective of whether the wood is sourced from forests or agroforestry, is now obsolete. In the third issue (Oct-Dec 2020) of this magazine, I offered a perspective on having a separate act for trees outside of forests to bolster the growth of wood-based industry sector. Due to the lack of appropriate legislative framework to implement the agroforestry policy already in place, India is not able to promote

wood-based industries and increase the production of raw materials, and is relegated to being a net importer of wood and wood products.

To further understand the problems and prospects of wood sector in India, Institute of Wood Science and Technology (IWST) continued consultations with various stakeholders associated with the wood sector including the farming community. Accordingly, three possible solution strategies were developed and suggested, namely:

- ♦ Revised draft guidelines for the establishment, facilitation and regulation of wood-based industries.
- ♦ Draft for the enactment of an act called the Growing Trees Outside Forests (Promotion and Facilitation) Act 2022.
- ♦ Strategy on Indian forestry standards and certification.

The revised draft guidelines for the establishment, facilitation and regulation of wood-based industries aim to create a separate classification for wood obtained from agroforestry systems as an immediate measure to distinguish it from forest timber. Farm wood by definition includes all wood, whether cut up or fashioned or hollowed out for any purpose obtained from trees outside forests (ToF); whereas ToF means trees located on all lands outside notified forests, recorded forest and such other forests which have been identified by the Expert Committee constituted by the state government as forest lands and to which Forest Conservation Act 1980 applies. The idea of growing trees outside forests for consumption by wood-based industries benefits the principle of forest conservation and therefore the Forest Authorities of India should play an active role in the attempt to promote agroforestry. An institutional forum for all stakeholders in the form of the National Wood Council has been provided to spearhead campaigns such as '**Grow More Trees Outside Forests**' and '**Wood is Good**' to spur a mutually healthy balance between demand and supply. All wood-based industries which use 'Farm wood' need to be registered online with the respective state or UT governments and submit records of all woods procured and used by them at specific intervals in an online electronic format that

There is a need to set a good precedence for the practice of sustainable management of forests in India and a special case of Indian Agri-wood production in India at international forums for the global acceptance of indigenous frameworks of certification

the State/UTs forest department may prescribe. In essence, a different framework for wood from agroforestry has been suggested which is distinct from the existing framework for forest-based industries. The framework also provides for e-monitoring of the supply chain of raw materials for the industries so that the industries don't procure illegal timber from the forests. The system can be made robust by non-compliance to procurement from legitimate sources being made incompatible with the industry itself. Besides these, other small changes have been suggested based on the experiences of last five years to remove ambiguities and unnecessary hardships.

2. Considering the absence of a legislative framework to implement the policy on agroforestry in India, IWST has submitted a proposal to MoEF &CC to enact a new legislation called "*Growing Trees Outside Forests (Promotion and Facilitation) Act*" to address the various problems associated with the cultivation of ToF. The proposed act aims to: i) facilitate the availability of planting stock of accredited or certified quality; ii) provide a framework for the issuance of IT based Certificate of Origin and Ownership and establish a procedure for chain of custody and the legality of farm wood on par with the standards of international communities such as European Union, UK and USA; iii) promote efficient, transparent barrier-free inter-state and intra-state trade and commerce of farm wood; iv) establish a national framework on farming agreements for farm wood; v) facilitate establishment and promotion of farm wood based enterprises; vi) encourage farmers and other land owners to cultivate long rotation species such as teak, pine, rosewood, sandalwood, red sanders, agarwood, mahogany etc. and matters connected there with or incidental thereto. In essence, the

proposed act aims to replace transit permit based bureaucratic regime with a separate IT based framework for farm wood, where all wood harvested, transported and marketed can be traced for their legitimacy with due diligence. It starts with the establishment of an efficient system of recording data with the help of modern geo-spatial tools (remote sensing and geographic information system) with parameters such as number of trees on farm, species grown, harvesting schedule & quantity of products, identification of the area of production, geo-coordinates of all plots of land where relevant wood and wood products produced with date, name and address of persons in the value chain of wood etc. The data from this system will be used for the issuance of Certificate of Origin and Ownership (CoO). Mobile apps shall be used for populating the database and issuance of the certificate. All enterprises using such farm wood shall be registered online and will be integrated with the database to demonstrate chain of custody for all wood products. This system will empower the farmers and industries to demonstrate legality and chain of custody for all wood and products manufactured from identifiable and legitimate sources. The data system and IT based apps will give confidence to banking institutions and industries to enter into farming agreement with land tenure holders for growing of tree species on economic terms. Even the government can plan production linked incentives (PLI) for this sector.

3. Lack of availability of certified wood as a raw material is one of the major hurdles for the wood-based industries to export their finished wood products to other nations. Certification of wood and wood products is the main trade barrier for the Indian exporters. To overcome this challenge there is a need to develop an Indian system of certification for the wood procured from forests as well as ToF/ agroforestry. At later stage, if any farmer/ industry/ forest department or division need to go for any international certification schemes from the Indian framework of certification as per market demand, it becomes easy for such a transition to take place, as the substantial documentation process has already been done in the process of certification under Indian certification framework. Moreover, there is a need to set a good precedence for the practice of sustainable management of forests in India and a special case of

Indian Agri-wood production in India at international forums for the global acceptance of indigenous frameworks of certification (Vocal for local).

3.1 : Developing an Indian System of Forest Certification: India has been practicing scientific and sustainable forestry from last one and half century. Most of our forests are being managed based on the prescriptions of approved Working Plan documents that are prepared on the principle of sustainability. Despite practicing scientific and sustainable forestry in India, we are unable to impress upon the outside world (especially the Western world) about the significance of sustainable forestry practices adopted in India. To promote Sustainable Forest Management (SFM) practices, the concept of forest certification came into being during late 1990's in western countries due to the genesis voluntary forest certification schemes promoted by Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC). Although forest certification is perceived as a voluntary and market driven process, it often becomes a trade barrier for the export of wood and wood products from India. On the other hand, implementation of western forest certification systems like FSC and PEFC in Indian conditions would be quite tedious and expensive to implement. For instance, FSC certification scheme consists of 10 principles, 55 criterias and 200 indicators related to SFM. Similarly, Network for Certification and Conservation of Forests (NCCF), a NGO from India has come up with 59 criteria and 239 indicators for SFM which is endorsed by the PEFC. Adhering to such a large number of Criteria and Indicators (C&I) makes certification a very complex process which would be difficult to implement in Indian conditions.

Considering the difficulty in adopting western certification systems, there is a need to develop an "Indian Framework" for certification of wood and wood products in India as an alternative to the Western Certification Systems. In order to ease forest certification process in India, IIFM (Indian Institute of Forest Management), Bhopal has come up with 8 criteria and 37 indicators for SFM through Bhopal-India Process. The same C&I developed by IIFM has been adopted in the National Working Plan Code, 2014 and they are being implemented in most of the

Network for Certification and Conservation of Forests (NCCF), a NGO from India has come up with 59 criteria and 239 indicators for SFM which is endorsed by the PEFC.

forest divisions across the country under the guidance and complete control of the Central Government. Hence, it would be desirable to come up with an Indian framework of Forest Certification based on C&I developed by the IIFM adopted in the working or management of forests. MoEF&CC can authorize ICFRE/any other similar institutions as certifying agencies for the purpose of the certification scheme in India. This scheme will provide required synergy and correct narrative between the role of the central government in controlling forest management practices in the states and improving the efforts of the states in sustainable management of forests. All forest divisions will have to undertake this certification scheme with funding from CAMPA.

3.2: Certification of Agri-wood: In India, wood coming from agricultural land (Agri-wood) contributes about 90% of raw material requirement of wood-based industries. However, most Agri-wood produced on farm land is not certified owing to lack of clear cut C&I and appropriate system for certification of such wood. Significant contribution of Agri-wood as raw material in production of wood products is quite unique to India and application of C&I developed for the forests of western world to Agri-wood is not suitable to be applicable in the Indian conditions. So, there is a need to come up with Indian framework for certification of Agri-wood as well. Additionally, there is a need to set a good example of the success story of the Indian Agri-wood production and its contribution in the growth of wood based industries in India and its indirect benefit on forest conservation at international forums. For the certification of Agri-wood, the responsibility of setting certification standards may be entrusted to the Indian Plywood Industries Research and Training Institute (IPIRTI) and the Institute of Wood Science and Technology, Bangalore. A simple and cost-effective Indian framework for Certification of Forests and Agri-wood would help the farmers and industry to adopt the certification system in India.

Other essential interventions:

1. India has an excellent Forest Policy ecosystem. However, there is no legislative framework for implementing the policy. Forest (conservation) Act 1980 should be amended to include forest management aspects. National Working Plan Code should be made part of the act, whereby working plans will be legal document and timber and other forest products obtained from such forests will become legal products, and satisfy the condition of legality being imposed in European Union countries, U.K and USA. Therefore, we should have the Forest Conservation and Management Act in place for effective and sustainable management of forests in India. Ideally, Indian Forest Act 1927 should also be subsumed into this proposed act to remove any ambiguity with regard to matters related to forests in India.
2. National Working Plan Code 2014 mandates to set aside 10% forest areas for plantation working circle to augment supply of wood especially for long rotation timber species as part of productive function of forests and providing commercial and livelihood opportunities to local forest communities. State governments may provide for tripartite arrangement by including Forest Department, Local stakeholders and Private Wood Companies or entities for undertaking plantation in such areas earmarked for Plantation Working Circles. However, native species should be given preference over exotic species to maintain the other ecological services provided by the forests without disregard to social and biodiversity safeguards.
3. State Forest Development Corporations in India should shift to long rotation native species instead of undertaking short rotation crops of eucalyptus, casurina, subabul etc. They may also adopt above business models with private companies with due regards to social and biodiversity safeguards.
4. Earlier policy of wood substitution should be discontinued and concerted efforts should be made to increase the use of wood as a climate change mitigation measure in building construction. All government departments such as CPWD/PWD etc. should only use wood in their construction across the country.
5. Special Task Force should be constituted to suggest ways and means to augment teak and pine timbers from India. These two species constitute more than 70% of the imported timber in India.
6. The rationalization of Custom Duty on Wood and Wood Products should be undertaken to promote value addition in India. For example, there should be differential duty of at least 15% between wooden logs and sawn timber with zero custom duty on import of wood logs provided there is no restriction on export of indigenous wood logs. Similarly, paper and paper board, articles of paper pulp, of paper or of paperboard and printed books, newspapers, pictures and other products of the printing industry, manuscripts, typescripts and plans can be placed at 20% custom duty instead of the 15% at present whereas pulp of wood or of other fibrous cellulose material recovered (waste and scrap) paper or paperboard are imported at custom duty of 5%. This principle of 15% value addition should be applied under Advance Authorization/ DEEC scheme.
7. Rationalization of GST and IGST to promote furniture industry: Rationalization of GST is needed on two counts, namely, domestic market demand generation and application gradual value-added principle on wood products. GST should be rationalized. The products are from HS code 4401 to 4404 and should be with 0% GST without any exception just like agricultural produce. This will support the farmers cause of getting better price for wood from the agroforestry. Similarly, items under HS code from 4406 to 4409 should be levied 5% GST as a one step value addition as intermediary product at MSME such as Saw mills etc. Items with HS codes from 4410 to 4421 should be levied 12% GST. This will facilitate further value addition as wooden furniture and modular furnishing, generating further employment under MSME sector and import of such furniture and lifestyle items will not be favorable. Hence, here is a two-pronged strategy of reducing GST on local manufactured furniture and increasing custom duty on imported furniture to augment wooden furniture and furnishing industry in India.

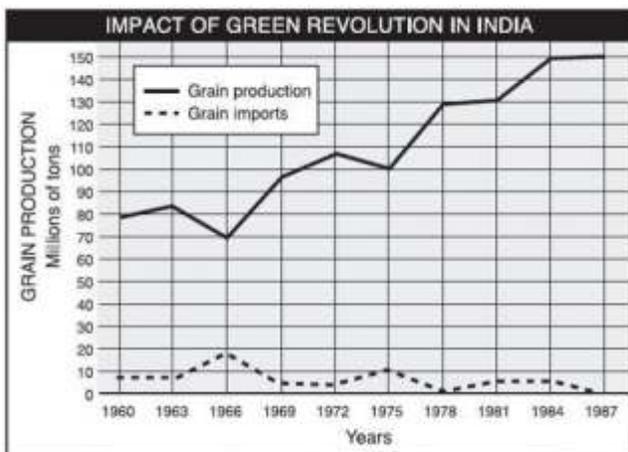
8. Seasoning and Preservative treatment: Seasoning and preservative treatment of sawn timber, plywood and panel products including board, flooring and flush doors meant for use in buildings, residential houses and furniture making etc. should be made mandatory with due safeguards. Modernization and expansion of capacity of existing factories and establishment of new wood based industries to manufacture high quality international standard products suitably treated to improve their longevity and durables exclusively from farm grown wood should be facilitated and incentivized. Suitable regulations and standards should be laid down and institutional framework for quality marking and certification of such products should be put in place. These measures will prevent extensive damage caused to such untreated products by termites, wood borers and fungal pathogens and improve the longevity and durability of wood products and their utility as long term carbon sinks. This will also prevent the colossal losses suffered every year by the consumers and the nation and save our natural and planted forests indirectly.
9. Import of Wood at ports and plant quarantine condition: Arbitrary Phytosanitary requirement on Timber import should be rationalized. Several representations are pending without any outcome. There is a Schedule-III in P&Q Order 2003 which deals with prohibited timber. There are two schedules VI and VII permitting import under specified conditions. The sacrosanct condition is Methyl Bromide fumigation (MB) before export. Most Countries have banned it. There is a 5 times penalty on those who import timber with other fumigants approved in the country of export besides re-fumigation in India. Request is to allow any and all wood which is not on Schedule III by condition of MB fumigation in India without any penalty. Much good and competitive wood cannot be imported because of harsh conditions in P&Q Order 2003.
10. Providing trained professionals to wood sector: Wood sector is one of the unorganized sector having acute shortage of trained manpower especially in the area of Wood Science and Technology. Presently only about seven institutions in the country are offering courses in the form of post-graduation, diploma and certificate courses in Wood Science and Technology. Further, there are no institute/ university in the country offering graduate program in Wood Science and Technology. To fill this gap, the IWST has proposed to start B.Tech. program in Wood Science and Technology in collaboration with Indian Plywood Industries Research and Training Institute (IPIRTI), Bangalore. In this regard a detailed proposal has been submitted to government for necessary consideration. This course is aimed to train the students to make them professionals in wood processing, wood properties, wood chemistry, wood modification, engineered wood, wood energy, etc.
11. Export Promotion: Give emphasis on promoting export of panel products fulfilling the statutory obligation/formalities to be completed in the least possible time, promoting indigenous machinery and technologies and facilitating testing services to ensure to meet the product quality at international level. Strengthening R&D and testing infrastructure including a scientific workforce to develop more products and processes using various indigenous lingo-cellulosic materials for self-reliance of the country. Promote Make in India and Atma Nirbhar Bharat Abhiyan (Self-reliant India Mission).
12. Utilization of Agro/Crop Residues for Value Addition: The use of other renewable resources such as agricultural residues (wheat straw, rice, straw etc.) in the production of composite panels (i.e., particle boards, fiberboards) and paper products has recently been considered attractive both from the economic and environmental point of view. The use of straw can by this way help to protect the virgin forests in regions where there is a shortage of wood. In addition, great quantities of straw residues are available today where the burning of straw has been prohibited, and no proper (efficient) uses for these wastes have been found up to day. Special promotion as 0% GST and free inputs and establishment cost subsidies etc. can be explored with a High-Powered Committee.

Integrated Planning of Agroforestry and Forest Industries for Accelerating Rural Development and Climatic Resilience

1. Historic Background

During 1960s, the country underwent traumatic experience of three wars, one with China and two with Pakistan. Added to those were crop failures. But, with a resolve to be self-sufficient, country implemented necessary measures and produced a record surplus of food grains in 1970s, proving soothsayers of impending disaster (“Famine 1975”) totally wrong. The measures included: creation of infrastructure needed for increasing agricultural production, in particular, State Agricultural Universities (SAUs), agricultural Institutes, experimental stations, extension workers, all geared to help the progressive farmers (see Figure 1).

Fig. 1: Impact of Green Revolution on agricultural productivity in India



Source: James Killoran et al., *The Key to Understanding Global History*, Jarrett Publishing Co. (adapted)

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The key to Understanding Global History Jarrett Publishing Co. (adapted)

2. The Brewing Agriculture Sector Crisis

The agriculture sector in the country is currently passing through a period of crisis, aptly described in the Times of India Editorial of March 13, 2018 in the following words: “Employing over 58% of the workforce,

K.D. Singh

Former Director, Country Capacity Building, FAO, Rome
Email : karndeosingh1936@gmail.com

agriculture makes up around 15% of the economy. The size of the pie is very small. Fragmentation of the land holdings and low yields are long standing problems. To add to them, is a new one arisen: climate change. So far government stock response has been to announce higher support prices or waive loans. Recent experience shows that these responses are at best palliative. Structural reforms are the need of the hour”.

Other reports during the year were the following:

Feb 14, 2018, (on front page) “Modi Calls urgent meet of experts to discuss farm crisis”.

Mar 22, 2018: Farmers’ suicides, compared to a year earlier, declined by nearly 10%. There were 11,000 cases in 2016, as reported by Agriculture Ministry.

Nov 1, 2018: Need to blend subsidy with investment to Enhance Agriculture Sector Growth: Finance Minister.

In contrast to 1960s, when the country was at the mercy of other nations for food aid, the food problem is more or less under control. The national economy is growing well. The agricultural productivity has significantly improved and demand for more land stabilized. The time has come to have a bold and long term strategy to solve emerging agriculture sector problems, in particular, **creation of gainful employment, farmers return on investments and mitigation of climate change impacts.**

The National Agriculture Policy (2005) states that “Agriculture has become a relatively unrewarding profession due to generally unfavorable price regime and low value addition, causing abandoning of farming and increased migration from rural to urban areas.....” **Farmers will be encouraged to take up farm-/agroforestry (AF) for higher income generation by evolving technology, extension and credit support packages and removing constraints to**

development of agroforestry”.

The second part in the above statement calls for some serious thinking as to how the stated condition necessary for the success of agroforestry can be realized. A key requirement for the success cannot be over emphasized viz. to see that trees grown are part of a value chain or committed end value. This calls for a preview of the situation when trees will mature, their prices and end-use. Ideal is, if there is a tie between industries and farmers in tree growing. This will also help in getting R&D investment for Agroforestry and even buy-back.

3. Promoting Agroforestry and Forest Industries Partnership

It is well known that agroforestry has significantly benefitted from partnership with forest industries. WIMCO and ITC are good examples, which have played a pioneering role in evolving high yielding clones of desired tree species and raised yield from 4-5m³/ha to 30-40 m³/ha. The need is for evolving an effective institutional mechanism at the Central and State levels to provide continuing policy, technical and financial support to agroforestry and promote collaboration with forest industries, when and where required. Mutually beneficial partnership, like cited above, could set good examples for planning nationwide expansion of agroforestry, boosting of sagging agriculture sector contribution to national GDP, supplement the declining farm income, contribute to environmental amelioration and arrest land degradation associated with heavy use of fertilizers and irrigation. Another basic consideration is that such partnership will provide new source of income and employment opportunities to the landless and thereby reduce the widening gap in economic development of agriculturally advantaged and disadvantaged areas.

It is in the interest of both farmers and industries that AF development takes place with mutually assured partnership. This way a long term arrangement can be made so that both parties have win-win situation. Investments could be made by farmers and industries in an assured environment to get reasonable profit margin. It may be noted that the price of wood produced from AF is about half that from natural forests. In an environment of certainty farmers may plants species most desired by

industries and also get needed investment for that purpose. In fact, PCCs (Producer-Consumer-Cooperative) could be established at a block or any other suitable level. This may include representatives of Farmers, Industries and the Government to facilitate the process of production and harvest planning and getting felling and transit permit, certification of produced wood and providing other needed support services.

The emphasis thus should move from primary production alone to primary production linked with industrial processing. There is scope for such initiatives in the country, which is importing substantial quantity of industrial wood. Agroforestry could meet both of these goals in a cost-effective manner provided a far-sighted policy and institutional mechanism could be put in place. Yamuna Nagar Forest Industries Complex is oft cited as a successful initiative.

Agroforestry Yamuna Nagar (Haryana) Model (2014)

Annual Wood supply: 2.3 million m³

Price of Unprocessed Wood: INR 3,500 millions

Price of Processed Product: INR 17,000 million

Employment Generated: 150,000

Sapra (2014)

With synergy between agroforestry and forest industries, there is high value addition in different stages of wood production, given as follows: (Singh 2008):

- Primary area production (planting and tending);
- Secondary area production (logging and transport);
- Tertiary production (marketing and processing); and
- Recycling.

Primary area production is defined as a process within an area unit that creates services and commodities useful to satisfy human needs and could be utilised for the purpose. Primary area production may be past, actual or potential; natural or influenced by man.

Secondary area production is defined as the actual harvesting and transport of primary produce to delivery (consumption) point. Delivery point is to be kept flexible depending on delivery conventions.

Tertiary production is defined as conversion processes beyond delivery point in industries or otherwise.

Recycling is defined as conversion processes where reuse of area products occurs.

It should be noticed that all production stages do not always exist. Two or more of them can coincide. In agriculture, e.g. the third and fourth phase may not exist. However, in wood production, including forestry and agroforestry, all four phases are relevant and need to be technical and economic reasons.

There is great scope for more initiatives like Yamuna Nagar, as only a small fraction of farmers are engaged in agroforestry. The demand for additional wood in 2020 is estimated at 150 million m³, of which share of industrial wood is 50 million m³ and non-industrial wood 100 million m³. Agroforestry could meet both of these production goals in a cost-effective manner. Another interesting fact is that wood produced at the farm costs on an average half compared to that bought at the forest depot: one metric cube of wood at mill site costs around US\$ 30 compared to US\$60 per cubic meter from the national forests. What is missing is a national policy and institution to promote integrated production-consumption decision making.

4. Land Evaluation for Climate Resilient Agroforestry

From a very long time, we have been taking measures that improve GDP growth outside agriculture sector in India. But the truth is GDP

growth originating in agriculture is at least twice as effective as GDP growth originating outside agriculture, in reducing poverty.

Small and marginal holdings agriculture is important for raising agriculture growth, food security and to improve the economy in India. These holdings contribute to 80% of Indian agriculture. In direct words, the future of sustainable agriculture growth and food security of the nation depends on the performance of these small and marginal farmers.

In the year 2000-01, the Agriculture Census data showed that 121 million agricultural holdings exist in India. In these, around 99 million holdings were small and marginal.

The low and uncertain economic output from non-irrigated and small farmer lands, is the main problem, which depends on vagaries of adequate rain. Agroforestry permits choice of tree species adapted to climate as well as agricultural crops. Adverse weather conditions are expected to reduce the level of expected crop- and tree-biomass production, but not cause their total mortality. Further, tree cover has a moderating effect and create moderating effect on the growing conditions of the chosen annual crops and provides tree-fodder and wood of great value in famine like situation.

National Conferences on Agroforestry, held at Chandigarh in 2005 and 2006, attended by a wide spectrum of scientific community, progressive farmers and people's representatives, pointed towards great opportunities for enhancing farm income on a sustainable basis from adoption of agro-climatic zone adapted agroforestry systems compared to mono-cultural agricultural practices.

Table 1: Choice of Agroforestry Practice

Land Capability Class	Recommended Package of Agroforestry practices	Potential Area (million ha)	Expected annual yield (m ³ /ha)
I	Agroforestry in favorable climate conditions (irrigated fields / moist soils)		9020
II	Agroforestry in unfavorable conditions (semi-arid and arid climates)		505-10
III	Ravinous and degrades lands (Block forestry plantations)		255-10

A tested system is already being gainfully practiced on a large scale by medium and large farmers all over the country under irrigated conditions, but its potential has to be fully realized by small farmers without irrigation facility. Table 5 presents potential available land for agroforestry arranged in the decreasing order of the benefit / cost ratio depending on the agro-ecological zones as well as irrigation. The lands with the highest potential (Land Capability Class I) can further be sub-divided into three categories: 1) Irrigated agricultural lands with the present area of 50 million ha; 2) Rain-fed areas with favourable weather conditions estimated at 20 million ha; and 3) Rain-fed low lying flood plains also around 20 million ha. These three categories of lands have potential to make highest contribution to agricultural output through proper application of improved seed varieties, irrigation and fertilizer inputs, also termed as the three pillars of green revolution. In all likelihood, these lands (in total 90 million ha) will be able to produce enough of both food and wood to meet the 2030 needs of entire nation with proper application of science and technology.

The dry land farming presents a major challenge to research and development.

The agroforestry practices in adverse soil moisture conditions have been placed under Land capability Class II with an estimated area at 50 million ha. They are located in arid and semi-arid zones of the country with scanty and erratic rainfall and unpredictable agricultural production. The dry land farming presents a major challenge to research and development.

Under adverse climatic conditions, adoption of a mixed land use strategy (with agriculture, trees and cattle) is likely to be a good strategy: say 1/3rd (the best land) for food production; 1/3rd with fodder and 1/3 with tree crops. Formation of Federation of Farmers is also likely to promote an economy of scale. With economic development, food habits of people change and demand for fresh fruits, vegetable, eggs and meat rises. An integrated approach to farming is most likely to provide best guarantee against unpredictable climatic conditions.

The Land Capability Class III, estimated at 25

million ha, includes all gullied and ravenous and degraded lands. On account of past abuse and over use of land, many agriculture areas have become degraded and are subject to uncontrolled cattle grazing. These lands open possibilities for plantation crops to open income and employment opportunities to the landless group, which form a significant component of the population in the rural areas. It is important that value addition component is well planned initially in order that income and employment opportunities multiply for the people. Ideal for this purpose may be to develop a tie with forest industries using public-private partnership. The indicated level of yield seems feasible, if site-species matching is properly done and the right technology used for raising the tree crop(s).

The Planning Commission Task Force Report on 'Greening India for Livelihood Security and Sustainable Development' (2001) provides valuable data on agroforestry models for different agro-ecological zones and different tree and agriculture crop combinations and associated benefit-costs. The expected yield per year per ha

quoted in the last column of Table 4 seems feasible with the current state of technology used for producing the planting stock. Several papers presented at subsequent Agroforestry Conferences indicate feasibility of achieving a much higher level of yield (see Kulkarni 2004, Dogra et al. 2006, Dhiman 2007). These studies clearly show that tree components, if well chosen, could significantly add to the farmer's income. Further gain is possible by integrating crops with trees and cattle by a factor of 1.50 to 2.0 (Rai et al. 1999); and by integration with wood based industries by a factor of 3-5 (Sapra 2005). These estimates need to be checked region by region.

On account of past abuse and overuse of land, many agriculture and forest areas have become degraded and are subject to uncontrolled cattle grazing and lopping. These lands open possibilities for raising plantation crops to ameliorate land quality and create productive employment opportunities, meeting local needs of small timber, fuel and fodder; and even value addition possibilities through partnership with forest industries and raise

capital through public-private partnership. In fact, globalization of agriculture and rising level of per capita income will both cause a relative reduction in demand of land for subsistence agriculture, which was the key factor in the past for forest land degradation and area loss. On the other hand, trees are becoming an integral part of agricultural economy, where trees have significant ecological, social and economic functions.

5. Pre-Investment Surveys (PIS) for optimal Forest Industries Location

Pre-investment studies provide a scientific basis for decision making about the location and capacity of wood-based industries, keeping in view the joint benefit- cost ratios. The typical problem formulation of such studies is as follows: "How much industrial wood (present and potential), specified by species, dimensions and grades, can be made available at tentative mill sites, within alternative cost limits per volume unit on a sustained basis?"

The question raised is formulated in inventory terms in Table 2.

Pre-investment study for establishing wood-based industries, based on existing agroforestry resources is a challenging task, as the latter have very irregular distribution pattern and fast turn over, sometimes only 4-5 years depending on market prices and farmers need. The goal is to capture reliable geo-referenced information to provide location specific statistics on crops and trees for simulation of alternative tree growing and tree utilization strategy. Such studies are recommended to be conducted on a pilot basis in different regions of the country as the future basis of establishing new wood based industries. In case farmers become share-holders in the wood-based industries, then their concern will be to maximize benefit and minimize the cost of integrated Agroforestry and Industries Complex.

Table 2: Example of Detailed Objectives for a Pre-investment Inventory

General Objective	Detailed Objectives	Inventory Specification
How much industrial wood	1. Description of survey area with regard to land classes; forest land broken down into forest types (soil, vegetation, terrain, site quality)	Areadata by Systematic Grids (photo interpretation)
By species.		
Dimensions and grades,	2. Estimation of growing stock per hectare within classes of forest types	Volume sample plots
	3. Growing stock, classified by species studies dimension and grades	Sample trees volume tables Cull
Can be made available	4. Operative and relevant classification of area and growing stock from point of view of the management and logging system applied	Problem - oriented classification
At tentative mill sites	5. Estimation of additional factors which are relevant from the point of view of logging and transport	Accessibility studies

NRSC have made land use / land cover map of the entire country based on IRS LISS 3 data (see Table 7). Forest Survey of India is conducting country-wide survey of trees growing outside forests (TOF) using LISS-IV data and field survey. Both the databases have potential value in pre-investment survey for industrial locations.

Table 3: Summary statistics from NRSC Land Cover/ Land Use Map

Land Use/ Land Cover class	%	(Sq. Km)
Built-up land	2.72	89364
Agricultural land	55.07	1810403
Forest land	21.48	715026
Wasteland / Grassland	10.97	360844
Wetlands, water bodies, snow and glacial, etc.	9.76	311626
Total Country	100.00	3287263

Source: NRSC 2015

6. Effective Education, Research, and Extension (ERE) Support to Agroforestry is a Necessary Condition for Success of Agroforestry

As was presented in the introductory Section of this report, effective Education, Research and Extension is a necessary condition for enhancing agricultural production combined with development of high yielding varieties, irrigation and expansion of area under cultivation. Agroforestry is an equally, if not more, challenging land use as it combines knowledge about agricultural crops grown on an annual basis and perennial tree species, which can be grown in combination at different rotation and spacing. Of course, there is more existing knowledge for raising single species plantations, in particular, poplars and eucalypts. Keeping in view emphasis on water conservation and maintaining biological diversity more research on indigenous tree species is required. We are at a starting phase of systematic research on AF.

A question can be raised: Why is agroforestry is not getting due technical and financial support, to realize its full potential. It is true that agriculture universities and ICAR Institutes are active in AF Education, Research and Extension and there is a

dedicated central AF institute at Jhansi. The institutional support does not seem to be sufficient as was presented in the introductory Section of this paper. There are agriculture officers to look after development of agriculture and forest officers to take care of forest. **There is need for effective ERE support in case of Agroforestry, in particular, when the goal is expansion of integrated Agroforestry and Forest Industries practices.**

The role of forestry faculties in Agriculture universities and Forestry Colleges seems very crucial for advancement of this sub-sector. Although the courses on forestry / agroforestry are taught in **53 Institutions** (including Forest Sector Colleges and Forest Faculties of Agriculture Universities) across the country, the curriculum is highly uneven and focuses on the primary production phase. **The agroforestry education needs to be more holistic and address the challenge, not only from lab to farm but also from farm to factory.** To accelerate the development process and achieve national goals of rapid rural development and climate resilience in a time bound manner, an institutionalized extension network at the block level; and R & D knowledge at the ecological region level spread over the entire country is an essential requirement. This way, we may achieve evergreen revolution in the country on the models of the green revolution. There is, no doubt, about it.

The following major technical problems relating to AF development have been repeatedly identified in all Conferences on the subject, which may be considered while assigning tasks for ERE support:

- ♦ Preparing Supply-Demand Outlook (Strategic Directions) on a periodic basis for agroforestry development linking potential production with market demand and prices (viz. PIS data).
- ♦ Advising farmers on tree planting, choice of species, treatment, access to high quality planting stock of proven suitability, especially at the initial tree-planting phase.
- ♦ Preparing a management plan for AF facilitating access to markets for farmer grown timber and tree products, partly due to rules intended to curb illegal logging.
- ♦ Marketing and Price support system to ensure right prices and smoothen market fluctuations.

- ♦ Establishment of tree producer and consumer societies (PCS) to facilitate production,

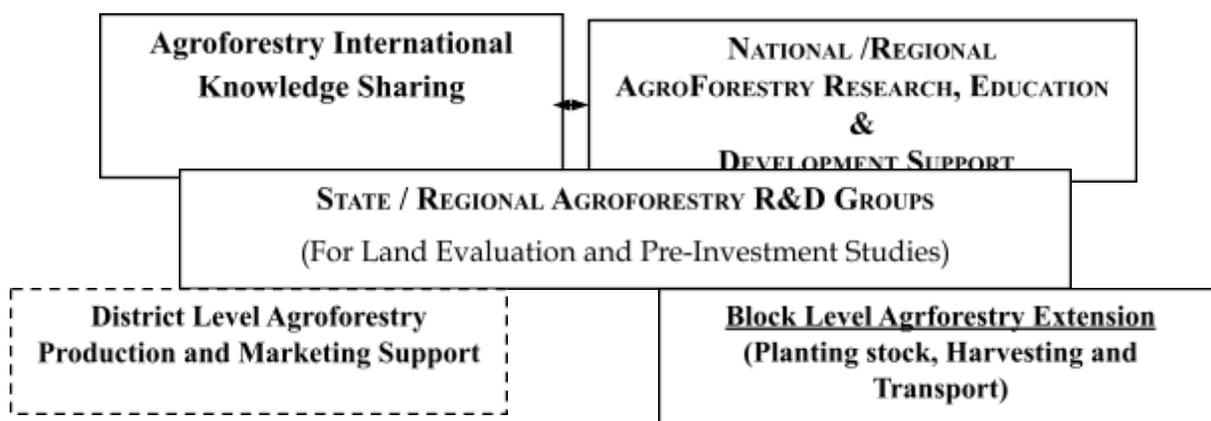


Fig.2: All-India coordinated Agroforestry Research and Development

In Figure 2, the State and Central AF Research & Development Institutes are shown to have the main function to provide knowledge and technology support to extension workers and farmers for planting, harvesting and marketing for getting the best prices. The state units need to work in close cooperation with the district and block institutions. A system of annual meetings and feed-back mechanisms needs to be developed to improve and streamline the process. It is expected that Agroforestry Institutions, with help of strategic planning and institutional support outlined above, will enable farmers to use knowledge and contribute to village, state and national level development, in the same manner as agriculture has done.

7. The Extension Support to Agroforestry

Findings of a sample survey of agroforestry in the Chhachhrauli Block of the Yamuna Nagar District (Rai et al. 1999) is being used to help planning of appropriate extension institution (District / Block / Village levels) keeping in view the level of benefits / money involved. The AF Extension could ideally be based at the Block level, where it could link with the development planning process of agriculture and

other sectors. The district could be the unit for marketing and price support. In fact, all other sectors have the district as the common planning unit. Thus, production and marketing could go hand in hand.

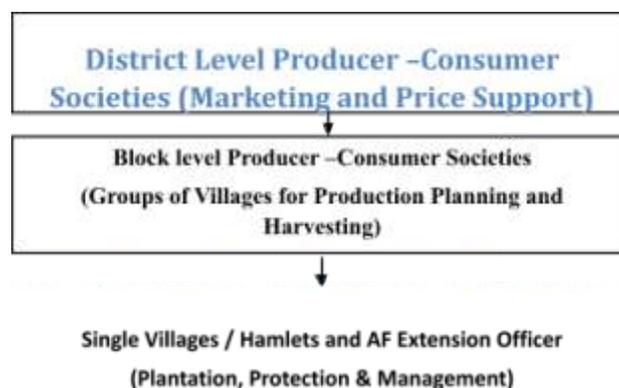
It is in the interest of both farmers and industries (and Government) that AF development takes place with mutual assured benefits. This way a long term arrangement can be made so that both parties have win-win situation. Investments could be made by farmers and industries in an assured environment to get reasonable profit margin. It may be noted that the price of wood produced from AF is about half that from natural forests. In an environment of certainty farmers may plant species most desired by industries and also get needed investment for that purpose. In fact, PCSs could be established a block or any other suitable level. This may include representatives of Farmers, Forest faculties Industries and the Government to facilitate the process of production and harvest planning and getting felling and transit permit, certification of produced wood and providing other needed support services.

Production, planning and management are recommended to be implemented at a Block level for

providing extension support, as is the case with Agriculture Extension. At the next higher level, Market Information Centers (MIC) is suggested, which would be a very important input to sustainable Agroforestry management, ensuring fair prices to community and taking further steps regarding pre-processing and processing, value addition in general. At the professional level, the Forestry Extension Officer (based at the district level networked with Research Institutes) would provide knowledge and information services to the Block.

Concluding Note: The time has come to have a bold and futuristic land use strategy to solve poverty problem in the tribal and rural areas by working with the people and industry as major partners. As the nation advances economically, subsistence agriculture will be very stressful and decline in relative terms. People will shift from less paying occupations, like subsistence farming to more paying activities offered by integrated farming, services and manufacturing. It is important to plan the agriculture sector development (including agroforestry, forestry and range) and make appropriate institutional arrangements ahead of time in the overall context of the national economic development on an informed basis. The future strategy should provide

Fig.3: Producer –Consumer Cooperative for Sustainable AF



disincentive to subsistence agriculture (in tribal areas) and include incentive for market economy. In the country with upbeat economy, support to subsistence agriculture such as it is practiced currently in the tribal areas or by small farmers is like pushing them to get into the vicious cycle of poverty and environmental degradation, the very anti-thesis of MDG (Millennium Development Goals).

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Status of Wood-Based Industries in India- Some Thoughts for their Growth

Mankind has used wood due to its versatility since time immemorial for housing construction, furniture, agricultural implements, transport vehicles, and above all a fuel for various house hold needs. It is estimated that about 270 million tons of fuel wood, 280 million tons of fodder, over 12 million cubic meter (cu.m) of timber and a range of non-wood forest products are extracted from the forests of India annually. Due to better understanding about the ecological functions of forests there has been a shift in timber centric management of natural forests and focus is towards their conservation for ecosystem services.

Wood products are greener compared to their alternates/substitutes which have higher embedded energy and other adverse environmental implications. Substituting by a cubic meter of wood for other materials like cement concrete, steel, aluminum, plastics, results in the significant CO₂ savings. Moreover, the carbon sequestered during growth of trees remains locked in wood products. It is therefore necessary to increase the use of wood and wood products in all possible ways. Impressive economic growth in India in recent times coupled with increasing consciousness about environment and sustainable development is gradually leading to increase in consumption of wood and wood products such as furniture, construction timber, paper etc. In July 2020, CPWD removed the ban on use of timber in construction on the advice of the Ministry of Environment, Forest and Climate Change, which is bound to create additional demand for wood and wood products. Various bamboo composites have also been included by Central Public Works Department (CPWD) in Delhi Schedule of Rates for various applications.

Due to reducing timber supplies from natural forests there is increasing focus on production of industrial round wood from Tree Outside Forests (ToF) areas under various agroforestry systems. Wood-based industries (WBIs) play a significant role in converting wood logs into

Arun K. Bansal, IFS (Retd.)

Former Addl. Director General of Forests, India
Chairperson, Promotion, Communication and Advocacy, NCCF
E-mail: bansalka@yahoo.in

intermediary products that can be further worked upon to make durable, aesthetic looking and functional consumer items. Although India is exporting wood products like furniture, handicrafts items, wooden toys to niche markets in developed countries it continues to import sizable quantities of wood logs, timber and other wood products.

In this paper an attempt is made to discuss the status of WBIs in India and to suggest policy initiatives necessary for the development of this important sector.

Forest & tree resources in India

India's forests are under severe anthropogenic pressure due to growing demands for forest products by the people living in and around forests and huge cattle population. Per capita forest area in India is only 0.05 ha which is only one-tenth of the world average (0.52 ha) and the productivity of India's forests is also low (0.7 cu.m./ha/year) compared to the world average at 2.1 cu.m./ha/year). According to ISFR 2021 Forest cover¹ exists over 71.38 Mha comprising of three categories viz. Very Dense Forests, Medium Dense Forests, and Open Forests respectively 3.04%, 9.34% and 9.34% of the total geographic area (TGA). In addition, notionally 2.91% of TGA of the country is under tree cover², generally known as ToF³.

National Forest Policy, 1988, brought in policy shift towards managing forest primarily for eco system services. NFP envisaged the forest-based industries to raise the required wood raw material preferably by establishment of direct relationship between the factory and the individuals and to encourage farmers to grow tree species required for industries. This policy shift caused enhanced focus on ToF, particularly agroforestry to reduce pressure on forests and to meet the demand of wood and wood products. There are no exact and authenticated

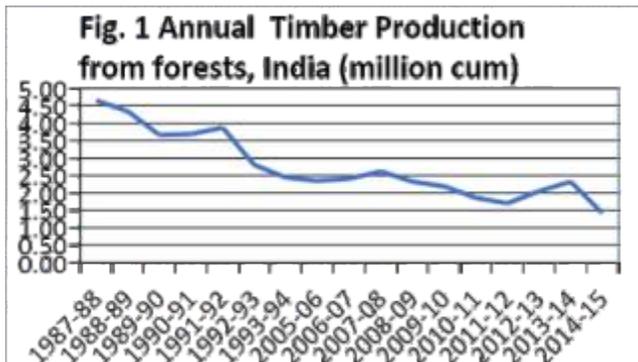
data on extent of agroforestry in India are wanting although there have been several assessments reporting widely varying estimates (11.12 Mha – ISFR 2015; 25.32 Mha- Dhyani et al. 2013).

Production of Industrial Round Wood⁴

There is no authentic national/sub national data base related to tree species-wise production of industrial round (IRW) wood in the country. National account statistics includes computed values to as a part of contribution of Forestry and logging based on reported production from forests and estimated growing stock of ToF. According to National Accounts Statistics 2020 the average annual growth of value of industrial wood from forest and ToF areas during 2011-12 to 2018-19 was 5.7% at constant prices.

Production of IRW from forests

Figure 1 depicts Annual timber production from Forests in the country which reveals decreasing trend as expected due to policy shift towards conservation of natural forests and their management for



ecological stability and eco-system services. According to the Forest Sector Report (2019) five highest timber producing states are Uttar Pradesh, J&K, Himachal Pradesh, Madhya Pradesh, and Uttarakhand.

Production of IRW from ToF

There are no regular official statistics of wood production from ToF areas. A High Level Expert Group constituted by the XV finance Commission in its report submitted in July 2020, mentions total consumption of wood to be 65 million cu.m. in 2017 of which 3 million cu.m. was produced from forests,

around 47 Million cu.m. was produced from plantations (mainly agroforestry systems), and balance 15 million cu.m. was imported (Anon, 2020). This indicates that around 25% of the demand for wood is met from imports. Of the balance around 94% is from ToF, primarily from Agroforestry.

It is thus evident that in future ToF is going to be the main source of IRW required by the WBIs. Therefore, efforts need to be made to enhance cultivation of various tree species under different agroforestry systems to match the requirements of WBIs with a view to gradually reduce imports of wood logs to the extent possible. Agroforestry is also important to achieve the national goal of bringing 1/3 of TGA under forest/tree cover. Moreover, it provides additional and assured income to farmers and reduces their vulnerability to crop failures due to failure of monsoons. It also has huge potential to contribute to national resolve to double farmers' income.

Bansal committee constituted by MOEF & CC in July 2011 studied the 'regulatory regime regarding felling and transit regulations for tree species grown on private land' and recommended for exemption of tree and bamboo species preferred by farmers and not naturally available in neighbouring forests from transit permit and felling regulation, authorizing Gram Sabha to regulate felling and transit of trees/timber grown under agro/farm forestry or private lands in respect of exempted species, evolving common regional strategy for simple uniform mechanism/ procedure to regulate the transit of forest produce, to evolve transparent and simple methodology for maintenance of records of tree plantation on private lands to maintain a dynamic resource inventory (MOEF & CC, 2012).

India enunciated the 'National Agroforestry Policy' in 2014, first such policy anywhere in the world, aiming at expansion of tree plantation in integrated manner with agriculture crops and livestock to improve productivity, employment, income and livelihoods of rural households, especially the small holder farmers, to protect and stabilize ecosystems, and promote resilient cropping and farming systems to minimize the risk during extreme climatic events, to meet the raw material requirements of WBIs and reduce import of wood

and wood products to save foreign exchange.

A Sub-Mission on Agroforestry (SMAF) under National Mission for Sustainable Agriculture (NMSA) is being implemented since 2016-17 in the 20 States and 2 UTs which have liberalized transit regulations for selected tree species. SMAF seeks to promote agroforestry practices/models suited to different agro-ecological regions and land use conditions by planting trees on farmlands, peripheral and boundary plantations. This will also create additional income opportunities for farmers while contributing to mitigation of climate change impacts.

Tree plantation in private lands also continues to be promoted under various state programs and schemes. Agroforestry is also a component under externally aided projects assisted by JICA (e.g. Tree cultivation in private lands in Tamil Nadu Biodiversity and Greening Project, Odisha Forestry Sector Development Project). In addition to

government efforts paper mills are also promoting cultivation of selected tree species, viz. Eucalyptus clones, Casuarina, Subabul, in several states viz. Andhra Pradesh, Karnataka, Odisha, and Telangana. Some of these plantations are also certified under internationally recognized forest certification schemes.

Wood Based Industries

Classification of wood processing industries as per the National Industrial Classification (NIC), as revised in 2008 in consonance with the latest United Nations International Standard Industrial Classification Rev. 4 is given in Table 1. The economic activities which use wood as raw material are covered mainly in division 16 (Manufacture of wood and products of wood and cork, except furniture), and Division 17 (Manufacture of paper and paper products). Furniture is included in 3100, or the installation of wooden fittings and the like (included in 4330).

Table 1: National Industrial Classification, 2008 – Manufacture of wood products

1610	Saw milling and planing of wood including unassembled flooring, parquet flooring, railway sleepers
1621	Manufacture of veneer sheets, plywood, laminboard, particle board, and other panels and boards
1622	Builders' carpentry and joinery (excluding unassembled flooring) including structural wooden goods e.g. beams, rafters, roof struts, glue-laminated and metal connected, singles and shakes, and prefab buildings and elements thereof.
1623	Wooden containers including wooden boxes, barrels, packing cases, plywood chests, basketry, grain storage bind etc. made of bamboo and reeds.
1629	Other products of wood and articles of cork, straw, and plaiting materials – including wooden industrial goods, agricultural implements, articles of bamboo, cane and grass, articles of leaves of palm, dhak, pine, khajoor, and articles of veg. fiber.
2826	Wooden spool, bobbins
31001	Furniture made of wood
31002	Furniture of cane and reed
32401	Dolls and toys, including those of wood
1701	Pulp, paper, and paper board
1702	Corrugated paper and paper board and container thereof
1709	Other article of paper and paper board

Of the various WBIs only paper industry is in the organized sector. Wooden furniture, joinery and other household wood-products are traditionally made to order by small workshops or individual artisans. The Indian carpenters and artisans are accustomed to teak and other hardwoods and consumers also have a strong preference for dark

tropical woods. Teak is typically seen as a benchmark with respect to grade and price, as compared to other wood species. Familiarity with woods other than those found in India and certain tropical hardwoods is low. In recent years larger firms are increasing in number, to serve both the export and growing domestic market for wood furniture and other wooden items.

Domestic farmed and plantation timber includes teak, Eucalyptus, Poplar, Melia dubia, and Acacia spp. Major imported wood species are Meranti, Teak, and Pines along with small quantities of temperate hardwoods viz. ash, maple, cherry, oak, walnut, and beech for commercial and home interiors and furniture, some of which is made for exports. Sawn timber imported from Finland, Canada and some other European countries may be largely certified since in these countries major forest areas are covered under PEFC Forest Management Certification.

Paper Industry

The paper industry has undergone phenomenal growth since independence. The total installed capacity of the industry has grown at a compounded annual growth rate of 6 per cent over the past decade. In 2109-20, the member industries of the Indian Paper Mill Association (IPMA) had total installed capacity of 4.8 million tons of paper and paper boards and capacity utilization was close to 90%. Although the paper industry comprises a number of small-scale mills, relatively large mills continue to contribute to a sizable share of total production.

With increasing standards of living the per capita demand of paper is continuously increasing although it continues to be low by global standards – in 2013 it was 9.3 kg compared to even other Asian countries such as Indonesia (at 22 kg) and China (at 42 kg). Production growth for paper and paper boards has been lower than the increase in demand, necessitating imports. Consequently, several paper products including newsprint, coated/uncoated/corrugated paper, craft paper, paper board, Toilet /facial tissue paper(HS code 4801 to 4805, 4808, 4810) are imported. Their total volume imported during 2019-20 was 2.99 million tons.

Consequent to policy changes in NFP, 1988 related to supply of forest raw material to Industry most paper mills switched over from bamboo to farm grown hardwoods which constitutes around 80 per cent of the total requirement of wood-based segment of the paper industry. Over the last two decades, paper industry has invested huge resources in R&D for genetic improvement and clonal propagation of high-yielding and disease resistant plants of short

rotation tree species and have established farm-industry partnerships for cultivation of pulp wood tree species under agroforestry extending over an estimated 1.25 lakh ha. Many such plantations are also FSC certified.

Wood based panel industry

Panel industry comprises plywood, Particleboard, medium density fiber board (MDF), and constitutes an important sector of WBIs. Indian Plywood & Panel Industry consists of around 3,300 units (small, medium and large units) largely, ~80%, in unorganized sector and has 6-7% CAGR and supports around 1 million livelihoods with a market size of app. Rs. 25,000 Crores. Century Plyboards India Ltd. and Greenply Industries Ltd. are the two pan India companies dominating the organized market with more than 50% share. There are about 30 particle board industries in the country mostly in unorganized sector except few, and use plantation timber lops and tops, wood wastes and agro-residue

Table 2: Production of wood-based panels (2017-2019)

Product	Million cu.m.		
	2017	2018	2019
Plywood (including block boards)	8.93	9.50	10
Particle Board, Oriented Strand Board and similar boards	1.07	1.14	1.2
High/Medium Density Fiber Board	0.89	0.95	1.0

as the basic raw material with an annual production of about 1 million cu.m. The MDF industry sector has installed capacity of about 1.4 million cu.m. and production is 1.15 million cu.m. (80% of installed capacity). Indian MDF industry has a market size of nearly 1,600 crores. In the past five years, the industry grew at a CAGR of 20%.

Production of wood-based panels in last three years is given in Table 2 (Pandey & Roy, 2020). Core veneers are made from domestically produced plantation wood, face veneers are largely imported

mainly from Indonesia, Gabon, Myanmar and China. For block board in-fills in addition to domestic fast growing plantation timbers imported pinewood is also used.

Furniture and handicrafts industry

India's furniture and handicraft sectors are largely in the unorganized sector and most wooden furniture, joinery and household products are made to order by small workshops or individual artisan, constituting 85-90% of the total sector. There is virtually no data on the SMEs and artisans except that there are few well known furniture/ handicrafts clusters viz. Saharanpur, Jodhpur, Hoshiarpur, Natungram, Channapatna. Chanapatna cluster for wooden toys for children using vegetable colours has Geographical Indicator under WTO in Indian wooden handicrafts are in demand world-wide for their beautiful designs. Most common species used in handicrafts are Teak, Sheesham, Mango, Mahogany. Some highly expensive items are made of Sandalwood, Rosewood, Walnut and Oak.

A recent report by KPMG Advisory Services Pvt. Ltd. prepared for the National Skill Development Council mentions that India's absolute consumption of furniture is very high, although the per capita consumption is low as compared to other countries, largely due to huge income disparity but having an increasing trend. Demand for furniture in India surged at 12% annual rate over 2007-2012 and in 2013 it increased at a rate of 15%. Marked by increasing customer preference for readymade, branded furniture, the market is moving more towards organized segment. Preference is tilting towards high-end, maintenance free and easily installable products with customization options. Demand for ready to assemble furniture is resulting in higher use of engineered wood in furniture manufacturing.

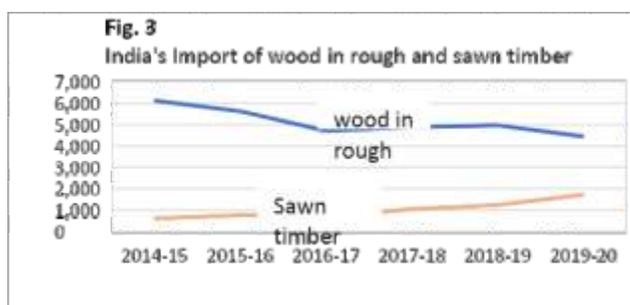
The High Level Expert Group constituted by XV Finance Commission in its report of July 2020 (Anon., 2020) recommended for subsidizing light mechanization of unorganized sector along with design, branding and marketing linkage to reduce wastage and improve cost effectiveness, functionality and quality furniture manufacturing in the country, promotion of MDF and PB manufacturing industries in the country to provide

critical raw material for mechanized furniture production in organized sector, Improved availability of solid wood/timber in the country through organized and aggregated plantations, to reduce high end solid wood furniture imports.

A study by FICCI in May 2020 mentions that India is currently uncompetitive in furniture but has a great opportunity to be among top global manufacturers and exporters due to favourable labour cost of workers, cost competitiveness in Cotton fabric (textiles), differentiated furniture design capability. India is a preferred location by top global furniture retailers like IKEA. It recommends setting up furniture hubs in selected SEZs and has approached GoI for augmenting the supply of certified timber for exportable furniture and in the interim allow duty free timber for furniture exports. According to a recent study by Tandon and Tewari, 2019 (<https://www.livemint.com>) the Indian domestic furniture market is expected to grow at an annual rate of 12.9 percent between 2020 and 2024.

India's international trade of wood and wood products

India is a net importer of wood and wood products. The average import and export values in last four years are 2500 and 900 million USD respectively. Major imports are of wood in rough, sawn wood, sheets/veneers for plywood, plywood and fiber boards. Whereas the import of wood in rough is having a declining trend sawn wood imports are on rise due to better sawing quality compared to quality of processing by domestic sawmills (Figure 3). A recent ITTO study projects 6.4% average annual growth in total round wood demand in India's wood-based industries between 2021-2030 resulting in increased imports of round wood, sawn wood, primary and processed wood



products and secondary processed wood products (Kant and Nautiyal, 2021).

Although India is a net importer of wood and wood products, in respect of some products primarily made from tropical Indian hardwoods including teak, mango, sheesham, it is net exporter due to niche markets in developed countries (Figure 4).

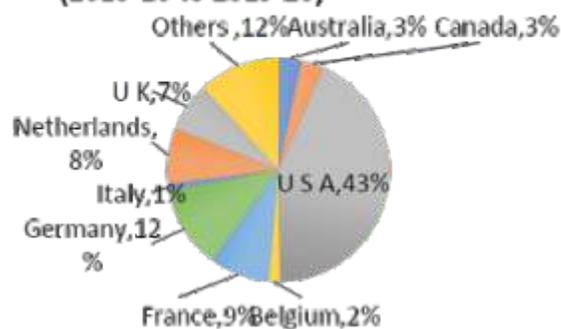
Although the export values of various manufactured wood products are low but there is an increasing trend in last few years particularly wooden furniture including table/kitchen ware, builder joinery, wooden toys.:

Key regulatory regimes related to WBIs:

Following are some important legal provisions impacting the growth of WBIs in India:

- a) WBI (Establishment and Regulation) Guidelines 2016 provide for granting or renewal of licenses to WBIs (other than paper industries) with the approval of the State Level Committee headed by PCCF & HOFF to be given after assessing availability of timber in the State/UT through an appropriate demand and supply study. However, licensing is not required for Industries/processing plants which use imported wood or legitimately sourced wood products other than logs (sawn timber, wood based panels, bamboo, reeds etc.) or round log/timber from species declared as agroforestry/agricultural crops and/or exempted from the purview of the felling and transit regime in the concerned States/UTs. Such industries are required to be registered with the Forest Department of the concerned state/UT and regulated as prescribed by the concerned State/UT. The guidelines require all WBIs to follow environmental and other applicable regulations prescribed by the State Pollution Control Board, Central Pollution Control Board, and MOEF & CC under the Environment Protection Act, 1986 and other Central/State Acts.
- b) There is no regulation for verification of legality (certification) or quantitative restrictions, other than phytosanitary measures, for import of wood and wood products to India, except for species

Fig. 4
Average Export value of Wooden Furniture (2015-16 to 2019-20)



restricted under CITES. It has been reported that India is the third largest importer of the illegally logged timber in the world, and accounts for close to 10% of the global illegal wood trade (IUFRO, 2016). It is noteworthy that many developed countries including EU and Australia, have stringent processes for legality verification for import of wood and wood products. Plant Quarantine (PQ) order 2003, Ministry of Agriculture, Cooperation and Farmers Welfare (MOAFW), GOI, requires proper fumigation before import of wood and wood products into India. However, the prescribed treatment continues to depend upon methyl bromide which is classified as a class 1 ozone depleting substance. There is a need to prescribe alternate treatment regime.

- c) CITES Appendix II includes the genus *Dalbergia*. Consequently, each shipment of products made from sheesham and rosewood requires a CITES permit except for finished musical instruments, parts and accessories made with rosewood. This has serious implications for India as bulk of wooden furniture and handicraft items exported from India are made from *Dalbergia sissoo*. However, the CITES Management Authority in India has designated the Export Promotion Council for Handicrafts (EPCH) as the competent authority to issue the comparable document in lieu of the CITES permit for handicraft products made from *D. sissoo* and *D. latifolia*. EPCH is issuing such certificates under its VRIKSH timber legality and certification standard following the prescribed procedure. Recently, MOEF & CC has constituted a working group to prepare a proposal on *Dalbergia sissoo* for COP 19.

d) It is important to note that more than three-quarters of India's timber products are exported to the countries that now have laws in place to restrict import of illegal wood and forest products. These include European Union Timber Regulation (EUTR), Lacey Act of USA, Australia illegal Logging Prohibition Act, 2012, and California Air Regulation Board (CARB) certificate (formaldehyde emission from wood composites). To avoid potential decline of export of wooden furniture and other wood products to these countries it is necessary put in place a system to facilitate issuance of document (similar to the one issued for CITES compliance) acceptable under the regulations of the importing countries. Internationally recognized and Indian

Certification Schemes developed by NCCF (for Forest Management, ToF, and Safeboards) can facilitate such processes.

Therefore, there is a need to put in place specific measures to verify that India's imported raw materials and domestic wood used by WBIs are legally sourced from sustainably managed forests or ToF areas. It needs also to ensure that India continues to supply wooden furniture and other products to its niche markets in developed countries and also access new markets for the growth of domestic WBIs. It would also be worth considering import duty concession on import of wood, sawn wood, and other wood products that are used for re-export after value addition (through handicrafts/manufacturing) in selected SEZs for a limited period.

Conclusion and recommendations

From the foregoing discussion, it is evident that there is a need for greater focus on production and use of wood as a Carbon Negative multi-purpose material and its production system is highly cost effective Climate Change migration strategy. To meet India's International Climate related commitments and achievement of key sustainable development goals, it is a national imperative to adopt a national wood use policy. The following recommendations emerge from the analysis of current situation.

A. Promotion of Agroforestry:

Agroforestry needs to be organically integrated with the concept of "Grow more wood use more wood". Following are some important actions for effective implementation of the National Agroforestry Policy in true spirit:

1. A rapid assessment of potential regions/ areas for growth of WBIs and critical analysis of policy and legal regimes to evolve strategic initiative to promote agroforestry systems aiming at production of required industrial woods. There is a need to create uniform regulatory system across the country in respect of agroforestry wood, in case deregulation is not considered feasible and also facilitate independent third-party certification system for production of certified quality planting material.
2. Quick analysis of resources in existing Agroforestry rich states/ regions including species wise growing stock and sustainable annual harvests and supply chain mapping of timber/wood produces aiming at addressing the bottlenecks if any and creating better market linkages through a system of tracking and traceability of wood so as to target international markets. One possibility is to create a system of registration of trees with species on an online platform and issuance of Certificate of Origin that will also facilitate smooth movement of wood/ timber across the country.

B. Enhancing use of wood products:

It is necessary to provide positive policy push for greater use of wood products in key growth sectors for green/sustainable development through

- 1 Embedding the "concepts sustainability" in public procurement policies.
- 2 Inclusion of wood as an important subject in the courses in "Civil Engineering" and for "Architects" to create required awareness among architects and engineers.
- 3 Establishment of wood markets across the country for smooth sourcing of legal wood by the WBIs.

C. Addressing gaps in wood commerce:

- 1 **Productive use of degraded lands:** There are sizable lands in various stages of degradation that can be and need to be brought under productive use by raising plantations of suitable tree species in a mission mode. In the case of degraded forest lands which continue to remain unattended due to grossly inadequate budgetary allocation to the forestry sector by the GoI and the States (even the approved working plan are not being implemented in totality), although attempts have been made several times for involvement of private sector through Public Private Partnership model but a real and serious attempt is still to be made addressing the concerns of all stakeholders.
- 2 **Efficient production of quality timber by Forest Development Corporations:** The management of forest areas that have been given to forest development corporation for commercial plantations need also be reviewed and necessarily follow up action taken to enhance the wood production and productivity these areas for timber required by the wood products industries to reduce imports.
- 3 **The Export-Import (EXIM) Policy,** especially related to wood and wood products in many cases tend to support imports and restrict exports. Although some efforts are made from time to time to restrict imports (e.g. recent duty increase on agarbatti sticks from 10% to 25%), facilitate exports (e.g. VRIKSH timber legality and certification standard by EPCH), it is necessary to have a comprehensive analysis, of the EXIM policy, customs duty regime on imports, as well the non-trade barriers and make it supportive to the growth of domestic WBIs.
- 4 **Substitution of imports** by locally grown timber is necessary but it requires a clear cut understanding of the nature and characteristics of the imported timbers, their supply chain from the point of import through to the consumer products. Although information about species wise import is available through the EXIM data bank, there has been no serious attempt to map the supply chain and how the imported timber is actually use in which sectors e.g. Construction, Furniture, transport. This information is very crucial to examine if and up to what extent imported timber can be effectively substituted by fast growing tree species and medium/long rotation tree species generally grown in agroforestry systems, or long rotation tree species found in other ToF areas and also to evolve strategies to develop appropriate processing technologies and infrastructure.
- 5 **Qualitative improvement in WBIs:** Although there are voluntary standards brought out by BIS for some manufactured products actual production as per these specifications is very low. To enhance the competitive strength of SMEs, the WBI sector may be deregulated by repealing/amending the WBI (establishment and Regulation) Guidelines 2016 and making use of certified timber obligatory along with adherence to minimum product quality standards to ensure efficient utilization of timber and other resources by the WBIs. It would be a good if industry bodies like FIPPI start creating awareness as well as facilitate improving quality of products manufactured by its members and adherence to product standards.
- 6 **Promote Credible Forest Certification process in India:** It is necessary that the available Indian certification schemes having global recognition, such as those developed by NCCF and endorsed by Programme For Endorsement of Forest Certification are facilitated and promoted to enhance exports of wood products to their niche markets in the developed countries. Simultaneously, the wood products industry should be encouraged to adopt voluntary certification for domestic markets by making certification as a requirement in public procurement policies.

References:

Contact author at bansalka@yahoo.in

Agroforestry: The missing link for unlocking full potential of Indian farmers

Sajjan Bhajanka

Chairman, Century Plyboards (I) Ltd, Kolkata,
President, Federation of Indian Plywood and
Panel Industry (FIPPI)
Email : sajjan@centuryply.com

It is widely-accepted that our rural economy has to be strengthened and our farmers' income has to be doubled to ensure a sustainable growth of our economy. While farm



productivity measures pan out, newer revenue and employment streams are essential and would play a pivotal role in achieving this. Agroforestry has emerged as a tremendous opportunity. Firstly, it can create significant value and employment in rural India. Secondly, it will have a positive impact on our balance of trade and contribute to our nation's climate and sustainability goals.

Wood consumption in India - Challenges and opportunities

India consumes about 90 million cu.m. of wood today of which more than 90% comes from trees outside of forests (TOF). While some wood is used in the paper and pulp industry, most of it goes into furniture as an end use. The furniture industry is heavily underpenetrated in India (per capita consumption of about USD 5 vs a global average of

about USD235). As a result, the industry is highly fragmented and mainly contributes low value-added products. One of the most critical challenges faced is access to quality and cost-effective inputs: some raw materials (e.g. particle board) are about 25% more expensive in India and hence our overall exports are 27% more expensive as compared with China.

Despite these challenges, the industry holds great potential. India is poised for a demand boom, fueled by the government's efforts in revitalizing the real estate sector and our robust consumption segment. This growth will need a massive 4x supply growth in raw materials for the industry, primarily composite panel products like MDF, plywood and particle boards which in turn will require an increase of 110-115 million cbm in timber requirements (from about 85 million cbm to about 200 million cbm). While this

Benefits that a well thought through policy shift in agro forestry can drive

Rural job creation & income enhancement

New employment generation in rural areas
2-2.5 mn new jobs across the value chain

Substantive impact on farmer incomes

Macro economic : Self reliance and GDP growth

Self reliance - Atmanirbhar Bharat - Import substitution and export potential

Significant GDP multiplier (~10x) for every \$ of timber produced: \$150Bn value creation potential

Climate and sustainability

Support India's sustainability & climate agenda
2 Bn+ mt carbon sequestration potential

Drive clean power sources: biomass / wood based power units at a rural cluster level

growth can be supported by the current model of importing wood/timber, a fundamental question arises, "Can we tap this growth and create value for the country, its farmers and rural entrepreneurs?"

Agroforestry – Potential for employment and self-reliance

Agroforestry can play a central role in building our rural economy. While today, our timber output is only a fraction of that of global leaders (Canada, Malaysia & Indonesia), we do have the potential to be among the leading suppliers on a global scale. Our land area (2nd largest arable land resource in the world) and diversity (in terms of climate and geographic ecosystem) lend us an inherent advantage that is tough to match. With the right approach to improving acreage and productivity, India can become self-reliant in its timber requirements. Countries like China have shown how a robust and visionary policy framework within the country's context, can help unlock growth and enable self-reliance – a strategy that led to more than 2.5x growth in their composite panel products industry, in the last decade.

Key action points – Achieving 'Atmanirbharata' towards addressing timber requirements

A four-pronged approach is recommended. First, a 5% shift of agriculture area from cash crops to timber plantations through incentives. This will not just increase revenue streams from timber plantations, but also reduce the surplus of our cash crops, potentially improving realizations.

Second, shifting agroforestry from forest to agriculture sector. Today, wood produced from farmlands is treated as forest produce requiring regulatory clearances. This discourages farmers from growing trees. We need a policy that ensures all the economic benefits of agriculture are extended to the farmers engaged in agroforestry.

Thirdly, consumers of timber need to benefit from an increased ease of doing business (composite panel products). This can be achieved by removing the licensing requirements for wood-based units and other industries primarily using 'Farm wood' and its produce as raw materials. This will enable local producers and other users of farm wood to build sustainable businesses at the plantation sites,



generating employment and livelihood opportunities for farmers.

Lastly, there is a need to create a National Wood Council with representation from the Ministry of Forestry and Agriculture Department. This agency can play a nodal role in streamlining "chain of custody" for plantation / plantation based products.

Time to unleash potential - Provide employment, Create value, Boost the economy.

Enabling our agroforestry industry can have significant benefits not just in terms of employment and value creation, but also in improving our balance of trade, and helping achieve our climate and sustainability goals. Plantations, localized primary processing, and composite panel industries can

together result in employment of 2.0 -2.5 million people. The full value chain from 110-115 million cu.m. timber (timber to furniture) can create value-added produce to the extent of USD150 billion. An equally important benefit is that of carbon sequestration: an increase in forest cover that too of "younger trees" could have a 2.00 billion metric tons carbon sequestration potential by 2050.

The agroforestry industry is on the cusp of a transformation. With the right enablers and guidelines this segment can have a lasting and sustainable impact on our rural economy, empower communities and enrich lives. All it requires is proactive intervention from multiple ministries, government agencies, and things will get promising for all stakeholders - from producers to end consumers.

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to preserve for Future

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Flush Doors
Shuttering Ply
Plywood and Block Board
Solid Wooden Flooring
Decorative Hardwood Lumbers
Outdoor Decking
Sports Infrastructure
Softwood Lumbers
Wooden Pallet
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+91-8697973600 / 9374539020

info@costaawoods.com
connect@costaawoods.com
www.costaaawoods.com



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Integrated Development of Agroforestry and Wood-Based Industries: A Way Forward for Carbon Neutral Economy

Agroforestry and private forestry for carbon neutral economy

Government of India (GOI), in the recently announced budget of 2022-23, has used 'Agroforestry and Private Forestry' as instruments to achieve the carbon neutral economy. Agroforestry covers short rotation tree crops which are generally cultivated by farmers, while the private forestry covers medium and long rotation tree crops, which are generally planted by plantation companies or individuals in their land. India has almost reached the level of self-sufficiency in producing small sized wood through agroforestry but is still heavily dependent on imported timber due to shortage of large sized wood from the forests and the farmers cannot afford to produce it. The recent initiative of the GOI encouraging private forestry may serve the dual purpose of encouraging local production of large sized wood and mitigating the impact of climate change.

Under Nationally Determined Contributions (NDCs), India has committed to create an additional CO₂ sink of 2.5 to 3.0 billion tonnes by 2030 under the Paris Agreement of the UNFCCC. The plantations under agroforestry and private forestry not only sequester carbon but the wood products manufactured from their wood also store carbon during their lifetime. The focussed action on agroforestry and private forestry may help in achieving the targets under NDCs and will also provide momentum to move towards achieving the goal of having 33% of the geographical area under forest and tree cover as envisaged in National Forest Policy of 1988.

Present status of agroforestry

During the late seventies and eighties, some of the states have implemented self-funded as well as externally aided social forestry projects in which focus was on extension of agroforestry. The wood-based

R.K. Sapra, IFS (Retd.)

Ex-MD, Haryana Forest Development Corporation
Email: sapra7@gmail.com

industry started meeting its demands of raw materials by establishing a direct relationship with the farmers. Due to focus on agroforestry, the area under Trees Outside Forests (TOFs) increased from 5.6% in 2001 to 8.9% of geographical area of India in 2021 and annual wood production increased from 69 to 85 million cubic metres as per the India State of Forest Reports (ISFRs). The area under agroforestry plantations would produce wood regularly and eighty to ninety percent of these areas will always remain under green cover helping in carbon sequestration. As the availability of timber declined from the forest areas and the farm wood could not substitute for the timber from forests entirely, the Government liberalised the import of timber in nineties. As per Sustainable Trade of Wood and Wood-based Products in India (2021), 15 million cubic metres round wood equivalent of wood and wood products for about INR 450 billion, were imported.

To meet the shortage of raw materials, a few companies like WIMCO Seedlings Ltd. (UK) and ITC, Bhadrachalam Paperboard Ltd. (AP), etc., promoted farming of tree crops through providing quality plants, package of practices and assured buy back arrangements in 1980s. These models have ensured the backward integration of availability of raw material with wood-based industries. Similarly, Yamunanagar cluster of wood-based industries in the State of Haryana which is known as 'plywood capital' of the country, presently has the capacity to manufacture about 40% plywood of the country. This cluster is the biggest market for farm wood and has benefitted all the stakeholders including the farmers, labourers, contractors, transporters, traders and industrialists. Hence, the integrated development of agroforestry and wood-based industry would ensure the faster growth of wood sector.

Issues in growth of agroforestry sector and action required

Farmers: The farmers suffer mainly due to hassles in harvesting of trees and inter-state transportation of wood; poor quality of planting material in nurseries; inadequate extension services not supported by research and development; wide fluctuations in prices of wood due to long harvesting period; and no incentive for carbon sequestration. To resolve the above issues; firstly, there should be Pan-India amendments to the rules on felling trees and inter-state transportation of wood through developing an online system for registration of plantations, felling of trees and ensuring seamless movement of wood. Secondly, there should be a framework for accreditation of private nurseries for providing quality planting stock. Thirdly, the wood markets with effective networking may be established. Fourthly, the symbiotic models of ITC, WIMCO, etc., may be promoted. Fifthly, the carbon trading may be facilitated and sixthly, intensive R&D efforts may be made.

Wood-based Industry: The wood-based industry mainly suffers due to complicated licensing policy as the new licenses/expansion of units are issued only after assessing the increased availability of wood; costly farm wood competing with agricultural produce; non-certified farm wood and stiff competition with imported wood products. To resolve the above issues; firstly, wood-based industry may be treated at par with the food processing industry. Secondly, composite wooden panels may be promoted to reduce the demand of solid wood in the long run. Thirdly, upgradation of wood-based industry may be facilitated and fourthly, extensive training and development programmes for skilled manpower.

Projected Benefits: The projected benefits from the above plan will be;

Agroforestry: The annual production of wood from plantations of short rotation trees like poplar, eucalyptus, bakain, etc., would be about 100 million cubic metres of timber worth about INR 420 billion and would generate employment of about 371 million person days (writer's estimate).

Private Forestry: The annual production of timber from plantations of medium rotation trees like gamhar, kadam, silver oak, kikar and long rotation

VISION-2047 (Amrit Kaal) and projected benefits

- ♦ The following VISION-2047 is proposed during Amrit Kaal (period of 25 years).
- ♦ Additionally, 10 million ha of farmlands (3% of geographical area of India) may be brought under plantations, out of which five million ha may be brought under short rotation trees and another five million ha under medium and long rotation trees.
- ♦ Development of 100 clusters of wood-based industries
- ♦ Making India a net wood products exporting country

Policy initiatives

The following policy initiatives need to be taken for the faster development of the wood sector.

- ♦ Setting up National Agroforestry Board (MoCI).
- ♦ Enactment of legislation on TOF (MoEF & CC).
- ♦ Liberalising licensing policy for wood-based industry based on farm wood (MoEF & CC).
- ♦ Reducing Goods and Services Tax on wood products manufactured from farm wood (MoF).
- ♦ Aggressively promoting private forestry by providing incentives like discounted loans, capital subsidies and tax concessions (MoF).
- ♦ Reviewing export and import policy to encourage domestic production of wood and wood products (MoCI).
- ♦ Promoting voluntary certification of farm wood and regulating import of illegal timber (MoCI).

trees like teak and shisham would be about 37 million cubic metres of timber worth about INR 645 billion and would generate employment of about 147 million person days (writer's estimate).

India is becoming net wood exporting country. It is heartening that the initiatives and reforms for development of agroforestry sector are being monitored at the level of PMO. The implementation of the initiatives will create large scale employment opportunities, increase the income of farmers, improve business opportunities for various stakeholders, increase revenue for the Government including earning of foreign exchange. The farm wood would not only meet the demands of wood-based industry but would also be able to meet the ecological requirements of the country.

Public private Participation in production of Wood from Degraded Forest Areas and wastelands of India to Become Self-reliant in Wood Requirement

Introduction

Forest management policies in India are framed based on the needs of the day. Britishers thought that wood in Indian forests is in plenty and they went on a felling spree for continuous usage. When it was felt that the wood resource is not inexhaustible, Britishers started planting different species, like teak for timber purposes, Wattles, Sissoo, Eucalyptus, etc. for timber and fuel wood purposes. After independence, forests were worked extensively for nation building. However, during 1980s a paradigm shift happened in the thinking of policy makers that forests are to be protected for ecological security of the country and the wellbeing of people. Sustainability has become a mantra and working in forests with out approved working plans has become an act of violation. Since the 1980s, people started linking quality of life to the quality of the environment and various courts started taking cognizance of it and they started linking Article 19 (Right to Live) and Environment.

Policy makers started experimenting to take forestry to the footsteps of villagers by way of Social Forestry, made people partners through Joint Forest Management for Natural Resource Management provided them incentives and usufructs sharing for protecting forests and Wildlife

Hemanth Kumar,

Deputy Director General Forests (Central)
South Eastern Zone, Chennai.

Email: ro.mofcc@gov.in

(Eco development Schemes), now with the acts like PESA, Forest Rights Act, Bio-Diversity Act etc., people started enjoying authority/ ownership over forests. As the days progressed, India, slowly drifted from wood self-reliant country to a major importer of wood. As of now India's Wood Import's share, stand at 1.91% of the total world's wood import.

Projections made by Ministry of Environment Forest and Climate Change (MoEF&CC) indicate that by 2020 India is in need of 152.85 million cu.m. of Wood (Table 1) and there is a huge gap in our requirement of wood and its products and production.

Table 1: Wood requirement as per Asia-Pacific Forestry Sector Outlook Study II (Country Report-India, 2020)

Sl. No	Industries	Round Wood Equivalent (RWE) in Million cu.m.			Remarks
		From short rotation species	From Long rotation species	Total	
1	Paper and paper board	35.84	0	35.84	With an increase in Education outlay from 2% to 6% demand bound to increase. More Housing units more wood needed Demand for wood is increasing year after year, with the improvement of wage rates, urbanization, living standards. As per the Asia-Pacific Forest Sector Study, demand is increasing by about 5% in every 5 years interval, since 2000
2	News Print	6.22	0	6.22	
3	Rayon grade pulp	3.80	0	3.80	
4	Construction industry	5.70	22.80	28.5	
5	Packaging	4.50	4.50	9.0	

These alarming figures are forcing us to rethink about a system that makes us self-reliant in our Timber requirements especially for our domestic and industrial consumptions. For which, we have to actively think about concentrating on production Forestry in our traditional forest areas and involving private sector in the production of wood from Government lands, with sufficient safeguards attached to the agreements and promoting Farm/ Agro forestry in a large scale. Before going into the details including merits of involving private sector in wood production, it is prudent to discuss in brief how policies influenced the working of our forests, are described in brief as below

Pre-Independence Period:

During colonial rule in India, the forest policy gave more importance to the exploitation of forest resources with out concern for conservation. The Britishers over exploited the Indian forests for their colonial expansion. Since 1855, the establishment of Railway networks required large quantities of wood for sleepers and low-cost engine fuel, and the expansion of railways and deforestation are directly related, which resulted in over exploitation of forest resources. The Forest Policy 1894, the first formal policy in India which gave importance primarily to commercial exploitation of forest products, State custodianship, and permanent Cultivation. This policy was primarily based on Dr.Voelcker's recommendations given in the report on 'Improvement of Indian Agriculture' in 1893.

6	Agricultural Implements	1.25	1.25	2.5
7	Sports goods	1.37	1.37	2.74
8	Plywood	14.60	14.60	29.20
9	Veneer	0.35	0.35	0.70
10	Matchbox	4.00	0	4.0
11	Mining	2.50	2.50	5.0
12	Miscellaneous industry	7.58	7.58	15.16
13	Furniture	0	7.53	7.53
14	Automobile	0	0.87	0.87
15	Railways	0	0.02	0.02
16	Handicrafts	0	0.95	0.95
17	Particle Board	0	0.35	0.35
18	MDF Board	0	0.28	0.28
19	Catamaran	0	0.16	0.16
	TOTAL	87.71	65.11	152.85

Post-Independence Period:

(A) Forest Policy, 1952

The Indian Forest Policy, 1952 was a simple extension of colonial forest policy. This Policy re-emphasized the 'need for sustained supply of timber' and 'need for realization of maximum revenue' from forests. However, it became conscious and realized the need to increase the forest cover to one-third of the total land area. Hence, Indian forests continued to be exploited for timber and remained the main source of timber until the advent of the Forest Conservation Act 1980.

In pursuit of achieving the policy dictum, in 1969 a first-of-its-type project was initiated in Maharashtra. The creation of a Forest Development Board, which converted 13,522 hectares of 'poor quality' forest in the Vidarbha region into teak plantations, received wide acclaim from forestry experts and forest economists in the country. This model formed the basis for the recommendation of the National Commission on Agriculture (NCA) to establish Forest Development Corporations (FDCs) in India to launch an aggressive production forestry program.

NCA envisaged that such forestry programs could get the forestry sector out of the rut to flow productivity and meet the demand for essential forest-based industrial products.

The interim report on production forestry laid down the following objectives:

- ♦ Raise the per hectare productivity both in respect of volume and value;
- ♦ Create much more employment for skilled as well as unskilled hands;
- ♦ Give substantial support to the economy of the backward areas and

the tribal population which depends on the growth of forestry activities;

- ♦ Expand or establish a large number of industries based on raw material from the forests;
- ♦ Enter the export market in Wood and wood products and
- ♦ Have a sustaining impact on employment in secondary and tertiary sectors.

By the time the final report of NCA was published in 1976, many states had already established Forest Development Corporations (FDC) and the respective States have leased large areas of Forests to FDC. At present, the FDC's are producing roughly 1.97 million cu.m. of Wood. A table representing present status of FDC's which are engaged in plantation Activity is given in Table.2.

Table 2: Brief on the present status of FDC's which are engaged in plantation Activity (Area in ha)

State	Year of Establishment	Annual Turn over	Area Given on Lease	Predominant Species and its area under cultivation	Remarks	
Madhya Pradesh	1975	85 Crores	425000	Teak, Bamboos	235714	Annually Teak is planted in about 8 000 ha
Maharashtra	1974	120 Crores	393051	Teak, Bamboos	295118	Seed unit and nurseries of the FDC have been awarded IS/ISO9001: 2008 certificate
Chhattisgarh	2001	so crores	197322	Teak, Bamboos	119167	Annually Teak is planted in about 3000 ha
Tamil Nadu	1974	80 Crores	156485	Eucalyptus	75000	Corporation is ISO 9001: 2008 Certified, in planting Eucalyptus, Rubber, and Tea (3 Corporations)
AP & Telangana	1975	100 Crores	83700	Eucalyptus	80563	In the rest of the areas Cashew, Coffee, Teak, medicinal plants. The corporation annually plants between 3000 and 6000 ha eucalyptus and produces round-wood/ pulpwood between 100,000 to 200,000 m ³
Karnataka	1971	52 Crores	62154.6	Eucalyptus	41663	4443 ha is under Rubber and 12919.6 ha under Cashew Plantations
Kerala	1975	20 Crores	10500	Eucalyptus	8480	1400 ha of teak, 200 ha Coffee, 320 ha Cashew, 100 ha Tea
Gujarat	1976	38 crores	5714	Eucalyptus	3990	The corporation came into existence by merging three corporations
Odisha	1990	53389		Cash Crops	25000	
W. Bengal	1974		44000	Cash Crops	1372	Mainly Rubber
Tripura	1976		8184	Cash Crops	8132	
Andamans	1977		2160	Oil Palm & Rubber	2160	
Arunachal Pradesh	1977					Forest Lands leased out in Tirap and Changlang districts, but felling stopped by Hon'ble Supreme Court
Total Area			14,41,660		8,96,359	

With the implementation of the Forest Conservation Act, 1980, (FC Act) there was a shift in the approach towards Conserving Forests and sustainability principles (Annual Allowable Cut) started taking prominence. FC Act banned the clear-felling of green trees.

(B) Forest Policy 1988

Indian Forest Policy, 1988 is the second forest policy after the independence of India and first forest policy which recognized the role of local people in forest protection and management of forests for achieving improvements in community livelihood. The National Forest Policy in 1988 made a very significant and categorical shift from commercial concerns to focus on the ecological role of the forests and participatory management. This policy emphasized the conservation of forests and marked a shift in approach from revenue-oriented forest management to conservation forestry. Forests started to be considered as "Protectors and Producers"

1988 Forest Policy has mandated some checks and balances for the felling operations of FDCs. In its guidelines dated 2 August 2001, MoEF & CC laid down the following conditions for felling:

- ♦ All young to middle-aged fruit-bearing trees up to 20 trees per ha will be retained in native forests.
- ♦ Young to middle-aged semal, khair, rosewood trees as well as other superior miscellaneous species up to 20 trees per hectare uniformly spread over the area will be retained.
- ♦ No felling shall be done on either side of streams or riverbank up to 20 m distance from the stream.
- ♦ The section size at a place shall not exceed 20 ha.
- ♦ 20 m-wide strips of the natural forest should be retained on all sides of the section.

Outcomes

As a consequence, the annual production of timber from forests had declined from 10 million cu.m. in the 1970s to about 4 million cu.m. by 1990. Following the Supreme Court order in 1996 to ban the felling of trees without an approved Working Plan, timber production from forests further reduced to about 2 million cu.m. annually. The average timber

production from forests during 2005-10 was about 2.38 million Cu.m per year. Meanwhile, the efforts in taking forestry to the footsteps of people started giving good dividends. Trees outside Forests (ToFs) have improved the wood production qualitatively and quantitatively and now they are the main source of industrial wood in the Country. It is estimated that the annual availability of wood from ToFs has been to be 44.34 million Cu.m.

Experiences from FDCs which are involved in plantations on forest areas:

1. Productivity from FDC lands (cu.m./ha/year) ranges in between 0.09 cu.m. in Maharashtra and 4.39 cu.m. in Tamil Nadu and the country average productivity is 0.77 cu.m. The average productivity from Tropical forests is 0.88 cu.m. and of World Forests is 1.09 cu.m. By any standards productivity of Forests managed by FDCs is less.

2. FDCs were asked to reclaim degraded forests, for example, Tripura Forest Development and Plantation Corporation (TFDPC) was created to restore degraded forests through rubber plantations. Maharashtra FDC has nearly 20,000 ha of degraded forests under it for rehabilitation. Maharashtra FDC has also carried out extensive afforestation of wastelands as part of the Wasteland Development Programme during 1988- 91 and raised plantations over 2.35 lakh ha of wastelands, mostly outside FDC forest lands, Madhya Pradesh FDC has undertaken rehabilitation of degraded bamboo forests over 13,000 ha.

3. FDCs always faced lots of stiff opposition from locals, as the aim of FDC is to maximize the profitability, so their preference is to plant Monocultures, whereas locals don't need trees but the people need tree communities that will give them tangible and intangible benefits.

4. Profit-sharing between the FDC and local communities has always been a bone of contention.

5. Of late Community Forest Rights also started posing problems, to name a few incidents where local people forcefully stopped carriage of felled wood, stating that the wood extracted is from their lands (on which they have community rights) it happened at many places in the Rajnandgaon district of Chhattisgarh, Nandurbar forest division, in

Gadchirolli and Chandrapur districts of Maharashtra, in Mohgaon project area of the Madhya Pradesh, in Cooch Behar Forest Division of West Bengal, etc.

An initiative by private farms in bridging the gap between production and demand:

Several initiatives have been taken by the Indian industry for meeting the demand of raw material; the attempts have mostly started after 1988 National Forest Policy prescriptions that advocated industry-farmer interface. A few Tree Plantation Companies in India undertook plantation of wood species and

supply logs of wood to other companies that use them as raw materials for their industries e.g. plywood and board manufacturers, paper and pulp manufacturers, furniture manufacturers, match manufacturers, etc.

Nearly 3,43,000 hectares of farm forestry plantations have been promoted by the paper industries who are members of the Indian Paper Manufacturers Association (IPMA). It is estimated that this land mass can produce approximately 20 million tons of wood at 60.00 tons/hectare yield. Details of the company-wise data on plantations promoted by the paper industry are given in the Table-3.

Table 3 :- Details of plantations promoted by major paper companies in India

S.No	Company	Plantations (hectares)	Estimated wood generation (In MT)
1	ITC	42000	25.20
2	BILT	40000	21.00
3	JK	46000	27.60
4	APPM	29000	17.40
5	SPM	15000	9.0
6	TNPL	2000	1.20
7	SPB	200	0.12
8	Orient	27000	16.20
9	Century	17000	10.20
10	Star	35220	21.13
11	MPM	35000	21.00
12	HNL	30000	18.00
13	WCPM	25000	15.00
Total		343420	203.05

(Source: Asia-Pacific Forestry Sector Outlook Study II, Country Report-India, 2020
A MOEF & CC' publication Page no.51)

Lots of research went into the development of new varieties and clones for farm forestry in India. Industry developed a mechanism of buy-back arrangements with Farmers and farmers also started feeling such mechanism to be profitable to him and all these culminated in bringing roughly as many as 1.20 million hectares of private lands under farm forestry for meeting the demands of plywood and board manufacturers, paper and pulp manufacturers, paper and pulp manufacturers, furniture manufacturers, match manufacturers etc., the supply is not good enough to meet the demands of the industry.

Involving Private Participation-Governmental Initiative

In October 2014, Madhya Pradesh Rajya Van Vikas Nigam (MPRVVN) had organized a workshop to discuss leasing of degraded forest land for industrial plantations. The workshop was attended by forest officers, officials from paper industries, and members of various federations of commerce and industry as a followup to the guidelines for reforestation of degraded forest land with pulp wood species through collaborative involvement of state-owned Forest Development Corporations (FDCs) and participating paper mills.

Three models of using degraded forests for raising commercial plantations by FDCs were discussed in the workshop:

Model 1- Leasing out 2000-3000 ha of degraded forest lands, having site quality IIIA, III B, IVA, IVB, through tender for 40 years to the highest bidder to industries, bringing direct private investment. Under this model, 30 percent of the land had to be provided by the companies for the Nistar rights of the local community. Communities cannot interfere in the remaining 70 percent of the land.

Model 2 -Bipartite agreement between FDC and paper companies on degraded forestlands in possession of FDCs like MPRVVN and FDCM were proving to be financial liabilities. Paper companies need to invest in FDCs to double the area that is treated annually by FDCs. The highest bidder would become entitled to the supply of raw material.

Model 3 -Tripartite participation of FDCs, farmers, and paper mills proposed by the Executive Director of MPRVVN-two agreements required-first between farmers and FDCs and the other between FDCs and paper companies.

Farmers would be encouraged to raise plantations on private land which is not suitable for agriculture. FDCs would fund the planting and felling costs of farmers at a 5 percent simple rate of interest and also provide farmers with technical assistance. Paper companies would enter into buy-back arrangements with FDCs. Net profit would be shared between the FDC and farmer in the ratio of 25:75.

Effectively FDCs would act as middle men for farmers under this arrangement. It was concluded that FDCs would receive a considerable improvement in their financial status due to

increased business opportunities from the second and third models. Also, it was expected that paper companies would benefit from an adequate supply of raw material at reasonable price because of such arrangements. However, not a much headway happened through this exercise.

The way ahead:

Taking the thinking of making India self-reliant in wood production further, and by keeping the experiences of the department while dealing with such situations in mind, handing over of degraded forest lands with guarded precautions can be one possible solution.

Forests in India are continuously subjected to the factors that are accelerating the process of forest degradation. Degradation refers to reduction in productivity and/or diversity of a forest due to unsustainable harvesting (removals exceeding replacements, changes in species composition etc).

Because of variety of reasons the productivity of Indian forest stands at only 0.7 million m³/hectare/year against to the global average productivity at 2.1 million m³/hectare/year. The factors that are accelerating degradation process in Indian Forests include

1. Land Erosion,
2. Shifting Cultivations,
3. Over Grazing,
4. Removal of nutrients,
5. Fire,
6. Pests and diseases,
7. Pollution/ climate change
8. Invasion of Alien Species, etc.

Table 4:- Status of land degradation in India

Cause	The degraded area in Ha		Remarks (% increase with respect to 2003-05)
	2003-05	2011-13	
Vegetative Degradation	2,82,83,544	2,92,98,553	103.59
Water Erosion	3,56,10,063	3,60,99,042	101.37
Wind Erosion	1,83,47,639	1,82,33,594	99.38
Salinity	39,99,206	36,74,759	91.88
Water Logging	5,99,597	6,53,908	109.06
Frost Shattering	31,09,262	33,38,404	107.37
Mass Movement	8,43,554	9,27,986	110.0
TOTAL	8,79,93,871	9,22,26,246	104.81

Whether Degradation is confined only to Forests?

An emphatic answer to the question is a big no. In India, the lands are eroding and getting degraded at alarming rates everywhere. MoEF&CC in association with ISRO in June 2016 came out with a publication titled, Desertification and Land Degradation Atlas of India. The study is based on IRSAW iFS data of 2011-13 and 2003-05. The details of cause for land degradation and extent of degradation given in table-4.

The above table shows that the degradation process is going on unabatedly and significant areas are becoming degraded and it must be stopped.

Thus, we have waste lands and degraded forests in huge numbers, which can be brought under the purview of PRODUCTION FORESTRY, with the involvement of government, private, and the people. At the same time giving emphasis on growing more wood outside the Forests.

Conclusions:

- ♦ Strong emphasis must be given to the production of wood from our traditional forests, by not compromising the principles of Sustainability,
- ♦ Research on Seed and its technology and its certification, Provincial trials also must be undertaken on a priority basis,
- ♦ Better to choose an option of taking up of large tracts of waste lands available in the country (9.22 Crore Hectares) under production forestry and do intensive farming of Short Rotation Species,
- ♦ Forest Development Corporations also must step up their timber production (improve productivity), by employing modern plantation techniques, using better planting materials, judiciously following the silviculture principles, etc. Old plantations (after taking 2-3 coppice crops), the seedling trees must be uprooted and replaced with the species which are more vigorous and disease resistant,
- ♦ As, wood requirements are largely met from ToFs, a proper mechanism must be devised to certify them, so that more returns will incentivize the farmers to grow more trees on their fallow lands,
- ♦ More relaxations in the Transit of wood will also act as a booster for growing more trees by farmers,
- ♦ A system of buyback, Crop insurance, Carbon credits etc. will incentivize the farmers and will help in growing more wood.
- ♦ If the degraded lands are taken up, then there have to be State specific rules, as, different states have different kinds of land-related problems, like Shifting Cultivation, Nistar rights, Naxal Problems, etc.
- ♦ Care must be taken on the judicious use of these sources like soil and water, by the participating companies. They must work on amelioration of soil (by the way of using Vermicompost, Vermiculites, Organic Manures, etc.) and in improving water availability in the soil by going for SMS structures.
- ♦ The companies must not be allowed to use Genetically Modified seeds and Companies must not be allowed to plant exotics.
- ♦ They must undertake SMC works in the areas allocated to them like permanent Structures must not come up in those areas, Diversion of water sources shouldn't be allowed.
- ♦ Due diligence be given to the Acts like PESA, FRA, Bio-Diversity Act, etc. Profit-sharing with local communities must be just and transparent.
- ♦ Finally, FORESTS ARE PROTECTORS AND PRODUCERS, so due care must be taken before taking up a decision of handing over our precious ecosystems. Our past experiences in similar kinds of exercises proved that our predecessors were wrong, in due course of time we lost huge tracts of forests.

Company Background:

KumarEngineeringCo. is a pioneer in India for making indigenous global standard machines being used in the wood working industries as Plywood, Laminate & Furniture, Founded in 1990 by Mr. Sunil Srivastava (M.D.) on Engineering graduate with breakthrough experience in advance automation with strong focus on research and development, our organization is recognized worldwide for technical excellence and development of innovative products. The numerous industry milestones, new products, technical upgradations and patents that have resulted from our work continue to provide long-term benefits to our clients.

We are ISO: 9001 2015 certified company located in NCR District Rohtak, Haryana, approximately 40 miles from the capital city of New Delhi and easily accessible from the airports.

Core Competencies:

- ♦ Double Head Wide Belt Top Sanding Machine
- ♦ Double Head Wide Belt Bottom Sanding Machine
- ♦ Heavy Duty Both Side Sanding Machine
- ♦ Triple Head Calibrating and Sanding Machine
- ♦ Heavy Duty Laminate Sanding Machine
- ♦ Heavy Duty Both Side Calibrating Machine
- ♦ Super Heavy Duty Both Side Calibrating Machine
- ♦ Single Combi Head Sanding Machine
- ♦ Single Head Calibrating Machine
- ♦ Double Head Both Side Brushing Machine
- ♦ Triple Head Both Side Brushing Machine
- ♦ Automatic Edge Cutting Machine (ServoControlled)
- ♦ Hardwood Calibrating & Sanding Machine.
- ♦ Sanding Machine with Cross Belt for UV/Lacquer.

Our Clients:

We have a diversified client base & enjoy strong patronage of 500+ national & international clients including leading Plywood, MDF, Laminate and other wood-based product manufacturers, research organizations and government agencies. Apart from pan-India presence our machines are being increasingly exported to Nepal and preparing for other neighboring countries.

We look forward to receiving your esteemed order and forging a strong relationship with you. Please feel free to contact us for more information



Relevance of Sustainability Certification for Agri-Wood in India

Introduction

Forest Certification has become a significant market mechanism to promote responsible forest management from last 2 to 3 decades. The consumer is now asking whether the products he is using are derived from legally harvested wood and that the forests are managed with best practices which takes care of environmental, societal and economic aspects. Further, Forest Certification is a tool that promotes responsible forestry through dialogue between private sector, government, environmental and social NGOs and the wider civil society with no single interest group being able to impose its views on the others thus bringing in multi-stakeholder governance.

Over the years Forest Certification has become a reality. Forest Certification therefore, is a mechanism for forest monitoring, tracing and labeling timber, wood and pulp products and non-timber forest products and the quality of management is judged from environmental, social and economic perspectives against a series of agreed standards. The key to Forest Certification is the development of a system that combines auditing forest practices with tracing forest products.

Presently the available certification mechanisms are 1) Forest Certification and 2) Sustainability Certification. These two mechanisms are discussed

H.D. Kulkarni

Vice President (Retired), ITC Ltd., Paperboards & Specialty Papers Division,
Plot No: 7, Survey No: 5/1 5A,
Narlas Sun Shine Villas, Gundlapochampally,
Medchal District, Hyderabad-500100,
E-mail: sudhaharsh17@gmail.com Mobile: +91 9849496020.

below with which the agri-wood can be certified. The first Forest Stewardship Council - Forest Management (FSC-FM) certification was for Ambadi Estate Rubber Plantation in India. Later, the pulpwood plantations promoted by paper industry in India were certified.

Forest Certification

Forest Stewardship Council (FSC) is the main organization which lead the Forest Certification in the world. FSC was founded in the light of the 1992 UN Conference on Sustainable Development in 1993 by concerned business representatives, social groups, and environmental organizations like UNEP, WCMC and WWF. The FSC is an international non-profit, non-governmental organization to support environmentally appropriate, socially beneficial and economically viable management of world's forests and FSC certification is voluntary (<https://FSC.org>).

The Credible Forest Certification as a tool has the following objectives:

- ♦ Promote socially, environmentally and economically responsible forest management;
- ♦ Safeguard biological diversity in managed forests including High Conservation Value Forests;
- ♦ Respect the ownership and user rights of local communities and indigenous peoples;
- ♦ Provide a forum for dialogue between different stakeholders and establish frameworks for resolution of social conflict over utilization of forest resources;
- ♦ Ensure transparency of both forest management and the forest products trade;
- ♦ Provide a market mechanism allowing companies and consumers to identify and purchase timber and non-timber forest products from well-managed forests.

Today, there are many Forest Certification schemes like FSC, PEFC (Program for the Endorsement of Forest Certification), MTCS (Malaysian Timber Certification Council) and LEI (Lembaga Ekolabel Indonesia). However, certification schemes vary in standards, consistency, transparency, means of verification and in the degree to

which governance is open to different stakeholders.

The main aim of the Forest Certification schemes is to manage forests which results in increased forests in the world. Forest Certification helps in sustainability as well as meeting the SDGs (Sustainable Development Goals).

Start of Forest Certification in India - Nostalgic memories!

In the year 1999, I came across FSC which is based on Environmental, Societal, Economic chambers having 10 Principles and 56 criteria (P & C).

PRINCIPLE 1. COMPLIANCE WITH LAWS AND FSC PRINCIPLES: Forest management shall respect all applicable laws of the country in which they occur and international treaties and agreements to which the country is a signatory and comply with FSC P & C.

PRINCIPLE 2. TENURE AND USER RIGHTS AND RESPONSIBILITIES: Long-term tenure and user rights to the land and forest resources shall be clearly defined, documented and legally established.

PRINCIPLE 3. INDIGENOUS PEOPLE'S RIGHTS: The legal and customary rights of indigenous people to own, use and manage their lands, territories, and resources shall be recognized and respected.

PRINCIPLE 4. COMMUNITY RELATIONS AND WORKER'S RIGHTS: Forest management operations shall maintain or enhance the long-term social and economic well being of forest workers and local communities.

PRINCIPLE 5. BENEFITS FROM THE FOREST: Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

PRINCIPLE 6. ENVIRONMENTAL IMPACT: Every forest management operation must preserve biological diversity and its associated values, the water resources, the soil and the fragile and unique ecosystems, in addition to the landscape. By fulfilling these objectives, the ecological functions and integrity of the forest can be preserved.

PRINCIPLE 7. FOREST MANAGEMENT PLAN: A management plan - appropriate to the scale and intensity of the operations - shall be written,

implemented and kept up to date. The long term objectives of management and the means of achieving them, shall be clearly stated.

PRINCIPLE 8. MONITORING AND ASSESSMENT: Monitoring shall be conducted -- appropriate to the scale and intensity of forest management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

PRINCIPLE 9. MAINTENANCE OF HIGH CONSERVATION VALUE FORESTS: Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

PRINCIPLE 10. PLANTATIONS: Plantations shall be planned and managed in accordance with P&C 1 to 9 and Principle 10 and its Criteria. While, plantations can provide an array of social and economic benefits and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

Further, FSC brings out as to how Forest Certification helps, ensures or beneficial based on three perspectives of Environmental, Societal and Economical aspects as follows:

Environmentally appropriate: Ensures that the harvest of timber and non-timber products maintains the forest's biodiversity, productivity and ecological processes.

Socially beneficial: Helps both local people and society at large to enjoy long term benefits, requires adherence to ILO Conventions and also provides strong incentives to local people to sustain the forest resources and adhere to long-term management plans.

Economically viable: Forest operations are structured and managed so as to be sufficiently profitable, without generating financial profit at the expense of the forest resource, the ecosystem, or affected communities.

I was enthused to take forward the journey on FSC certification for ITC promoted Farm Forestry

pulpwood plantations. In an innovation workshop in the year 2002, this idea was put-forth to ITC management to strengthen the “Triple Bottom Line” – Economic, Environment and Society in doing the business on paper and paperboard. The forward looking ITC Management readily agreed for the initiative as it will lead the company towards sustainability.

In the same year, we invited expert from Wood Mark Soil Association UK, a FSC accredited certifying body (CB). The expert stated that the Farm Forestry plantations are eligible for FSC certification. But it appeared to me that it is difficult to satisfy all the P & C of FSC and achieve certification of the Farm Forestry plantations. The views put forth were:

- 1 The farm land may get converted to forests. Or plantations grown on farm land will be turned in to natural forests.
- 2 Farmer is afraid that his farm land will get converted to forests and will be taken away.
- 3 Monoculture and Eucalyptus controversy may not be in line with FSC certification. FSC has Policy of promoting indigenous species and exotics are to be used as a last resort after due diligence. More than two species culture is good compared to monoculture. Due to monoculture biodiversity is lacking. No more than 75% of the managed area is taken up by a single tree species is the norm but against the norm farmers are cultivating Eucalyptus, Casuarina and Subabul as mono-crop. Farmer will plant only the species which are useful / economical to him/her under Farm Forestry and not for biodiversity cause.
- 4 Long-term binding is required for FSC and farmer is averse to this idea.
- 5 Wood grown in farm land such as Eucalyptus, Casuarina, Subabul etc., is declared as “agri-produce” and not forest produce as per the GO of Andhra Pradesh government (APGOMs. No. 158 dated 10-6-1999). Wood is procured through Agricultural Market Committee (AMC) a state govt. organization from the plantations grown under Farm Forestry.
- 6 Fast wood forestry - short rotation cycle wood is coming from the farm land to the mills i.e. at 2 to 2.5 years plantation wood as against the rotation cycle of 5 to 7 years. Such wood is difficult to certify.
- 7 Intercropping restrictions – the farmer sometimes grows trees with GMO (Genetically Modified Organism) cotton and such agroforestry plantations are not be eligible for certification.
- 8 Certain area is to be earmarked for wild life, 10% of forest designated as conservation zone and 5% of forest designated as a protected area in the farm land. Farmer may not accept this idea as his land is meant for agricultural production and not for forest related activity.
- 9 Plantation management on land that was previously natural forests is designated to maintain / enhance remaining characteristics of the earlier natural forests. Conversion of Forest to Farm Land cutoff date was 1995. The lands after 1995 are not eligible for certification.
- 10 The logging practiced is manual in the pulpwood plantations grown by the farmer. Such practices are termed as primitive as no safety or logging standards are followed as per RIL (Reduced Impact on Logging), safety standards etc.
- 11 Other issues such as large number of farmers (more than 80000) how to handle them? A management plan is required with monitoring mechanism. Controlling the operations in the field such as application of pesticides, fertilizer, irrigation etc., is difficult as the land is not owned by the company and farmer is at his will, may or may not follow instructions as per the requirements.

However, the efforts continued and it was thought fit to take it forward with the help of MoEF&CC. Discussions were held on FSC certification as it is a new thing for India and MoEF&CC should promote Forest Certification. MoEF&CC was of the opinion that India has an age old and well laid out system of certifying timber – “Hammer system” and FSC is not required as it involves third party audit of forests by outsiders and under the present forest policy it is not possible. At the same time, in the year 2005, we proposed setting up of “Indian Forest Stewardship Council” to the “Grover Commission” on Forest policy review.

As FSC certification was not going forward, the pressure was building up on the company as certain valued customers wanted only FSC certified paper and paperboard as per their company policy. As short-term measure, a) ITC Farm Forestry plantations were visited by the Forester deputed by the customer who certified that the wood is coming from legal source grown by the farmer in his own land and not derived from forests. b) ISO 14000 norms appeared which also dealt with plantation and environment issues. c) Visit of FSC official took place with whom the possibilities of FSC certification were explored. d) Bhopal India process - Criteria and Indicator were published but it did not lead to certification. e) MoEF&CC conducted several meetings on certification under the guidance of PEFC. f) Later NCCF came into being around 2018-19.

To speed up the certification process a South African FSC expert was invited who stated that the company is almost ready and certification can be taken up under "Group certification". He listed the requirements such as writing of Forest Management plan for the Farm Forestry plantations, establish an institutional mechanism, carry out EIA and SIA, stake holder consultations etc.

During this period (2008 & 2009), through WWF India GFTN membership was obtained in July 2009 and the process of certification became clear. GFTN is a WWF initiative to eliminate illegal logging and improve the management of valuable and threatened forests, while encouraging sustainable forest management practices and minimizing the forest footprint of industries trading in or procuring forest goods. At the same time (2009-10) certifying bodies such as Rainforest Alliance-Smartwood, SCS, SGS started functioning in India.

A decision was taken to sort out the farmers / plantations which will comply with FSC FM requirements and give up those which do not comply with the FSC P & Cs. All these efforts resulted in FSC C-o-C (chain of custody) certification in 2010 and FSC FM (Forest Management) certification in 2012 for 22000 ha pulpwood plantations (Kulkarni, 2017 & Nagar and Kulkarni, 2017). Thus, the company was able to meet the customers' requirements of FSC certified paperboard as well as enhanced its image on sustainability.

Sustainability Certification(SC)

Majority of Indian industries are now publishing Sustainability Reports. To start with GRI Format was adopted for Sustainability reporting in ITC (<https://www.itcportal.com/sustainability>). There are now several formats available. The WBCSD (World Business Council for Sustainable Development) also has wider membership of industries world over and report their performance on Economic, Social and Environmental aspects. In India WBCSD is represented by TERI as it has large Indian industry membership which focus on sustainability.

The GRI based Sustainability Reports are graded as A, A+, A++ etc., based on Economic, Social and Environmental performance. The Sustainability Certification (SC) are of 2 types:

Limited assurance: The certifier does not give full assurance as he is not satisfied with the data which has limited scrutiny carried out by the organization in processes, products, accounts etc. matters.

Complete assurance: The certifier gives full assurance once he is satisfied with full data scrutiny which is cent per cent followed or complied with.

Now, if we decide to adopt SC model then the farmers or industry have to choose one of the above-mentioned criteria i.e. Limited assurance or Complete assurance for certification of agri-wood. The SC model has developed certain Matrices which are also cumbersome to follow.

The SC issuance will have to come from a registered body whose mandate is to issue such certificate. For agri-wood SC, if IPIRTI is chosen as an agency for issuance of the SC then IPIRTI Bylaws need amendment with respect to inclusion of the mandate for issuance of SC.

To make SC effective and widely accepted, one need to involve WWF, UNFF, GFTN, etc., organizations of repute. In our case, we can think of organizations like CII, FICCI, IFFCO and many other Indian organizations.

Once the standards / protocols are developed for certification it should be "Bench marked" with any global body like FSC, PEFC and other organization dealing with certification like Global GAP, IND GAP or any agricultural / horticultural certification body which will give the required value / credence /

acceptance to the certification. If this is not done, then the value of certificate issued will remain just as a paper and will not carry any value as it is not approved internationally. This will also not help in achieving the goals such as export of products to countries who are looking for valid / accepted certification.

Further, the agri-wood SC fall under two types viz., "Processes certification" which follow the global best practices in agri-wood plantations. The "Product certification" several standards exist such as ISO, ISI for Plywood and other timber products. But product specific usage such Pure, Mixed grade etc. are required to be developed. There can be separate certificates issued either for process or for the product or one certificate which include both product and process depending up on the requirement of industry.

The other organization which is dealing with SC is SFI (Sustainable Forestry Initiative). SFI is a sustainability organization operating in the U.S.A. and Canada that works across four pillars viz. standards, conservation, community and education. The main aim of SFI is to promote sustainable forestry in the world.

Why separate and new mechanism for Agri-wood certification

The reason for seeking separate certification scheme for agri-wood and wood products is that agroforestry wood is derived from short / medium rotation tree crops and they are purely grown on farm land for meeting the raw material demand of the industry.

The trees grown on farm land are agri-produce just like any other agri-crop and not forest produce.

The Forest Certification is more or less acting as a trade barrier (Especially in European Union, Lacey Act in USA).

Cost of Forest Certification (both one time and recurring cost) is very high which the MSME or the farmer cannot afford it.

In this new scheme of agri-wood certification, there is no concept of turning agroforestry plantations into natural forests on long term basis which the FSC, PEFC and other certifications schemes insist on through P&Cs such as HCVF etc.

There was an exercise on simplification of standards under FSC in India. But FSC does not permit for major changes to P & Cs and only few minor changes to meet the local needs were proposed (KPMG). This may act as a driver for developing new certification scheme for agri-wood.

These days every certification body talks of due diligence (DDS) and risk assessment (RA). It is okay for a literate farmer or a management representative to full fill the needs of DDS and RA. All most all the certification schemes are highly document oriented. There is a need to lower this requirement as many farmers and industries are averse to the idea of laborious work involved in creating and maintaining the documentation.

Way forward for Agri-wood certification

Simplification of the EHS (Environment, Health and Safety), Forest Rules, labour laws, HCVF(High Conservation Value Forests), Peoples rights, etc., is required if we go for new sustainability agri-wood certification which will be India specific certification scheme.

Once, the frame work of P & C are developed, then they are to be bench marked with the global schemes so that there is international recognition for agri-wood certification of Indian scheme.

This agri-wood certification (if named as sustainability certification), one need to understand who requires this certification i.e. Wood Based Industry or Farmers. This will help in financing the certification costs. If industry requires certification especially Plywood and Panel industry, then following to be considered

- For production of 10 million cubic meter/year plywood, the plantations area required works out to nearly 7 lac ha. Presently, Plywood industry does not promote plantation to this extent (7 lac ha) except few large plyers who are promoting plantations but their plantations does not exceed more than 35,000 ha. Therefore, there should be grouping of plantations which are grown by farmers on their own like Eucalyptus, Poplar and Melia etc. and involve them in certification process.

Paper industry however is well placed and getting the FSC FM certification of plantations promoted by

them. The certification costs are entirely born by the paper industry. The paper & paperboard customers abroad want only FSC FM certification.

A word of caution - Financially sound companies may opt to go for FSC certification as it is widely accepted internationally which will also open up markets for export of the certified products abroad. Plywood industry like Green Ply has obtained FSC FM certification. In case of Paper industry, large area of pulpwood plantations are FSC FM certified. Others may also take this route then the Agri-wood sustainability certification scheme may not find its utility.

Wood Based Industries obviously have to incur costs for developing standards for agri-wood certification and also to meet the certification costs in future. Alternatively, seek funds from government (from cess fund, CSR fund etc.).

Farmer per se does not want to involve on his own and face all the hassles of certification as well as the costs. Farmer will also ask what benefit he / she

will be deriving from certification. Say higher rate for the certified wood or incentives for becoming member for certification. Once the industry decides to look after the costs and interest of farmers, then agri-wood certification scheme will become viable.

Industry should be ready to motivate farmer to participate in agri-wood certification and pay premium price for the certified wood derived from his land. Farmers consent is a must as the certification belongs to the land owner.

Institutional mechanism for "Group certification" is to be established between industry, NGO and the farmer. An agreement is to be signed between these 3 parties giving validity to institutional set up for taking up certification.

No certification is done without stakeholder consultations. It acts as boon to farmers and other stakeholders in case there are problems with the industry. A platform is available to redress the grievances and compliance is to be given to the certifying body by the industry.

Conclusion

For agri-wood certification, India should develop simple certification scheme and mechanism to help farmers as well as industry enabling to market agri-wood and products both domestically and internationally which will assure that the wood and wood products are derived from sustainably managed plantations. There is a need to develop suitable P&Cs applicable to Indian conditions.

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Certification of Sustainability and Legality Assurance of Agro-wood Procurement in India

Shiv S Panse,
International Forestry Expert - Timber Legality Assurance Systems
Email: sspanse@gmail.com

1. Introduction

Wood based sector is very complex in nature in India. Markets are highly unregulated, imperfect, and oligopolistic as far as the price; availability and quality parameters are concerned. Past decades have shown a high population growth, increased construction activities in the real estate sector, high economic growth, and attractive schemes have increased the demand for wood and wood products in India. Construction, plywood & panel products, and furniture are the major application areas consuming around 45 percent of the total wood consumption. The major species, which are commonly used are Indian Teak, Neem, Mango, Babool (Acacia), Rubber, Silver Oak, Deodar and Eucalyptus are a few among others. They contribute around 35 percent of total domestic wood consumption. According to the 2022-23 budget announced (01 Feb 2022) about 68% of the capital procurement budget will be earmarked for domestic industry for 2022-23 up from 58% in 2021-22. 5-7% biomass pellets will be co-fired in thermal power plants resulting in carbon dioxide savings of 38mmt annually. Sovereign Green Bonds to be issued in public sector projects to reduce carbon footprint initiatives in the economy.

The natural forests cannot meet

the increasing demand for wood and wood products and hence the same is fulfilled partly by timber obtained from forest plantations and Trees Outside Forests (TOF) in the ratio of approximately 20% to 80% respectively. In South and Southeast Asia 68% of the planted forests are in India, Indonesia, Malaysia, and Thailand (Anon, 2005). Future of the industry's survival mainly depends on the availability of wood from Trees Outside Forests (ToF) and imported wood. Proposed demand for domestic wood in 2022 is approximately 80 million cu.m. (Anon, 2021).

The transboundary movement of wood and wood products within and outside India need to be recognized with their legality status with respect to its origin, harvesting approvals, transportation, and export. In addition to being known for its origin, the chain of custody of products shall be maintained throughout its journey. The effective and efficient management of legality in this key area ensures credibility of producers and suppliers towards volume and quality of produce traded. However, small, and marginal producers face documentation and other quality management issues, during the supply chain, where agro-forestry operations and agro-industrial plantations are involved.

In India, most of the rural population is dependent on agriculture and particularly vulnerable communities i.e., tribal, and other forest dwelling communities for whom wood and wood products and ecosystem services serve as an economic and social safety net. Like other timber producing countries India's forests are also under threat from expanding agriculture at industrial and subsistence levels, as well as uncontrolled and illegal logging. To protect suppliers and producers from illegal trade of wood and wood products, the government is committed to apply different approaches to ensure legal trade of wood and wood products from agroforestry sector. This document is an effort with an aim to support the Government's efforts including the integration of legality and chain of custody aspects as main components of the supply chain control of agroforestry products in India.

2. Certification/ Standard Needs for sustainability and legality assurance -

Certification may be defined as the set of requirements put in place by industry, regulators, or other entities. These requirements give rise to the driving documents for all certifications. Certification schemes provide information about the criteria of compliance with which the product, process, or service is certified. Any Certifying Body (CB) that

aspires to establish product/ services certification needs to be accredited according to accredited standard, one such example is ISO/IEC 17065. It defines the “requirements for bodies certifying products, processes and services”. The first version of “ISO/IEC Guide 65” was published in 1990s. ISO/IEC Guide 65 has been referenced and used across industries and regulators around the world. Various industries and governments have migrated towards requiring third-party accreditation of the CBs that certify the products, processes, or services which enter or are being used in the country or region where the regulators are responsible.

To provide credibility and assurance towards legality and chain of custody, responsible competent authority needs to be accredited as per above standard. The increases authority’s efficiency, productivity, and effectiveness of overall certification operation. It boosts motivation, co-operation, and quality awareness including competence amongst employees and helps in defining roadmaps for control over records, etc. Standard also provides thrust to the image of CB, its quality, worldwide recognition, credibility, and an edge over unaccredited competitor.

The risk of trade in illegally harvested and traded wood in supply chain of domestic wood and imported wood sourced from different geographic locations has increased due to increased consumption trend and no standard procurement procedures among traders and suppliers. To reduce the barriers and obstacles caused by lack of credibility or trust in the Indian timber sector with respect to high risk of trade in illegally harvested wood, it is a need to prepare a good database of wood coming from different sources and certify accordingly. The certified value-added products generate potential revenue and information about financial benefits from products exported to European countries (Germany, France, Netherlands etc.) and the United States (US) that historically have been buying wood and wood products from India.

2.1 Standard references- This section provides brief information about certain standard references supporting CB’s establishment involved in different service and product certification. ISO/IEC 17065-

- ♦ ISO/IEC 17067-Fundamentals of product certification and product certification schemes (guidelines for understanding, developing, establishing, maintaining, or comparing schemes).
- ♦ ISO/IEC 17021- for assessing certification bodies to ensure that they are competent and conform to all types of management systems.
- ♦ ISO/IEC 17000:2004- general terms and definitions relating to conformity assessment
- ♦ ISO 22095:2020 - Chain of custody General terminology and models.
- ♦ ISO 20400:2017- guidance to or organizations on integrating sustainability within procurement as described in ISO 26000.

Product Certification Bodies Accreditation Standard (for bodies certifying product, process, or any service).

2.2 General layout - General layout of any certification has been given below describing various sections in brief. CBs can also opt to adopt different lay out provided all information as per the relevant standard requirement are covered. An example of 8-section layout is provided below.

- ♦ Section 01 - Scope
- ♦ Section 02 - Normative references
- ♦ Section 03 – Terms and definitions
- ♦ Section 04 – General requirements
- ♦ Section 05 – Structural requirements
- ♦ Section 06 – Resource requirements
- ♦ Section 07 - Process requirements
- ♦ Section 08 – Management system requirements
- ♦ **Annex A-** Principles for product certification bodies and their certification activities (General, Impartiality, Competence, Confidentiality and Openness, Responsiveness to complaints and appeals and Responsibility)
- ♦ **Annex B-** Application of this International Standard for processes and services (Explanations of how to apply this international standard to the certification of processes and services)
- ♦ **Bibliography**

3. Concept of sustainability and legality assurance scheme

Every organization has governance, environmental, social and economic impacts of climate change. Sustainable Agro-wood supply chain is a powerful instrument for an organization to contribute to sustainable development and to the achievement of the United Nations Sustainable Development Goals. By Integrating sustainability in supply chain policies and practices, institutions may become capable of managing risks to mitigate adverse impacts of climate change. This improves an organization's productivity, performance and communication among stakeholders, purchasers etc.

The concept of introducing a mechanism i.e. sustainability and legality standard, an innovative idea for organizations to meet their sustainability responsibilities by providing an understanding of:

- ♦ what sustainable management of agro-wood is;
- ♦ how sustainability impacts different aspects of supply chain of wood coming from agro-forestry and trees outside forest; and
- ♦ how to implement sustainable procurement through policy, strategy, organization and process.

4 Drivers for sustainable procurement

The sustainability and legality standard or scheme will help in overall development of organisations objective to evaluate its conditions and management techniques needed for sustainable procurement of wood and wood products. This also helps in successfully implement and continually improve sustainable agri-wood procurement and feasibility to improve at later stages upon successful implementation. The scheme/ standard is also intended for individuals who are responsible for the actual procurement within their organization. Below items highlight some of the main drivers towards sustainable procurement.

4.1 Risk management - Risk assessment is a tool to safeguard supply of quality agro-wood from tree growers, identification of factors that could have a negative impact on the sustainable supply of agro-wood and wood products, unintended consequences that could arise in supply chain,

Main features of Sustainable Agri-wood Certificate-

- ♦ applicable to any wood based industry involved in procurement of agri-wood for public or private purpose regardless of its size and location.
- ♦ adoption of this certification by large organizations will promote opportunities for small and medium-sized organizations in their supply chains.
- ♦ intended to be understood by any stakeholder involved in, or impacted by, the sustainable procurement decisions and processes.
- ♦ provides an overview of the principles of sustainable procurement.
- ♦ able to manage risks (including opportunities), addressing adverse sustainability impacts through due diligence, setting priorities, exercising positive influence and avoiding complicity in supply chain.
- ♦ guidance on sustainable procurement at a strategic level within the procurement practices of an organization is also provided to ensure achievement of key sustainability priorities.
- ♦ assists top management in defining a sustainable procurement policy and strategy with respect to agri-wood procurement.

and possible corrective actions to address potential risks. Effective implementation of a risk management plan is a key to success for perpetual supply of agro-wood.

4.2 Competitive advantage - Maintaining sustainable practices enhances economic advantages while also reducing environmental burdens. Sustainable policies and procedures within the organizations help business to improve motivation and productivity, as well as benefiting both people and nature.

4.3 Cost optimisation - Sustainable procurement of agro-wood resources reduces barriers to implementation of sustainable requirements, minimizing costs and overly burdensome requirements. They facilitate access to information about meeting the standard, training, and financial resources to build capacity throughout supply chains.

5. Principles of sustainability and legality assurance

Sustainable agro-wood procurement has the most positive environmental, social, and economic impacts on the supplier as well as buyer. It ensures considering the principles as a basis while procuring agro-wood. Following core principles may be considered with the sustainability and legality assurance towards agro-wood supply chain controls.

5.1 Legality - Agri-wood is being procured from sources identified as legal in accordance with regional and international forestry laws. Organisations must ensure that they are legally registered with the local authorities, state or central governments, and have valid legal status.

5.2 Traceability - Organizations must proactively demonstrate geo-locations of the agro-wood being procured. This will help in linking finished products from its raw material sources back to its origin. Organizations shall be responsible to self-declare the source of origin of agro-wood to minimize second or thirdparty monitoring. to ensure credibility and trust within the organizations, responsible personnel shall be held accountable for the products not meeting the traceability requirements. Appropriate mechanisms shall be implemented in the field to ensure robust traceability checks.

5.3 Fiscality - Wood based industries or organisations shall make sure that adequate fee/ taxes or price (i.e. minimum support price) are paid in time and no procurement is done without paying applicable taxes associated with agro-wood procurement.

5.4 Transparency - There needs to be a mechanism to be developed by the organisation/ company to demonstrate transparency pertaining to taxes/ fee paid to respective authorities involved in the supply chain. This also includes disclosure of harvested/ procured volume at least annually and or periodically upon request from competent authorities.

5.5 Environment Protection - Agro-wood procurement shall be done in such a way that all measures towards environment protection be considered. These factors include protection of soil health, no harvesting in exclusion zones,

harvesting above 40% slope etc. among others to protect the environment. Care must be taken to reduce improper use of pesticides that can adversely affect human health, contaminate water sources, food crops and the environment.

5.6 Human rights - Organisations need to demonstrate that no process or activity involves human rights violations. Requirements in line with International and national labour laws must be followed in office and the field while procuring sustainable agro-wood.

5.7 Social responsibility - Organisations/ wood-based industries shall ensure no agro-wood is procured in violation of social obligations. Contractual agreement must be enforced before procurement procedure starts. All aspects pertaining to social responsibility shall meet minimum requirements as per company policy or agreement.

5.8 Penalties - Appropriate action or penalties shall be imposed, should there be any violation against communities or environment. Penalties with respect to environmental damage must be imposed according to regional laws such as seizure of procured agro-wood to avoid recurrence.

6. Certificate or assurance

To help the wood based industries, wood and wood products suppliers/ exporters, traders and intermediaries involved in domestic and international trade a certificate or statement of compliance towards "Sustainable and Legal Procurement of agro-wood" may be issued. This may be considered as a token of credible assurance system being followed by the relevant parties involved in agro-wood supply chain. The certificate/ statement of compliance shall be issued in line with the International best practices for procuring agro-wood from sustainable sources i.e. plantations, farmer's field, private lands, trees outside forests etc. Every possible effort shall be made to ensure that due-diligence shall not only provide evidence of legality, but also demonstrate that the sustainable agro-wood procurement process does not cause over-exploitation and subsequently lead to degradation of forestry resources. The nature of the certification shall be voluntary. It shall also aim at improving self-governance of supply chain controls of wood and wood products.

Road map to Up-Skill Manpower Required to Boost Furniture Sector in India

Furniture sector in India is largely unorganized and grossly under-developed. Being an unorganized sector, 95% of workforce involved in manufacturing of furniture are school drop-outs and majority of them rely on traditional carpentry skills to produce hand-made furniture. On the other hand, there is huge potential for the growth of furniture sector. Currently, total Indian furniture market is valued at around US\$ 17.70 billion and it is expected to grow at a CAGR of 13.37% between 2020-2026 (Business Wire, 2021). India has a great opportunity to be among the top global manufacturers and exporters of furniture due to low cost of labour, attractive traditional furniture designs and availability of variety of raw material like hardwoods (teak, rosewood, red sanders, etc.) Bamboo and Canes. With growing economy, rising income, rapid urbanization, and growing number of middle class families in India, the hunger for wooden furniture is growing rapidly. The domestic demand for furniture is valued at around US\$7.6 billion in 2020 and it going to increase by four times by 2035 (Fig.1) with a value of about US\$ 24.4 billion (Price Waterhouse & Co, 2021). Although traditionally, Indian furniture market is dominated by small unorganized players, with changing economic conditions in the country many big players like Godrej furniture, Zuari furniture, Durain and multinational players like IKEA are entering the domestic furniture market in a big way and helping in the expansion of domestic furniture market.

To meet the demand of domestic furniture market, we spend about \$603 million every year to import furniture from other countries and China alone contributes more than 50% of total import to India (Das, 2020). Country wise breakup of furniture import is given in Fig.1. India also has a huge potential for export of furniture. According to an estimate, furniture sector alone has the potential to push the exports up to US\$50.00 billion (Jha, 2020). Precisely because of this reason, the Department for Promotion of Industry and Internal Trade (DPIIT)

Shivakumar C.M.

Institute of Wood Science and Technology, Bengaluru.

Email: shivak@icfre.org

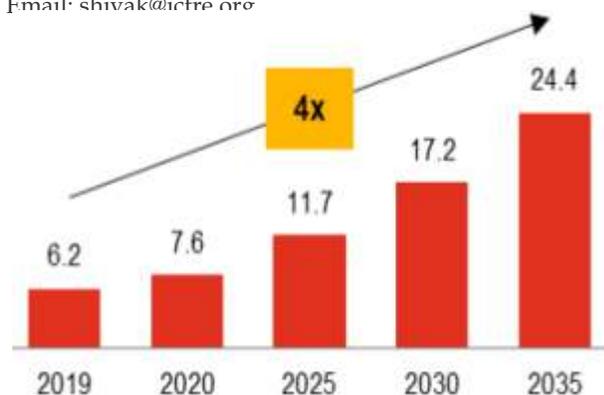


Fig.1: Demand projection (in US\$ billion) for furniture in India (Source:Price Waterhouse & Co, 2021)

has recognized furniture and toy industry as one of the key sector to promote furniture manufacturing and make Atmanirbhar Bharat. This sector employs over 5.0 million employees and it is expected to increase to 11.29 million employees by 2022 (KPMG, 2013). Although, there is tremendous potential for generating employment to meet the growing demand for furniture, recruiting quality labour is a huge challenge owing to various problems. This article highlights some of the major challenges faced by the furniture sector and also attempts to provide a road map to address the challenges.

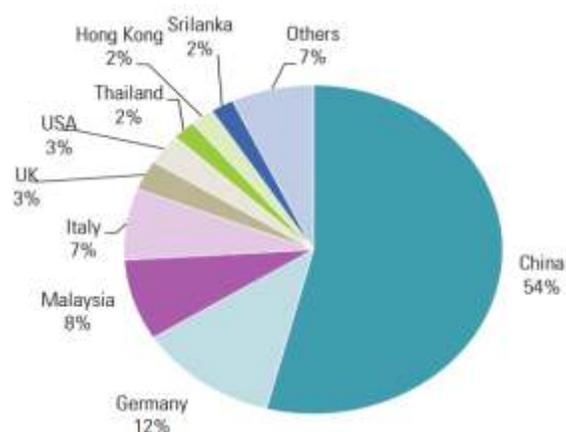


Fig.2 : Country wise breakup of furniture import (source; KPMG 2013)

Inadequate infrastructure to up-skill the manpower to meet the industry demand:

Wood alone contributes about 65% of all furniture made in India and the demand for wooden furniture is growing rapidly as individuals have begun utilizing wood for outfitting pantries, decorating and for other different purposes. However, there is no trained manpower to work on wood and wood products. Although there are about 14750 Industrial Training Institutes (ITIs) across the country to provide trained manpower to various industries, out of which only about 450 ITIs impart training on carpentry (KPMG, 2013). Further, most of these 450 ITIs don't have advanced machinery and tools to provide hands on training to the students to cater the needs of furniture sector. Today, many furniture manufacturers in India do have imported technologically advanced machinery and tools to work on wood products. However, presently the local workforce do not have required skill set to operate such machinery and tools.

To fill this gap there is a need to revamp and upgrade the existing ITIs in terms of curriculum, tools, and also upgrade the skills of tutors teaching in ITIs. Further, there is also a need to add about 300 additional ITIs to the existing 450 ITIs, so that each district can have at least one ITI to meet manpower requirement of wood and furniture sector. Further, the machinery used to train the students need to be improved to impart training to the unemployed youth. In this endeavor, Institute of Wood Science and Technology (IWST) having worked for more than eight decades in developing various wood products and training many wood working professionals through Advanced Wood Working Training Centre (AWTC) facility located in Bangalore, has prepared a detailed proposal to revamp/establish new ITIs with state of the art machines and also worked out the cost of establishing well equipped ITIs across the country to meet the manpower requirement of industry.

As per the estimate of IWST about Rs.3.00 crores (excluding land cost, building cost and running cost) is required to strengthen/create each ITI having infrastructure in terms of advanced tools. So, to strengthen the existing 450 ITIs and create additional 300, we need investment to the tune of about Rs.2250.00 crores. Further, to provide trained faculty/tutors to all ITIs across the country, IWST can

train the trainers through Training of Trainers (ToT) program in its AWTC facility. AWTC is in operation from last 20 years and has trained more than 2500 wood working professionals from across the country. Considering the contributions of IWST and AWTC for furniture and wood sector, Ministry of Skill Development and Entrepreneurship, Government of India has recognized IWST- AWTC as Centre of Excellence in the field of Skilling Ecosystem in the country. Hence, AWTC can play a significant role in training the master trainers to provide skilled tutors to all the ITIs across the country.

Lack of synergy between academia and industry to develop skilled manpower:

There are only about eight academic institutions across the country which offer Master's degree/Diploma/PG Diploma/certificate courses in Wood Science and Technology. Further, there are very few institutions that offers course to meet the needs of furniture industry. Courses offered by these institutions are not aligned with global trends. There is complete disconnect between industry and these institutions in terms of providing technology and skilled manpower for this sector. So, there is a need to bridge this gap by strengthening these institutions to provide technology and trained manpower to the furniture sector.

Lack of industry standards for manufacturing furniture in India.

No standard parameters are available to keep the quality check in Indian furniture sector to ensure standards in engagement of manpower and also test the quality of furniture produced in India. Further, no standards are available for furniture industry to benchmark production (KPMG, 2013).

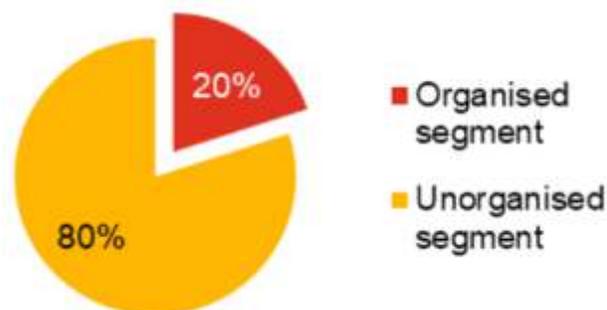


Fig. 3. Proportion of organized and unorganized firms in furniture sector in India (source; Price Waterhouse & Co, 2021)

Furniture sector is highly unorganized:

Indian furniture market is dominated by micro and small players and they are not organized. According to an estimate 80% of the furniture sector is represented (Fig.3) by unorganized small and micro players (Price Waterhouse & Co, 2021). Since majority of the firms are small, they do not have direct market exposure and they lack sufficient capital to invest on heavy tools and to hire wood working professionals. However, with entry of big corporates like Godrej furniture, Zuari Furniture, Durain, IKEA, etc. the scenario is going to change very soon.

Difficulty in attracting talented manpower

Attracting the trained manpower in the furniture sector is a big challenge owing to the following reason:

i) Pursuing carpentry as a profession is often pursued as socially inferior job:

Traditionally carpentry is being practiced as a family profession and the wood working skills are mostly passed to the next generation in an informal way. Precisely because of this reason, people holding

formal diploma certificate/degree in existing workforce is less than 3% and the rest 97% of them are school dropouts. Although there are many carpentry ITIs across the country, the student enrollment in those ITIs is low, as carpentry profession is often considered as socially inferior job. Hence, there is a need to rename the existing carpentry course offered by the ITIs as “Advanced Wood Working Course” to attract the students.

ii) Youths prefer white collared jobs over blue collared jobs.

iii) As furniture sector is largely unorganized, professionals working in this sector are often underpaid. Hence, attracting youths to work in furniture sector is a big challenge.

To overcome challenges related to up-skilling of manpower required for furniture industry, collective action is required from all stakeholders consisting of policy makers, industry representatives, traders, research organizations and academicians to strengthen the furniture sector to boost the export of furniture and wood products from India.

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India's Solid Wood Furniture Market: Challenges and Solutions

Introduction

According to Invest India Report 2021, India is the 4th largest consumer and 5th largest producer of furniture in the world with a market size of around USD 32bn. Different agencies have forecasted a double-digit annual growth rate of 12-14% for furniture sector during 2020-26. As the domestic market is huge and the local demand is high, India's export share to global furniture trade accounts for just under 1% only. Currently India's top export destinations include US, Germany, France, UK, Netherlands and Australia. The top countries where India currently imports from are China, Malaysia, Germany and Italy.

Opportunities

40% of India's population will be living in urban areas by 2025 up from 31% in 2010 and will account for more than 60% of consumption. Moreover, the changing family structure to more nuclear households has reached 70% and is projected to increase to 74% by 2025. They spend 30% more per capita than joint families.

Challenges

Government of India has identified furniture manufacturing as one of the twelve manufacturing sectors termed as 'sunshine sector' and announced set up of four SEZs

Pranesh Chhibber

Country Director,

Forestry Innovation Consulting India Pvt. Ltd. (Canadian Wood)

to boost the industry to increase export earnings. However, this ambitious transformation to become a world class manufacturing hub will not be an easy task unless serious efforts are put in at every step of this journey. Traditionally India has been a hardwood loving country, where teak, rubber wood, mahogany, rosewood, sheesham, mango, acacia, sal and walnut etc. are the major domestic species used in the solid wood furniture industry. Imported species such as ash, walnut, oak, beech etc. are also popular in the domestic market. However, softwood species such as chir pine, kail and deodar were also extensively used earlier from the hill areas of the North, which are now not commercially available but imported softwood species have rapidly replaced them as well and captured a share from the hardwood species too in many applications.

Manufacturers face challenges in getting required volumes of local wood species regularly and consistently at stable and viable prices. Besides, these are usually not well seasoned nor graded or dimensionally stable due to the lack of a well established and enforced system. The lack of a QC enforcement mechanism to ensure quality of raw material is a big challenge for many manufacturers.

Teak was the preferred wood for making almost any kind of furniture for both indoor or outdoor, which continues to be to an extent with the inferior plantation teak supplementing the meagre availability of Burma and CP Teak. However other species mentioned earlier have geographical barriers for free availability as they grow and are available only in certain parts of the country. Increased logistics expenses and handling charges primarily due to high fuel prices have made teak wood expensive for a common man.

Further, availability of certified wood from local resources is next to zero and for export-oriented manufacturers looking for certified wood as a raw material have to rely on import of such wood.

India imports 6-7 million m³ of wood and wood products annually to meet its demand due to the non-availability of sufficient domestically grown wood.

Furniture in India is predominantly produced by non-mechanized unorganized sector (approx. 80-85%) which is small scale, highly scattered and labour intensive with low productivity. As such low volume and low value products are just suitable for the domestic market. Low level of mechanization does not allow mass production and also affects the workmanship resulting in poor fit and finish.

Further, since the machines and tools used in the unorganized sector are 'entry level' it thus results in higher levels of wood wastage at different manufacturing steps, at times going as high as 40 percent.

The organised (mechanised) sector with good quality machines and tools are mainly panel processors such as MDF and/or particle board. Even these manufacturers in the organised sector are much smaller in size compared to factories in the west or even in far east thus they suffer from poor economies of scale.

Even though cheap labor is available, most of them are poorly trained nor do they undergo an organized upgradation of skills through training; whatever is learnt is through on-job experience by trial and error. Many manufacturers are reluctant to come forward in providing or sponsoring for training and skill upgradation due to their own reasons.

Logistics cost too is high as majority of manufacturing hubs such as Jodhpur, Jaipur, Moradabad, Saharanpur, Delhi-NCR and so on are faraway from the major seaports paying heavy freight for inland haulage that too mainly by road, which is time consuming.

Even material handling in these manufacturing units is highly manual and laborious which ideally could be done mechanically to bring the handling cost and time down and thus be more efficient. Due to the low scale of production and lack of sufficient volume of finished goods, transportation by train is not found commercially viable.

Timber is the major raw material required for making solid wood furniture and the industry demand is majorly met by import of various species from different countries. However, taxes, duties and the turnaround time involved in completing the import process and getting the preferred wood vary from country to country.

Basic import duty ranges from 5% on logs to 10% on lumber and engineered wood products with a 1% social welfare surcharge applicable on the basic import duty. Wood and wood products imported from ASEAN countries are exempt from any import duty. However, 18% GST is applicable on wood imports irrespective of the country or region from where it is imported.

This high duties and taxes on imported wood which is the main raw material for solid wood furniture making is a major challenge and roadblock for India to become a major furniture manufacturing hub.

Studies have shown that currently manufacturing of furniture in India is approximately 25% costlier than China and the major contributors to this the low mechanization, small scale operations resulting into low productivity compounded by high import duties, GST and phytocentric policies of the government.

In 2018, India's Union Govt. allowed 100% foreign direct investment (FDI) for single brand retail with a caveat of sourcing certain percentage of its turnover coming from goods locally sourced, thereby paving the way for the likes of IKEA to enter India.

Canadian Wood: Your solution provider and knowledge partner

Canadian wood species have proven to be excellent alternatives to the popular wood species used in India, by offering better workability, good strength and value for money. These mature naturally grown trees, usually aged around a minimum of 100 years, are legally harvested from certified and sustainably managed forests in British Columbia, provide high quality lumber for various applications, both indoor and outdoor.

Majority of the lumber from B.C. comes in ready to use condition - duly sawn, seasoned and graded to standard grades and sizes and offers high dimensional stability, saves time, material and money.

Five species we promote are Western hemlock (for furniture & interiors), Douglas fir (post, beam & structural applications), Yellow cedar (door & window frames & carved doors), Western red cedar (cladding, pergola, gazebo, decking and all outdoor applications) and Spruce-Pine-Fir- (SPF-For wooden cottages and low-cost furniture and interiors).

Being the crown agency of Govt of BC to promote Canadian wood and technology in India, FII provides technical support to stakeholders in selecting the right species and grade based on the end use. FII-India assists importers/consumers to source Canadian wood from the local market as well as

directly from the suppliers in Canada, depending upon the requirement.

FII is very active in creating awareness on Canadian wood species and educating potential customers on their properties and applications through seminars (webinars now) and training workshops apart from conducting product trial and establishing 'demo' projects with prominent stakeholders. We also create awareness about B.C. Canada being a world leader in certification and sustainable forest management.

We connect the lumber manufacturers and suppliers in B.C. with potential buyers in India and hand hold both the parties throughout the process for a successful and continuing business relationship.

With the lowest deforestation rate, (0.01% in 2018), Canada can offer continuous supply of quality wood for various applications and India's manufacturing demand for the next 200 years/centuries to come.

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Website:



www.timberfederation.in

Sri. Naval Kedia,
President
e-mail: naval@costaawoods.com
Mob: +91 98302 00497

Sri. D. Ramakrishna,
General Secretary
e-mail: dwararamakrishna@gmail.com
Mob: +91 944017 6081

Zonal Offices:

East: "Diamond Prestige", Room No. 409, 41A,
AJC Bose Road, Kolkata - 700017 (WB).

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West: "Timber Bhawan", Room No. 409, Plot No. 47,
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India's Paper Industry – Issues & Challenges

India's paper industry can be broadly classified into three categories in terms of raw material used - wood based, agro residue (Bagasse / Wheat Straw) based and waste paper / recycled fibre (RCF) based. In terms of finished products, there are five categories - writing & printing paper, packaging paper & paperboard, newsprint, specialty paper (tissue paper, security paper, etc.) and others.

Domestic scenario

Per capita paper consumption in India is currently around 15 kgs, while the global average is 57 kgs (200+ kgs for developed countries). India is way behind in terms of per capita consumption and it is projected to increase significantly in the coming years. The demand for paper in India is growing at 6-7% per annum. India's share in world production of paper is about 5%, with estimated production of over 19 million tonnes per annum (TPA). The annual turnover of India's paper industry is estimated to be INR 70,000 crores (domestic market size of INR 80,000 crores), with around INR 5,000 crores contribution to the Exchequer. The industry provides direct employment to 500,000 persons and indirectly to around 1.5 million.

The key drivers for growth for the industry are many. Greater emphasis on education and literacy by the Government coupled with growth in organised retail and demand for better quality paper are the major drivers for writing and printing paper. Demand for better quality packaging of FMCG products marketed through organised retail, booming e-commerce, rising healthcare spends, over-the-counter medicines and increasing preference for ready-to-eat foods are the key demand drivers for paperboard / packaging paper.

Need for additional capacity creation

About 1 million TPA of integrated pulp, paper and paperboard capacity is required to be created in India on an annual basis over the current capacity to meet the growing demand. Such investments would create a multiplier effect on the economy through

Rohit Pandit

Secretary General,
Indian Paper Manufacturers Association (IPMA).
Email : sg@ipmaindia.org; secretariat@ipmaindia.org

gross capital formation, generation of direct employment and further giving additional livelihoods to people involved in agro / farm forestry).

If the investments are not made, the growing demand will be met through imports, which will result in a substantial foreign exchange outflow. The compounding effects of this over a 10-year period are truly staggering. While the industry has already made significant capital investments to ramp-up capacities, the gestation period is long and the economic viability of the investments has been impacted significantly by raw material shortage and rising imports.

Major area of concern – raw material scarcity

India's paper industry has agro forestry roots and strong backward linkages with the farming community, from whom wood, which is a key raw material, is sourced. Of the total demand for wood, over 90% is sourced from industry driven agro / farm forestry, with the rest from Government and other sources. India's paper industry is wood-positive, that is, it plants more trees than it harvests.

Pioneering work has been carried out by the industry over the last three decades in producing tree saplings (e.g. Eucalyptus, Subabul, Casuarina, Acacia, Poplar, etc.) which are disease and drought resistant and can be grown in a variety of agro climatic conditions. A large part of this wood is grown in backward marginal / sub-marginal land, which is potentially unfit for other use.

Substantial amounts have been spent by the Paper Industry on plantation R&D, production of high quality clonal saplings, technical extension services to improve agro / farm forestry services, hand holding of marginal farmers over a gestation period of 4-5 years.

In India an estimated 500,000 farmers are engaged

in growing plantations of Eucalyptus, Subabul, Casuarina, Acacia, Poplar, etc. On an average, about 125,000 hectares are being brought under agro / farm forestry on an annual basis, with around 1.2 million hectares on a cumulative basis across the country. This has generated significant employment opportunities for the local community, especially in the rural areas, and also significantly supplemented the income of farmers.

India is a fibre deficient country. Inadequate raw material availability domestically is a major constraint for the paper industry. Availability of wood domestically at 9 million TPA is inadequate compared to demand, which is currently about 11 million TPA and is projected to rise to 15 million TPA by 2024-25. Consequently, the cost of wood has been going up significantly over the years. Mill delivered cost of domestic wood in India is higher by almost USD 30-40 per tonne as compared to other Asian countries. Due to this single factor, cost of paper production in India is higher by USD 100 per MT.

Threat from rising imports - economic viability being impacted

High cost of raw material coupled with significant increase in fuel cost and other inputs has resulted in a substantial increase in the cost of domestic manufacture of paper and paperboard. Such input price pressures, coupled with huge differential costs of fuel and energy, including logistics costs, and the high cost of capital, have made the Indian market amenable to imports, leading to underutilisation of existing domestic production capacity.

Imports of paper, paperboard and newsprint into India have been steadily increasing. Even as the industry is grappling with the issue of producing paper and paperboard at competitive costs, the problem has been exacerbated by the Government's policy of extending preferential tariff treatment to paper and paperboard under the free trade agreements (FTAs) and other bilateral and multilateral trade agreements and pacts.

Thus, while domestic industry is operating under extremely challenging conditions, substantial quantities of paper and paperboard is imported into the country at significantly lower costs under the aegis of the FTAs.

India is a fibre deficient country. Inadequate raw material availability domestically is a major constraint for the Paper Industry.

Under the India-ASEAN FTA, import duties on almost all tariff lines under paper and paperboard have been progressively reduced, and from a base MFN rate of 10%, the basic customs duty came down to 0% with effect from 01.01.2014. Under the India-Korea CEPA, the basic customs duty was also progressively reduced and became 0% with effect from 01.01.2017. Under the Asia Pacific Trade Agreement (APTA), with effect from 01.07.2018, India extended import tariff concessions to China (and other countries) and offered 30% margin of preference, thereby reducing the basic customs duty from the existing 10% to 7% on most grades of paper.

It is an acknowledged fact that as a result of the global economic scenario, the Indian Pulp & Paper Industry has become very vulnerable and endeavour of major global players in the international market is to push large quantities of paper and paperboard into the Indian market. Leading the pack are manufacturers in Indonesia and China who enjoy substantial amount of export incentives and other advantages.

The conventional markets for China and Indonesia have been the USA and EU. In both these markets, anti-dumping / anti-subsidy tariffs have been imposed on import of paper / paperboard from China and Indonesia to protect their domestic industries. Further, the economic slowdown in developed economies and export dependent economies like ASEAN countries has led to significant excess capacity of paper and paperboard in these countries.

Taking advantage of the low import duty rates, these countries find India as an attractive outlet for diverting their excess inventory. Consequently, these export-led economies in Asia continue to target the fragile Indian market.

India's Imports of Paper & Paperboard (DGCI&S)

Year	Imports in Thousand Tonnes				Imports in INR Crores			
	Total	China	ASEAN	South Korea	Total	China	ASEAN	South Korea
2010-11	535.2	155.6	28.8	6.2	3,411	677	159	31
2011-12	694.1	189.3	49.1	11.9	4,422	870	240	64
2012-13	787.0	193.2	39.6	31.2	4,914	931	226	161
2013-14	874.6	233.7	83.0	22.2	5,987	1,188	426	135
2014-15	1,011.0	258.3	107.0	48.5	7,223	1,293	589	288
2015-16	1,112.8	234.2	146.9	82.9	7,014	1,192	782	458
2016-17	1,417.7	323.5	249.8	96.7	8,237	1,586	1,332	525
2017-18	1,719.7	399.9	331.2	118.6	9,702	2,252	1,810	654
2018-19	1,478.2	253.8	290.8	105.2	9,134	1,831	1,830	715
2019-20	1,637.5	289.4	342.7	114.2	8,973	1,853	1,966	668
9 Year CAGR (%)	13.23	7.14	31.67	38.22	11.35	11.84	32.24	40.66

Data does not include Newsprint

Data for 2020-21 not taken into account due to the global COVID impact

Imports of paper and paperboard (HS Codes 4802, 4803, 4804, 4805, 4808 and 4810) into India have been steadily increasing, in spite of adequate domestic production capacity. In the last nine years, imports have risen at a CAGR of 11.35% in value terms (from INR 3,411 crores in 2010-11 to INR 8,973 crores in 2019-20), and 13.23% in volume terms (from 0.54 million tonnes in 2010-11 to 1.64 million tonnes in 2019-20). Imports are growing at a very high rate as compared to the increase in domestic production rate with underutilisation of domestic installed capacity.

Imports of paper and paperboard into India from ASEAN in the last nine years have grown at a CAGR of 32.24% in value terms and 31.67% in volume terms. Imports from South Korea have grown at a CAGR of 40.66% in value terms and 38.22% in volume terms. Imports of paper and paperboard into India from China, in the last nine years have grown at a CAGR of 11.84% in value terms and 7.14% in volume terms.

Increased import of paper and paperboard is severely impacting the economic viability of many Paper Mills in India apart from revenue loss to the Government and outflow of substantial foreign exchange.

Domestic industry has invested huge amounts in the recent past to upgrade and implement clean technology, product quality, agro / farm forestry, etc. and more investments are in the pipeline. Such

large investments cannot and should not be jeopardised by allowing imports at concessional / nil rates.

Given this state of affairs, domestic industry is being discouraged from further investments in capacities – which are necessary to meet the expected growth in domestic demand for paper and paperboard. The inevitable consequence of a fall in investments will be a multiplier adverse impact on the Indian farmer community with whom the industry has strong linkages, generation of fresh employment in rural areas and a significant outflow of foreign exchange towards increased imports of paper and paperboard.

Apart from the overall negative impact of duty-free imports on the domestic paper industry, it is making most small and medium Paper Mills in India commercially unviable, and also jeopardising the livelihoods of thousands of farmers engaged in agro-forestry and supplying wood, the primary raw material to Paper Mills. This is against the Hon'ble Prime Minister's initiative of "Make in India", "Aatma Nirbhar Bharat" and "Vocal for Local".

Recommended policy interventions

Paper industry has the potential to enlarge the country's green cover. The Government should

consider making available some part of the country's degraded forest land, FDC (Forest Development Corporation) land and non-forest Government land for pulpwood (+ fuel wood / fodder) plantations under collaborative arrangement, so that India's paper industry can access raw material at competitive rates and become globally competitive. Even providing 10% of degraded forest land for raising pulpwood plantation in collaboration with Paper Industry would make available approximately 2.5 million hectares of productive plantation. The benefits that will accrue include substantial employment generation in rural areas, savings in foreign exchange outgo, potential for carbon credits, and significant increase in forest / tree cover.

In order to provide a level playing field to the domestic industry, paper and paperboard should be kept in the Negative List (that is, no preferential treatment in terms of import tariff) while urgently reviewing the existing FTAs (ASEAN, Korea) and formulating new FTAs.

The basic customs duty on import of paper and paperboard (HS Codes 4802, 4803, 4804, 4805, 4808 and 4810) should be increased to 25% (WTO Bound rate is 40%).

Import of paper and paperboard should be

allowed only on the basis of Actual User License so that only genuine users import the right quantity of paper for their consumption. The import policy should be changed from 'Free' to 'Restricted'. This would curb wrong practices being adopted by the traders in the market.

Non-Tariff Measures (NTMs) / Technical Barriers to Trade (TBT), like making BIS marking mandatory, should be imposed on imports of paper.

A Paper Import Monitoring System should be implemented so that there is proper monitoring of imports coming into the country in terms of valuation, quality, classification etc. This will help greatly in curbing of unscrupulous practices, revenue loss to the Government, and benefit the end consumer.

Import of stock lot should be banned (like done for coated paper under HS Code 4810).

Suitable safeguard, anti-dumping and countervailing duties on imports of various grades of paper should be expeditiously imposed.

The above-mentioned steps will safeguard the health and financial viability of India's paper industry, and should merit the Government's serious consideration.

Conclusion

Paper is an integral part of the daily lives of people. Paper is one of the most environmentally sustainable products as it is biodegradable, recyclable and is produced from sources which are renewable and sustainable.

Paper industry has been closely associated with the national objectives of Literacy, Greening India, Rural Employment, and usage of Sustainable Resources, besides meeting paper needs of the Indian consumers.

Paper mills in India have been working towards better energy efficiency, green energy, employing a range of innovations and technologies. Paper mills have also undertaken significant upgradation of process technology to comply with stringent environmental norms / standards so as to reduce fresh water consumption and effluent and emission generation.

Paper industry has invested huge amounts in the recent past to upgrade and implement clean and green technologies, product quality, agro / farm forestry, etc. and more investments are in the pipeline. Such large investments cannot and should not be jeopardised by allowing imports at preferential customs duties.

The Government needs to support the industry that has strong backward linkages with the farming community, generates employment in rural areas, and significantly contributes to the national objective of bringing 33% of land mass in India under tree cover, apart from also significantly contributing towards the national objectives of education and literacy.

India Pulp and Paper Industry- A Case Study of Supporting Farmers to Promote Trees Outside Forests

Introduction

Pulp & Paper Industries (Forest Based Industries- FBIs) in India post implementation of National Forest Policy 1988 have faced tremendous challenges in sourcing their wood and bamboo as raw material. Government support to source raw material was withdrawn and was indicated that industries to source their RM on their own. There has been long challenging 34 years of progressive and emphatic journey so far, Pulp & Paper Industries have evolved and grown a lot.

About 50 years before, fiber used was bamboo and mixed hardwood, which was mainly sourced from Government forests. Comparing today's cost of production and quality of fiber the quality was very poor and cost of production was also high with high chemical consumptions and lower yield, though paper was accepted by the market as Paper market was the sellers' market. Over a period of time market has been globally competitive with lesser cost of production and exceptional demanding quality of paper. In India continuous adoption of improved global technology, Indian Paper industry have kept pace and are expanding their global foot print though the cost of production is still high specially when we consider RM costs.

Demand and supply dilemma for Indian pulp and paper industry

Existing capacity requirement of RM is around 12.5 Million MT per

Deepak Kumar Khare

Vice President- Raw Material,
BILT Graphic Paper Products Ltd, Gurugram (Haryana)
Email: deepak.khare@bgpppl.com

annum for Pulp & Paper industries in India and with my own assessment about 10 Million MT per annum is required by other FBIs like plywood, MDF and poles (organized and unorganized) leading to overall demand of about 22.5 Million MT per annum.

If we observe historically, RM availability is a cyclical process and RM prices get impacted accordingly. Having an assured supply for any forest-based industry in India has always been a concern and the prices are governed mainly by demand and supply.

Industries have progressed by generating their own RM near their own catchment and protecting it by assuring viable lucrative prices to farmers so that they continue to plant and maintain coppicing crops in the long run to enhance their income by way of supplying wood to pulp and paper industry outcome of it is that about 1.2 Million hectares of farm forestry plantations have been accomplished by the industry that too mainly on unutilized wasteland.

Backward supply chain with reference to raw material (wood & bamboo)

Wood and bamboo are biological products and these are grown on Farmers land providing much needed sustainable rural employment all throughout its backward supply linkages beginning raising plants at nursery/CPC, site preparation, planting, protecting, harvesting and transporting to consumer. Challenge or threat as perceived by FBIs post NFP 1988 to arrange their own raw material, got converted to an opportunity by encouraging farmers to plant Eucalyptus, Poplar, Casuarina and Subabul on their own land, has turned out to be a boon for the industry, most of the units have developed or in the process of developing their own decentralized cost-effective self-sustaining catchment with the vision to overcome biggest challenge of assured raw material supply.

Challenges overcome in managing raw material supply chain with long term sustainability:

- ♦ Lower yield per acre- yield enhancing research & development programme.
- ♦ Higher gestation period- reduced through research & development
- ♦ Availability: sustained & assured RM supply throughout the year.
- ♦ Manual labor dependent operations-explored mechanized operations and implemented.
- ♦ Industry's image & carbon footprint concern - reducing distance of sourcing with reduced consumption of fossil fuel and as well as

providing trees as continuous carbon sink in a unimaginative big way.

- ♦ Evolution of wood yield/acre and gestation period of tree crops- enhancing financial viability for farmers with increased carbon sequestration per unit of land:

Considering 1988-89 when farm forestry began, it was not a smooth go-getter amongst farmers. Tree crops were seed rooted with excessive genetic variation with a rotation of 7-8 years yielding about 10-12 MT / Acre. Acceptability of farm forestry efforts amongst farmers was very poor as tree crops had long gestation period with low yield, not lucrative to farmers, against these odds industry continued to make efforts to overcome these challenges. Various global success story learning were incorporated like selection of site specific, genetically superior, high yielding Eucalyptus / Poplar "Candidate Plus Trees" (CPTs), testing of the CPTs were conducted with finally selection of successful clones it took about 13-15 Years to reach favorable stage of reducing gestation period from 7-8 years to 3-4 years and improving yield from 10-12 MT per acre to 35-40 MT per acre. Simultaneously Casuarina and Subabul Tree improvement programme too have been successfully incorporated amongst farmers. Various viable and successful Agroforestry, Agri-Horti-Forestry models have been introduced with intercropping of Wheat, Soyabean, Tobacco, Chillie and with various vegetables which has resulted in further improved financial viability for farmers.

Secondly with the improvement in yield per acre requirement of land for raw material gets reduced or the other way higher availability can be fetched from the same quantum of land. These efforts have resulted in successful covering of 3 main pillars of sustainability viz. economic (benefits to farmers and Industries), environment (sequestering additional carbon) and social (providing regular employment to rural community).

Pulpwood seed rooted and clonal plantation: Improved productivity and reduced gestation period

Efforts to ensure long term and sustained availability of raw material

Pulp & paper industries with above mentioned efforts have resulted in acceptability of pulp wood crops amongst farmers as any other agriculture crop, which give them continuous returns and protect farmers against any natural vagaries, overall cumulative planting has taken place more than the overall demand of the Mills even to the extent of planting 120,000 hectares in a year: IPMA. In addition to fulfilling own requirement, pulp & paper industries have supported demand of Plywood/



Seed rooted plantation Clonal Plantation

MDF manufacturers and have also provided supplies to poles market which is quite un-organized, consumes huge quantum of Eucalyptus and Casuarina wood. Eucalyptus and Subabul are coppicing crops which add to the additional availability during their due cycle of harvesting.

Evolution of wood harvesting:

From labor intensive to partial mechanized – From Axe to hand saw to power chain saw and from manual debarking to mechanized debarking

Wood or bamboo harvesting is highly labor dependent, about 15-20 years before, harvesting labors availability, cost was affordable and was not a concern. Gradually opening of various avenues, migration of rural labors to urban areas, opening up of various Government schemes and other freebies resulted in shortage of overall labors. Indian pulp & paper industry geared up long before as it anticipated such challenges well in advance and started exploring mechanization at feasible stages of harvesting since 2009-10.

Wood harvesting involves cutting of trees, billeting

to the desired sizes, debarking, loading of the billets into the trucks and finally transporting to the consuming mill sites. Initially cutting of trees was done through axe which was slower and inefficient, led to wastage of wood. Introduction of first mechanization was through power chain saws which led to reduction of about 5% labor and enhanced higher recovery of exploitable wood though it was miniscule per MT of wood say about 0.5- 1% still considering harvesting of

about 22 Million MT of wood annually it is about 0.2 Million MT. Countries Like Brazil etc. have complete harvesters where tree is cut, debarked and cut into billets of uniform sizes in few minutes. In such countries pulp wood plantations move into thousands of hectares at a stretch, provide cost feasibility of holistic mechanization in terms of efficiency and huge scalability involved from a single site.

Pulp & Paper industry interventions- Wood harvesting in India



**Harvesting through axe
(Wastage of wood)**



**Harvesting through power chain saw
(Conservation of wood)**

Out of various harvesting stages, debarking of wood is rate determining stage which is slowest and consumes higher cost. To overcome this during the year 2009-10 exploration and development of de-barkers, considering Indian conditions began and in

about 2 years' time rotor mobile de-barkers were introduced commercially, gradually replacing manual debarking providing savings of about Rs.200/MT and able to keep pace with demand of debarked wood.

Pulp & paper industry interventions- mechanized wood debarking in India



Manual debarking



**Bark wood fed to mobile de-barker
Through PTO driven tractor**



Debarked wood loaded into truck

Continuously supporting reduction in transportation costs and carbon footprint:

Pulp & paper industries fiber sourcing strategy continuously improved and evolved with a vision to develop its resources nearer to their respective mills of which encouraging results have been achieved with reduction in average procurement distance from 700-800 Kms to 250-300 Kms, resulting in reduction in transportation cost. Considering current freights, it provides cost advantage / savings of about Rs. 700-800 /MT compared with previous landed price of total procurement. Secondly trip wise carbon emissions (reduction in usage of fossil fuel) too have reduced contributing favorably towards combating climate change.

Conclusion

Indian pulp & paper industry passionate efforts specially referring to build a robust, sustainable, reliable and cost reducing supply chain has paved the way to survive from the challenging times of previous 30-35 years resulted in wood reliable supply sustenance with reduction of about Rs.1000-1200/MT in overall backward linkages beginning from Farmers field to Mills chippers. Mills' achieved savings has suitably been shared with farmers. Which have resulted in continuous FF plantings and sustained supply of wood to mills.

Unfortunately other than pulp & paper industry in India, no other FBIs have dealt the same with long term vision whether it is MDF, plywood or furniture sector. If this becomes passionate and committed efforts by all FBIs then the day is not far off when all the stake holders to become globally competitive adding a lot to the bottom line and also adding higher quantum of green cover (TOF) to sequester additional carbon supporting affirmatively in combating climate change. Long term vision has to be broad so as to consider undertaking Farm Forestry plantations as investment not as cost with this, they will reap high financial returns in the long run for sure. Whatever best environment friendly improved technology is put in place if carbon sink is missing in the chain, environment will continue to deteriorate, leading to irreversible global warming. The natural carbon sink available is green leaf having Chlorophyll as the answer which converts ever increasing CO₂ to O₂ in presence of sunlight is the best and most feasible solution to overcome global warming or to combat climate change. To achieve this we to undertake massive afforestation, which finally gets converted to wood as trapped carbon means in other words "Wood is only Good" to counter climate change.



Debarked wood visible in de-barkers

Indirect benefit in protecting forests / green cover:

Another highlight of Pulp & paper industries massive farm forestry programme, it has resulted in protecting forests indirectly. Villagers who used to venture in the forests for pilfering head loads of fuel wood have started getting the lean waste wood and bark at their doorstep, pilferage from forests reduced leading to regeneration of root stock and green cover and also ample time availability for villagers to do constructive work for additional livelihood endeavors.

Projected Trends in Supply and Demand of Timber in India Upto 2030

Introduction

Wood has traditionally been an input material for a majority of industries. The easy availability of alternate material and conservation oriented policies over the past five decades have shifted the focus from timber to other products like metals, plastic, engineered wood, etc. However, given an opportunity, timber still holds an important position of choice among the users. Prohibitive costs due to declining supply, durability related issues with non-traditional timber, lack of workforce specialized in wood-working with majority shifted in engineered wood related tasks has made the timber considerably out of reach of the common person.

In the detailed biennial survey conducted by the Forest Survey of India, the total forest cover of the country in 2019 was estimated to be 712,249 sq km which is 21.67% of the total geographical area of the country. Combined forest and tree cover outside forests currently adds up almost a quarter of the total geographical area of the country. The total estimated growing stock in the country is almost 6000 million cubic meters (mcum) of which more than 70% lies inside forests with an average growing stock of 55.69 cubic meters per hectare. The growing stock of trees outside forests is estimated to be around 1650 million cubic meters. Owing to the conservation policies adopted by the successive governments, the onus of providing timber lies mainly on areas outside forests. The timber

Raman Nautiyal¹ and Promode Kant²

¹Scientist and Head (Retd.)

ICFRE, Dehra dun

²IFS (Retd.) and Director, Institute of Green Economy, Gurugram

produced from government owned forests is around 2 million cubic meters annually while it is almost 47 to 49 million cubic meters from areas outside forests. While forests mostly produce traditional timber like Teak, Sheesham, etc., areas outside forests mainly produce short rotation tree crops like poplar, eucalypts, casuarinas, etc.

Although the forest cover has seen a continuous increase for nearly two decades now, India still remains deficient in timber production and an increasingly large part of its demand is met from imports. Around four decades back timber produced from the recorded forest area was in the range of 10-15 million cubic meters per year. However, after notification of the National Forest Policy, 1988, the focus on conservation of forests increased leading to a decline in the production of timber from the state-owned forests. With severe restrictions being placed by the Supreme Court of India on harvesting from forests, the decline has been even sharper after 2000.

The major sectors that consume wood in the form of timber are Plywood & Panels, Veneers, Pulp & Paper, and Furniture. The construction sector is another sector which consumes a significant quantity of wood products mainly plywood and panels including fibre boards. Thus, this sector is largely dependent upon the plywood and panel industry to fulfil the demand created. Some quantities of traditional timber is also used. However, with common housing units, this consumption is likely to be small when compared to the products from the panel industry.

The international trade in wood products commonly comprises round logs, saw logs, sawn logs, hoop wood, plywood, panels, fibre boards, pulp & paper, veneers and furniture. Other products are traded in very little quantities capturing which is neither feasible nor desirable when overall estimates are to be constructed.

In absence of validated data of high integrity, the only way, at present, to construct estimates of timber production and demand and supply is through the use of proxies. The approximate rates and ratios of wood used in different products have been determined and the total timber availability and possible demand by high wood consuming industrial sectors have been estimated.

Production and trade of Timber and wood products

Timber in India comes from two major sources, namely, the state-owned forests and areas outside forests comprising farm forestry, agro forestry and private plantations. While the former mostly produces

traditional timber, the latter caters to the demand of plywood, panels and paper industry with species like poplar, eucalypts, casuarinas, etc. A small portion of traditional timber is also produced but due to long rotation, sometimes as high as 40 to 50 years in case of teak and sissoo, the traditional timber species have not been a favourite of farm and agro-forestry components of areas outside forests. Table 1 gives the quantity of timber produced by state-owned forests from 2005-06 to 2019-20.

The total timber produced from state owned forests is revolving around 2 to 2.2 million cubic metres every year and there is no chance of it increasing as focus is more on conservation allowing removal of dead, decayed and drying timber. The working plan plays an important role in timber harvest from government forests.

The estimates of total production of timber, veneer and plywood is given in table 2 below:

Table 1: Quantity of timber produced

Year	From State-owned forests
2005-06	2.33
2006-07	2.39
2007-08	2.60
2008-09	2.31
2009-10	2.18
2010-11	1.89
2011-12	1.78
2012-13	2.07
2013-14	2.39
2014-15	2.20
2015-16	2.09
2016-17	2.20
2017-18	2.16*
2018-19	2.15*
2019-20	2.17*

* Figures are based on 3-year rolling averages

Table 2: Estimated production of Industrial round wood, sawn wood, veneers and plywood**Production in thousand cubic metres (000 m³)**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ind. roundwood	46,968	45,962	45,136	44,534	43,961	45,012	46,143	46,682	47,072	47,598	48,154
Sawnwood	27204	25741	24838	24246	23599	24164	24698	24829	22765	22770	22864
Veneer	3675	3924	4352	4561	4892	5251	5754	6185	8924	9434	9942
Plywood	3869	4122	4394	4676	4967	5286	5634	6029	8930	9500	10000

The production of industrial round wood from both, government forests and areas outside forests has more or less remained constant around 45 to 47 million cubic metres. The production of sawn wood has seen a slight decrease from 2009 to 2019. However, production of veneers and plywood has seen a marked increase during this period. From a

meagre 3.7 million cubic meters in 2009, the production of veneers has reached almost 10 million cubic metres in 2019. Similarly, production of plywood has also seen a boost from an estimate of around 3.8 million cubic metres in 2009 to 10 million cubic meters in 2019. The import of major wood products is given in table 3 below:

Table 3: Estimated quantity of imports of major wood products

Product	unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Round wood	mcum	5.09	4.79	5.82	6.39	6.23	6.23	5.69	5.2	4.62	4.56	4.37
Sawn wood	mcum	0.16	0.16	0.45	0.5	0.55	0.55	0.73	0.74	0.92	1.18	1.56
Veneering sheets	mkgs	19.7	21.54	134.13	90.36	125.29	167.7	286.49	326.16	312.23	299.84	319.9
Fibre board	mkgs	94.06	165.52	183.15	192.26	203.7	168.16	180	210.71	268.33	296.38	266.62
Plywood and panels	mcum	0.2	0.28	0.4	0.31	0.2	0.2	0.19	0.17	0.2	0.25	0.46

The imports of major wood products like round wood, sawn wood, veneering sheets, fibre board and plywood and panels play an important role in fulfilling the demand for these products by the Indian market. While import of round wood has slightly decreased in the past decade, sawn wood has seen a marked increase. Importing sawn wood is

now favoured as it is easy to handle and no or very little additional infrastructure is required to convert the round wood to sawn wood. Similarly, the imports of veneering sheets and fibre board have seen a marked increase. The export of major wood products is given in table 4 below:

Table 4: Estimated quantity of exports of major wood products

Round wood	cum	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Sawn wood	mcum	0.02	0.02	0.02	0.05	0.05	0.03	0.04	0.02	0.01	0.01	0.00
Veneering sheets	mkgs	20.25	15.69	9.54	6.91	3.68	7.38	5.15	6.07	3.78	13.84	10.44
Fibre board	mkgs	11.47	12.78	13.36	16.54	15.52	13.41	15.19	15.79	11.84	16.37	24.82
Plywood and panels	mcum	0.11	0.14	0.11	0.07	0.12	0.13	0.11	0.25	0.23	0.10	0.11

The exports of these wood products from India have been in very minute quantities when compared to imports. The internal market absorbs most of the production. Some exports are also to the nearby countries like Nepal where Indian manufacturers have established units. The exports have been generally negligible except fibre board.

Estimates of demand forecasts for timber

The major sectors that consume wood as raw material comprise pulp & paper, furniture, panels (including plywood) and construction. The estimates of demand by these sectors are given in table 5 below:

Table 5: Estimates of demand for timber and wood by major consuming sectors

Year	Pulp and Paper	Furniture	Plywood	Construction	Total
2022	12.5	9.47	17.88	21.79	61.64
2023	12.5	9.95	20.69	20.88	64.02
2024	12.5	10.44	23.94	19.96	66.84
2025	12.5	10.92	27.70	19.05	70.71
2026	12.5	11.40	32.06	18.14	74.10
2027	12.5	11.89	37.10	17.22	78.71
2028	12.5	12.37	42.93	16.31	84.11
2029	12.5	12.86	49.68	15.39	90.43
2030	12.5	13.34	57.49	14.48	97.81

The demand by pulp & paper industry is likely to be constant at 12.5 tonnes per annum or even decrease as the number of wood-based paper industry has shown a declining trend (from 31 in 2010-11 to 18 in 2017-18). The increase in demand for paper and paper products is, in all likelihood, to be fulfilled by recycled fibres. In case of furniture, the demand is expected to increase slightly, from around 10 million cubic meters in 2022 to 13 slightly above 13 million cubic metres in 2030. The major increase in demand of timber is expected to be fuelled by the plywood and panel sector as it provides a huge quantum of material to the construction sector and refurbishing, furniture and renovation. The expected demand for timber, mostly traditional, by construction sector is expected to decrease owing to the use of panels and alternative material.

Thus, with business - as - usual, the demand for timber by 2030 is expected to be in the range of 97 to 100 million cubic meters. Most of it is expected to be fulfilled by imports, the production of timber within the country being constant, from 49 to 51 million cubic meters annually. Here also, the farm-forestry and areas outside forests will play a big role as a significant shift from traditional timber to panels like plywood and fibre-board is expected. Increase in construction can also see a rise in demand for scaffolding material, which is a mix of iron and wood. The timber for this is also expected to come from the plantations of related species.

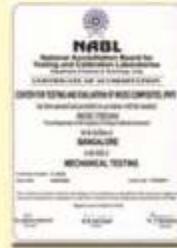


INDIAN PLYWOOD INDUSTRIES RESEARCH & TRAINING INSTITUTE (IPIRTI)

(Autonomous Body of Ministry of Environment, Forest and Climate Change, Govt. of India)

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- Modern testing facility for fire resistance doors
- Synthetic resin adhesives used in panels
- Raw material analysis of chemicals used in resins
- Identification/classification of timbers/binders used in panels
- Retention of preservative chemicals in treated wood/plywood
- Fungal/borer/termite resistance of wood/wood-based products
- Specialized testing such as thermal conductivity, acoustic properties, weathering studies, emission of formaldehyde in panels etc.



For Further Details Contact :

DIRECTOR, IPIRTI, P. B. No. 2273, Tumkur Road, Yeshwanthpur, Bangalore - 560 022,
 Ph: Director: +91-080-28394341, Gen: +91-080-28394231-32-33, Fax: +91-080-28396361,
 e-mail: director@ipirti.gov.in, contactus@ipirti.gov.in, web : ipirti.gov.in, bamboocomposites.com
 Kolkata : 2/2, Biren Roy Road., Sarsuna, Pincode: 700 061, Ph: 033-24983120
 Mohali : Plot No. B-65, Phase 7, Indl. Area, Pincode: 160 055, Ph: 0172-5095875

Thinking Realistically Beyond Conservation v/s. Production Debate

Forestry sector before and soon after independence supported different sectors in nation building by generating revenue from sale of wood and other forest produce, creating economical activity through development of forest based industry by supplying raw material, helping in mitigation of poverty by providing life support system including food from forests for millions of local people, and by host of other activities. Forest management in those days was targeted for generating both the goods and services on sustainable basis. State forest corporations were established in different states during 1970's to handle commercial aspects of forest management. The main role assigned to them was to scientifically work forests especially harvesting of timber and other forest produce in addition to raising plantations and their management in some states. This restructuring of forest organizations was considered essential for effectively managing the forest resources for conservation and production on the one hand and extraction of forest produce and its trade on the other hand.

The journey

Conservation and production have been inherent ingredients of forest management from the very beginning. Every forest have/had some ecologically, aesthetically, scenically, culturally, and religiously sensitive patches which have been repeatedly managed under protection working circle, tourist working circle or even overlapping working circles. Even individual trees and small groves/strips with unique size, shape, location, value, etc., have always drawn respect and protection not only from forestry establishment but also from local residents. There is a very large list of sacred trees and groves, across the country, which draw the highest level of protection even from locals as numerous taboos are attached with them. These are well documented and also considered as important hot spots of biodiversity and cultural value. Further, creating a very large

R. C. Dhiman

Head (Former) Wimco Seedlings,
#2621, Sector 123, New sunny Enclave, Mohali-140301, Punjab.
Email: dhimanramesh@yahoo.com

protected area network for both flora and fauna with legal support is another extremely important step towards conservation.

The first and second national forest policies enunciated in 1952 and 1988 respectively were similar in some aspects but diagonally apart in some others. Whereas, both the policies advocated for increasing the forest cover to 33% of geographical area, 1988 policy was in divergent from the earlier one regarding management of forests under conservation plans rather than for production of goods especially timber. This new paradigm of forest management towards the conservation of land and biological resources for ecological stability and environment conservation post 1988 policy has created a new order that resulted in significant transformation of forestry sector. This significantly increased the awareness of public towards numerous services generated by forests. At the same time, the material support which was available from forests for different sectors especially for the forest based industry received a serious setback. Our search for alternate sources for such goods resulted in both positive and negative exposures. The positive exposure has been to develop an alternate land use of farm grown wood, whereas, the negative exposure is in the form of increased reliance on imports of wood and wood related products that started draining out a significant share of foreign exchange.

The achievements in increasing forest cover to targeted level of 33% of geographical area, as advocated in both 1952 and 1988 policies, remained far below expectations. Forestry programs implemented after old policy of 1952 even have/had dismal record in improving the forest cover; however, the existing forest resources were sustainably managed for generating both the goods and services on regular basis which were significantly supporting the development activities

and the life support system of local people. The forestry programs implemented post 1988 policy created almost a complete vacuum on wood production from government forests. The latest biannual report on status of forests (Forest Survey of India) shows a marginal increase in forest and tree cover in the country, it also mentions a gradual deterioration of forest quality in term of tree cover density of dense forests. One interpretation of these reports regarding a marginal improvement in tree and forest cover in open and low density forests could be due to decreasing dependence of locals on them. It is a matter of fact that the firewood requirement has significantly declined in the recent past due to free distribution of around 8 crore LPG gas connections to poor people who were earlier completely dependent on firewood collected from such forests. Even there is a significant penetration of LPG usage among other families all around resulting lesser firewood demand and consumption. Further, regular food stuffs supplied through PDS and also the cash support is significantly decreasing pressure on forests. Many people in hills and remote areas are now able to make their subsistence based on the above government support programs and are slowly abandoning their fields which are showing recovery in green cover through natural regeneration.

A select wood based industry, sensing the worst to come as a result of this shift in forest management towards conservation, proactively initiated plantation programs and succeeded against numerous odd factors in growing wood with the help of farmers. This new approach of growing trees on farmer's field gained momentum among some other wood users who started similar activities of raising plantations to remain active in respective businesses. A favorable ecosystem of farmer-industry interface has developed and is regularly evolving for maintaining symbiotic synergy between the two. This new consortium of farmer-industry ecosystem is now generating over 90% of wood resource which is meeting the bulk of industrial and domestic demand of the country. According to an estimate there are 5 mha of commercial forests in India which are currently meeting the bulk of wood demand (Dhiman 2013) compared to 2-3 million cu.m. from government forests. The remaining demand (6%) of wood and wood products is met

A favorable ecosystem of farmer-industry interface has developed and is regularly evolving for maintaining symbiotic synergy between the two. This new consortium of farmer-industry ecosystem is now generating over 90% of wood resource which is meeting the bulk of industrial and domestic demand of the country.

through imports costing around Rs. 50000 crores per annum.

Conservation v/s. production debate

It is a matter of debate and speculation that how much of officially harvested wood (out of 2-3 million cu.m.) comes from naturally regenerated forests, plantation forests, and salvage marked trees form the rest of the forests. The current wood harvests from government forests also include removals from planted forests which are reported to be 13.269 m ha during 2020 (18.39% of the forest area) (FAO 2020). It is well documented that a significant quantity of wood harvested is from trees which are inventoried under salvage marking in many states especially in hill forests where green felling is not allowed in favor of conservation forestry. Earlier the trees belonging to dead, dyeing, top broken, diseased and fallen categories were considered for salvage markings. But of late, only dried and fallen ones are considered in the inventory of such trees. At times, the quantity of wood harvested from such trees in some forests is significantly higher than that could be expected under normal working conditions. The official websites of forest departments of two hilly states of Himachal Pradesh and Uttarakhand mentioned wood harvesting of approximately 5 lakh m³ annually (2 to 2.5 lakh m³ in Uttarakhand and 2.5 to 3 lakh m³ in Himachal Pradesh) which is largely from such trees. The excessive death and wind fall of so many trees from forests managed under conservation plans indicates and establishes that the

conservation forestry is not meeting the set goals and leading to the vulnerability of such forests to excessive damage. The gradual reduction of density in thick forests in hills is possibly associated with this phenomenon of conservation forestry in addition to may be some other factors. Scientific management of forests aims to maintain their hygiene by removing the competing unwanted vegetation from ground flora by site preparation before establishing new crops, cleaning and thinning in between and manipulation of top canopy thereafter to keep the damaging agents away from forests. The current scenario of regular and repeated wild fires in many forests is one of the results of applying no management operations under conservation forestry and making them fire- and pest- prone jungles.

A rational approach in forest management both under conservation and production plans is to keep the land resources under adequate vegetation cover. Under production forestry, regulated regeneration and felling conducted in a series of operations maintain adequate forest cover, whereas, under conservation forestry it is deliberate retention of trees which could also generate dead wood as stated above. Undoubtedly, the production approach demands heavily on time, money and human resources but the dividends in the form of goods and services available therefrom are much higher. Costs on extraction per unit are under check because of concentrated felling operations unlike from selection working under conservation plans where they are scattered through the forest territory. One inference that could easily be drawn from the evolving scenario of conservation v/s. production forestry is that the harvest of trees would continue to exist whether it is on the name of improving hygiene of forests (salvaged trees harvest) or those under normal forest working by applying scientifically and technically sound forest management under production forestry. The only difference would be whether to follow the route of sustainable forest management which regularly provides goods and services or under conservation forestry making removal of dead woods. With this clarity, it looks genuine to sustainability manage the exiting forest resources in the best interest of forests, country and people.

Forest is a complex ecosystem of numerous living

macro- and macro- species of flora and fauna. All species in any forest have certain physical life. These, on their death, are reproduced themselves through natural means or with assistance. Old vegetation loses vitality, vigour, growth and even carbon locking potential-a product that gained significant importance during the recent years. Therefore all the forests and species need reproduction at some stage to maintain their growth, production and reproduction in addition to optimally harness the site potential for both ecological service and production of goods.

Sustainability of current production system ?

Agriculture and forest are two legally and operationally recognized land uses whose records are separately maintained by the revenue and forest department respectively. Indian Forest Policy (1988) and Indian Agriculture Policy (2000) provide guidelines for the management of production systems associated with these land resources. Both these policies also desists transfer of land to other uses keeping in view the ecological security and needs for land use produced goods for subsistence of millions inhabitants along with other developmental activities. Agroforestry is currently an overlapping land use on revenue land though some of its versions are also available on forest land. Unlike forest land use, there are no legal provisions regulating agroforestry on agriculture land use. Farmers are free to adopt any crop specific production systems (except banned crops like poppy and cannabis etc) depending on food crops for self-use and sale. Adoption of large scale plantations in agroforestry by willing farmers is purely for sale perspective. This sector is gradually growing over the years with increasing demand for wood which is providing him better returns than traditional crops. The practice is closely associated with prevailing market conditions for trade of wood and at times a very high fluctuation in trading prices is associated with expansion and contraction of the practice.

Wood based industry is now totally dependent on agroforestry produced wood since over 90% of its demand is met from farm grown wood. The two key stakeholders in its success and sustenance are farmers and wood based industry. The market forces are

keeping them glued to each other without any legal, social, environmental, and some other commitments. Farmers may have many other options to shift to other crop production systems for better economic returns. Industry, without much option, has to depend on it. During extreme crisis the industry calibrates business to market forces including reallocating their production to new locations based on cheaper raw material availability at regional, national and international levels. Locations near sea ports, where low cost wood is invariably available from imports, are also the destinations for many industrial units which in the long run may affect expansion of agroforestry and the wood availability in the established locations. This is extremely high risky proposition for both the industry and the country for which some safeguards in the form of developing some alternate land resources for sustained wood production are needed.

The entire narrative discussed above is not for advocating production forestry at the cost of conservation forestry. Conservation of forest resources needs a due priority but a very heavy tilt towards it may not be sustainable on the longer run based on conflicting socio-politico-economic environment. This approach also has a cost for execution of scientifically sound conservation plans in the total forest areas under conservation forestry which are missing for the time being. Further, it is not desirable to put almost the entire countries forest resources under conservation plans in a developing economy in which the demand for forest based goods is increasing at a very high rate. In land deficit and densely populated countries like India, it is better to follow a middle path of integrated and balanced management approach accommodating both the production and conservation plans for its forest resources. The pragmatic approach could be one to dedicate certain areas under conservation plans where there are no anthropogenic interferences to maintain their sanctity. India has already a network of 987 Protected Areas including 106 National Parks, 564 Wildlife Sanctuaries, 99 Conservation Reserves and 218 Community Reserves covering a total of 1,73,053.69 km² (5.26%) of geographical area. The protected areas are constituted under the provisions of the Wild Life (Protection) Act, 1972, which are further complemented by other Acts viz. Indian Forest Act, 1927, Forest (Conservation) Act, 1980,

Environment (Protection) Act, 1986 and Biological Diversity Act, 2002 and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. The extent of protected area network could further be enhanced to other higher levels for giving extra importance to conservation forestry. The remaining forest area needs to be rationally managed for both the goods and services.

Both the conservation forestry and production forestry are multifunctional which complement and supplement each other in generating goods and services. Undoubtedly, the conservation forestry is meeting a larger role of ecological and environmental services but is also generating some amount of goods including wood. The same is true for production forestry where a larger objective of the management plans is the generation of wood but they, being under permanent vegetation cover for the entire production cycle of tree crop, continue to serve conservative objectives. There is therefore space for production forestry on remaining land which needs to be managed on sound professional and technical principals and by ensuring adequate safeguards like reproduction of the new forests in the shortest possible time frame on their felling to avoid vegetation-less land, retaining natural vegetation in ecological sensitive niches like water bodies and streams etc.

Way forward

National Working Plan Code -2014 prescribes 10% of the total forest area for production forestry by raising quality plantations. It also proposed that there shall be an exclusive or overlapping plantation working circle in the working plan to cover existing plantations, blanks and under stocked areas not suitable for assisted natural regeneration (ANR), clear felled areas, road side, river side, canal side, rail side, sea side areas and lands under CAMPA etc. (MoE&F, 2014). If we sincerely follow these guidelines to put plantations on 10% forest area, and by achieving around half the productivity that is achieved by farmers, the country could turn the scenario from wood deficit to wood surplus country. Unfortunately, this has not attracted the desired interests and urgency, may be due to the limitation of

financial resources. Availability of money is a limited factor even in developed world countries which are increasingly engaging with private sector for developing & managing production forestry under some contractual arrangements.

GAIN (2019) cited a Table-1 given below for imports of logs in raw form from different countries (US dollars) which indicates that Malaysia and New Zealand are the two major countries which supply logs to India. Besides wood in log form, these countries also export semi-finished wood and its products to India. Though Malaysia is neighbor across the Bay of Bengal, New Zealand is on the far

eastern edge of globe and is supplying logs over long distance not only to India but to many other countries. 42% of New Zealand's lumber production is exported to different countries which is earning a significant foreign exchange to that country. There is one thing common in these two countries that make them strong in wood production and its export. Both these countries, like India, were ruled by the Britishers and therefore the forest management systems, policies and programs were somewhat similar to those applied to Indian forests. Both have taken some views on their policies and programs related to forestry sector for the benefit of their respective country.

Table-1: India's imports of logs (HS Code 4403) by country (US\$ Million).

Exporting country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Malaysia	327	382	413	421	535	596	556	598	513	383	295
New Zealand	77	95	84	123	207	230	229	241	208	228	246
Suriname	0	0	0	0	3	10	14	21	28	37	82
Solomon Islands	6	0	1	0	15	19	4	5	68	61	53
Ghana	57	83	50	47	46	56	44	48	65	57	51
Ecuador	24	26	17	14	31	45	62	72	64	81	62
Brazil	1	0	1	0	6	5	9	11	28	39	41
Costa Rica	15	17	22	25	48	56	50	57	58	47	57
Papua New Guinea	32	44	43	59	63	36	56	107	102	64	76
Panama	14	10	8	11	22	30	26	26	32	27	37
United states	1	2	1	2	6	8	20	36	14	12	14
Rest of the world	545	632	554	632	849	916	965	787	388	241	193
Total	1100	1293	1194	1336	1831	2008	2035	2011	1566	1278	1206

(Source: Directorate General of Foreign Trade, Ministry of Commerce.)

Like India, New Zealand's forests were also managed and looked after by the forest department. The country brought in drastic reforms in forestry sector during mid 1980s (Kelsey 1997) by separating the management of forests and organization structure for each of the conservation and production roles. It was decided to manage production forests under separate entities including concessions route, establish a separate department of conservation with responsibility for managing conservation lands including the state's indigenous forests, and managing indigenous and introduced fauna and managing public recreation (Roche 1990, Kirkland 1988). The ownership of the plantations became much more diverse after 1996. This reform brought considerable revenue to the state and a marked improvement in the economy. According to

O'Loughlin (2006) the decentralization and privatization process provided considerable evidence that the private sector is more able to effectively manage plantation forests, than the State sector. The funding by private investors in wood processing facilities and commercial and business capability led to stark increase in the profitability of the plantation forests. The department of conservation is effectively managing, preserving and conserving the tree and forest genetic resources, biodiversity, flora and fauna on indigenous forests specially set aside for this purpose without any ambiguity of overlapping roles and jurisdiction. Today, New Zealand is among a few select countries those are known for clean and green environment and whose economy is largely based on agriculture and forestry.

Pandey (2021) cited another example of Malaysia wherein the largest integrated paper company Sabha Forest Industry is engaged in a collaborative project for managing approximately 0.3 mha area in which approximately 0.2 mha is kept aside for commercial production of pulpwood of acacia and eucalyptus to produce approximately 2.5 Mt wood per annum. The company pays a royalty of Rs. INR 100/MT of pulpwood in addition to bearing the costs for conservation of remaining area for services. The project is effectively managing plantation and conservation areas in collaboration with state in addition to providing revenue to the state and generating 5 million man days employment.

There have been repeated debates and discussions, during the last around 3 decades for encouraging participation of private sector in raising forest plantations in India as well. The last effort was made during 2016 when the Ministry of Environment, Forests & Climate Change issued the guidelines for the participation of private sector in the afforestation of the degraded forests (Dhiman 2016). Every time when the issue is discussed, its proponents and opponents put forward their views far and against citing numerous ecological, economical, cultural and social concerns and ultimately the move is halted. Providing government land on long term lease to private parties for raising plantations is a normal practice in number of countries across the world (Landell-Mills and Ford 1999). These leases are also called forest concessions in many countries. The total area under forest concessions is estimated to be around 35 Mha in Brazil (Plinio 2021) which is one of the leader in the production forestry. There are different variants of such leases based on the mutual understanding of the lesser and lessee. In India too, providing land on long term lease for developmental activities was a normal practice in the past. Many of such leases were on forest land those were given for developing the land for different activities including agriculture. Many of such leases now stand expired on completion of the original lease period or terminated post enactment of land ceiling act. However some leases are still continuing may be via litigation route. Forest management and growing plantations have been under government domain and providing forest

**The total area under forest
concessions is estimated to be
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production forestry.**

land on lease for growing plantation were not common in India except to government controlled forest corporations.

The above two case studies of Malaysia and New Zealand clearly indicates that India too needs some innovative transformation in forestry sector to bring in practical balance in conservation and production of forests. Country is already spending a huge amount on plantation activities promoted under different programs, missions, submissions and schemes every year. We already have commercial wings of forest corporations which are growing and managing forest plantations on leased forest land in many states. By now we have adequate experience on the quality of the forest plantations traditionally raised by the forest department, by the forest corporations, and by individual farmers on their fields. Rationally and logically thinking, professionally managed plantations on forests land should be of very high quality compared to those grown by numerous untrained and uneducated farmers. However, the situation is all together different. According to preliminary observations recorded by the author, poplar productivity on farmer's fields was recorded higher at 6 years felling cycle compared to that grown on forestland for 12 years in the tarai region. Many of us take a view that the two situations of forest land and that of farmer's fields are different and cannot be compared. Whereas, there is also a counter argument that no one debar the government agencies to manage these lands for growing quality productive plantations similar to the farmers. It is inferred that the government working system is too rigid which does not allow liberty in taking innovative and dynamic decisions in managing land resources like the individual farmers.

Conclusion

Many countries have taken a realistic and pragmatic view in balancing the role of forest land for generating both goods and services. Similar synergy could also be developed in India where fund crunch is failing to use the true productive and protective potential of forests and degraded land. Even the last guidelines issued to rope the private sector for this purpose during 2016 stressed “that the government forests are maintained from public funds, which are limited. As a result of low investment, the productivity of the forests is poor resulting in serious consequences on biodiversity, hardships to the local communities and shortage of the raw material to industry”. With creation of forest development corporations, the process of leasing land was initiated to these government controlled bodies. Despite a lot of conflicts of interest between the two organizations having same human resources but working on opposing objectives of conserving and harvesting forests, the country has accepted the system in letter and spirit. It is continued without much debate despite the current business model of forest corporations is not self sustained with reduced availability and trade of forest produce. Therefore initiating a few pilot projects on raising plantations under public-private-partnership would develop confidence and experience to move forward. The two models of Malaysia and New Zealand could be the starting point. There could be many more variants of such partnerships by dove-tailing the conservation objectives with the production programs. Let us realize the essence of 2016 guidelines and freeze further discussion and start action. This is the need of the hour and cannot be overlooked forever.

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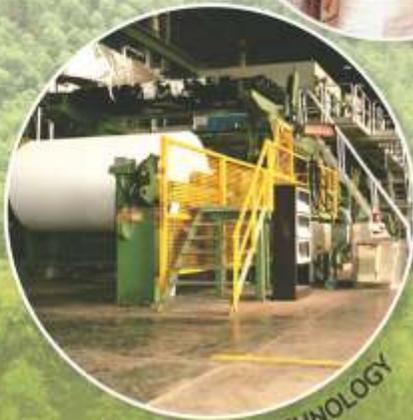
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AGRO FORESTRY



RURAL EMPLOYMENT



TECHNOLOGY

GROWTH with SUSTAINABILITY

Sustainability is at the core of India's Paper industry. Paper is one of the most environmentally sustainable products as it is biodegradable, recyclable and is produced from sources which are renewable and sustainable.

Paper Industry is not only conserving the environment but also regenerating natural resources. Through the agro-forestry initiative of the Indian Paper Industry, more than 1.2 million hectares of land has turned green and thousands of jobs in rural India have been created.

Of the total demand for wood by India's Paper Industry, over 90% is sourced from industry driven agro-forestry. The industry is wood-positive, that is, it plants more trees than it harvests. Pioneering work has been carried out by the industry over the last three decades in producing tree saplings (e.g. Eucalyptus, Subabul, Casuarina, etc.) which are disease and drought resistant and can be grown in a variety of agro climatic conditions. Substantial amounts have been spent by the industry on plantation R&D, production of high quality clonal saplings, technical extension services and hand holding of marginal farmers.

Indian Paper Manufacturers Association

PHD House (3rd Floor), 4/2 Siri Institutional Area (Opposite Asian Games Village) New Delhi - 110 016 (India)
Tel : +91-11-26518379, +91-11-41617188, Email : sg@ipma.co.in / secretariat@ipma.co.in
Website : www.ipma.co.in

IPMA Members



Grow More Wood, Use More Wood: Experience and Thoughts Sharing

I truly believe that “Wood is Good” if it is preceded by “Grow More Wood”. Here, I am sharing my experience of Agroforestry development by wood user industries in their catchments in India and also a few thoughts about a practical, successful model and how should the Government agencies help. I worked with forestry and wood sourcing side of Pulp and Paper Industry for about 30 years. Recently, as sometimes in past also, I saw a video about paper industry being criticized for cutting trees and destroying environment etc. I have not seen a similar, strong narrative which mentions about furniture, house furnishing etc. needed for each home and which is also made by cutting trees. I am not sure what is the reason for this bias especially when -

- ♦ we all know well that both are essential for humans. It is the consumption pattern that drives felling of trees for the specific purpose. It is not the manufacturers to be blamed but the consumers themselves.
- ♦ we all know that majority of the deforestations have happened for firewood needed, timber demand, agriculture and pastures conversions. Major deforestations have not been for making paper making
- ♦ paper industry in India, Brazil, Thailand, Indonesia, Australia is based on planted wood and not wood from natural forests. In fact, the entire wood-based paper making in India is from farm grown wood by hundreds of thousands of farmers in India.

So, how did the Indian paper industry achieve this position to make paper entirely from farm grown wood? Here is a story narrative, giving the overall perspective. The individual mills stories are much more different and interesting, for further research by academics of business management

Many of the recent times (but prior to last two decades) wood-based paper mills were actually planned and based on wood and bamboo supply

Dharmendra Kumar Daukia*,
Vice President, Greenpanel Industries Ltd.
Email: ddaukia@gmail.com

from natural forests in India - ITC, APPM, BILT-SEWA, AP Rayons, WCPM etc. This was by design, built into the working plans of that era and was based on principals of annual allowable harvest. However, the increasing demand for paper was putting pressure on wood and bamboo supply. There were negligible efforts for sustainable production forestry on forest land, which is owned and managed by the state forest departments across India. The forests in India are basically owned and governed/ administered by Government Forest Department (Indian Forest Act 1927, State Forest Acts). There were two important changes that happened in 1980s:

- A Forest Conservation Act 1980,
- B National Forest Policy, 1988 which is claimed to have a “legal flavour”
NFP, 1998 Clause 4.9 “.....As far as possible, a forest-based industry should raise the raw material needed for meeting its own requirements, preferably by establishment of a direct relationship between the factory and the individuals who can grow the raw material by supporting the individuals with inputs including credit, constant technical advice and finally harvesting and transport services.....”

These two documents put together meant that:

- a Forests are meant for ecology and environmental conservation etc.
- b Forest Based industries should work with farmers to meet its wood requirements

Consequently, and largely as a result of these two events, the wood and bamboo supply became quite costly in Andhra, Maharashtra, Karnataka, MP, etc. At the same time the impact of reduction in bamboo supply due to previous flowering was becoming visible. raw material supplies were becoming scarce and costly. There was no production forestry allowed for fast growing hardwood species in the forests of India.

*The views expressed are author's own and not of the organization represented

Therefore, a long-term alternative solution was needed for industry to survive and meet the demands of paper. Two options emerged, logically:

Growing wood on degraded forest land and making it into production forestry venture: Approaching the Government of India.

Growing wood on farm land and this was also seen as an important option.

While the option one was seen as full of big hurdles, the option two was seriously considered for wood growing by mills. WIMCO's Poplar propagation and successful commercial nursery model was highly appreciated by all over India by that time. Punjab's Eucalyptus growing program (1980s) on farm lands was also a strong indicator that fast growing, short rotation (7-8 years) species could be successfully grown by farmers of India. There were other such smaller success stories happening across India.

Having clearly realized the way forward, the professionals from mills went abroad to learn about better nursery and silviculture techniques to increase productivity and grow wood efficiently. Some went to Brazil, others to Australia. Industry's forestry professionals' delegations were sent to Indonesia, Malaysia and other places to learn about how other countries were dealing with the subjects of growing wood on massive scale to reduce pressure on natural forests.

Modern nursery set up started in 1989-90. Clonal production of Eucalyptus started in India in 1990s by a few mills. Some innovated, some copied the new technologies and others increased scale of their polybag nurseries. Some mills distributed Subabul seed in hundreds of tones. A few mills worked on greening the central, eastern coastline with bare rooted Casuarina plants. But by the end of that decade i.e. the year 2000 (end of millennium also), Indian paper industry was again upbeat. In subsequent two decades they grew wood in association with farmers of India. They helped grow even more than they needed.

It all happened without any major policy changes/ support on this front in this last decade of the millennium. I have been a participant and witness to that developmental growth story of entrepreneurial

Major Clonal Nurseries in India: Fast Growing Hardwood Species

Industry / Agency	Location: Operational Nurseries
ITC	Bhadrachalam
JK Paper	Raygada
	Sirpur Kagaznagar
	Songarh
BILT/ Associates	Ballarshah
	Ashti
	Sewa
APPM	Rajamundry
TNPL	Kagithapuram
WCPM	Dandeli
Century Paper	Lalkuan
Harihar Polyfibres/ Grasim	Devengiri
OPM	Amlai
Eucalyptus Cluster	Bhadrachalam
Eucalyptus Cluster	Jangareddygudem
Casuarina Cluster	Cuddalore
Pragati Biotech	Hoshiarpur
WIMCO	Rudrapur
HFDC Seonthi	Seonthi, Haryana
APFDC	Styavedu

and managerial spirit. One by one, many state forest departments removed many restrictions on cutting, billeting and transport as step by step represented by Indian paper industry, working together.

Currently, the clones of fast growing hardwood species are produced at following locations in India, mostly by paper mills but many others also. There may be many more, but these are the major ones.

My re-iteration to the critics is that "Paper produced in India is from farmer grown wood and not from Natural Forest based wood". My proposal to the other wood-based industry is that it is doable to grow wood in association with farmers and therefore, instead of looking at Government supports- DO IT YOURSELF.

It is interesting that recently, we have AGAIN witnessed very sharp rise in prices of wood of fast-growing wood species in North India. It has impacted the plywood industry the most. The other issues of WBI are the need for obtaining FSC certified wood and/ or Certification for Legality, Certificate of Origin of wood etc and how can it be solved.

The issues of severity of wood supply cycles and also these ones on certification, legality etc. can be solved by making systematic efforts for developing long term relationship with farming community and growing wood in association with them. Such efforts have to be made by individual mills themselves – big or small. The Indian paper industry has largely

worked on same lines and working directly with farmers. I remember that around 1997-98 or so ITC Bhadrachalam was offering Rs. 100 per MT as incentive to its supported farmers (who planted their plants) and who would get wood supply source certified by its field staff. Wood price at that time was around Rs. 800 per MT or so. So, the incentive was about 12% higher price. This scheme was effectively operative in the close catchment of the mills- say 80-100 km.

Today, if one stands near the top of temple hill of Bhadradri Sita Rama chandraswamy Devasthanam, and faces towards Godavari river, one would see a vast stretch of Eucalyptus plantations up to the distance eyes can see. Both the banks of the Godavari river are well protected with tree line. This is the scenario near most of the big paper mills' locations and interestingly also near all big nursery locations. One can open Google Earth and see the land scape near Pragati Biotech, Hoshiarpur. A very large farm land has been occupied with fast growing hardwood trees. My observation is that a modern nursery of big scale of 2 million plants and above is a big trigger for rapid growth of farm forestry adoption in its vicinity.

The Indian Paper Makers Association members have been quite active all these years and supportive to each other while almost coaxing each other to plant more and more of high yielding varieties of fast-growing hardwoods. In the references I have given a link file link which can help locate all such nursery sites of paper mills and other clone producers, as I know it. My strong recommendation to non-paper, wood based industry like plywood, particle board, MDF etc.: Set up Modern Nurseries, Trust and Support the Farmer with your Nursery. Start Growing Your Own Wood. The efforts on wood growing side have to be supported with the appropriate wood procurement policies. Right kind of wood procurement policies and high yielding, high quality plant supply goes together: hand in hand, for high degree of success.

I have made an effort to compile a of list of points to be adopted by wood based industry for sustainable wood supply and the same is presented as below. All these points work like a magic and within a period of 5 years the results are extremely promising. The only thing to be kept in mind is that all the points must be followed together as package for the magic to work.

Right procurement policy:

1. One species one price (no consideration of distance): Example – Sugarcane, Cotton, Paddy Mills. There should be no differentiation in prices between vendors, distances, and locations. With one price the nearest farmer gets best remuneration and in the next cycle the development of agro forestry will be more in proximity of these mills. This formula works like a magic. Offer an appropriate single price at which sufficient material is received at mills
2. Prominently display the quality and purchase price at the mills' gates and effective date, for all to see. Try and make price changes only once in month. Decide intelligently but keep prices stable for longer time.
3. Direct purchase from farmers: Modern, Digital systems can be put in place. Depute a few officers or staff to enable and facilitate the same – depending on the scale of the manufacturing units.
4. Incentive for company promoted farmers in 25 km radius listed villages- 50 Rs. / MT, as confirmed by field staff.
5. Remove the impression of wood supply vendor being more important than farmers. Farmer should always be given higher respect and importance and guidance. Overzealous procurement managers of the mills should amend their procurement methods in favor of giving first priority to resource development and nil priority to trader development. The monopoly of traders, observed over last 30 years, has been to exploit the farmer as well wood based industry. Traders' role, fundamentally, is to carry out harvesting and logistics efficiently. That is how they should develop. Farmers should be paid directly by mills.

Farm forestry support:

1. Own most modern, clonal nursery: Produce and distribute more plants than the mills require to harvest to support mills operations. A modern nursery project cost, for fully supporting the mills wood requirements, is about 1-2% of project cost. Similarly, in the in initial years the operations cost of nursery plants production would need to be supported by manufacturing mills. This also in range of 1-2% of mills wood cost. After 3-4 years of

actively running the farm forestry development program, the farmers are able to bear the operations cost, meaning there by that there would be no need, thereafter, to subsidize the plants supply to farmers. As the project reaches maturity and expansion stages these costs go down.

2. Contract farming within 15-20 km: minimum 20-25% of requirements should be thru remunerative MSP based contracts. Remunerative price commitment during the low-pricecycle (Supply being more than demand: Buyers' market) is important.
3. A few nearby farmers' visits should be organized to the factory every week. Over a year long period about 45 batches of farmers visiting the factory helps to create a very strong understanding and bond with the factory.
4. Farmers' education about spacing and longer rotation is very important.

For example: wider spacing of 500-600 trees per acre of Eucalyptus (max.) with longer rotation of 6-8 years is good for maximizing farmer profits and sustainability. It needs to be understood and remembered that if farmer profits, the mills sustainability is eventually ensured.

Productivity improvement: Institute a reward system for productivity improvement on farmers' field.

It is extremely important to educate and encourage the farmers to not to harvest in panic during low prices. Trees are not perishable. Wood becomes tradeable commodity only when trees are harvested and brought to market. Tomato, potato, wheat & sugarcane have to be harvested when they attain maturity. But that is not the case with

fast growing hardwood trees. Farmers can plan and wait till the demand supply equation is more favorable for them to get remunerative prices. If wood-based industry owners/managers are serious about long term sustainability of their business, they should help the farmers to hold their trees growing in the fields. It will help improve wood quality, increase the productivity of farmland, achieve soil nutrient balancing and at the same time balance the price structure in the trade. It is therefore even more important to buy directly from farmers and not from traders.

5. Promote more and more tree growing as agroforestry and encourage allied activities like beekeeping with the trees to help improve the farm economics in the long run. HAPPY FARMER, COMPETITIVE INDUSTRY: That is what will be the outcome.

While the Indian entrepreneurs have a lot of action points to undertake as listed above, there are a few points for the government agencies also to work on for making tree growing in India more competitive.

Complete Free Trade for farm wood irrespective of the species. All farm grown products be made free from whatever bottlenecks are there. Government usually listens to the stake holders and takes appropriate actions in national interest if industry really shows action on ground. Industry should make specific requests w.r.t. bottlenecks and species.

Agroforestry Board of India (AFBI) : This was one of the important recommendations of the National Agroforestry Policy of India (2014) to set up an Agro-Forestry Board.

Conclusion:

India has tremendous entrepreneurial will, energy and investment acumen. The country's farmers are highly progressive, adaptive. The agro-climate is conducive for large scale agroforestry development for wood based industry to prosper. The non-paper wood based industry should immediately initiate steps for growing wood in association with farmers.

Wood Raw Material Needs in Plywood Manufacturing – Practical Estimations from the Floor: A different perspective

H. Vaidyanathan

Plyinsight,

366, sector 8, Part 1, Urban Estate, Karnal – 132001 (Haryana)

The past couple of years during the Covid19 pandemic period have seen a lot of discussions, debates and input through various forums and webinars with regard to the development of policies and facilitations for India to become a wood resource-rich country in the decades to come. It must be regarded as a matter of great success that we have been able to utilise the low productivity and troubling times of the pandemic in order to come together as sector stakeholders, beyond professional barriers to contemplate on many of the aspects of ‘stabilisation’ and improvements in the plywood sector with regard to wood (round logs) requirements all of which come from Agroforestry (AF) and Trees outside Forests (ToF) in our country.

As we already have a number of statistics from many sources with regard to wood raw material requirements for various wood based industries (WBI) and future projections regarding the same, let us try to figure out this requirement in its simplest form of practicality, from a plywood factory floor, irrespective of all the existing figures. It is important to consider this form of a perspective so that we try to understand the aspects of wood resource management and relevant policy/facilitation requirements, from the point of view of actual usage by a sector industry - plywood manufacturing, in this case.

Significance of this Estimation

In general, we have cubic meters as the measure of wood resources and its end products. However, the plywood industry has been practically using the incoming weight in metric tons measure for its purchase of wood. Considering this fact, it is very important to estimate wood requirements for the plywood industry taking along this aspect of day-to-

day operations. The significance of this kind of analysis will be that we may be able to arrive at a more precise measure of wood requirements and the need for AF & ToF resources, with respect to the plywood industry. This may also be worked out for other industries such as MDF, particle boards, paper & pulp sectors that use wood resources in bulk. As the output/yield from timber plantations are also mostly calculated in MT/Ha/Year, this may prove to be a more realistic effort on the estimation of wood requirements, based on which future facilitations/policies/regulations may be envisaged as appropriate.

The species of timber considered is Eucalyptus as it is the next best sought after wood in the Indian plywood market apart from a great primary liking for Gurjan/Keruing (*Dipterocarpus* spp.) plywood, due to its colour and weight characteristics. We are considering wood purchase in a plywood factory for eucalyptus timber for every 10 day lights of hydraulic hot press, which produces 10 sheets of 8' x 4' x 18mm thick plywood sheets during every hot-press cycle of 25 minutes.

Timber requirement estimates at the Hot Press

For every 10 day lights hot press, running 24 hours:

- One production cycle of 25 minutes needs 6,550 mm square feet (35 sq ft raw assembly size X 18.7mm assembly thickness X 10) of dried core veneer for assembly of 18mm thick plywood for hot pressing (1.7mm core veneer per layer).
- If the hot press produces 50 production cycles in 24 hours of work @ 25 minutes per 18mm

thickness, it would need $50 \times 6,550 = 3,27,500$ mm square feet of core veneers at less than 6% core veneer moisture content (MC).

- ♦ Considering that 1 ton of Eucalyptus provides around 4,500 mm sq.ft. of core veneers, this press would need $3,27,500 / 4,500 =$ approx. 73 Tons of log purchase per 24-hour running.
- ♦ In short, every 10 daylight hot press producing 18mm plywood with Eucalyptus would require 73 T of incoming timber for core veneer per 24 hours. Let us say 75 T.
- ♦ If a well-managed plantation produces an average output of 20T per ha of Eucalyptus wood every year, at a rotation of 5 years (100T), this press will require $75/100 = 0.75$ ha output of 5-year rotation, per 24-hour manufacturing day (every work day).

This shows that for every 10 daylight hot press using Eucalyptus species, timber availability should be $75 \times 300 = 22,500$ T, which in turn should come from $225 \text{ ha} \times 5$ (yrs rotation) = 1,125 ha = 2,780 Acres of plantation land managed at 5-year rotation, having timber yield of 20T per ha per annum.

If there are an equivalent of 800 X 10-daylight presses (8,000 daylight) in Haryana State alone, the plywood industry of the State would need to source eucalyptus species wood logs from $2,780 \times 800 = 2,224,000$ Acres (approx. 0.9 M ha of plantations) all round the year.

In effect, eucalyptus timber sourced from about 0.9 million ha of 5-year rotation plantations, at a timber yield of 20 MT/ha/Year, can produce 400,000 sheets of 18mm thickness, 8'x4' size plywood (Face veneers excluded, as they are not made with Indian wood yet) from 800 hot-presses with 10 daylight each working 24 hours, amounting to about 21,400 cubic meters of plywood. As India's production of plywood touches 12 million cubic meters (FIPPI), we shall need close to 505 million Ha of 5-year rotation plantations of eucalyptus for the plywood industries alone, at the current rate of consumption and yield.

Way Forward

The Forest Act, 1988 Amendment clearly lays out that WBI have to look for raw material resources on their own. This makes it clear that industries in our

sector have to make their own arrangements for quality timber resources of their chosen species. Government departments are not going to involve other than for regulatory/facilitation purposes whatsoever. In this scenario, the plywood industries (PWI) need to compete with other wood-purchasing major sectors such as Paper & Pulp industries, MDF and Particle Boards. In order to ensure consistent supply of peelable timber resources for its factories PWI must start forming strategies and approaches toward ensuring raw material supplies for quantity, quality and competitiveness against imports as well as for export possibilities.

Some of the activities that may help PWI in the way forward:

- ♦ Managements of industries may start gaining knowledge about clones available & their yield possibilities for different chosen species, based on their requirements.
- ♦ Factories may start exploring tie-ups and buy back arrangements with farmer-groups, farmer-societies, farmer-associations and similar farmer producer organisations (FPOs) around their locations (catchment areas). This will also help easily make documents to establish CoC for sustainability certifications.
- ♦ Factories may also involve in value addition to farmers by arranging specific clones from recognised institutes at a subsidised rate, and by having awareness programmes related to future timber requirements and market possibilities.
- ♦ Managements may engage with their respective Agri- & Forest- administrations in order to create better plantation infrastructure and expansion of farm areas under agroforestry (AF) and also in continuously pushing for higher timber output from available AF lands.
- ♦ Managements may tie-up with FPOs in order to work on reviving degraded lands for AF plantations. This may also enable farmers to go for higher girth timber with larger spacing plantations which in turn may benefit industries with the possibility of peeling face veneers from specific species such as Melia Dubia (Malabar Neem).

Associations can play a big role

PWI regional Associations can think of enhancing their role in ensuring a proper system of functioning in the sector. For example, by raising just Rs. 100/- per daylight, per month from factories, an association having 8,000 daylights under its membership can raise Rs. 8,00,000/- per month. This fund is more than sufficient to initiate & maintain all development, coordination works with FPOs and various other departments. This will also continuously enable automatic participation from all factories, small or big. Such initiatives will go a long way in ensuring unity, cooperation, participation and energy levels of the PWI sector in India.

Without a combined, well-coordinated approach from industries toward raw material requirement-based strategies for the future, our PWI sector will be in serious operational bottlenecks in the years ahead. In view of the expansion of MDF factories across various locations in India by organised players of the sector, the smaller and medium level industries will have to look into a more serious strategy toward profitable and viable operations, if they have to survive smoothly in future. It is hoped that the PWI sector of our country appreciates its imperatives in order to remain economically stable & competitive in the days ahead, as well as provide our markets with good quality, sustainable and durable products.

ADMISSIONS OPEN

One year Diploma in Advanced Woodworking

Course Description:

The Diploma Course was launched in the year 2018-19 jointly with M/s. Biesse Manufacturing Company Private Limited. This program offers an excellent opportunity for trainees to acquire required skill set to work on wood and wood products. This course structured to provide first hand experience in handling state of the art machineries to make them employable in wood based industries. This course has eight major modules namely, Fundamentals of wood materials, Fundamentals of Engineering, Wood processing using advanced machines & allied processes, Loading & unloading systems, machinery safety, maintenance of machines, Assembly & Joinery, Advanced application of software (CNC, CAD/CAM & 3D-Pytha) and project work. Upon successful completion of training, the trainees will be able to handle most of the advanced woodworking machines that are used in the wood based industries.

Eligibility	: Pass in Pre-University Course/Senior Secondary/ XII/ Equivalent from recognized Board. (Graduates in Science / Forestry / Engineering are encouraged to apply).
Course Fee	: Rs. 35,000/- for the entire course
Extra	: Rs.1,650/- per month towards Accommodation Charges Food Charges (as per actual)
Security Deposit	: Rs. 5,000/- (Refundable)
Intake	: Maximum 30 Candidates



INSTITUTE OF WOOD SCIENCE AND TECHNOLOGY

(Indian Council of Forestry Research and Education)

An Autonomous Body of Ministry of Environment, Forest and Climate Change, Govt. of India
P.O. Malleswaram, Bengaluru – 560 003, India Website: <http://iwst.icfre.gov.in/awwtc/awwtc.htm>
Ph: 080-22190148, 150 Fax: 080-23340529 E-Mail: awtc_iwst@icfre.org, dir_iwst@icfre.org

TESTING AND TRAINING SERVICES @IWST

Testing Services

- ♦ Identification of wood
- ♦ Physical properties of wood tests (Specific Gravity/Density of Wood, Moisture Content, Shrinkage)
- ♦ Mechanical properties of wood (Static Bending, Compression Parallel to Grain, Compression Perpendicular to Grain, Tension Parallel to Grain, Tension Perpendicular to Grain, Hardness, Shear, Nail Holding Power, Screw Holding Power)
- ♦ Determination of calorific value of wood
- ♦ Thermo gravimetric analysis of lignocellulosic material
- ♦ Determination of penetration and retention of preservative in the treated wood
- ♦ Wood polymer composites
- ♦ Preservative solution analysis
- ♦ Proximate analyser (fixed carbon content, volatile content, ash content and moisture content)
- ♦ Estimation of percentage of Sandalwood oil and GC analysis of oil
- ♦ Distillation of essential oil and estimation of oil yield by hydro distillation method
- ♦ Identification services decay fungi/mould
- ♦ Supply of fungus culture per tube
- ♦ Testing of bio-efficacy of preservatives/ insecticides against borers
- ♦ Sandalwood farming and managing its health Consultancy
- ♦ Testing of wood preservatives/fire retardants
- ♦ Specific information by post

Short Term Training Courses (3/5 days)

- ♦ Bamboo: Tissue Culture
- ♦ Sandalwood: Tissue Culture Techniques
- ♦ Sandalwood: Seed Handling, Nursery and Plantation Technology
- ♦ Wood Seasoning and Preservation
- ♦ Sandalwood: Farming and Management of its Health
- ♦ Extraction and Quality Assessment of Sandalwood and other Essential Oils
- ♦ Wood Modification
- ♦ Field Identification of Important Timbers
- ♦ Clonal Propagation of Melia dubia
- ♦ Sandalwood: Establishment and Maintenance of Healthy Nurseries and Plantations
- ♦ Insect Pest Management
- ♦ Bamboo Agarbatti Stick Making

For further details, please contact :

The Head, Extension Division
Institute of Wood Science and Technology
18th Cross, Malleswaram, Bengaluru - 560 003
Phone: +91-80-22190170, 201, E-mail : extension_iwst@icfre.org

The Greenply Industries Limited - Augmenting Raw Material Availability for Sustainability

The sustainable availability of indigenous fibrous raw material at reasonable cost is the main bottleneck for the survival and development / survival of wood based industries in India. In view of forest conservation policy and other state laws prohibiting allotment of the land to the industries, has become a major challenge to ensure the sustainable raw material availability for the survival of industry and its programmatic growth.

Greenply is the pioneer industry amongst the Indian interior infrastructure companies to take various self-sustainable initiatives to combat the problem by development of raw material through promotion of large scale plantations with suitable species. Efforts are directed to keep the environment amelioration, ecological balance of the area and socioeconomic upliftment of local inhabitants as prime consideration. The plantation project will help in creation of huge carbon sink, effective to mitigate the global warming impact, apart from great contribution toward soil and water conservation in the plantation areas. It helps in achieving greening mission of India to cover 33% of the area under forest cover. For each tree we use, we will maintain 6-7 trees of different stages. It means we intend to maintain 600% green cover to meet our requirement.

Moreover, lops and tops of the trees, caters the local need of fuel and fodder. It will not only conserve the natural forest but preserve it the future by reducing the pressure on it. It will also provide huge employment opportunities in rural area, particularly for landless section and women. Each acre of plantation along with nursery development, during its entire rotation, generates around 200 man-days of work. Out of this, around 60% goes to women.

Multifold strategies are being adopted in line with the specific requirement, adaptability to local

J.K. Jain

National Head for Plantation and Special Projects,
Greenply Industries Limited.

environment and micro conditions, suiting to location of particular unit. So far Greenply has planted around 12 millions of saplings covered around 16000 acres of land at different catchments, adjoining to the manufacturing units

1. Approach to promote plantations:

The approach is to work and grow together, maintaining triple bottom line, striking the balance amongst economic, environment and social aspects. The salient features of plantation program are as given below.

- 1 To promote massive plantations on marginal



and degraded lands.

- 2 Development and distribution of best quality seedlings of fast growing short rotation tree species with the aim to improve productivity and raise plantations to achieve raw material self-sufficiency and its sustained availability in future.
- 3 Promote perfect backward integration with tree growers of locality.

4 Provide the technical knowhow at free of cost to the tree growers from nursery to post harvest stage in the catchment area.



5 To establish demonstration plots and interaction with local inhabitants by periodical meetings for their encouragement, promotion environmental awareness.

6 To demonstrate improved forestry techniques to achieve higher productivity per unit area in collaboration with best regional forestry research organizations located in different parts of the India.



7 To go for clonal propagation of pulpwood tree species, by selecting elite parental trees with desirable characters to provide genetically superior planting stock for plantations.



8 To create an eco-friendly environment and to improve the socio-economic status of tree grower.

9 To conserve natural resources and reduce pressure on natural forests.

10 To create large scale employment opportunities in rural areas, particularly for women in the developmental work.



2. Specific unit wise strategies

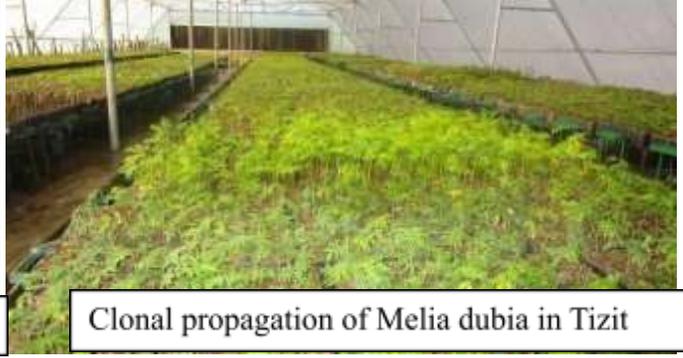
Greenply is having 5 units in India and area wise specific strategies are adopted for best possible advantages

1. Tizit – Nagaland
2. Kripampur- West Bengal
3. Rajkot – Gujarat
4. Vadodara – Gujarat – Under establishment
5. Sandila – Uttar Pradesh- Under establishment





Initial seedling Nursery at TIZIT, unit Nagaland



Clonal propagation of Melia dubia in Tizit

Tizit unit -Nagaland

The plantation activities started around decade back on small scale, with the development and free of cost distribution of seedlings to the local farmers for plantation in their fields.

Several campaigns were launched to create the awareness, which has started giving favorable results and local people are coming forward to share their lands for plantations.

Mutual trust is the key to success such schemes.

The far sighted vision of Management and its apt execution have successfully developed a very good mutual trust between local inhabitants and Greenply. The approach has helped in overcoming the problem of land availability by the Greenply.

One of the letter from local council, reproduced below, indicates the example of mutual trust of Greenply with local inhabitants and their willingness to participate in this developmental activities.

At TIZIT, we intend to go for plantation on around

400 acres of land annually with fast growing species having short gestation period of around 6-7 years.

Due to Concerted efforts of Greenply, the unit could get the FSC FM certificate.

The first unit in Indian panel Industries



CHAIRMAN LAPA VILLAGE SOCIETY



Afforestation of Denuded hills in Nagaland

The species promoted are Duabanga, Melia, Terminalia, Chukrasia, Eucalyptus, suiting to the site.

2. Unit Rajkot- Gujarat

The initial survey reveals that some of the areas in Gujarat had good farm forestry plantations in the past but the plantation activities were discouraged due to lack of proper market in the area. Therefore assured market opportunities, if provided to the farmers, can rejuvenate the area. In Gujarat, all the farm forestry plantation crops are kept free from any govt. control, like felling or transit rules. It is also one of the motivating factors for the farmers to opt for plantations for better returns.

- ♦ Greenply has started a well-planned program here in the catchment.
- ♦ Developed a demonstration plot having Eucalyptus, Subabul and Melia dubia in and around 10 acres of area, along with a clonal propagation centre.
- ♦ Provide market opportunities to local farmers by purchasing the local available wood.
- ♦ To have buy-back arrangements with the farmers, intend to go for plantation of short rotation crop with the help of social forestry wing or by their own.
- ♦ The social forestry wing of the forest department provides support and seedlings for the farmers to go for plantations.



3. Unit Kriparampur- West Bengal

In West Bengal, we intend to go for plantations to develop suitable species, according to our need and agro-climatic zone.

We have four zones to work –

- First, Nearby factory,
- second -Nadia, 24 North Paragana;
- third – Bankura, midnapore area;
- Fourth – Baripada area in Odisha;

The suitable species are –

- Lambu – (KHAYA)
- Melia dubia,
- Siris,
- Eucalyptus,
- Kadamb,

The target is to go for around 250 -300 acres of plantation every year.



Clonal propagation centre at Rajkot for quality saplings

Eucalyptus with cotton as intercrop



Our farmer getting Award from Gujarat Forest





4. Unit – Sandila – Uttara Pradesh

The unit is under Establishment under our subsidiary. Greenply has started plantation even before the establishment is completed.

Keeping in view the following prevalent prominent factors-

- ♦ Land availability for plantations- a main constraint.
- ♦ Prevalent agro forestry plantations practices,- bund plantations.
- ♦ Good level of awareness amongst the farmers in U.P.
- ♦ No restriction of felling and transport of Eucalyptus and other agro forestry produces .
- ♦ Suitability of species for plantations and its natural adaptation.



- ♦ Restricted availability of good planting material.
- ♦ We are arranging the quality planting material to the farmers .

These saplings will be distributed within 50 KMs radius of our plantation with the intention to increase availability of raw material in the plant vicinity, reduce logistic cost and improve productivity by double in compare to normal seedlings of the nearby farmers

5. Vadodara – New MDF Plant

We are in process of establishing a new MDF unit in Vadodara district of Gujarat. This is the potential catchment for agroforestry in the Gujarat. Adopting the best possible approach. Greenply has taken up the plantation, prior to establishment of the MDF project, well in advance. Greenply wants to maintain the plantations equivalent to more than 3 times of the requirement , and steps are taken on the ground.

During current year we have ensure the planting of around 9 Million clones and good quality seedlings covering around 11000 acres of area under plantation, , sufficient to meet our entire requirement of raw material on maturity. The rotation normally here is 3-4 years.

In order to have quality seedlings arrangements are made to supply quality seedlings at the nearest point to the farmers The philosophy is very clear to grow together and become self sufficient in fibrous raw material as sustainability is no more an option but imperative in Greenply.



6TH INTERNATIONAL CONFERENCE ON LAMINATES

Strength of Unity

Indian Laminate Manufacturers Association (ILMA) is nonprofit making organization of manufacturers of Decorative and Compact laminates or high pressure laminates, Particle Boards, Plywood and Pre-lam (Short Cycle Laminates). It is the only registered association of the laminate industry at national level and we are proud to complete 20years since 1998. More than 140 manufacturers of Laminates of India are the registered members of ILMA.

ILMA is a place where companies collaborate to get more opportunities to grow their business. ILMA is a symbol of Indian Laminate Manufacturer's unified commitment to provide seamless & world-class decorative surfaces. ILMA assembles its manufacturers on a unified platform & voices out its fair opinions. It unanimously provides a healthy competition, creating great opportunities by using different strategies and combining the views of the manufacturers.

Key Achievements

1. Organized six International Conference on Laminates between 2010 to 2018
2. ILMA Institute of Technology to enhance production capabilities of members employees
3. Restrict import of low quality laminate
4. Study on Cleaner Production
5. Launch of Technical book on laminate
6. Catalogue shows at National and International Level
7. Launch of awareness video on Laminate application
8. Networking with members for raw materials, production, market and government policy related issues
9. Export incentive benefits to laminate exporters
10. Support to PM Cares fund during pandemic

Upcoming Events

1. 7th International Conference on Laminates during Delhi wood March 2021
2. Catalogue show at Interzum, Germany 2021
3. Online technical workshop on production and environment aspects during October 2020.
4. Environment clinic with Pollution control board (December 2020)

FOR REGISTRATION

Contact us on +91 9904125666/ +91-79-400 53443
Write to us at ilma@live.in
Join us on [Facebook.com/ilma.org.in](https://www.facebook.com/ilma.org.in)
Visit our Website www.ilma.org.in

REACH OUT TO US AT

INDIAN LAMINATE MANUFACTURERS ASSOCIATION
Regd. Office:
301, ILMA, Shubham Complex, Nr. Vastrapur Lake, Opp. Sanjeevani Hospital, Vastrapur, Ahmedabad, Gujarat, INDIA 380015.

Emerging Trends in Wood Science and Technology Research in India: Relevance and Applicability of Research at the Industrial-Scale Needs

Forest Products Research in India is mainly happening in the discipline of Wood Science and Technology (WST). Collaborative interdisciplinary research by Biologists, Material Scientists and Technologists are happening in this discipline, mainly in the R & D institutions of the Indian Council of Forestry Research and Education (ICFRE) - in the Institute of Wood Science and Technology (IWST), Bengaluru and at the Forest Products Research Division of the Forest Research Institute (FRI), Dehra Dun, followed by the major non-ICFRE institutions like the Indian Plywood Industries Research and Training Institute (IPIRTI), Bengaluru and at the Wood Science and Technology Division of the Kerala Forest Research Institute (KFRI) in India. Contributions of other institutions and University Departments engaged in research in this line are not significantly large, strong or integrated ones enough to compare with the outputs of the above major dedicated institutions and hence is not attempted; however, they are not counted as individually insignificant. Outputs are, in general, worth to classify in the two directions of the following type:

- ♦ Developing/appropriating (innovative) technologies for process/products for better utilization of the resources
- ♦ Generation of data on variation of growth/yield and wood properties-end use correlations related to (production) forestry/Agro Forestry (AF) for genetic improvement of trees for better wood quality

While research in the former direction directly benefits the wood-based industries, the latter indirectly benefits the industry by way of supporting to develop better wood raw material resources of improved quality. Forest Products Research in Wood Science and Technology (WST) in the country at present is focussed in the following areas:

T. K. Dhamodaran

Chair of Excellence (Forest Products), ICFRE
Institute of Wood Science and Technology, Bengaluru 560 003.
Email: tkd.icfre@gmail.com

- ♦ Generation of database on wood properties of lesser known and plantation grown timbers including bamboo for property-end-use correlations and as a tool for genetic improvement of trees for future plantation purpose
- ♦ Wood biodegradation – fungi, insects/termites, marine borers – Natural durability
- ♦ Grading of timber, assessment of product performance parameters
- ♦ Value-addition, classification and grading of timber for different end uses
- ♦ Development of non-destructive testing (NDT) methods
- ♦ Developing techniques for overcoming residual growth stresses in logs
- ♦ Wood Preservative Treatment for enhancing durability of timber - Eco-friendly preservatives and treatment methods
- ♦ Thermal and Chemical Modification of Wood for improved dimensional stability and durability
- ♦ Wood Protection from biotic and abiotic agents and weathering - Surface Coatings
- ♦ Timber Seasoning – Dehumidification, vacuum & solar drying - Appropriate seasoning techniques for plantation timbers
- ♦ Use of thermal storage techniques in enhancing the utility of solar timber drying kilns
- ♦ Evaluation of Woodworking and Finishing qualities of Indian timbers
- ♦ Wood Adhesives
- ♦ Reconstituted Wooden Panel Products from plantation species and invasive species
- ♦ Development of Wood Polymer Composites

- (WPCs)
- ♦ Finger-jointing for reduction of wastage in processed wood
- ♦ Bamboo Lumber
- ♦ Nanotechnology in Wood Utilization - Nano Wood Composites, Wood Coatings, Transparent Wood
- ♦ Technologies for use of secondary and plantation grown timbers
- ♦ Finding uses for lops and tops -wood waste for value addition
- ♦ Conducting PG and Doctoral courses in WST
- ♦ Extension, Training & Outreach Activities – Transfer of Technology – Catering the training needs of the woodworking industry sector with an aim to aims to enhance skill in woodworking to attain global competitiveness by using state of the art machineries.

Among the Bamboo Technology, the following areas are found active:

- ♦ Develop & promote engineered bamboo products (panels, flooring, and structural material)
- ♦ Establish primary processing centres, improvement of machinery, tools and related technologies for training and livelihood improvement
- ♦ Using bamboo for low-cost housing constructions
- ♦ Establishing certification and grading standards for bamboo and bamboo products
- ♦ Design Interventions for improving the quality and diversity of bamboo products
- ♦ Designing equipments for fast and economic harvesting of bamboos
- ♦ Preservative treatment of bamboo to impart enhanced durability

The major areas of research in WST concerned with are:

- ♦ **Timber Mechanics, Woodworking & Finishing:** Grading of timber, assessment of product performance parameters; utilization of ultrasonic techniques for assessment of hollowness in standing trees; evaluation of woodworking and finishing qualities of Indian timbers; technologies for use of secondary and plantation grown timbers; finger-jointing for reduction of wastage in processed wood; wood adhesives.
- ♦ **Wood Preservation:** Field evaluation of natural durability of timber species; developing environmentally safe preservatives and treatment methods, penetration and treatability of various species; wood modification; nano-technology applications in wood utilization
- ♦ **Wood Seasoning:** Design, fabrication, installations and training on operations of timber seasoning kilns; dehumidification drying, vacuum drying, Microwave drying, and solar drying of wood and bamboo; drying behaviour of timber - drying schedules; use of thermal storage techniques in enhancing the utility of solar timber drying kilns
- ♦ **Wood Composites:** Reconstituted panel products from plantation species and invasive weeds
- ♦ **Bamboo Technology, Usage and Industry:** Develop & promote engineered bamboo products like panels, flooring, and structural material; establish primary processing centres for improved machinery, tools and related technologies; using bamboo for low cost housing/ constructions; establishing certification and grading standards for bamboo and bamboo products; improving the quality and diversity of the design and uses of bamboo products; designing equipments for fast and economic harvesting of bamboos; and refining preservative treatment of bamboo for enhanced durability.
- ♦ **Cellulose & Paper:** Evolving the efficient and economic process for preparation of easy bleaching pulp; suitability of tropical hard woods for paper making; Agriculture residues, grasses and plantation of fast-growing species of hardwood for pulp and paper; developing high yield pulping process, improving of high yield pulps, bio-degradation of lignin; beater/wet additives; Development of specialty paper; and Conducting pilot plant trial runs on papermaking.

An analysis of the emerging trends in the Forest Products Research (FPR) in the WST Discipline in the country is attempted to assess the relevance and applicability of research at the industrial scale needs. For this, simply, we have to determine where we are now, where we have to go and for what purpose, and whether the route needs correction etc.

Emerging Trends in WST Research in India

Raw Material Level

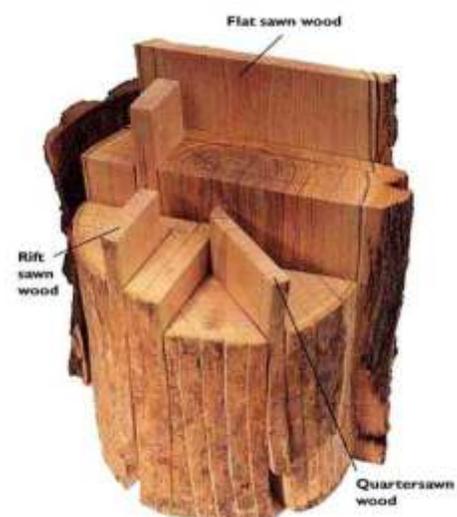
It was the nature of available wood raw material at the time makes the sphere of FPR to develop appropriate processing practices, plant and machineries and design of products and its manufacturing as demanded by the markets of the time. From the R & D efforts appropriate for utilization of large-sized wood of traditional timbers like rosewood, ebony, teak, shisham, and other forest grown timbers at the beginning, for all solid wood using sectors; later, a time has reached where R & D efforts in wood utilization is shifted first to selected plantation timbers and then to alternative non-conventional timber resources such as the rubber wood, coconut wood, bamboo and rattan. Present emphasis is on timber from Agro Forestry (AF)/Tree Outside Forests (ToFs), as it is the present major source of timber for Wood Based Industries (WBIs).

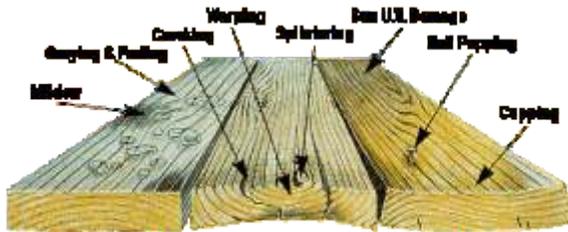
Generating data on wood properties for better and appropriate end uses for conservation of natural resources remains to be the beginning step for better wood utilization, followed by research and development inputs for better processing and diverse product development and transfer of technology. Techniques for overcoming residual growth stresses in logs in fast grown plantation species while in sawmilling as well as to avoid development of drying stresses and consequent drying defects in wood were looked into. Primary conversion and sawmilling field are getting changed in terms of modern sawmilling machineries for better output of sawn timber.

Wood Property - end use correlations of different timber species were generated and tree improvement programmes for better wood quality were facilitated, especially for timbers of high demand for construction, furniture and panel products, pulpwod, etc. About 450 timber species

have been evaluated for their physical and mechanical properties which forms the basis of their classification for various end uses. This data is published in various Indian forest records and as research articles. Traditional, alternative, and secondary as well as plantation grown species suitable for various end uses are suggested.

Maximum recovery from logs, especially from the low girth plantation timbers, is always the objective of Sawmilling studies. Developing appropriate sawing methods for species with high growth/drying stresses which could induce defects (like Eucalypts) - to reduce wastage of wood - was another objective in sawmilling research. Strain indicators are developed which can measure growth strain non-destructively, made it possible to assess the growth stress in highly stress sensitive plantation species like Eucalypts and made it possible to identify low-strain clones for solid timber production. Adoption of radial and balanced tangential sawing yields planking materials that can be seasoned almost free from surface cracks and warp. The major problem of this distortion-degrade has been solved by adopting Saw-Dry-Rip (SDR) method of sawing and high-temperature seasoning. SDR have enabled Poplar (*Populus spp*) to be commercially used widely for several value-added products such as pencil making, doors and window shutters, light furniture and for making quality packing cases etc.





Finger Jointing Machine by OEM

For the processing of harvested timber, we had appropriate sawmilling techniques, machineries and information about appropriate sawing patterns for better yield coupled with high quality sawn timber. Primary and downstream processing machineries of different brands with widely varying qualities were being produced by the original equipment manufacturers (OEM) in the related engineering industry. Machine design and manufacturing is not a part of FPR in India due to the inherent weakness in OEM in the country's forestry sector. As traditional machineries in wood processing were all designed for the processing of large to medium diameter timbers, and as the situation has changed demanding the processing of small diameter plantation timbers for various purposes, especially for the plywood industry, IPIRTI is now reported to be strengthened for providing appropriation of machinery and lay out and consultancy for this purpose. Processes such

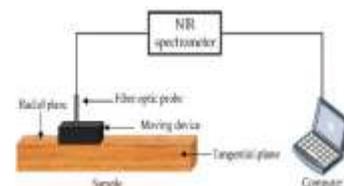
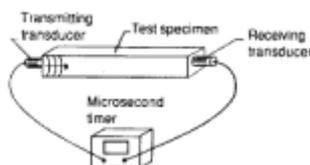
as long-term storage and steaming for the alleviation of growth stresses were identified for the efficient utilization of such species.

Use of *Non-destructive Testing (NDT)* Methods Near infrared (NIR), Infrared (FTIR), UV-visible reflectance, UV resonance Raman spectroscopy and fluorescence spectroscopy and ultrasonic NDT techniques were standardized to study chemical changes in wood, species identification, testing for defects (hollowness), etc. in timber and bamboo.

Product Level

Wood Fuel & Waste utilization:

The primary use of wood for fuel/ energy; even though now also a significant quantity of wood is used for fuel purpose, a significant reduction in its household use is happened due to the convenience of LPG that has adopted in majority of houses of the middle-level income. Now, wood and related agricultural lignocellulosic wastes are getting converted to wood briquettes as feed stock for biomass power generation industry, boiler industries and other industries requiring biomass for meeting the energy demands. High density fuel briquettes were successfully prepared using invasive forest weeds, Lantanacamara and Prosopis juliflora biomass using an industrial briquetting machine. The briquettes were found to have high energy density with the low ash content of less than 2% gave added advantage for the bio-energy/fuel sector. Charcoal making from waste wood and bamboo along with coconut shells is prevalent now also, as an industrial raw material. Charcoal of brittle nature/poor hardness is used to be converted to briquettes. Charcoal being the raw material for the further value-added product, activated carbon of great value for industrial uses, high quality charcoal of good hardness was converted to granular active carbon also. From the polluting batch process of earth pit to drum to kiln methods of traditional charcoal production, improved pollution-free continuous production methods have been



developed for charcoal production at an industrial scale. Appropriate technologies for the community-based organization (CBO) level production of active carbon were developed by down-scaling the traditional large scale rotary kiln method of physical activation process of production of granular active carbon to medium scale rotary fluidized bed reactor technology.

Solid wood products:

The profuse utilisation of wood in products such as building components, furniture and other domestic utility products as thick sized members is now out of date due to the scarcity and cost of traditional timbers; design interventions facilitated the use of minimum timber satisfying structural stability. From the primitive harvesting and processing machineries, tools and equipments, step by step modernization to the extent financial resources permits and by considering the sustainability principles, introduction of more and more mechanization is the trend of the time which had the advantages of keeping the dimensional qualities along with improved finish for maintaining enhanced aesthetics fetching more domestic and export market and profitability. So far, improvement and development of heavy processing plants and machineries/ equipments are not formed as an integral part of the forest product research sector in the country; rather they are the concerns of the OEM (original equipment manufacturers) of the mechanical engineering industries. FPR sector is often concerned with developing processing technologies only. It is likely to continue this trend and is preferred also due to various reasons of lack of concerned expertise and facilities in OEM in the forest products research sector of the country. Similar is the situation in bamboo and rattan processing and utilization sector as well as in the wooden furniture and handicrafts sectors. Minor sectors like the wooden toys, pencil and match splints manufacturing sector are reported to be suffering from the shortage of traditional raw materials and are now looking for research inputs for finding out the alternative from plantation species which could be made available from the



Agroforestry or ToFs. All these industries are having ideas of its mechanical facilities requirements; rather, they are looking for trial scale commercially validated suggestions on the suitability of alternative plantation timbers, for which the present Indian forest products research community needs to find answers. Suggestions available from laboratory research needs to be translated to industries through pilot scale validation researches.

Preservative and Fire-retardant Treatments and Surface Protection Coatings:

As usual, later, diverse products were started manufacturing from selected plantation and other secondary species which includes some species of low durability and perishable timbers too. With this situation, studies on wood properties - end use correlations and its variations due to species, site, growth and even within species so as to facilitate appropriate species-specific utilization along with the chances for tree selection to the later implementation of tree improvement programmes (genetic) which are important for developing plantation forestry. Requirements of durability enhancement for the less durable and perishable timbers when used in product manufacturing called for R & D inputs in preservative treatment which started with the development of traditional CCA (copper - chrome - arsenic) formulation, followed by the replacement of arsenic with boron (CCB) for more environment-friendliness; the use of these fixative chemicals for pressure treatment of structural timbers, especially for outdoor uses. The primitive use of creosote for the treatment of railway sleepers were discontinued, as the use of wood is slowly got withdrawn from this sector. Similar was the case with CCA treatment of power transmission wooden poles used. A lot of research in preservative treatments for catamarans and its effect on marine waters were conducted, but later the field was saturated and much use of the efforts were not field-absorbed and further inputs were stopped for the time being in the country. The use of perishable timbers for indoor furniture and panelling products called for the use of preservatives of low mammalian toxicity and low cost. The use of boron, with formulations of boric acid and borax, initially with the incorporation of 0.5% sodium pentachloro



phenate (NaPCP) as a powerful antisapstain fungicide, especially for the utilization of highly perishable timbers like rubber wood, was established; however, the use of NaPCP, as later found not environmentally friendly, got slowly withdrawn from the field. Treatment methods of dip diffusion appropriate to rural scale handling of limited quantity of timber to the commercial/ industrial scale treatment process of vacuum – pressure impregnation (VPI) suitable for handling large quantity of wood within short time were standardized and the treatment schedules and other parameters were optimized. Later efforts to develop more eco-friendly preservatives led to the formulation of a zinc – boron – copper, 'ZiBOC', by FRI, Dehradun and is recently approved by the Bureau of Indian Standards (BIS) for commercial application. However, adequate information on the VPI treatment schedules appropriate to various species and different preservatives for achieving the desired retention levels with respect to Indian Standards are still scanty. Even though various other types of preservative chemicals/formulations of waterborne or oil soluble compounds are known in the scientific world, none are in effective commercial use presently in significant quantities other than the boron compounds (boric acid- borax formulation & CCB) due to reasons of price and eco-friendliness. Easy availability of ZiBOC is still an issue for its wide level commercial trials. Glue line treatment for plywood protection is also progressing in the similar line with similar preservatives as that is used for the solid wood sector. Limited research in using natural products such as oils of *Pongamia pinnata*, *Jatropha curcas*, *Simarouba glauca*, Cashew Nut Shell Liquid (CNSL) and Neem oil as well as bark and heartwood extracts is also getting experimented even though its industrial potential are limited and yet to be assessed in detail.

Many times, a proven wood preservative chemical cannot be used for treatment of impermeable species due to constricted capillaries in wood and the bigger



size of the molecules of the preservative chemical. Nano-sized molecules are able to penetrate timber through and through with less efforts and time. *Hevea brasiliensis* (Rubber wood) specimens treated with Nano zinc oxide by pressure and non-pressure methods showed that it is well absorbed by the wood specimens and gets fixed (92% fixation in leaching experiments). The efficiency of Nano zinc oxide against termites in the field, and brown rot and white rot decay fungi in the laboratory was evaluated and compared with normal zinc oxide. Nano zinc oxide showed more antifungal property than normal zinc oxide. The pressure treated wood specimens were found to be in sound condition against termites after 24 months of field exposure. The study reveals that Nano zinc oxide could potentially be used as an effective wood preservative. Making use of nano-material embedded eco-friendly wood preservatives and surface protection in coatings (photo-stabilization/ surface protection coatings) (e.g., with Nano zinc oxide/ Nano titanium dioxide) is a modern trend in the forest products research; but its techno-economic viability and environmental (health related) implications has yet to be ascertained. Photo-degradation of soft and hardwood surfaces has been carried out under artificial accelerated and outdoor natural weathering conditions. Nanoparticles based wood coatings for outdoor applications were studied. A method of dispersion of nanoparticles in polyurethane based on functionalization of the nanoparticles with 3-glycidoxypropyl trimethoxysilane (GPS) was developed. Surface modification of Nano-particles with GPS was very effective in avoiding agglomeration of the particles. Dispersion of zinc oxide nanoparticles in polyurethane clear coating significantly restricted the colour changes and photo-degradation of wood polymers. UV resistance of rubber wood surfaces could be significantly improved by UV coating containing TiO₂ Nano-particles. But, instead of the easily treatable rubber

wood, some difficult to treat (refractory) timber could have been experimented for better reliable and useful indicative results!

Colour changes of wood surfaces caused due to exposure to UV irradiation were correlated with the degradation of lignin. Effect of extractives on photo-degradation has also been studied for arriving out remedies.

Modern non-conventional/non-toxic wood preservation methods such as the chemical and thermal to hydro-thermal modification of wood employing various types of chemical methods such as acetylation, benzylation, furfurylation etc. for the chemical modification and employing heat treatment and/or steam for the thermal and hydro-thermal modifications respectively were attempted. Eco-friendly thermal processing is found enhancing the

dimensional stability and durability of wood for flooring application. Thermally modified wood is reported to be extremely suitable for the materials of very high dimensional properties desired for mass timber construction elements. However, the technologies of thermal and chemical modification of wood are still remaining in the shelves due to lack of pilot scale manufacturing and testing in the country. The concept of mass timber construction itself is in infant stage in India, due to lack of designing, testing facilities and non-availability of CLT and GLT wood material in required quantities. Entrepreneurship in manufacturing CLT and GLT in the country needs to be promoted. Modification of difficult to treat timbers by microwave technique for improving impregnation of preservatives was also attempted. These techniques, even though found very potential and the basics are

Wood Seasoning:

Use of properly dried (seasoned) wood being the most important concern in wood utilization for dimensional stability and durability of timber products, and as improper machineries and methods can cause severe wood loss due to defects development. Research in timber drying started with the most economic and energy saving air drying method, followed by the dry kiln method for comparatively fast drying with better control over drying defects through control over the drying temperature and humidity in the kiln chamber which is difficult to achieve in the open air drying in the atmospheric ambient temperature and humidity. As kiln drying requires artificial heat energy, the process is always expensive in terms of heat energy. Use of solar kilns for pre-drying timber was developed and the designs of solar kilns were continuously improved for tapping and storing solar energy more efficiently employing blackbody radiation techniques. Integration of hybrid solar thermal energy storage system in a booster reflector augmented greenhouse type solar timber dryer was developed.

Developments in vacuum drying led to products of superior colour and other qualities, though expensive. Fabrication and performance study of



vacuum-based convection-heated wood dryer for fast and efficient drying of Indian timbers were done and further design improvements were made for improved efficiency; . seasoning studies on important species of bamboos for handicrafts using dehumidifier and Vacuum kilns, vacuum press drying studies on Melia composite were successfully attempted.

Microwave drying is also developed for specialty products. Rationalizing kiln drying schedules for various species is always the need of the wood industries. Apart from the air and kiln seasoning, chemical seasoning was attempted for bamboos and found practically yielding better results. Machineries for wood seasoning, the dry kilns, of various capacities along with their associated steam boilers of various quality specifications are in wide use and take at least two weeks to get a charge seasoned. Therefore,; due to these reasons a greater number of kilns are essential for a mill depending on its flow of material and hence could be one of the top investment points in a wood processing unit.

developed, for want of pilot level testing before commercialization, industrial taking is still awaited in India. Our industries are importing modified timber for use in flooring, mass timber structures, etc. and have yet to get popularized due to reasons of cost and technology. Remedy for the reduced flexural strength while subjecting wood for thermal modification needs to be arrived at yet.

Effect of fire-retardant formulations (of ammonium sulphate, ammonium phosphate, zinc chloride, boron compounds, silicic acid and sodium silicate, and phosphoric acid) on glue shear strength of treated plywood indicated success in fire retardant tests and glue shear strength tests.

Reconstituted/ Engineered Wood Panel Boards:

The most popular forest wood traditionally used in India for making plywood, the most popular traditional reconstituted wood board product, is Gurjan; of course, along with other softwoods suitable for peeling. However, like all other WBIs sector, plywood sector, the strongest sector with around 3,300 units all over the country is shifted to the use of medium to small diameter plantation timber due to the shortage of traditional raw materials. Technologies were appropriated for the peeling of small diameter logs and spindleless peeling laths were introduced. Research inputs were mainly provided from the national level institute IIRTI, for reconstituted wood-based panel board manufacture sector. Unlike other forestry or forest products research institutes of the country, as this institution was originally tuned for and by the plywood industries of the country, a major share of its R & D contributions is of directly applicable to industries. Research for developing cost effective and eco-friendly glues/resins and panel products and testing for the quality assurance required as per the Indian and International Standards such as the CARB are the major concerns of this sector, which mainly IIRTI is handling to a significant extent. In order to reduce the pressure on timber, various institutions in the FPR sector in the country is doing research on developing improved technologies for the traditional panel products like particle boards and medium density fibre boards which could utilize



all lingo-cellulosic forestry as well as agricultural wastes; along with modern cutting edge engineering panel products like CLT, GLT (Glulam), LVL, Bamboo Lumber, OSBs, etc. This has to continue. Studies on the bending behaviour of glued

laminates from finger jointed sections of commercial timbers revealed the potential of *Populusdeltoides* in making laminated short beams. Suitability of Poplars for MDF boards was also ascertained. Particle boards and fibre boards using lop and tops of *M. composita* are being developed. *M. composita* is also found suitable for producing Indian Standard combi-ply. Investigations into the role of length to pitch ratio of finger profiles on the flexural properties of finger jointed sections suggested affecting the flexural properties only when similar tip thicknesses are used for joining the sections. Radio Frequency curing of adhesives in manufacturing of plywood is also attempted. Application of nanotechnology in panel research field lead to reveal the effect of Nano-clay as filler on physical and mechanical properties of plywood. Pilot scale facilities for de-structured bamboo board manufacturing were arrived at and its trial for technology was demonstrated at FRI. Studies on the effect of Nano-clay as filler on physical and mechanical properties of plywood have arrived at products of improved physical and mechanical properties.

Emission of formaldehyde from wood composites (particle boards, plywood, etc.) is a cause of major concern from environmental point of view because it is harmful for human health. Efforts are on in minimizing such emissions throughout the world.

Particle boards made from *Melia dubia* using urea – formaldehyde (UF) resin with different proportion of a chemical scavengers, ammonium bicarbonate and sodium metabisulphite were found very effective in reducing formaldehyde emission to acceptable limits (EI class - <8 mg/100 g)) without affecting bond strength.

Wood Polymer Composites (WPCs):

For utilizing the various types of lingo-cellulosic resources which are otherwise not suitable for meaningful end uses, modifying their properties by making composites with synthetic polymers resulting products with superior properties desired for various end uses were initiated. Use of wood fibres in thermoplastic composites, lignin filled thermoplastic composites, bio-composites from engineered natural fibres, polymerization filled composites, wood-fibre plastic composite foams with improved cell morphology by continuous process, development of bamboo fibre filled thermoplastic composites. etc. are of current fields of activities in the wood composite research sector. The potential of composite boards over solid wood as better sound absorbing materials is also revealed recently.

Use of synthetic polymers has grown tremendously because of the capability to mould these thermoplastics into complex shapes and engineer desired properties into them. However, plastics have poor mechanical properties, e. g., stiffness, bending strength, etc. To improve the mechanical performance and to reduce the cost, plastics are often reinforced by fibres or particles. Glass and carbon fibres are most commonly used reinforcements for thermoplastics, but are expensive and their production is highly energy intensive. Today, Natural composites are fast emerging as a realistic alternative to glass fibre reinforced composites. Advantages of wood fibres as a reinforcing element for thermoplastics arise from the fact that they are light weight, non-corrosive, and less abrasive to processing equipments. Because of low density of plant fibres, a wood fibre reinforced product will always be thicker and hence stiffer than the one reinforced with the same mass of glass or carbon fibre. Non-abrasive nature of natural fibres permits very high volume of filling (up to 70%) in the

composite. Higher filler content will reduce the amount of more polluting polymers used in a given component.

Further, high specific strength and modulus, low cost, and availability in most geographic regions make wood fibres even more attractive as fillers. The compact design of biological fibres introduces an element of redundancy which is very desirable from the safety point of view. Natural fibres are carbon dioxide neutral in their production (they derive carbon from air and not from oil or natural gas) and require only small energy inputs for processing. Natural fibres cause less dermal and respiratory irritation, and are more pleasant to work with than glass fibres. Despite of all the advantages mentioned above natural fibres are less frequently used to reinforce common thermoplastics such as polyethylene, polypropylene, polyvinyl chloride, and polystyrene because of difficulties associated with surface interactions between hydrophilic wood fibre and hydrophobic thermoplastics. Such divergent behaviour results in difficulties in compounding these materials, and poor mechanical properties of the end product. A survey of literature reveals that adhesion and chemical affinity between cellulose and polymer matrix can be improved by using coupling agents, which can react with both matrix polymer and reinforcing fibre.

Natural fibre as reinforcements for both thermoplastics and thermosets are one of the fastest growing types of additives in plastics. Conventionally in India, fillers such as clay, calcium carbonate, aluminates, silicates, etc are used to reduce the cost and to improve stiffness of thermoplastics. As on now, natural fibres filled plastics are not commercially popular in India. The technologies used abroad are expensive and often not suited for machineries, production practices and raw materials available locally. Systematic studies to improve the interfacial adhesion between natural fibres and matrix materials, to study natural fibre filled composites, a 28mm co-rotating intermeshing twin-screw extrusion system was developed by the ICFRE research efforts. The system is equipped with two volumetric feeders and a twin-screw side feeder. Studies on processes optimization have been completed, and this enabled to constitute a screw-profile for homogeneous dispersion of fillers with

least degradation of matrix resin and wood fibres.

The study on wood polymer composites has shown that biological fibres and synthetic resins like polypropylene and polyethylene can be combined to make composites that are equally strong, but environmentally friendly. By using a suitable coupling agent, it is possible to produce advanced composite materials that take advantages of both natural fibres and synthetic resins. A novel vinyl monomer with isocyanate functional group was synthesized. The maximum grafting yield achieved in this new coupling agent is ~9% as against 1-2% reported for maleated polypropylene. The functional group in this coupling agent gets grafted as single monomer unit without any oligomerization, which further improves its efficiency as coupling agent. Also, the isocyanate group of this coupling agent is less reactive to water, this is very important, as side reactions with residual moisture in wood can be avoided. Thus, this new coupling agent has proved to be superior than most of the commercially available coupling agents. Complete characterization of the composites were made. Mechanical properties, chemical ultra-structure, water absorption, thermal behaviour, non-destructive evaluation of mechanical properties and damping behaviour of the composite materials have been systematically studied. The study provides complete understanding of the material. In conclusion, the coupling agent synthesized proved to be a much superior than those reported in the literature. Addition of wood fibres at all levels leads to significant improvement in stiffness, tensile strength and flexural strength with some loss of impact strength.



Developments in Nano-technology have been made use of for the preparation of Nano-cellulose filled and other biodegradable composites for packaging. Development of transparent wood composite and evaluation of its properties has been successfully attempted and the results are in the process of pilot scale testing. Role of Nano-fillers in wood composites and finger-jointed solid wood were also reported to be studied. Nano cellulose filled starch-based composites led to the development of completely bio-degradable composites by blending TPS with poly lactic acid (PLA) along with the fillers in different proportions. Value-addition of low-density woods by producing Nano-wood-composites (NWCs) with enhanced properties for high-end applications was investigated. Three low density wood species, viz., *Maesopsis emini*, *Ailanthus excels* and *Melia dubia* were impregnated with two resins (PF & U/Melamine F) blended with different proportions of clay and silica nanoparticles using vacuum - pressure technique for improving their various technologically important quality parameters. Density and strength properties of all the three woods were found to be improved by 15-25% and 30-55% after impregnation with resin-nanoparticle blends compared with untreated control. Similarly, a study on the role of Nano-fillers in composites and finger jointed wood revealed substantial reduction in curing time is achievable by radio frequency curing of Nano-fillers incorporated wood composites and finger jointed wood.



Recent Novel/Innovative Findings:

Nano-cellulose

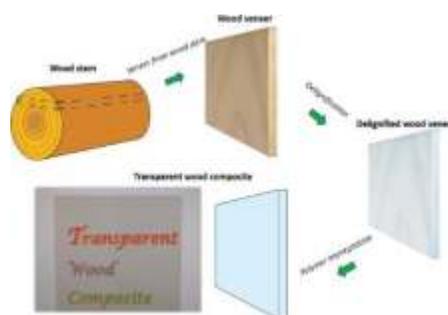
Research in developing Nano-cellulose Networked Natural Fiber Composites (NNNFCs) at IWST has arrived at in a protocol to synthesize Nano cellulose from pulp fibres; the technology was standardized and the unique property of Nano cellulose to form a complex network was effectively used to develop completely biodegradable natural fibre based composite material. The Nano cellulose film exhibited very high stiffness (storage modulus 120 Gpa.) and negligible damping coefficient. Composites with density ranging from 0.1 g/cc to 0.8 g/cc prepared by mixing Nanocellulose suspension with fibres showed increased tensile strength, flexural strength, dynamic modulus of elasticity and electrical resistance and these properties of the composites were found to be increasing with increasing density. The material can be tailored for the desired properties by varying the Nano cellulose proportion and processing conditions. The developed material can be used as biodegradable packing material.

Transparent wood composite

A flexible and biodegradable transparent wood was fabricated by using poplar wood veneer and water-soluble polymer - polyvinyl alcohol. The transparent wood exhibited high optical transmittance, high haze and light diffusion property. Optimization of lignin removal and bleaching process was carried out. Transparent wood composite (TWC) was prepared by infiltrating epoxy resin in the lignin modified wood.

Wood Adhesives:

Adhesive is a substance capable of holding materials together by surface attachment. Use of adhesive in wood bonding is an important means of improving utilization of wood and also other lignocellulosic materials. Adhesives play an important role in the wood-based panel industries and are backbone of panel industries. The use of right type of adhesive is very important from the point of view on the quality of the resin, products as well as its cost. The formaldehyde-based synthetic resin adhesives are more widely used and among them the



most important are, Phenol-Formaldehyde (PF), Resorcinol Formaldehyde (RF), Phenol-Resorcinol- Formaldehyde (PRF) resins; and among the Amino Resins, Urea- Formaldehyde (UF), Urea-Melamine-Formaldehyde (UMF) for bonding 'warm water resistant' (WWR) grade panels and Melamine-Formaldehyde (MF) for bonding Moisture Resistant (MR) grade panels have been developed. The MF – MUF resins possess better water resistance properties compared to UF resins, they are especially suggested for the manufacture of flooring tiles from bamboo, bamboo laminates and also for finger-jointing of saw mill waste timbers. The required percentage of hardener for cold setting at room temperature has been worked out. The process parameters for manufacture laminates/tiles like spread, assembly time, hot press temperature, pressure, and time have been optimized. Several protein and starch-based materials like tapioca flour, maize starch and maidawere in use up to 30% as extenders for UF resin adhesives for the manufacture of MR grade plywood. As the conventional UF resin when used for making panels releases excess formaldehyde to the atmosphere during the manufacture and use, amino resin with low formaldehyde releasing property were developed by employing suitable *formaldehyde scavengers/adsorbing agents* and the process parameters for resin manufacture and resin properties have been standardised. The UF and PF Resins suitable for pre-pressing techniques in panel making were also optimized.

The basic raw material for phenolic resin is phenol and formaldehyde which are of non-renewable petroleum origin. Due to the hike in the cost of petroleum, there was remarkable increase in the cost of phenol which influences the cost of phenolic resin adhesives and ultimately the product made out of it. The shortages and the price increase of the basic raw material has led to search for alternative lower cost materials based on non-petrochemical resources which can find partial or full substitution of phenol in phenolic resin adhesives. However phenolic resins are still used in large quantities for specialty grade of panel products. Studies on the analysis of formaldehyde emission in urea formaldehyde resin adhesive bonded wood particleboards have shown that formaldehyde content in the boards reduces gradually and attain the minimum level of 10 mg /100-gram board in about 90 days. The formaldehyde content seems to stabilize at this level.

Partial substitution of phenol in PF resin with naturally occurring renewable materials such as lignin, cardanol, black liquor, tannin and para phenol sulphonic acid were arrived at. Development of highly water-soluble phenol cardanol formaldehyde resin (PCF) to bond BWR and BWP grade panels was achieved through identifying a suitable de-foaming agent to reduce the foaming problems caused on high-speed glue spreaders has also been worked out. This resin is also suitable for paper laminates. Cost of PCF resin is cheaper by 25-30 per cent compared to conventional PF resin. Lignin - formaldehyde (LF) resin as a partial substitute for PF resin were also arrived at. Process parameters to obtain lignin were worked out. Methodology for the preparation of lignin-formaldehyde has been established. Encouraging results have been obtained by replacing 50 per cent of PF resin with lignin-formaldehyde resin developed. Lignosulphonate modified phenolic resins for bonding BWR and BWP grade plywood employing the commercially available lignosulphonates from pulp mills, modified to ammonium lignosulphonates. Technology has been developed wherein about 40 per cent of phenol and 30-34 per cent of formalin could be replaced with CSF in CSF-PF resin suitable to bond BWR and BWP grade plywood cost of resultant resin is reduced by around 40% in comparison with PF resin. The process for conversion of CSF into resin forming intermediates,

As much as 400- 600 per cent of mimosa wattle tannin extract on phenolic resin has been used to produce a strong boil proof bond with veneers of a number of wood species.

copolymerization of phenol with CSF resin forming intermediates and formaldehyde to form resin have been worked out. Adhesive composition has been developed. Process parameters for plywood manufacture bonded with CSF-PF resin have been optimized. Resin formulation for replacing 30 per cent of phenol by para phenol sulphonic acid in phenol formaldehyde resin suitable to bond BWR grade panels have been worked out and looks for upgradation in pilot scale.

As conventional PF resin cannot be used for bonding preservative treated veneers as this led due to bonding problems, suitable improved PF resin compositions for bonding preservative treated veneers have been developed. The process parameters for manufacturing the panels are standardized. The panels made using the treated veneers with improved PF resin finds wide applications for exterior grade plywood like marine and shuttering type. These products are termite and decay proof.

Adhesive formulations based on Phenol - wattle bark tannin have been developed for BWP grade plywood. As much as 400- 600 per cent of mimosa wattle tannin extract on phenolic resin has been used to produce a strong boil proof bond with veneers of a number of wood species. The process parameters for making the panels have been standardized. Press temperature required for the resin to cure is lower than that of the conventional PF resins. These adhesive formulations have been adopted in plywood manufacture. The direct savings in the cost of adhesive is 30-40 per cent. Fast curing PF resin adhesives for bonding higher grades of plywood has been evolved to reduce hot pressing cycles to almost 50 per cent to the existing practices. This enhances the total production and reduces the production cost. This can be achieved by using acid -alkali catalysed modified resin blended with Mimosa/Wattle bark powder, catalyst and hot-pressing cycles.

The process for condensing catechol with

formaldehyde was worked out. The process parameters for manufacturing the panels were optimized. The products confirmed to the requirement of IS 848 for BWR grade panels with respect to species of vella pine, pali, white cedar, and poon, whereas the strength properties were not met with respect to gurjan species. However, addition of ammonium maleate improved the glue adhesion strength properties with gurjan. Also, the catechol was tried as an accelerator for cashew nut shell liquid phenol formaldehyde (CNSL-PF) resin and CNSL Formaldehyde (CNSL-F) resin. The results have been encouraging for the manufacture of BWR grade panels. To overcome the problems of excess/free formaldehyde vapour and lesser pot life of the resin while using multivalent phenols for the resin formulation, optimized process conditions for the manufacture of BWR grade panels have been arrived at and the technology has been adopted by few industries for commercial production of panels.



Phenolic adhesive compositions capable of self-releasing (without the aid of releasing agents) for concrete shuttering plywood were also developed. Suitable room temperature setting phenolic-based sealant compositions were developed and introduced in the industry successfully. Putty compositions based on cellulose nitrate as well as UF-PVAc was developed which finds wide application for surface repair of plywood. Special adhesives for species refractory to bonding in plywood manufacture (such as kapur, oily keruing and chilauni) a resin system based on phenol and formaldehyde has been developed and adhesive formulation has been optimised and the process parameters are worked out for achieving good bond strength. Suitable PF resin for bonding Bamboo Mat based Composites has been developed. Process parameters for mats dipping, moisture content, assembly time and hot-pressing schedules have been optimized. Efficient phenolic resin system has been developed for bonding rice husk particle boards. The process for making particles, resin application system, mat forming system have been worked out. The resin system developed is less expensive as they

are based on naturally occurring phenolic materials. Cardanol substituted phenolic resin was developed to bond chir pine needle particles. The process parameters like moisture content of glued particles, assembly time, mat formation and hot press schedules have been worked out to manufacture grade II chir pine needle particle board.

Non-Conventional Alternative Timber Resources

Rubber Wood:

Rubber wood is a perishable, light to moderately heavy class timber with an average basic density of 550 kg/m³ at the after slaughter tapping felling age of 25-30 years. Mechanical properties of rubber wood were found comparable with those of other conventional timbers. Discoloration due to the attack of the sap stain fungi, mainly from *Botryodiplodia theobromae*, immediately after felling the trees and attack of insect borer beetles, mainly from *Sinoxylon anale* in dried material are found to be the major problems in the commercial utilization of rubber wood in India, especially in Kerala which is rich in rubber plantations requiring clear felling after slaughter tapping and optimum utilization of this non-conventional timber resource is very essential. Even though being not much eco-friendly friendly chemical, Sodium pentachloro phenoxide (NaPCP) remains to be the best among the different mouldicides for effective sapstain control. Among the attempt to hunt for alternatives to NaPCP, formulations of alkyl ammonium compounds are reported to be potential candidates. Traditional utilization of this perishable was limited for fuel wood and short life packing material. As value-added utilization of this non-conventional alternative timber resource will help to reduce the pressure on forests and costly plantation timbers, preservative treatment technologies were appropriated and standardized for enhancing the durability of timber for commercial scale industrial use in furniture and fixtures, panel products, etc.



employing eco-friendly and cost-effective preservative formulations of boron compounds. Simple dip diffusion treatment appropriate to rural level applications were standardized with respect to the treatment for various thickness of sizes. Application of end-coats with preservative formulations immediately after felling and cross cutting the logs, immediate conversion to sawn sizes followed by simple dip diffusion treatment in 10% boric acid equivalent (BAE) formulations of boron preservatives is suggested; duration of dipping with respect to various thickness of sawn sizes and diffusion storage time for getting the preservative evenly distributed within the treated timber were detailed. This was of great importance for offering protection to rubber wood-based packing case industry in the State, especially suitable to the rural context as the method has the advantage that it does not require any sophisticated or expensive plant and machineries and skilled operators. An economical and energy saving pressure treatment schedule for commercial scale vacuum-pressure impregnation (VPI) treatment of rubber wood for industrial use was developed and transferred to wood-based industries. Repetition trials with varying parameters such as different chemicals, concentrations, moisture levels, thickness of sizes, different schedules of vacuum and pressure application for different lengths of time (schedules) in pilot-scale as well as commercial-scale trials in industrial plants and the achievement of desired dry salt retention (DSR) as specified by the relevant Indian Standards, was confirmed in each and every case; the data thus generated gave enough confidence in facing any issues in rubber wood protection. This was of great benefit to the development of rubber wood-based furniture and panel board industries. The way to couple quality with production in the utilization of rubber wood is prescribed. An Indian Standard (IS 14960: 2001-Reaffirmed 2012) on 'Specifications on preservative treated and seasoned sawn timber from rubber wood' is also issued by the Bureau of Indian Standards.

As storage of raw material for a few months is most likely required for running a medium to large-scale rubber wood processing unit, owing to its acute susceptibility to biodegradation, under-water storage is found to be the effective way to protect the

timber in storage for a period of up to four months without adversely affecting major mechanical properties and treatability. Chemical modification of rubber wood through acetylation, a non-conventional method of wood preservation, is also attempted and found yielding acetyl weight per cent gains (WPG) of 18-22, sufficient to offer protection from biodegradation. Anti-shrink efficiencies (ASE) in the range of 85-88% were achieved, indicating the excellent dimensional stability of the product. Acetylation, in no way is found adversely affecting the physical and mechanical properties of rubber wood to a significant extent so that the utilization value is affected. Medium density fibre (MDF) boards made with acetylated rubber wood fibres at an acetyl weight per cent gain of 14 is found producing boards with superior dimensional stability (ASE 94.8%) and the bending strength is found improved.

Coconut stem wood:

Basic information on some of the wood physical and mechanical properties, sawn timber output, calorific value and quantity and quality of charcoal was generated for the stem wood of senile as well as root-wilt diseased coconut trees of various age groups to be able to ascertain their utilization potential. In general, it was reported that root-wilt disease did not have any significant effect on shrinkage and physical and strength properties of the wood, yield and quality of wood charcoal, etc. Recovery of sawn sizes is significantly higher from non-diseased over-mature palms (26.5%) compared to that of wilt-diseased mature palms. (24.5%); it falls to 16.2-11.9 per cent for palms of lower age groups. Relationships between tree height and sawn timber output have also been arrived at for the palms of various age groups. Strength properties of stem wood from over-mature palms compare quite well with that of other locally available structural timbers. Fibre saturation point of



coconut stem wood is found to be around 23% and the green to oven-dry volumetric shrinkage as 9.6%. The mean basic density of the utilizable portion of the coconut stem wood is found to be in the range of 500-600 kg/m³. Wilt disease is found not imparting any adverse effect on strength properties; strength properties of coconut stem wood from over-mature palms compare quite well with that of other structural timbers. Stem wood from wilt-diseased palms of adequate density can also be used for construction purposes. Except for modulus of elasticity (MOE), either wilt disease or age did not have any effect on the different strength properties such as fibre stress at limit of proportionality (FSLP), modulus of rupture (MOR), work to maximum load (WML) or maximum compressive strength (MCS). Hence, except in case where MOE is critical, coconut stem wood of adequate density can be used as an alternative timber for structural applications. As far as fuel wood potential of coconut stem wood is concerned, the average calorific value of air-dry wood is found to be 16.3 MJ/kg and it compares fairly well with that of hardwoods. Upper half of the over-mature and mature palms and full length of young palms which have been affected by root-wilt disease could be used as a fuel wood of adequate heating value or converted into charcoal. Charcoal from coconut stem wood is of good quality, suitable for domestic purposes. Charcoal of 26-29% yield with fixed carbon content of 67-76%, volatile matter content of 20-30% and ash content of 1-5% can be produced using a portable type 'Tongan kiln' made from side cut abandoned oil/grease drums. It was also reported that either wilt-disease or age of the palms did not have any significant effect on yield and quality of charcoal. Being classified as a 'perishable' timber, coconut palm stem wood needs to be preservative treated before putting into uses. The treatability of sawn sizes of wood from wilt-disease affected coconut palms in comparison with non-diseased palms were investigated and found that irrespective of age, height level and disease, the timber can be easily treated either with copper-chrome-arsenate (CCA) or with boron chemicals to the required dry salt retention (DSR) specifications of the Indian Standards. Depending on the end-use, the type of preservative and method of treatment can be adopted. Treatment schedules for both non-pressure

and pressure treatment process were standardized for both rural and industrial scale applications.

Eucalyptus wood:

The utilization potential of the two most common pulpwood eucalypts, *Eucalyptus grandis* and *E. tereticornis* as plantation species is examined. Age appears to determine the pulpwood quality; wood density and extractive content are found to be the main criteria for assessing pulpwood quality of eucalypts of various age. Silvicultural practices aiming at faster growth or higher yield is found not adversely affecting the pulpwood quality. The variations in wood properties due to location are also found not significant so as to affect the pulpwood properties. The study promotes the extraction of *E. grandis* at the age of even 3 years for pulping. As age seems to be the most crucial factor that determines the pulpwood quality up to 9 years of age in eucalypts; wood quality attributes were significantly influenced by various factors such as clone, age, site/soil type, spacing, irrigation, etc. The undesirable defect features noted in eucalypts are largely when used as solid wood are kino veins, surface checks, end splitting and collapse during drying. These are reported to be effectively controlled by genetic manipulation in tree improvement programmes. No significant differences in timber strength of *E. tereticornis* between the wet and dry belt plantations nor between the high and low altitudinal localities of *E. grandis* plantations in Kerala were recorded. The effect of silvicultural practices on fibre properties, wood density and heartwood content in Eucalypts from intensively-managed short-rotation plantations were also reported. Treatment techniques were also standardized for timber from eucalypts (*Eucalyptus grandis* and *E. tereticornis*).

Sandalwood:

Possibility of using Shigometer for an early non-destructive diagnosis of sandal spike disease in the field was reported. Adulteration of Indian sandal wood (*Santalum album*) with the low quality and cheap African sandal (*Osyris lanceolata*) was made detectable by developing methods of identification through the combined application of morphological, anatomical and biochemical characteristics along with molecular markers (DNA based tool) to check adulteration.

Indigenous Less Known Wood Species:

The wood and bark properties of eleven selected tree species growing in Kerala were assessed and suggested for the acceptance of branch wood as additional raw material particularly in the situation of raw material shortage. Even though branches are not identical to stem in all the technical properties, the difference between the two is not so large as to treat the branch material separately in the manufacture of pulp, paper and boards. Branch diameter is the most important raw material quality parameter as it influences many properties like bark percentage, heartwood proportion, fibre length and wood and bark density of many species. Among the indigenous species investigated, *Dillenia pentagyna* is found merits attention in establishing plantations of long fibred indigenous species in order to meet the minimum long fibre needs of the paper industry. The challenges in the utilization of plantation grown timbers of Kerala were described. Natural durability of some selected commercial timbers of Kerala with reference to decay was reported. *Hopea parviflora*, *Mesua nagassarium* and *Vitex altissima* were found to be appropriate to include under the durability class, 'highly resistant'. Wood of *V. indica* is classified as 'resistant'. The natural durability of *Vepris bilocularis* were also studied by accelerated laboratory soil-block test method.

The management of short rotation *Acacia auriculiformis* for small timber and its sawn timber output was reported. Growth and wood properties of *Acacia mangium* was investigated. A mean annual increment (MAI) in diameter at breast height (DBH) between 3.6-5.7 cm and mean annual increment in height between 1.8-6.1 m shows that the species is fast growing in good sites and slow growing in poor infertile sites. *Mangium* trees at the harvestable age of 10 years are found to attain a height of around 26 m and girth at breast height (GBH) of around 112 cm with a basic density ranging from 425-575 kg/m³, comparable to rubber wood of 30-35 years. Even though a heartwood content of around 50% of merchantable tree volume is found available, a soft core-wood portion of around 7 to 14% of the wood volume; comparatively larger quantity than that of other common timbers, is found not suitable to include in sawn timber as it can cause drying defects. The wood exhibited only normal shrinkage in the

range of 1.2% for radial and 2-4% for tangential directions from green to air-dry condition. Reaction wood and heart-rot and is found to be serious problems in this species. Mean sawn timber recovery achieved was 45%. Strength properties of timber from 8-year-old trees were found in a lower range compared to rubber wood. The timber is 'light to moderately heavy' and only 'moderately strong', appears to be suitable for all uses of general purpose. The wood is non-durable, requiring preservative treatment before use. Harvesting at an age above 10 years is suggested for better physical and mechanical properties. Except in the cases of its growth, it appears to be not at all a 'wonder wood', as claimed by many of the private sector planting organizations.

Eucalyptus spp. and *Gmelina arborea* forming important components of Agro Forestry (AF) systems in Kerala were examined with a perspective to support the paper industry. Harvesting at young age might result in wood supply with moderate density, lower extractive content, relatively less number of kino veins (in eucalyptus), and thinner fibre walls with larger lumen which are desirable in paper industry. There is also an indication that faster growing trees yield longer fibre without seriously altering wood density. Silvicultural management and genetic manipulation would therefore, offer considerable promise for better yield and desirable quality of wood. As Kerala has a significant extent of cashew (*Anacardium occidentale*) plantations, the wood and bark properties along with defects like interlocked grain in cashew timber was looked into. Wavy grain in *Grewia tiliifolia* was explained. Data on wood properties, fibre dimensions and uses of 15 selected less-known fast-growing tropical hardwoods indigenous to Kerala were described. Anatomy of branch abscission in *Lagerstroemia microcarpa* was described.

Bamboo:

Bamboo being an important renewable, eco-friendly low-input, non-conventional/alternative raw material resource to wood for livelihood as well as industrial purposes; baseline data on the bamboo sector of Kerala were generated, bamboo research in India during the 1980's were reviewed and the status of technology related aspects were detailed. It is suitable for utilizing for handicrafts, furniture and utilities, panel boards, construction, etc., if properly

preservative treated, being 'perishable' in nature. Reeds (*Ochlandra travancorica*) are the major category of bamboos that are extensively used traditionally for pulp and paper, textiles, and for woven mat products and related panel products industry in Kerala. For the above purpose, it needs to be stored in bulk for long durations. Dinoderus beetles are reported to be the important insect borers that cause serious damage to reeds while in storage in Kerala. Appropriate storage practices were arrived at employing prophylactic treatments with born compounds. As under-water storage avoids the contact with deteriorating organisms such as insects and fungi as well due to the possibility of leaching out some quantity of starch, under-water storage was recommended as the cost-effective outdoor storage method, if running water facilities are available. Reeds can be stored without deterioration for even up to eight months under water or disinfectant/preservative solutions in case where running water facility is not available. Finished mats produced from preservative treated/under-water stored material are found continue to offer protection against fungi and insects during service. Under-water storage is found helping to reduce the starch content significantly due to the bacterial starch-amylase hydrolysis promoted by the microorganisms in the storage water (stagnant/running), thereby makes the under-water stored material less attractive to borers while in service. Contrary to the popular notion, any strong correlation between starch content and susceptibility of bamboo reed (*Ochlandra travancorica*) to powder-post beetle attack were not observed in a study conducted. Postharvest protection of bamboo from insect borers by a technique enhancing starch hydrolysis was investigated. Storage starch being the food to insect borers, an attempt to investigate the effect of starch hydrolysis while in storage due to amylase activity attributed to respiration in tissues of harvested and stored bamboos of *Bambusa bambos* and *Dendrocalamus strictus*, the two most common bamboo species of Kerala, was made and found significant reduction in starch content during a post-harvest period of the first 7-10 days. Therefore, it is suggested to store harvested culms under shade for 7-10 days than using them fresh. The use of bamboo for pulp and paper was reviewed in depth and the

KFRI report entitled, 'Bamboo for Pulp and Paper: A state of the Art Review with an Annotated Bibliography', was published by INBAR. Two decades of bamboo research in KFRI as on 2001 was also reviewed and published. The tangential shrinkage in bamboo is found poorly correlated with density. Shrinkage behaviour of bamboo is not well understood. Wood starts shrinking below the fibre saturation point resulting strengthening of the wood fibres accompanied by shrinkage. However, bamboo is found starts shrinking from green condition, even when the moisture content is in the order of 100-105%. So, the term, FSP is found not applicable to bamboo. 90 Per cent of the total shrinkage in bamboo takes place from green to air-dry condition whereas the same for timber is around 50-60 per cent. This indicates that if green bamboo is used in furniture and as structural material, shrinkage taking place after assembling will lead to major problems. How bamboo could shrink even at high moisture levels needs detailed investigation. All the available information on local tools, equipment and technologies for processing bamboo and cane in the form of an illustrated manual of great use to bamboo and cane industries and entrepreneurs were prepared and published. Bamboos suitable for cultivation in the region and use in the handicrafts were identified. The need for standardization of bending test procedures for bamboo was projected in relation to the existing Indian Standard method of tests for round and split bamboos for facilitating the arrival of a Bamboo Building Code. The concept was further verified by actual bending tests conducted on *Guadua angustifolia* bamboo in short and long round form as well as split form. Bending tests of round short specimens with span length in the order of 700 mm as is suggested in the Indian Standard IS 6874: 1973 is found not reflecting the true strength potential of bamboo in actual structural applications. Even though cumbersome, bending test data of bamboo is found needs to be generated by conducting the long span 4-point bending tests. Details on various methods of preservative treatment, depending on the moisture content and form (green or dry; round or split), end use (out door or indoor, ground or non-ground contact), and availability of infrastructure have been reviewed for treating bamboo. Treatment methods reported in

literature have been critically reviewed and pros and cons of each method have been highlighted. Methods for enhancing the life of bamboo in structural applications were also reported. Bamboo is found pressure treatable. An effective schedule capable for commercial scale pressure treatment of bamboo for industrial use was developed. Because of its structural and anatomical differences from timber (refractory nodes limiting longitudinal penetration, impermeable outer skin and absence of ray parenchyma cells limiting lateral penetration) effective preservative treatment of round bamboos, especially in bulk quantities within short time, conforming to Indian Standards remains a challenge. A novel concept expected to be capable to overcoming the problems in treating bamboos, 'shockwave-assisted preservative impregnation', was investigated and found to have great potential for achieving uniform and through and through penetration of preservative even in green round bamboo poles within short time. However, the required dry salt retention (DSR) specifications of the Indian Standards could be achieved only by employing treatment solutions of high concentration (in the range of 15% weight/volume). Application of shockwave was found not causing any visual damage or defect to bamboo; basic density is found not adversely affected. Further studies are suggested for developing an appropriate and convenient to operate treating equipment along with standardizing or optimizing the technology with process parameters. Colouring of bamboo slivers using natural dyes for handicrafts, mat weaving and basketry was also developed and the color developed was characterized by comparison with standard color assessment system.

Anatomy of 21 taxa of bamboos found in Kerala was reported. A high degree of overlapping of features between genera was recorded. There are no well-defined characteristics useful in diagnosing or delineating various genera. May be due to many of these limitations, species level identification of harvested dried and/ old/used bamboo through anatomical tools is found difficult and requires inputs for developing DNA tools for species identification and certification required for commerce. Anatomical changes during culm maturation of bamboo were also studied. Culm

maturation period was found to be 2 years for *Bambusa bambos* and *Denndrocalamus strictus*, the two most common and abundant species in Kerala. Storage metabolites in culm tissues consisted mainly starch, had found no direct relation with culm age.

Bamboo has been traditionally used as a house construction material by the middle and poor class in India, especially in the bamboo-rich Northeast States of the country. Realizing the potential of bamboo as a cost effective renewable low-energy embodied partial substitute for the conventional high-energy embodied building materials, a durable model bamboo house was constructed at the KFRI Sub-Centre campus in Nilambur, Kerala for demonstration of the best construction practices for using treated bamboo for affordable housing. This was the first of its kind in Kerala, as an attempt to improve the traditional indigenous knowledge on bamboo housing by incorporating modern concepts of architecture and civil engineering technologies coupled with cost effectiveness and aesthetics in designing bamboo houses appropriate to Kerala conditions.

A portable modular bamboo house made with bamboo ply-board was also designed, fabricated and installed at the KFRI, Peechi campus of the Institute. The 170 ft² area structure was designed for framing the bamboo ply floor, wall and roof panels with steel pipes or rectangular sections and the entire sections were hinged together so as to facilitate the packing of the unit as a rectangular box with the component sections itself (without using external packing sections). The structure developed was suitable for application in disaster rehabilitation, housing in ecologically sensitive forest and pilgrim areas where permanent civil construction is undesirable. The structure also permits the jointing of two or more units together. The experience gained showed the potential of further reduction in the weight of the portable house for enhanced portability and improving the aesthetics for better marketing by better designing and cost reduction while mass production. Both the structures was opened to the public and the press; awareness and publicity efforts were made on convincing the potential of bamboo for application in both permanent and temporary housing. The attempt was expected to be capable to

create a positive awareness and impact on the promotion of bamboo for affordable green housing which can resist natural calamities like earthquakes.

The waste crooked basal and top portions of harvested bamboo can be considered to put into suitable or appropriate value-added utilization such as to convert into charcoal for fuel purpose. The study made for developing appropriate technology for production of bamboo charcoal showed that the charcoal yield and quality differs between the methods employed for production. In general, average yield can be taken as around 30%. Average ash content of bamboo charcoal was found to be 6-7%. The volatile content (9-20%) and fixed carbon content (74-84%) also found to vary depending upon the method of treatment and operating temperature. Bamboo charcoal is found to be alkaline in nature (pH 8.9-9.8). The poor hardness of bamboo charcoal is found to be a major impediment for its use in specialty purposes such as for the production of granular active carbon. Investigations on the possibility of employing the industrial scale pilot plants optimized for coconut shell charcoal production (for its further use in active carbon industry) revealed the need of re-appropriation of design of the plant and process parameters for the production of bamboo charcoal of desired quality.

Developments in wood adhesives made it possible to get developed various bamboo-based boards such as the bamboo mat boards (BMB), Bamboo Mat Corrugated Sheets (BMCS), Bamboo Mat Veneer Composites (BMVC), Bamboo Mat Compreg (BMC), Bamboo Laminates/Bamboo Lumber (BL), Bamboo Mat Moulded Skin Boards (BMMSB), Flattened Bamboo Boards (FBB), etc. which later led to development of Bamboo Based Housing System and Pre-Fabricated Bamboo Composite Houses.

Coloration of Bamboo Slivers for Handicrafts: An artisan friendly multipurpose and eco-friendly

staining treatment for bamboo slivers employing natural dyes for making decorative basketry and other products was developed. Use of mordents and optimized dyeing parameters were also suggested.

Preservative (with borax-boric acid) treated bamboo slivers were stained using ammonia fumigation and then treated in the bark extract of *Terminalia alata*. Moisture retardance of these slivers is achieved through linseed oil application. These slivers are quite soft to hands while making a product in addition to offering a wide variety of shades ranging from light brown to dark golden brown for decorative basketry. Such treatment was also.

Rattan (Cane)resources and their utilization were reported; out of the 21 species of rattan palms reported from the Western Ghats. The management and utilization of rattan resources in India were also reported. Rattan sector is important from the view point of the national priority in the upliftment of weaker sections of the society by way of their participation in local and international markets; present status and future opportunities were reported along with rattan trade and industrial development in India. Physical and mechanical properties of Kerala and the rattan rich Andaman & Nicobar Islands' -grown rattans were investigated along with anatomical features in relation to structure, properties and behaviour. Anatomical diversity of the Indian rattans was assessed in relation to biogeography and systematics. The most important anatomical features for species separation in rattans were reported to be the epidermal cell size and shape of the lumen. Anatomical basis for the physical behaviour, especially with reference to density and shrinkage of rattans were explained. By



reviewing the anatomy and properties of Indian rattans in detail, three most important structural features, viz., fibre wall thickness/structure, fibre percentage and metaxylem vessel diameter, in governing rattan behaviour, is found helpful for more effective selection of species and stem position for desired quality products. It is found possible to offer scientific explanation to the properties and behaviour of rattans based on their anatomical structure. An anatomical explanation for the breakability of *Calamus metzianus* and *C. lacciferus* was thus arrived at. A list of the commercial rattans of Kerala was published. A report on resource enhancement of cane species suitable for handicrafts was published. An identification key for Indian rattans was developed and published. As far as the chemical constitution of rattans were concerned, determination of mean lignin content of utilizable stem wood of seven rattan species grown in Kerala revealed that the lignin content varied from 17-27% and silica content by 0.9-2.7% among the different species. Among the species, variation in lignin content is significant while it is insignificant in silica content. The low silica content observed in all the Kerala species indicates that no special desilicification treatments are needed to include in their processing. The density and strength values show that rattans are light but relatively strong furniture material. The role of length/diameter ratio in the determination of compressive strength of the different diameter classes of rattans were looked into. For grading and recommending rattans for different uses, three diameter categories, viz., large (mean >18 mm), medium (10-18mm) and small (<10 mm) were suggested. Based on bending and tensile strength test data, three groups such as 'strong to very strong' (mean MOR and UTS >70 N mm⁻²), 'moderately strong' (45-70 N mm⁻²) and 'weak' (<45 N mm⁻²) were suggested. Potential end uses of rattans were also conveniently grouped to five bunches such as (i) furniture frames, (ii) chair seats/backs (iii) walking sticks, umbrella handles, sports goods, etc., (iv) handicrafts/ novelty items and (v) basketry. Grading rules for rattans were also developed. Primary processing techniques such as grading, oil curing, preservative treatment, bleaching and fumigation, drying, storage, etc. along with downstream processing techniques were

reviewed in depth. Utilization of rattans in India for furniture, handicrafts; mat weaving, basketry and other utility products; food, medicinal and other general uses were also reviewed. With regards to the traditional processing practices, extraction, transportation, site selection layout for processing, sorting, drying, straightening, bundling and stacking were investigated for assessing the scope of value addition. An oil curing technique was developed and the curing conditions and equipment set up were standardized for imparting an ivory white color to rattan products which are of great market demand. Oil curing has found the additional advantage of imparting enhanced durability to rattan by way of reducing the immediate fungal attack after harvesting.

Pulp and Paper:

Sesbania grandiflora and *Lannea coromandilica* were evaluated for paper making. *Sesbania grandiflora* is found to be suitable for making strong kraft paper under optimized conditions as an alternative fibrous raw material. *Lannea coromandilica* can be recommended to Indian Pulp and Paper Industry for making bleached grade writing and printing paper with adequate strength properties after blending 5% long fibre of bleached bamboo. Following specialty papers were developed: Mica paper for insulation tapes, Braille paper, high-grade tissue paper, absolute filter paper, medium filter paper, electrical grade paper, and pyroline cellulose sheets. A process for the preservation of ancient documents was also arrived at. Vegetable gums were attempted to use as wet-end additives. Manufacturing writing and printing paper from blends of rice straw, sabai grass soda pulp, bamboo and mixture of grasses, pulping and paper making characteristics of bamboo and bamboo dust for manufacturing of wrapping, writing and printing papers, production of wrapping paper, writing paper and kraft paper from hardwoods, production of kraft paper from softwood conifer mixtures, etc. are some important contributions from the 6 tonne/day capacity R&D pilot plant studies.

Evolving the efficient and economic process for preparation of easy bleaching pulp from bamboo; suitability of tropical hard woods for paper making;

agriculture residues, grasses and plantation of fast-growing species of hardwood for pulp and paper; developing high yield pulping process, improving of high yield pulps, bio-degradation of lignin, beater/wet additives, development of specialty papers, are the areas where works are concentrated.

Applicability of research carried out within the country at the industrial scale needs

As can be seen from the above discussions on the status of Wood Science and Technology WST research in the country, majority of the contributions are having applicability at the industrial scale needs at least indirectly, many are being data generation type; however, many outcomes on wood processing and product developments are having direct applicability to the wood-based industries.

Contributions in sawmilling, better primary conversion methods and machineries; especially suited for the processing of small dimension plantation timbers for the plywood sector are of significant nature to the wood-based industries (WBIs) of the country. Studies on wood properties and its variation benefited the Agro Forestry (AF) tree farming sector; for the genetic improvement of plantation trees species, tree farmers in cultivation, harvesting, transportation and processing and production and marketing of innovative products desired by the modern society, thereby by achieving better sustainability and profits to the WBIs and livelihood and employment opportunities to the artisans and workers. Information on better species suitable for AF and Trees Outside Forests (ToFs) sector were of great help to the WBIs, primarily for plywood sector, as far their raw material resources of the future are concerned.

Developments in wood preservation and seasoning techniques were always was the need of WBIs of the country, as the utilization of non-durable and perishable secondary timbers and non-conventional alternative timber resources such as the rubber wood, coconut stem wood, bamboo and rattans were the needs of the industry and the society at large. Enhancement of durability and dimensional properties (shrinking, swelling and movement) by employing the eco-friendly innovative preservative chemical formulations and the economic and energy

saving treatment and seasoning schedules developed for the purpose. Better/ modern seasoning plants and methods developed (such as the dehumidifier drying, improved solar kilns, vacuum and microwave drying, etc) for value addition were also of great support to the wood processing industry.

Similar is the case in the R & D efforts and related outputs in the field of reconstituted and engineered wood panel and wood polymer composite (WPCs) board manufacturing process and products development. Development of innovative wood and bamboo panel board products such as the Laminated Veneer Lumber (LVL), Cross Laminated Timber (CLT), Bamboo Lumber, etc. along with many different types of the traditional panel board products developed such as the plywood, particle boards, oriented strand board (OSB), etc. and many of the bamboo panel board products, mainly the bamboo mat board (BMB), bamboo corrugated mat boards (BCMB) bamboo flooring tiles for the construction sector, and eco-friendly and cost-effective glues/resins and processing technologies for the same benefited the WBIs of the country. R & D in the utilization of all types of ligno-cellulosic fibre wastes was especially beneficial to the WPC industry sector.

Recent concerns in changing Forest Policy and Management Research are also in favour of the long desire for achieving sustainability in industrial wood raw material. For this reason, an act to promote and facilitate the growing trees outside forests (farm wood) is expected to be enforced shortly. The amendment to the Indian Forest Act (2017) by omitting bamboo from the definition of 'tree' was of great benefit to millions of people growing bamboo in the private or homestead land. The Draft National Forest Policy 2018 realizing the need of developing industrial wood plantations throws some rays of hope in meeting the raw material demands of the future Indian WBIs.

WAY FORWARD

The status on Forest Products Research in Wood Science and Technology in India showed where we are now. An analysis of emerging trends in Forest Products Research in Wood Science and Technology showed our direction of travel so as to facilitate corrections, if required, for an early achievement of the goal of sustenance of industries by better and value-added utilization of available resources.

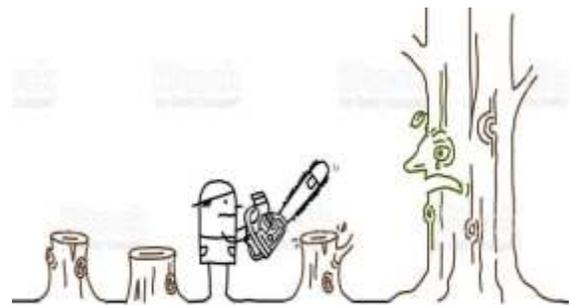
Developing value-addition technologies for the better/efficient utilization of the wood being the emerging motto of the Forest Products Research in the country, an analysis of the emerging trends revealed the following:



- ♦ The need for mandatory wood preservation as per Indian Standards for products from non-durable and perishable timbers which are available in plenty at low cost is evident. Analysis of the emerging trends revealed the need of continued research in developing further schedules in par with Indian Standards (for industries) for preservative treatment and seasoning of new plantation and secondary timber species, as many of these information is lacking now. Rather, many of the recent researches were found completely concentrating on highly academic goal set research with nano chemicals, etc. for treatment purpose, but with no environmental impact assessments and techno-economic viability and the unlikely immediate acceptance to the Standards make it non-utilizable for industries for the time being. Academic research should go in hand-in-hand with societal and industrial goals. In the field of developing eco-friendly wood preservatives, biomaterials like chitosan and non-metallic alkyl ammonium compounds may be worth looking in the Indian scenario. Investigations/review on the environmental implications and economic feasibility of the use of nano chemicals for wood preservation, wood surface protecting coatings, and glues/resins for wood composites/nano-cellulose composites is also need attention.
- ♦ Stakeholder participation needs to be ensured in all public funded research Forest Products. Technological viability of expected achievements for pilot and commercial scale validating trials needs to be ensured along with economic viability for commercialization and transfer of technology to takers.
- ♦ Further researches in effective prevention of formaldehyde emission from wood panel products, the need for developing more eco-friendly and cost-effective glues and chemical scavengers for formaldehyde emission control and international level testing certification facilities so as to conform emission control standards needs to be of prime concern in the country. The need of continuing research for utilization of all types of plantation timbers and other lingo-cellulosic and wastes for reconstituted panel board manufacturing and the promotion of value-added wood and bamboo products such as LVL, CLT, Bamboo Lumber, etc. for Mass Timber Structures and the research and training in designing, testing and demonstrating and popularizing the same for green building material is sensed
- ♦ Mass Timber Structures – multi-storeyed timber buildings are of recent interest, considering the benefits of timber utilization as a bio-refinery material. Engineered wood commonly includes the well-known panel board products such as plywood, particle boards, block-boards, medium density fibre boards (MDF), etc. and the later developed Glulam, CLT, LVL, etc. and are of being great use for a wide range of applications from furniture, walls, flooring, doors, roofs, cabinets, columns, beams, and staircases, among others, and for exclusive mass timber structures, R & D efforts in designing, testing and demonstrating and popularizing mass timber structures needs to be taken care.
- ♦ Data on the pilot/commercial scale validation testing and performance evaluation of many of the innovative new technologies/ processes/ products developed and the techno-economic feasibility

appraisal of the innovative technologies developed is highly warranted. As far as the innovative modern fields new biomaterials, advanced engineering products, novel packaging, nanotechnology and enhanced carbon locking concepts are concerned the seldom R & D efforts going on are only in the childhood stage in the country Innovative findings such as in the conventional wood preservative treatments, seasoning, composites, engineered wood panel products such as CLT, LVL, etc. for mass timber structures, eco-friendly nanocellulose composites for packaging, nanotechnology for wood protection, enhanced carbon locking through imparting increased durability to timber through nano chemicals, etc., needs to be validated in pilot scale and revalidated in commercial scale in industrial plants, along with examination of environmental issues that could create and its possible control.

- ♦ Techniques for extraction of DNA from old, dry and archaeological wood specimens being a hurdle in the DNA-based timber identification, research in this line is felt a need.
- ♦ Practically, no reliable published scientific data on quantitative conversion of solid raw bamboo to its products (conversion ratio) being found available in literature. , dDeveloping bamboo mensuration (weight or volume basis) & raw material-product recovery (species/culm-wall thickness/diameter correlated) quantification for supporting DPR preparation works for bamboo-based industries is found a need of the hour.
- ♦ All publishable Final Project completion Reports (PCRs) and Research Papers published in scientific journals may be uploaded in the websites of concerned Institutions.
- ♦ Technologies for utilization of solar energy for wood processing will turn out to be the future demand, and hence, this area needs to be catered.



OPENING OF WOOD BASED INDUSTRY'S LICENCE IN HARYANA PROS AND CONS SUSTAINABLE SUPPLY OF AGRIWOOD



IN
ASSOCIATION
WITH



Webinar on 26 December 2021 – Abstracts

Mr. J.K. Bihani, *President HPMA, Yamunanagar*

- The units in Haryana at present, are not getting sufficient quantity of wood. Where is the provision of wood to accommodate all?

Dr. MP Singh, *Director IWST, Bengaluru*

- There will be some problem in the beginning. Which is inevitable, but in 4 to 5 years everything will be back to normal. Because farmers will also move towards agroforestry
- There is a need to move to new area and to work in the direction of agroforestry where agroforestry is not being done so far.
- Such catchment areas should be created where agroforestry are encouraged.
- Farmers should also be assured that the wood will be bought by industrialists at a reasonable price. It is not only the industry who is in need of wood, farmers also want to move towards alternative farming. There is no doubt that agroforestry is emerging as a great option for the farmers.
- Under the agroforestry mission, farmers are given grant for planting tree. Industrialists can act as a bridge between the government and farmers regarding the

agroforestry mission.

- Two advantages to the industry, one they will continue to get wood as raw material for the industry; secondly agroforestry will be encouraged for green cover in the country.
- Industrialists and farmers together fix a minimum rate of wood.
- Industry and government should provide high quality nursery and seeds to farmers for agroforestry. To get better quality of timber.

Mr. Padam Jain, *Industrialist, Yamunanagar*

- Industry should get subsidy in freight to transport the material to far flung area.
- Opening of new markets as well a possibility of Exports is not on cards yet. Which is a demanding requirement today?

Mr. Rakesh Khurana, *Industrialist, Yamunanagar*

- Agroforestry will provide financial freedom to farmers because it is the best time that they should let them free from routine crops.
- This was not a proper time to open licenses in Haryana. All industries including WBI is in trouble during the Covid.

AUGMENTING AGRI WOOD FOR PLY AND PANEL INDUSTRIES: WAY FORWARD



IN
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WITH



Webinar on 9 January 2022 - Abstracts

Mr. Arun Singh Rawat, *DG, ICFRE, Dehradun*

- In timber farming, farmers have to wait for a long time for money. Therefore, farmers need an assurance that they will get a fair price for the wood they plant.
- The role of industry is big. Like helping with arranging saplings and getting a guarantee for buying wood.
- The work of the research organization is to continuously search for such varieties of plants and seeds, which can benefit both the farmer and the industry.

Dr. MP Singh, *Director IWST, Bengaluru*

- Farmers will also get the benefit of de-licensing the industry. Because then there will be more industry, due to which, obviously, the demand for wood will rise.

Mr. Sajjan Bhajanka, *President, FIPPI, Chairman, Century Ply*

- We should shift five percent land of regular crop to Agro forestry. This can certainly increase the prices of crops.
- All products related to agroforestry should be license free.

Mr. Naresh Tiwari, *Chairman, AIPMA*

- We should also think about exports. For this we should have to develop our technology as well.

Mr. Abhishek Chitlangia, *VP, Duroply*

- Should constitute co-operative societies, which will minimize the losses in variation of rates, which occurs due to 5-7 years rotation gap.

Dr. HD Kulkarni, *Forestry, Consultant*

- There are timber companies abroad, which act as a link between the industry and the farmers. This company manages from plantation to tree cutting.

Mr. J.K. Jain, *National Head (PSP), Green Ply*

- Industries will have to adopt and nurture nurseries and

plantation.

Dr. Dharmendra Kumar Daukia, *VP, (RM), Green Panel*

- Captive plantation will be a necessity for the industries to survive.

Mr. Subhash Jolly, *President, WTA*

- Industrialists should be supported as done by Chinese government.

Mr. Vishnu Prasad, *Industrialist, Tamilnadu*

- A data must be collected about the area wise plantation, so that it can be worthwhile to know to know which area has extra plantation for the industries and which area needs more coverage to plan our future.

Mr. Jikesh Thakkar, *Exe. Director AIPM*

- There is ample vacant land in every Grampanchayat's which can be utilized to promote agroforestry.

Mr. Shyam Agarwal, *Industrialist, Yamunanagar*

- Organized industries should focus more on export market primarily, so that broader market can be captured by both organized and unorganized sector.

Concluding Remarks by Dr. M.P. Singh, *Director IWST, Bengaluru*

- Farmers were encouraged for forestry only where they got market.
- Plywood, particle board and MDF have same raw material and it could be obtained in regular intervals.
- We have requested Govt. just to register instead of licensing to WBI. Almost all state Govt. are agreed and Haryana Govt. is first to open up.
- Industries are requested to plant at least the quantity they consume. Just 4-5 years effort will make a sustainable plantation for a regular supply of raw material from their own locality.

CHALLENGES & OPPORTUNITIES IN EXPORTING PLYWOOD & PANELS FOR INDIAN INDUSTRIES



IN
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WITH



Webinar on 22 January 2022 - Abstracts

Mr. Subhash Jolly, *President, WTA*

- Plywood & panel industries can contribute much more to the economy of our country by looking into exports.
- It will play a major role in augmenting supply demand equations and give thrust to stabilizing the market. Exports will contribute to our economy & GDP, as well as build confidence in the industry.

Dr. MP Singh, *Director IWST, Bengaluru*

- It is important to understand & appreciate that PWI works with 100% farm grown agriwood in India. We have the uniqueness of using only AF (agro forestry) resources for our PWI, by default. There is no forest wood used by this sector.
- We need to create our narrative, and let the world know that 100% of India's PWI products are legal & sustainable.
- Undergoing FSC/PEFC audits having more than 90 parameters & other documentation requirements is very costly for Indian small farmers, and we need to support them in the best possible way.
- One discouraging fact about associations in the PWI & Panel sector is that associations are not functioning with Capital. There is a need to raise collective capital, and make a working model.

Mr. Shakti Singh Chauhan, *Director IPIRTI, Bengaluru*

- In 20 to 25 years, we should aim to become net exporters of plywood & panel products.
- Surprised to see the volume of veneer imports into India. This wood veneer dependency has gone up dramatically. This area needs to be addressed and PWI must try to explore face veneer indigenization.
- 60% of furniture intermediate materials are imported, which is a big potential to realize and find out why & how to plug the gap.

Mr. Neeladri Basu, *Sr. VP (F & A) Green Panel*

- Need to address certified timber requirements for India.
- Logistics costs remains very high. We are short of ships & container access, 95% of which is dominated by China, Cost of logistics – should range around 6 to 7% whereas the current logistics costs hovers around 20 to 22%.
- Very low export benefits from government. All other exporting countries provide higher benefits for exporters.

Dr. Prasantha M.A., *Industrialist, Mangalore*

- Unorganized small players need information, and

awareness on basic technical data, standards, and basic export requirements like pallet packing, documentations etc.

Mr. Haresh Ajbani, *Industrialist, Mumbai*

- We convinced them (importers in first world countries) about our knowledge, resourcefulness, labour & capabilities and worked towards it.
- We need to upgrade our standards, speed and requirements at par with global standards systems and come out of the archaic ways of doing things. Standards need to be pro-active & market oriented.
- In terms of customization & specifications, we need to arrive at internationally used/acceptable language in our specification data. Companies can try to be high- value producers, even if we are not able to compete in low-cost exports.

Mrs. Sujatha D, *Scientist -'F' IPIRTI, Bengaluru*

- Resin formulation optimization for reduced formaldehyde emissions is not a very big issue.
- CARB & E0 are different, and have to be taken away from a combined mindset. PWI needs to understand specific market-based requirements in Standards & mechanical properties.

Mr. Anand Nandanwar, *Scientist -'F' IPIRTI, Bengaluru*

- BIS standards are quite similar to world standards, stringent enough.
- Standards are made & maintained based on consumer interests in mind.

Dr. Ranjana Yadav, *Scientist -'D' IPIRTI, Mohali*

- Resins are not weather dependent, contrary to perceptions.
- Always maintaining 0% core veneer moisture, especially when veneers cannot absorb any moisture from surroundings is detrimental to quality. We are basically killing the wood cells at 0% moisture.

Summary from Vaidyanathan, *Sr. Executive, WTA*

- The changing dynamics of world trade are very much in India's favour during these times. Quick improvement strategies may help a lot of industries enter quality exports & start building overseas trade relationships.
- Factories must be open to learning and changing from age old practices & prejudices. These are blocking our minds from improvising & improving.
- Improvement in quality with available domestic resources must be aimed.

STRATEGIES FOR ENHANCED ROLE of AGROFORESTRY IN WBI of SOUTH INDIA EXPERIENCES & WAY FORWARD



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Webinar on 29 January 2022 - Abstracts

Dr. C. N. Pandey, *Ex Director IPIRTI, Tech. Adv. FIPPI*

- Raw material security is a primary issue in WBI.
- After a lot of discussions and pondering, we arrived at a conclusion that if only extra 5% of our agricultural land is utilised for AF, then we will have around 7.5 M Ha of AF plantations (out of 150 M Ha used in agriculture). This will ensure a consistent AF raw material supply.
- As per a report, PWI & panel industry demand in 2021 was 15.47 M CBM in India. Our PWI production is around 10 M CBM & around 12.5 M CBM including PB & MDF. So there is still a gap of 3 to 4 M CBM.
- As housing requirements, education & spending power increase steadily, the plywood & panel requirements in India is projected to reach 57.5 M CBM by 2030.
- Our industry faces major RM crunch in face veneers (FV). There is meager contribution from local AF timber for FV currently.

Mr. Moiz Vagh, *Industrialist, Hunsur*

- Melia Dubia is a native species that grows anywhere.
- Most important fact is it can produce quality face veneer.
- We need to inform the farmer in the right way. If quality of timber suffers, farmer will ultimately suffer. Need for right information provided to the farmer is important.
- We must focus on quality seedlings, Quality Plantation Material, and appropriate knowledge to be shared.
- 100% of our Face Veneer is from Melia Dubia.
- Farmers have to be educated & hand-held by us, encouraging them to wait until they have good girth timber, resulting in higher profits too.

Mr. Narayanaswami, *Farmer, Coimbatore*

- We make sure to update farmers regularly, with the help of officers and scientists.
- We are in regular touch with scientists from IFGTB for improving AF in the region.
- Melia Dubia has given the best value for farmers with regard to timber for WBI.
- We do not have single window facilities & marketing support.
- There are different departments for different species. When everything is grown in agricultural land by a farmer, why have such complications?
- Need single point contact for sales of wood produce. Timber merchants have deep influence in profits. There must be direct sale points.
- Suggest government to form wood council for AF development & value addition in timber.

Dr. K. N. Murthy, *Ex PCCF, Karnataka*

- How do we expect the farmers to grow and gain interest in AF? We need to really see what the farmer is actually getting as his price for AF produce.
- Huge quantity of silver oak is available in Karnataka which can be taken advantage by WBI.
- Importers are giving good money for other imported species, but silver oak has not been getting the price it deserves.

Dr. H. D. Kulkarni, *Forestry, Consultant*

- South India has definitely led with various wood plantation initiatives over the years.
- Andhra had raised 3 lac Ha in AF. 45 lac Tons of wood is

extracted.

- We have seen about 40% of plantations uprooted because of lack of price in Andhra. Somewhat similar situation was seen in certain parts of Karnataka too and farmers started uprooting their plantations. This is a sad situation. The farmers are left high and dry in such situations.
- I would like to submit to the Karnataka State Forests Dept about the ban on Eucalyptus. Banning is a bad practice. We must regulate, rather than ban. Ban should be based on region wise scientific studies. Else, the farmers will be left high and dry.
- Tamil Nadu have banned interstate transportation of Eucalyptus. Such banning practices need to be revisited and performed in a regulated manner instead.
- Middlemen are powerful people & groups.
- Companies can think of introducing logging dept in order to manage wood resources, and to ensure that wood harvested scientifically and linking directly with the farmers.
- Regarding face veneers, some 22 species were identified for peeling face veneers.

Dr. A. Nicodemus, *Scientist 'G', IFGTB, Coimbatore*

- For the past 30 years it is only quantity, not quality. Industries have to involve in farm quality for overall progress.
- We can tailor make species based on specific quality requirements like girth & colour too.

Mr. Dharmendra Kumar Daukia, *VP, (RM), Green Panel*

- Captive plantations across China, Indonesia, Brazil, and such other countries can be studied appropriately.

Mr. Bimal Chopra, *Industrialist, Yamunanagar*

- We have to learn and speed up on raising plantation resources.
- The government should do away with license charges but can mandate plantation development depending on capacity of an industry.

Mr. Siraj Asger Ali, *Representative, SIPMA*

- We need to convince farmers not to cut premature timber.
- Industries should decide not to use juvenile timber, which reduces quality of products drastically.
- We must persuade and convince government to withdraw various regulations regarding.

Mr. Subhash Jolly, *President, WTA*

- Northern PWIs should involve more into development of indigenous species, especially with a focus on Melia Dubia for superior core veneer & face veneers.

Concluding Remarks from Dr. M. P. Singh, *Director IWST, Bengaluru*

- We need to have State level, and even Regional level organizations in order to support farmers & augment our RM requirements, and wood resources in general.
- It is really surprising that a State like Karnataka has not provided focus to development of WBIs. It has not been able to implement the guidelines of Centre surprisingly. The State has been moving more on a conservative side.
- If we follow the GoI guidelines, it is only registration as far as the PWI, PB & MDF are concerned.
- We need more industries to create the demand & support more farmers to get into AF.

Way forwards for –viable & consistent supply of AGRIWOOD for HARYANA Ply Industry



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Webinar on 16 February 2022 - Abstracts

Mr. Shubhash Jolly, *President, WTA*

- In spite of being a wood importing region, the Haryana plywood industry sector is one of the strongest contributors of the sector.
- Around 30% of the industry is on the verge of closing down. One of the main reasons being lack of sufficient quantity and quality of plantation timber.

Mr. Rajesh Guliya, *IFS, Ex DFO, Yamunanagar*

- WBI is under great pressure with existing imbalances of demand & supply in raw material.
- Many farmers harvested their plants because of drastic price fluctuations.
- Almost 30% of the smaller units had to close down due to their inability to manage the pressure of demand & supply imbalance in RM.
- Yamunanagar used to receive around 2,11,000 lac quintal wood on an average. About 1,50,000 lac quintals used to come from UP & the remaining from other sources.
- On an average only around 80000 quintals are available now based on available market data.
- Regular training of farmers & subsidized supply of QPM used to happen earlier on a regular basis.

Mr. J K Bihani, *President HPMA, Yamunanagar*

- Banks are running at peak credit limits & only the well established factories can survive in this scenario. There are lots of cash flow & liquidity issues. Covid has added to the pains.
- Instead of expanding the number of industries, let us initially focus on expanding wood availability & production.
- 18% GST on farm grown wood, similar to consumer goods like electronics, is quite out of logic.

Mr. J K Jain, *National Head (PSP), Green Ply*

- In a democratic country like ours, each state also has its own regulations. For example, (the transport ban on eucalyptus from TN to other States, & Karnataka banning eucalyptus plantations etc.)
- In addition, government can support by providing degraded forest land to Corporation, & industry can involve with Corporations for plantations.

Dr. Vivek Saxena, *MD, HFDC, Punchkula*

- Everyone has to come together. Panchayat & community plantation linking must be targeted by the industry.
- We need to figure out a way to bring together government – industry – farmers-research institutes through a simplified partnership.

Mr. Padam Jain, *Industrialist, Yamunanagar*

- As small players, we do not have the manpower, expertise & capital to involve in this raising RM resources for our selves.
- We have lot of export opportunities. But freight expenses are a huge set-back.

Dr. C.N. Pandey, *Ex Director IPIRTI, Tech. Adv. FIPPI*

- If we cannot measure our requirement, we cannot manage.
- Long term rotation plantation also has to be envisaged for face veneers.

Dr. Ajay Thakur, *Sr. Scientist, FRI, Dehradun*

- Wood availability improvement needs coordination & scaling.
- An average 10 day light hot press factory requires Eucalyptus from a source of 210 ha of plantations.

Mr. Ashwani Kaushik, *Industrialist, Yamunanagar*

- Require support from the respective departments for the industry.

Dr. MP Singh, *Director IWST, Bengaluru*

- Small consortiums can be made by small & medium industries for their RM requirements.
- Haryana Forest Department should take the lead. This is a good opportunity to take these efforts in order to include this into ToF under MoEFCC. We cannot run this with two ministries.
- There is an identity crisis. AF is with Min of Agri, responsibility is with MoEFCC.
- Industry must not look at the Gol guidelines in a negative way. People have struggled hard to free WBI licenses, so it should not try to bring back the issue of licensing.
- The Haryana government can make a wood Council with all the stakeholders & with a Member Secretary, either from FDC or they become the mission director also of AF submission.

Dr. Dharmendra Kumar Daukia, *VP, (RM), Green Panel*

- First thing Govt. can and should do is make farm forestry produce free trade across India. Once done 100% across all states, all districts, all taluka, we will go to next one

Mr. Vaidyanathan (conclusion), *Sr. Executive, WTA*

- Whether big or small industry, this is not a time to sit back & approaches formulated- be it consortiums, buy-back agreements, catchment development, or captive development- PWI has to come together and overcome the cyclonic winds of change in the industrial scenario of a fast developing Bharat.

PROMOTION & EXTENSION of TREES OUTSIDE FORESTS (ToF)



IN ASSOCIATION WITH



Webinar on 19 March 2022 - Abstracts

Dr. Shakti Singh Chauhan, Director IPIRTI, Bengaluru

- 90 % of requirement of WBI is fulfilled by ToF. WBI will need 580 Lakh cm³ of timber by 2030.
- Potential contribution from ToF may be 850 Lakh cm³

Dr. MP Singh, Director IWST, Bengaluru

- Guidelines for WBI should be more clarified regarding ToF and Agroforestry and further licensing policy should be simplified.
- ToF should be free from forest acts.
- There should not be any hindrance on transportation of ToF neither interstate nor intrastate

Dr. Chandrashekhar Biradar, Dir. CIFOR-ICRAF, CoP, ToFI

Four supporting factors for farmers :

- Technical know how regarding quality plantation.
- Financial assistance be to provided for short/long term trees.
- Insurance facilitation (eg. From stealing).
- Certification process to be simplified.

Dr. C.N. Pandey, Ex Director IPIRTI, Tech. Adv. FIPPI

- There are many fast growing trees suitable for WBI in different part of country, which should be brought into limelight and further research should be done on them.
- FIPPI has tried to convince Govt. on these. Various issues and govt. is considering the matter seriously.

Mr. Ashok Agarwal, National President, IIA

- Govt is distributing useless plants in large quantity.
- Govt is discouraging plantation of Eucalyptus in the state of UP.
- Quality clones are not available in Private Nurseries.

Dr. Ajay Thakur, Sr. Scientist, FRI, Dehradun

- Eucalyptus consumes water less than normal crops like wheat, Bamboo, Shisham etc.

Mr. J K Jain, National Head (PSP), Green Ply

- We must have to define properly Forest and Tree outside forest.
- WBI should be free from regulations to expand plantation of trees.

Mr. Dharmendra K. Daukia, VP, (RM), Green Panel

- We should make our effort to convince farmers to stop harvesting, whenever prices goes down recklessly.
- Try to purchase directly from farmers, whenever possible.

Mr. Manoj Gwari, Sec. & Tre. WTA

- Industrialist from North India are capable of individual farming in huge quantity on their own.

Mr. Vaidyanathan, Sr. Executive, WTA

- Small players are unable to bear the cost of certification, hence process and cost must be simplified.



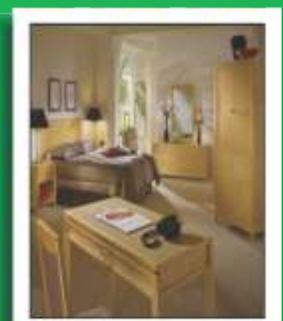
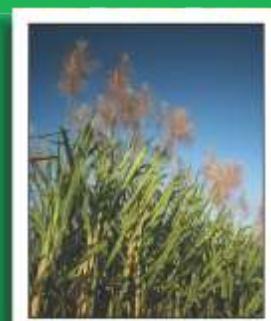
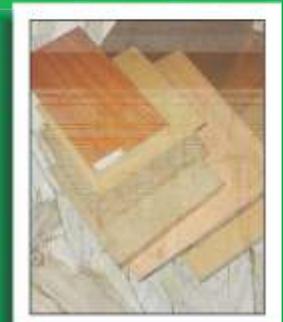
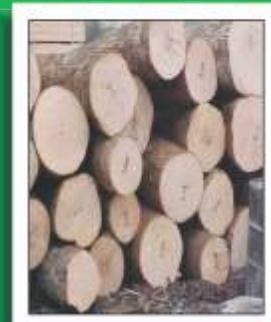
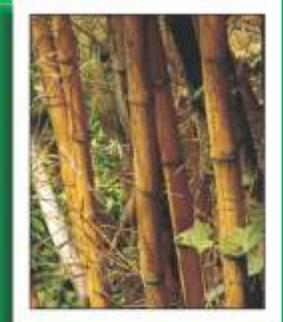
FEDERATION OF INDIAN PLYWOOD & PANEL INDUSTRY (FIPPI)

REGISTERED UNDER THE SOCIETIES REGISTRATION ACT XXI OF 1860, REGN. NO. S/2985/1968-69 DT. 4.1.1969

Part of FIPPI Achievements

With great efforts of Federation of Indian Plywood & Panel Industry (FIPPI), an Apex representative body of Plywood / Panel / Other Allied products including Furniture and Wood / Bamboo Working Machinery Manufacturers in India alongwith close cooperation with various Ministries and Premier Institutes through Agro and Farm Forestry and other Captive Plantation programme, the dying woodbased industry is again reviving in the country to produce various standard products like Veneer, Plywood, Panelboard, Particleboard, MDF, Laminates etc. which are internationally accepted. Further with great pursuance of the President and Senior Executive members of FIPPI we are highlighting and representing the crucial issues confronting the Plywood & Panel Industry. FIPPI also publishes quarterly Journal Indian Wood & Allied Products highlighting the development taking place in India and abroad, market profile, world timber market report, statistics, international exhibition and conferences, articles, write-ups etc.

FIPPI is cordially inviting all plywood / panel / bamboo / Laminates and other allied products manufacturers to become active member for the strengthening the platform of FIPPI and working for the development of the industry which is Internationally recognized by ITTO, FAO, European Union, IWPA, BIS, MoEFCC, Ministry of Commerce & Industry, BIS, FICCI, CII and other renowned Organizations.



FEDERATION OF INDIAN PLYWOOD & PANEL INDUSTRY (FIPPI)

404, Vikrant Tower, 4, Rajendra Place, New Delhi 110 008, India
Ph.: (Direct) +91-11-25755649, Other Nos. +91-11-25862301
Fax: +91-11-25768639, E-mail : fippi@fippi.org

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TUSKAR_s

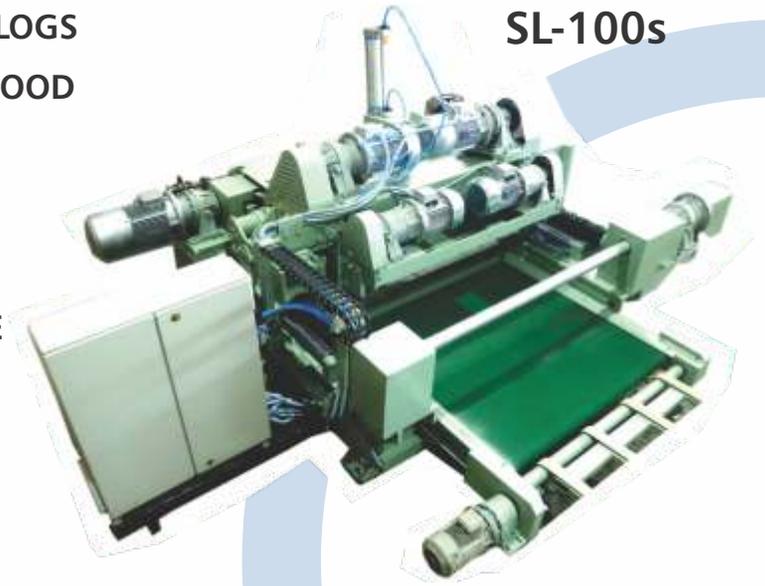
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For copies, write to:

Head, Extension Division,

Institute of Wood Science & Technology, Bengaluru

P.O. Malleshwaram, Bengaluru - 560 003.

E-mail: extension_iwst@icfre.org

Designed by: **Samvida Communications (OPC) Pvt. Ltd.**

Contact: Meghana S Belavadi, meghana@samvida.biz, +91 9886201993