Resilient and sustainable agriculture with enhanced income through agroforestry in Odisha

Arun K. Bansal

ABSTRACT: *Agroforestry refers to intentional integration of trees along with agricultural crops and/or livestock into agricultural landscapes. It represents a multifaceted approach to sustainable land management with profound implications for ecological resilience, economic development, and climate change mitigation. It has good potential to contributing in achievement of nine Sustainable Development Goals and additional employment generation in rural landscapes through production, processing and value addition involving a variety of tree products, both wood and non-wood. Globally practiced by around 1.2 billion people, it is getting recognised as a nature based solution having ability to mitigate climate change without compromising food security or biodiversity. Describing the contours of agroforestry in India, including actions taken for implementation of the National Agroforestry Policy 2014, this paper deliberates upon the prevalent practices and various initiatives to promote agroforestry in Odisha. Discussing the overall vision and objectives of the Odisha State Agroforestry Policy notified in June 2025, and strategic initiatives and key stakeholders identified for its implementation, the way forward lists the important action points requiring urgent attention.*

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1. INTRODUCTION

Agroforestry refers to land use systems where woody perennials (trees, shrubs, palm, bamboos, *etc.*) are deliberately grown along with agricultural crops and/or animals on same piece of land in some form of spatial arrangement or temporal sequences. It has been practiced in many countries in the world, including India, for centuries with multi-functional trees integrated in the crop and livestock-production systems ranging from scattered trees in farm land, to linear low of trees along farm boundaries, to tree canopies above crops, depending upon the agro-climatic and other local conditions. Tree cultivation on agricultural lands involves both ecological and economical interactions between different components and is an important pathway to improve productivity and sustainability of agricultural production systems, while potentially contributing to at least nine of the seventeen Sustainable Development Goals (SDGs) (Nair *et al.*, 2021; Arunachalam *et al.*, 2023).

Agroforestry is a comprehensive production system that not only provides many goods and services but also plays a significant role in reducing vulnerability and enhancing resilience of crop production thereby enhancing income and creating a safety net for the farmers. Apart from various produces from traditional systems, industrial agroforestry revolves around tree products with industrial round wood (IRW) as the main product, and fuel wood and fodder as bye products. Other products may be fruits, fibres, gums, resins, bamboo, and products used as in-gradients in pharmaceuticals and nutraceuticals, cosmetics *etc.* Thus agroforestry also has potential for additional employment generation in rural landscapes through production, processing and value addition involving a variety of tree products both wood and non-wood produces.

In recent years, agroforestry is getting recognised as a nature based solution (Nbs) having ability to mitigate climate change without compromising food security or biodiversity. A recent updated study on estimation of biomass carbon on agricultural lands has found that existing tree cover makes a major contribution to the carbon pool on agricultural lands, nationally, regionally, and globally. Agroforestry species sequester as much carbon in below ground biomass as the primary forests, and far greater than the crop and grass systems. The total biomass on agricultural land globally was estimated to grow 4.6% over the previous decade, with trees contributing more than 75% (Zomer *et al.* 2022). Highlighting the need for significant removal of carbon from agriculture, forestry, and other land uses (AFOLU), the special report by the Intergovernmental Panel on Climate Change on the impacts of global warming of 1.5^{o}C above pre-

Arun K. Bansal
bansalka@yahoo.in

IFS (Retd.)
Former Addl. DG Forests, India

industrial levels, underlined the role of trees outside forests. Trees in agricultural landscapes are mentioned to be no-regret strategy with large benefits for the climate, people, and the planet.

Globally, about 1.2 billion people practice agroforestry on 10% of the total agricultural cover, which accounts for over 1 billion hectares (Zomer *et al.* 2022).

2. AGROFORESTRY IN INDIA

Trees have a special role in the ethos of the people of India and a number of tree species are revered as sacred trees and sacred groves are found all over the country. Plantation of trees along the periphery of agricultural lands and integration of tree species with agricultural crops, in different crop combinations, has been traditionally practised in different parts of the country for subsistence and commercial purposes. Agroforestry offers better returns due to lower input costs, flexible labour requirements, higher profitability, diversity of income sources. In fact even the National Commission on Agriculture, 1976 had suggested for implementation of social forestry programme including farm forestry and extension forestry. The National Mission on Sustainable Agriculture' (NMSA) one of the eight missions under 'National Action Plan on Climate Change' (NAPCC) launched in 2008 with a view to mitigate and adapt to the adverse impact of climate change, has multiple programmes for the sustainable growth of agriculture sector including a Sub Mission on Agroforestry (SMAF).

In past few decades Industrial agroforestry and other Tree outside Forest (ToF) resources have gained importance primarily to meet the growing demand of IRW and Non-wood Tree Produces. Block/boundary plantations of several tree species are being preferred by tree growers in different parts of the country due to market demand and good financial returns. The main species under agroforestry include *Tectona*, *Eucalyptus*, *Acacia*, *Populus*, *Ailanthus, Melia*, *Salix, Dalbergia*, *Leucaena, Gmelina, Casuarina, Bamboos, Rubber etc.* Regulatory regimes related to movement of timber have also been liberalised through exemption of tree species preferred by farmers and tree growers in different states. Nationally, around 65% of the country's timber requirement is met from the trees grown on farms (Anon, 2014). Analysing the "Wood Consumption and Production in India during 2019-20" Bansal (2022) have found that 75% of the IRW comes from ToF areas.

"Agroforestry for doubling farmers' income: a proven technology for trans-gangetic plains zone of India" mentions that in the high lands indo-gangetic plains yield level of rice and wheat crops experienced stagnancy resulting in diminishing net profits. Tree species like Poplar and Eucalyptus have been proved as economically viable option for crop diversification. The comparative economic viability of poplar-based agroforestry system with rice-wheat system showed that agroforestry system is able to enhance farmers' income more than double in seven years and triple, if farmer get value of their carbon sequestered by agroforestry system (Singh *et al.*, 2018).

In a recent article "Farm based income through agroforestry in North India" Gusain *et al.* (2021) mentions that various economic studies on poplar based models, benefit cost ratio and NPV have been found satisfactory at 4-10% interest rate. So far, it has been observed that on prevalent cost structure and price obtained for the tree and crop produces, the farmers are likely to receive large benefits from agroforestry. Though the range of profits varies depending on various socio-economic factors. Analysing carbon stock in different land use systems of North West Himalaya Bharadwaj *et al.* (2023) found that the pattern of C-storage capacity in diverse land uses demonstrates that tree-based systems (forestry, agroforestry, and horticulture) generate much more biomass and so store more carbon than conventional agricultural systems.

Despite its huge importance, there is no national system in place in India for regular/periodic assessments of the aerial extent, production of wood and other tree produces of/from agroforestry. However, there have been several assessments of extent of agroforestry reporting widely varying estimates. Forest Survey of India in its biennial forest cover assessment - India State of Forest Report (ISFR) 2013 included a chapter on trees in agroforestry systems in India where in total green cover in the agroforestry system in the country, with notional 0.7 tree canopy density, was estimated to be 11.12 Million Hectares (Mha) (3.39% of TGA). This assessment was based on ToF inventory in 1798 sampled districts during 2006 to 2012, covering block and scattered formations excluding linear stratum and private forests (FSI, 2013) including tree with Diameter at Breast Height (DBH) of 10 cm or more. According to another assessment around the same time by Dhyani *et al.* (2013) gross area under agroforestry was estimated to be 25.32 Mha (8.28% of TGA) in 2013 which works out to only around 13% of the annual total cropped area, which is far below the global average of 43%. In a recent assessment ISFR, 2023 (FSI, 2024) based on ToF rural inventory data of 42972 sampled plots (following Grid based NFI design adopted) in during 2016 to 2022, area under agroforestry is estimated to be 12.76 Mha (3.88 % of TGA) in block, linear and

scattered formations in culturable non forest lands with private ownerships. This comprises of two parts – 11.82 MHa with trees with DBH 10 cm or more, and 0.94 MHa in respect of tree with DBH between 5-10 cm and bamboos. In both the reports in the case of scattered strata the crown diameter of each tree has been recorded from all field plots and has been converted into equivalent notional area corresponding to 70% canopy density. Areas under other stratum has been considered as such.

India became the first country in the world to enunciate National Agroforestry Policy (NAP) in 2014 with a view to not only enhance farm productivity but also increase resilience against climate changes, and thereby provide insurance against crop failures due to vagaries of nature and furthering forest conservation through reduction of pressure on forests for IRW, fuelwood, grazing, and other forest products. (Anon. 2014). NAP also recognises that agroforestry is perhaps the only alternative to meeting the target of increasing forest or tree cover envisaged in the National Forest Policy (1988). Agroforestry can also help in achieving India's NDC (Nationally Determined Contribution) target of creating additional carbon sink through additional forest and tree cover, and other national and international commitments and the goals of Mission LiFE (Lifestyle for Environment) making environmental protection and conservation as an inclusive and participative process.

Efforts for promotion of agroforestry in the country are being spear headed by the Ministry of Agriculture and Farmers' Welfare (MOAFW), the nodal ministry for agroforestry in India. Indian Council of Agricultural Research (ICAR) and Indian Council of Forestry Research and Education (ICFRE) have been in the forefront of agroforestry related R&D and have published agroforestry models suitable in different states/agro-climatic zones. In addition, the State Forest Departments (SFDs) are also involved in development of agroforestry models suitable in different regions/states. These models provide information about suitability of different combinations of perennial (tree) and seasonal (agriculture/ vegetable) crops in various agro-climatic zones – generic edaphic and environmental, and establishment/ management requirements, silvicultural practices and also economics, requirements, silvicultural practices and also economics. the SFDs are also involved in development of agroforestry models suitable in different regions. In addition to continued R&D, tree cultivation in private/ agricultural lands has/is also been/being promoted under National Forest Policy 1988, National Agriculture Policy 2000, Planning Commission Task Force on Greening India 2001, National Bamboo Mission 2006, National Policy on Farmers 2007, and Green India Mission 2010, and Externally Aided Projects.

In pursuance of the NAP the MOAFW initiated SMAF during 2015-16. However, due to unsatisfactory response from the States this was subsumed in *Rastriya Krishi Vikas Yojana* (RKVY) in 2022-23 with focus on Quality Planting Material (QPM). To enable production of quality planting material ICAR-CAFRI has brought out accreditation protocol for agroforestry nurseries during 2023-24, including an assessment framework (criteria and indicators) to assess and accredit nurseries. ICAR-CAFRI has been notified as the national nodal agency for the agroforestry component of RKVY to provide technical support, capacity building, setting up of nurseries *etc.*

Ministry of Tribal Affairs, GoI, has launched a scheme minimum support prices for non-wood forest produces (NWFP) in 2014-15, designed primarily as a social safety net for improvement of livelihood of primary collectors by providing them, fair price for produce collected by them. The scheme now covers 87 NWFP items and is being implemented by TRIFED through designated nodal agencies in each state. Although most of NWFPs are collected from forests, but several NWFP yielding tree species are available in non-forest areas and also grown under agroforestry.

3. AGROFORESTRY IN ODISHA

As in many other parts of the country, agroforestry has been practiced in Odisha traditionally to meet the subsistent/day-to-day needs of the rural population and also to supplement farmers' income. The prominent traditional agroforestry practices in Odisha include multipurpose trees on farm lands, multiple species tree gardens/orchards, and trees for fuel wood production in addition to fuel/fodder trees as live fences around farm lands. Home gardens, small-scale, multi- layered farming systems found near households, combine trees, bamboos, shrubs, crops, and sometimes livestock and provide a diverse range of products such as fruits, vegetables, medicinal plants, fuelwood, and fodder. As a part of wood balance study sponsored by the Principal Chief Conservator of Forests and Head of Forest Force, Odisha, Xavier Institute of Management, University Bhubaneswar (XIMU) has conducted a Household survey in 10 districts in the state where in it was found that around 59% of the sampled households reported access to trees on their own land, and the majority amongst them reported having one to five trees. Mango *(Mangifera indica),* Jackfruit *(Artocarpus heterophyllus),* and Saguan *(Tectona grandis)* were the three most commonly reported species in the overall sample (XIMU, 2022).

Odisha Forest Sector Vision 2020 included Trees outside Forests on rural and urban private lands and non-forest public lands as an important element in improved Forest extent and Condition. It is important to note that agroforestry is an important subset of Trees outside Forests.

The agroforestry models prevalent in the state are (a) Agri-silviculture systems that integrates agricultural crops with tree species on the same piece of land, (b) Silvo-pastoral Systems which focusses on combining trees with pastureland and integrating forestry with livestock rearing, (c) Agri-Horticulture systems that combines horticultural crops with forestry species, (d) Boundary Plantations involve planting trees along the boundaries of agricultural fields, and (e) Alley Cropping systems that allow rows of trees or shrubs planted at regular intervals along with agricultural crops grown in the alleys between them.

Main outcomes of 40 years of research in agroforestry in the State have been published by Odisha University of Agriculture and Technology (OUAT) under the title "Four Decades of Agroforestry Research in Odisha by All India Coordinated Research Project on Agroforestry (1983-84 to 2022-23)". The thrust area of research aims at identification of suitable trees including fruit trees and shrubs with popular field crops, their management in an agroforestry system under different farming situations for higher and sustainable production and conservation of available resources. (Mohapatra and Behera, 2023).

Under the Odisha Forestry Sector Development Project Phase 2, being implemented with assistance from Japan International Cooperation Agency, several agroforestry models are being evolved focusing on end uses of tree products *viz.* pulpwood model, NTFP-lemon grass model, timber model. (Anon., 2025)

The agriculture sector in the state serves as the bedrock of its economy with approximately 76% of total population engaged with the agricultural sector. Spanning ten agro-climatic zones the state has rich natural resources, a favourable climate, and adequate rainfall. However, only around one fourth of its total cropped area is irrigated and the remaining area relies on rainfall, rendering it vulnerable to climatic disruptions. Establishing financially viable tree component within agricultural landscapes not only enhances resilience to climate, hunger, poverty, and market fluctuations but also opens avenues for employment and income generation.

According to ISFRs 2013 and 2023 the estimated total green cover in the agroforestry system (notionally equivalent to 0.7 tree canopy density) in the State has increased from 0.51 Mha to 0.56 M ha (8.87 percent decadal increase). In another national analysis, land covered under agroforestry in the state was estimated to be 1.34 Mha which computes to 8.6% of the TGA or 20% of the total culturable land (Arunachalam *et al.* 2022). There is ample scope for extension of agroforestry in the currently cropped as well as in the fallow lands (1.05 Mha) and in other fallow lands (0.705 Mha). According to NITI Aayog technical report "Greening and Restoration of Wastelands with Agroforestry**,** about 12% of TGA of the State is assessed to be suitable with high/moderate agroforestry suitability index (NITI Aayog, 2024).

Government of India has recently announced "Green Credit Programme" to create a market based mechanism for providing incentives in the form of Green Credits to individuals, Farmer Producer Organisations, cooperatives, forestry enterprises, sustainable agriculture enterprises, Urban and Rural Local Bodies, private sectors, industries and organisations for environment positive actions - including tree plantation and related activities. Development of a suitable institutional mechanism is in process to enable/facilitate the tree growers to benefit from green credits under the Government India, and of carbon credits under the carbon market.

Paper mills in the country have been in the forefront of promoting tree cultivation in private lands to meet the requirements of wood raw materials. In Odisha, J K Paper Mills (JKPM), Rayagada, has been promoting tree plantation in association with farmers since 1991 in its catchment areas with a cumulative coverage of around 1.5 lakh ha. with its preferred pulp wood tree species - Eucalyptus, Casuarina, and Subabul. At present, 35881 ha plantations of Eucalyptus, Casuarina, Leucaena are FSC certified (FM/CoC). JKPM supplies high yielding disease and pest resistant planting material to farmers from its own nurseries, provides technical guidance for planting and maintenance of plantations as well as harvesting and takes up research and development for identification and improvement of planting material with emphasis on increasing productivity per unit area and time. Presently, JKPM is facilitating plantations covering annually around 7000 ha. in Odisha.

FSC Re-evaluation Audit 2019

In addition to paper mills, other private organizations are also promoting tree plantations in private lands, like MB Green Private Plantations Ltd is taking up Eucalyptus plantations in Mayurbhanj district.

During 2004-07, with the support of JKPM and VEDA Climate Change Solutions Limited an AR/CDM project titled Improving Rural Livelihoods Through Carbon Sequestration is also being implemented in the two states of India: Orissa and Andhra Pradesh. The project comprise afforestation with Eucalyptus hybrid (Clonal & seed) and *Casuarina equisetifolia* over 1607 ha in 1708 land parcels belonging to 1590 small landholders spread over six districts: Rayagada, Koraput and Kalahandi districts in Orissa and Visakhapatnam, Srikakulam, and Vizianagaram in Andhra Pradesh. VCCSL has piloted the CDM project in coordination with JKPM, farmers, and other stakeholders to facilitate the flow of Carbon revenue to the participating farmers with JKPM doing the main project implementation work/planting activities in the field. The plantations were planned to be managed with a 5 year rotation period. It is seen that after first cycle in several land parcels replantation/cropping was not taken up and there was land-use change. Till now, two cycles of monitoring have been completed and based on verified Carbon Emission Reduction (CERs) farmers have received payment @ Rs. 2000/year/ha for each cycle.

4. RECENT INITIATIVES

With a view to promote tree cultivation in private lands, the State has liberalised regulations related to transit of wood harvested from trees grown on private lands. Also, PCCF and HOFF Odisha issued guidelines in 2018 that nowhere in forest area Teak (*Tectona grandis*), *Acacia auriculiformis*, *Senna siamea* , and Eucalyptus shall be planted from 2019 onwards, and since these species are in high demand by public due to commercial importance, these species will continue to be raised in department nurseries for distribution to public, for planting in private lands (vide Odisha PCCF"s Circular No. 1102/12 (Affn.) 25/2028 date 04.10.2018). Moreover, with a view to promote processing of wood within the State transport of timber in round form is restricted for transport outside the State since December 2019 (vide Govt. of Odisha, Forest and Environment Department notification No. 10F (TR)34/2019-25023 dated 20.12.2019. However, round timber procured from Odisha Forest Development Corporation is permitted to be transported to other states from March 2023 (vide Govt. of Odisha, Forest, Environment and Climate Change Department notification No. FE-PRO-FPRO-0001-2017-4474 dated 09.03.2023)

4.1 National Bamboo Mission:

Bamboos are being raised by people in their homestead lands (back yards) as well as in farm lands across the State. Mayurbhanj and the adjoining areas of Balasore, Bhadrakh and Keonjhar districts, is an important region of the state for production of bamboos from private areas and bamboo is supplied to the two paper mills in the State and several paper mills in other states. Odisha Bamboo Development Agency is looking after the bamboo cultivation and other related activities. A analysis of bamboo resources in the state was conducted during 2016 as a pilot under GABAR (Global Assessment of bamboo and Rattan) an initiative of INBAR (Bansal, 2016). It was found that till 2014-15, bamboo plantations have been raised over 3,414.66 ha. of private lands, with bulk of the plantations being small parcels ranging from 0.01 to 0.25 ha. each. In an important initiative with a view to promote its cultivation in private lands, bamboo was omitted from the definition of tree in Section 2 Clause 7 of the IFA, 1927.

4.2 Sub Mission on Agroforestry (SMAF):

Odisha was one of the 23 States/UTs where activities under Sub Mission on Agroforestry were implemented from 2015-16 to 2021-22. Under this, 69 nurseries were established in the state and 1.27 million saplings were planted over an area of 3063 ha. Under RKVY training programs on "Accreditation Protocol for Agroforestry nurseries" (ICAR-CAFRI (2023) developed by ICAR-CAFRI under the aegis of Ministry of Agriculture and Farmers Welfare are being organised to enhance awareness among the stakeholders for its adoption. In Odisha Soil Conservation department is the State Nodal Agency.

4.3 JICA assisted OFSDP:

Tree cultivation in private lands is also being promoted under JICA assisted Odisha Forestry Sector Development Project being implemented in 7 districts, Angul, Boudh, Dhenkanal, Jharsuguda, Mayurbhanj,

Sambalpur, and Subarnapur, from 2017-18 for ten years. Strategy is based on providing an institutionalized platform for timber, NTFP and fruit plantations on private land to augment Natural Resource Base for sustainable and resilient livelihood with a target of 10000 ha. in five models viz. Agro-Hor-Silvi (mixed), Timber model, Pulp wood model, Horti-NTFP model, and Field Bund-Dyke model.

4.4 RKVY funded Project:

A five year project "Enabling Small Holders in Odisha to Produce and Consume More Nutritious Food through Agroforestry Systems" was implemented in two districts Nawapada, and Bolangir, from 2018-19 in collaboration with World Agroforestry Centre (International Centre for Research in Agroforestry). The broad objectives of the project, among others were to introduce and accelerate adoption of suitable agroforestry systems to enhance availability of nutritive food. Under this project a unique "Agroforestry *App* Odisha" has been developed and launched in December 2021, which can not only assist the farmers in identifying the right tree species but also provides information on integrated agroforestry systems, availability of quality planting material, and locations of the nearest nurseries.

4.5 Tree outside Forest India Program:

A joint initiative of MOEFCC & USAID Trees Outside Forests in India (TOFI) program was launched in 2021 covering seven states in the country including Odisha to bring together farmers, companies, and other private institutions to rapidly expand tree coverage outside of traditional forests. The program activities build on the State's progress and harness agroforestry to bolster the resilience of farming systems, while also further increasing the income of farmers in Odisha. It also attempts to promote certification of agroforestry and ToF areas. Draft "Odisha State Agroforestry Policy" was prepared under the program and it was *mutatis mutandis* notified by the state government in June 2025.

4.6 Vision 2030 for agroforestry research for Odisha:

Considering that despite evidence of successful Agroforestry practices in Odisha there is still lack of knowledge and little experience on establishment and management of specific models of Agroforestry under various Agro-climatic conditions in the state, and research support is important for wide acceptance of agroforestry in the State, Odisha University of Agriculture and Technology (OUAT) has prepared a Vision 2030 for agroforestry research.

Recently, Kalahandi has been selected as a district as export hub for wooden handicrafts, and Rayagada for tamarind, Kandhmals & Malkangiri for turmeric. This is likely to promote cultivation of related tree species under agroforestry.

4.7 Demand Supply Study by XIMB:

Timber demand-supply study for Odisha conducted in 2022 by XIMB has found that at the aggregate level, estimated demand has been around 60 times the legal state-owned supply. Against total estimated annual demand of 2.8 million cum present supply is only around 0.7 million cum. Although estimates are conservative, evidently the demand outstrips the supply from known sources across the districts of Odisha. The study also underlines the importance of self-reliance strategy resulting from the supply-chain shock caused induced by the COVID-19. It suggests including community via social or community forestry, involving VSS and private sector, to meet the demand supply gap, provided mono-cropping is not done. Thus, there is huge need and scope for promoting agroforestry in the state.

4.8 Odisha State Agroforestry Policy, 2025:

Government of Odisha, Forest Environment and Climate Change Department has notified the Odisha State Agroforestry Policy on 9th June / 4th July 2025. The Vision of the policy is to foster a resilient and sustainable agroforestry system that harmonizes agricultural productivity with sustainability and conservation of environmental values, climate resilience, socio economic development of marginalised rural communities while keeping in mind SDGs and preserving state's rich cultural heritage and ecological diversity. With the overall goal of creating a conducive environment for growth and sustainability of agroforestry benefiting both people and the planet, the policy objectives include integration of tree plantation with existing agricultural practices and, maximise tree cover, establishing a robust supply chain, legal framework that ensures traceability, simplified regulatory mechanism, and comprehensive market linkage between producers and consumers.

Amongst various strategic initiatives, the policy envisages setting up:

(i) A dedicated institutional mechanism to achieve synergy amongst various initiatives and coordination between the line departments and associated agencies to promote multifunctional agricultural landscapes through agroforestry and tree based production systems, a multi-stakeholder Task force under the Odisha Agroforestry Board to supervise the policy implementation, and

(ii) A agroforestry Science and Policy Council headed by the Chief Secretary, and comprising experts from organizations at the fore front of agroforestry namely ICFRE and ICAR-ICRAF, to advise decision makers on potential innovations and strategies for resolution of challenges, and intersectoral coordination and to achieve alignment with reacted national/state policies/rules/regulations, collaboration with international organizations for promotion of agroforestry.

Key stakeholders identified for successful implementation of the policy include Farmers and landowners, Educational Institutions and Research organizations, Industries and Private Sector, Non-Governmental and Community Based Organizations, Financial Institutions,

5. WAY FORWARD

Considering the increasing importance of agroforestry not only for ensuring sustainable agriculture, enhancing farmers' income, and meeting the raw material requirements of the tree products based industries in the state but also to mitigate the impact of climate change holistic implementation of the State Agroforestry Policy is necessary to achieve the full potential of agroforestry through creation of enabling governance and legal environment, and establishing the proposed institutional mechanisms. While actual grounding of the recently notified Odisha State Agroforestry Policy will take some time, following actions require urgent attention:

1. Establishing the State Agroforestry Board to mainstream agroforestry, encompassing all aspects of tree-based production systems covering the entire value chain, to achieve synergy between various ongoing and new initiatives through effective coordination and result oriented execution.
2. Mapping of existing and potential agroforestry tree products supply chains and identify potential districts/sub district areas for growth of agroforestry in the state.
3. Quick analysis of resources in existing agroforestry areas including species wise growing stock and sustainable annual harvest levels and rapid assessment of potential regions/areas for growth of tree product based industries. Encourage and incentivise establishment of tree product based industries in the state to provide markets for agroforestry products and also increase demand for local produces to reduce imports. It is also necessary to facilitate establishment of saw mills for production of sawn timber from wood harvested from agroforestry plantations, including from exempted spp. particularly since there is prohibition of transport of logs from the state to neighbouring states.
4. Relook at the regulatory mechanisms related to land and forest laws. Considering the increasing consumer awareness about "sustainability, traceability, legality" it will be prudent to ensure that harvested wood and other tree products are transported across the value chain with evidence of legality and sustainably managed resource.

   To achieve this, and without administrative hassles, land laws may be suitably amended to enable recording of trees growing/planted on private lands through a system of tree pass books, to facilitate harvesting on maturity and traceability place of origin through use of geotagging and other digital options including QR/Bar code. Need based certification of tree plantations through available and globally recognised ToF certification schemes may be incentivised.

   In this connection the State Government should organises multi stakeholder consultations involving all the stakeholder identified in the State Agroforestry Policy, 2025 on the model rules circulated by the MOEFCC (vide F. No. FP-8/8/2025 FP{E-261593 dated 18.06.2025) and frame rules for felling of trees in agricultural lands to encourage and incentivise farmers to integrate trees in their farming systems and to enhance ease of doing business in agroforestry tree products.
5. Development of farmer friendly package of practices for various proven agroforestry models in different agro-climatic zones in the State, and under Government schemes timely release of funds need to be ensured for success of agro/farm forestry plantations.
6. At present virtually no instruments are available for financing and insuring tree cultivation. Therefore it is necessary to develop financial instruments and insurance products suitable for tree growers through active stakeholder consultations.
7. There are a number of industries in the state which need to reduce their carbon foot prints. They may be encouraged to utilize a fixed percentage of the CSR funds towards tree cultivation in private lands in collaboration with farmer groups along with need based certification under available ToF certification schemes. Dovetailing with the green credit program of the Govt of India and with the Carbon Market provides a win-win situation for the industries as well as the tree growers.

8. Strengthening the extension of agroforestry through existing centres where trained manpower need to be engaged for proper and timely support to the growers and other stakeholders in the entire value chain. Build capacities of the concerned departments and frontline staff to have good understanding of agroforestry models and silvicultural practices.

REFERENCES

Anon., 2014, National Agroforestry Policy, India, 9p.

Anon., 2025, Odisha State Agroforestry Policy, 17p.

Arunachalam, A., R.H. Rizvi, A.K. Handa, S. Suresh Ramanan,, 2022, Agroforestry in India: area estimates and methods, Current Science, Vol. 123, No. 6, pp: 743-844.

Arunachalam, A. Ramanan S.S., and Singh, R., 2023. Agroforestry versus integrated farming system: Two versions of farm diversification in India. Indian Journal of Agroforestry, 25(2).

Bansal, A.K., 2016, *Bamboo and Rattan Resources in Odisha*, INBAR Technical report No. 38, 57p.

Bansal, A.K, 2022, *Wood Production and Consumption in India during 2019-20*, NCCF Policy Paper No. 1/2022, New Delhi, India.

Bhardwaj, D.R, Prashant Sharma, Dhirendra Kumar, Pankaj Panwar, Amit Kumar, Nazir A. Pala, Bhalendra Singh Rajput, Rakesh Kumar, Vipasha Negi, Priyanka Rajput, Anand Salve, Kafula Chisanga, Habibullah Tahiry, *Carbon stock inventory and biomass production in different land use systems of North West Himalayas*, https://www.researchgate.net/publication/373041246

Dhyani, S.K, A.K. Handa, Uma, 2013, *Area under agroforestry in India: An assessment for present status and future Prospects,* Indian journal of Agroforestry, Vol.15, No. 1

FSI, 2013, India State of Forests Report, 2013

FSI, 2024, India State of Forests Report, 2023, ISBN 978-81-950073-9-4

Gusain, Himshikha, J.S Butola, S. Dhobal, P. K. Poonia, (2021), *Farm-Based Income Through Agroforestry in North India*, e-newslett-July2021

https://www.researchgate.net/publication/353731377

ICAR-CAFRI (2023) *Accreditation Protocol for Agroforestry Nurseries*, ICAR - Central Agroforestry Research Institute, Jhansi, Uttar Pradesh; 29 pages.

Nair, P.R., Kumar, B.M. and Nair, V.D., 2021. *An introduction to agroforestry: four decades of scientific developments* (pp. 1-649). Cham: Springer.

NITI Aayog, 2024, *Greening and Restoration of Wastelands with Agroforestry*, 116p (ISBN No. 978-81-956821-3-3)

Mohapatra, Subash Chandra, and Sasmita Behera, 2023, *Four Decades of Agroforestry Research in Odisha by All India Coordinated Research Project on Agroforestry*, OUAT Publication No. 2023050004, 27p.

Singh, Mahendra, K.B. Sridhar, Dhiraj Kumar, R.P. Dwivedi, Inder Dev, R.K. Tewari, and O.P. Chaturvedi, 2018, *Agroforestry for doubling farmers' income: a proven technology for trans-gangetic plains zone of India*, Indian Farming 68(01): 33–34; January 2018

XIM, 2022, *Study on the demand and supply of timber for the establishment of wood based industries, in Odisha, School of Rural Management, Xavier Institute of Management University Bhubaneswar, 43p.*

Zomer, R.J., Bossio, D.A., Trabucco, A., van Noordwijk, M., Xu, J., 2022. *Global carbon sequestration potential of agroforestry and increased tree cover on agricultural land.* Circular Agricultural Systems 2:3. https://doi.org/10.48130/CAS-2022-0003).