

## Greening India perennially needs change in forest policy regime

According to the forestry production and trade database of the Food and Agriculture Organization of the United Nations, Rome, Italy, India imported US\$ 8.7 and 5.9 billion worth of wood and wood products in 2019 and 2020 respectively. This trend has been increasing since 1961 (US\$ 0.04 billion), keeping pace with economic growth (Figure 1)<sup>1,2</sup>. The small reduction in the 2020 import value does not indicate the much-needed reprieve from exported deforestation elsewhere. According to the Forest Survey of India's biennial India State of Forest Report 2021, the country has 71.38 million ha area under forest and 9.57 million ha area under tree cover. Further, the Report indicates that increase in forest cover within the recorded forest area (RFA) or greenwash (GW) area was 3100 ha, whereas increase in forest cover outside RFA/GW area was 150,900 ha compared to the previous assessment in 2019 (ref. 3). This clearly envisages a large-scale effort from the public toward greening the nation by growing trees outside the forests (TOFs). This was scientifically authenticated in a 2019 publication<sup>4</sup> regarding China and India leading in the greening of the world through land-use management. The land greening in China largely involves forests (42%) and croplands (32%), whereas in India it is mostly croplands (82%) with a meagre contribution from forests (4.4%)<sup>4</sup>. This has further proved that changes are taking place in agricultural landscapes. Even though India is ranked the tenth most forested country in the world, it is striving to bring 33% of its geographical area under forest cover with proper policy initiatives and an ecosystem approach to achieve the Sustainable Development Goal 15.1.1 (ref. 5), with commitment for the restoration of 26 million ha degraded land by 2030 under the Bonn Challenge<sup>6</sup>.

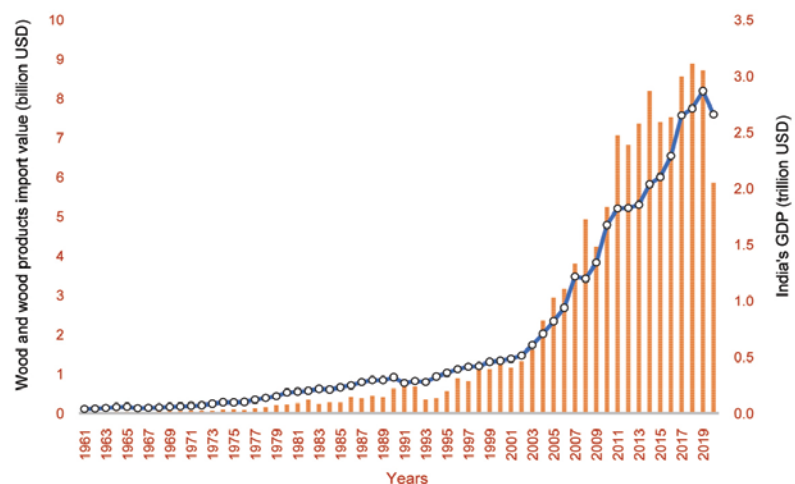
Enhanced tree cover landscape and carbon sequestration are viewed as a cost-effective climate change mitigation tool<sup>7</sup>. Even though the restoration of natural forests is the most preferred option from an ecological point of view<sup>8</sup>, agroforests, farm woodlots and tree plantations are land-use options that can balance the ecological and socio-economic needs of the local communities<sup>7,9</sup> and the national demand for wood<sup>8</sup>. They are considered particularly important to mitigate the further expansion of global drylands<sup>10</sup>. Therefore, fast-growing, short-rotation plantations are considered as one

of the potentially important components of future climate-smart designer landscapes with a combination of tree species<sup>11</sup>, particularly in tropical regions having favourable growth conditions. Further, it is widely viewed that tree cultivation in agricultural landscapes can shift the pressure from the remaining forests and help meet the increasing demand for wood in fast-emerging economies<sup>5</sup>.

Radical changes in approach and policy towards trees that are cultivated on farmlands in India are essential for forests across agricultural plateaus. Today's farmers live in the digital era and need regular income for their livelihoods. Therefore, they are venturing into the cultivation of high-value tree crops such as sandalwood (*Santalum album* L.) and red sanders (*Pterocarpus santalinus* L.f.), or fast-growing, short-rotation species like *Eucalyptus*, *Casuarina*, *Acacia*, *Poplar*, *Gmelina*, *Leucaena* and *Melia*. Tree cultivation is a long-term investment, and it reduces the regular income from annual crops from the same piece of land if planted with saplings. This requires accounting and auditing of green credits that farmers can earn each year, which could be used as a token for ensuring financial support from various institutions and Government subsidies. Further, to encourage farmers to cultivate trees, such credits can be converted into certified emission reduction carbon credits by encashing them in the global carbon market or at least in the national carbon budgets.

The estimated annual timber production from agroforestry and farm forestry as

TOFs in India was 44 million cubic metres, which is nearly 13 times higher than timber production from forest and forest development corporations<sup>12</sup>. This clearly indicates the chunk of wood supply from the TOFs. Presently, there is no national-level policy on TOFs in India, except the National Agroforestry Policy 2014. Any such policies in the country should first address the felling and transit of tree crops grown on farmlands. Cultivation of high-value tree crops such as sandalwood and redsanders was regulated by Special Tree Preservation Acts of the states and those used to fix tree ownership with the government even if a tree grows on private lands. However, such regulations are gradually getting deregulated in the country. Regulating the price of farm-grown timber and tagging the produce for legal trading is necessary. Even though the State Governments have exempted a few tree species from felling and transit regulations for harvesting and trading, special provisions and institutional arrangements are required for addressing the issues of farm-grown timber in India. Prime timber species of the country, viz. teak, rosewood, bijasal, etc. are not exempted from the felling and transit regulations. The Government of Karnataka is mulling over introducing a special law with respect to the cultivation of sandalwood in agricultural fields in the state<sup>13</sup>. Thus, revamping the prevailing forest policies and introducing new regimes is essential to encourage private efforts and funding toward greening of the nation and development of green-tattooed agricultural landscapes.



**Figure 1.** India's annual import value of forest products (hollow circles with blue line) and growth in gross domestic product from 1961 to 2020 (stacked orange bars)<sup>1,2</sup>.

A new institutional and organizational set-up in the Forest Department is required for tagging farm-grown timber using high-end technologies like DNA barcoding and microscopic anatomical authentication. Another aspect is the development of a standard certification mechanism for legal logging of trees on farmlands and custody of the harvested produce in trade. Similar to timber handling in Panama<sup>14</sup>, establishing a timber traceability and monitoring system through the use of electronic-microchip tagging and linking to the national database will help monitor timber flow from agroforests and farm forests in the country, and ensure the legality of tree cultivation on private lands and authority of wood ownership. Generation of data-based QR codes and application software for the verification of farm-grown timber in transit holds the key to informed decision-making and sustainable production of TOFs, besides protecting the existing natural forest in the country.

The International Day of Forests 2022 envisaged forests for sustainable production and consumption by provisioning wood for people and the planet on sustainable basis. Sustainability can be achieved when all stakeholders participate in the process and each gets a justified share of profit for their role. Though farmers are cultivating sandalwood and red sander trees, the Forest Department has to extract the wood and fix the prices. This process keeps the growers in a vicious cycle of doubts. In order to avoid such bottlenecks and enhance the green cover of the country with sustainable wood production process, policy reforms and special institutional mechanisms are required for dealing with TOFs.

India has set a target of bringing 33% of its geographical area under forest cover as envisaged in the National Forest Policy,

1988. The latest forest cover assessment claims a marginal increase in the country's total forest and tree cover. However, the claim of an increase in forest cover that was celebrated by the Government, was disputed by sector experts as they highlighted discrepancies in the methodology noting that the report counted plantations on the road, as well as rubber, coffee and tea plantations and also patches of trees as forest cover<sup>15</sup>. Many experts highlighted the duality in the definition of a forest. The Forest Conservation Act 1980 does not include forest land diverted for non-forest purposes and roadside plantations as forests. However, the biennial assessment of forest status considers such areas as forests. This needs to be addressed by formulating a separate policy. Trees are considered as the ecosystem service station. There is a need to provide incentives to farmers who adopt agroforestry in their farmlands for providing various ecosystem services. Further, there is a need to value trees beyond timber, viz. oxygen production potential, carbon sequestration potential, nutrient cycling, etc.

1. FAO, FAOSTAT database, Food and Agriculture Organization of the United Nations, Rome, Italy, 2022; <http://fenix.fao.org/faostat/beta/en/#data/FO> (accessed on 18 March 2022).
2. <https://data.worldbank.org/country/india?view=chart> (accessed on 18 March 2022).
3. FSI, India State of Forest Report, FSI, Dehradun, 2021, p. 586.
4. Chen, C. *et al.*, *Nature Sustain.*, 2019, **2**, 122–129.
5. FAO and UNEP, The state of the world's forests 2020: forests, biodiversity and people, Food and Agriculture Organization and United Nations Environment Programme, Rome, Italy, 2020, p. 188.
6. Bonn Challenge, Restore our future, 2017; <https://www.bonnchallenge.org/pledges/india>

7. Girardin, C. A. J. *et al.*, *Nature*, 2021, **593**, 191–194; <https://doi.org/10.1038/d41586-021-01241-2>.
8. Hua, F. *et al.*, *Science*, 2022, eabl4649; <https://doi.org/10.1126/science.abl4649>.
9. Ghazoul, J., Bugalho, M. and Keenan, R., *Nature*, 2019, **570**, 307; <https://doi.org/10.1038/d41586-019-01878-0>.
10. Huang, J., Yu, H., Guan, X., Wang, G. and Guo, R., *Nature Climate Change*, 2016, **6**, 166–171; <https://doi.org/10.1038/nclimate-2837>.
11. Koh, L. P., Levang, P. and Ghazoul, J., *Trends Ecol. Evol.*, 2009, **24**, 431–438; <https://doi.org/10.1016/j.tree.2009.03.012>.
12. Shrivastava, S. and Saxena, A. K., Report, Centre for Science and Environment, New Delhi, 2017, p. 45.
13. *The Hindu*, Sandalwood policy will be tweaked, 21 March 2022; <https://www.thehindu.com/news/national/karnataka/sandalwood-policy-to-be-tweaked/article65246397.ece>
14. Garcia, E. L., *Trop. For. Update*, 2020, **29**(2), 13–15.
15. Pandey, K., *Down to Earth*, 13 January 2022; <https://www.downtoearth.org/in/news/forests/india-s-forest-cover-increased-during-2019-2021-is-it-really-as-good-as-it-sounds--81108>

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## Insights on Indus settlement in the palaeo-Saraswati basin, Bhiwani district, Haryana, India

The famous South Asian Bronze Age civilization, also known as the Indus or Harappan Civilization, that flourished between 3200 and 1400 BC, is considered one of the three greatest urban riverine civilizations in the world<sup>1,2</sup>. The Indus Valley Civilization

(IVC) spread along the Indus river and extended from northeast Afghanistan to northwest India<sup>2,3</sup> (Figure 1 a), encompassing a vast area with an ecologically diverse environment<sup>4,5</sup>. About 1500 Indus sites, ranging from village farming communities to

large cities with thousands of people, were known to exist in the subcontinent<sup>2</sup>. However, in comparison to its wider extent, the true potential of the Indus/Harappan sites is yet to be explored. There is an ongoing debate regarding the cropping pattern and