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National Consultation on

Scaling Agroforestry

18-19 September, 2025

Proceedings and Recommendations

taas
Progress Through Science

Trust for Advancement of Agricultural Sciences (TAAS)

GOAL

Harnessing the potential of agricultural sciences for the welfare of people of India.

MISSION

Promoting growth and advancement of agriculture through science based, policy advocacy, public awareness and effective research and development partnerships.

OBJECTIVES

- To act as a 'Think Tank' to deliberate on key issues relating to agricultural research and innovation for development (ARI4D) and to influence policy decisions.
- To organize workshops, conferences, brainstorming sessions, seminars, policy dialogues and special lectures on emerging issues and new developments in agricultural sciences.
- To disseminate knowledge among stakeholders through publication of proceedings, strategy papers, policy briefs and success stories.
- To confer awards to the scientists and farmers of Indian and foreign origin for their outstanding contributions.
- To facilitate scientific interaction and partnerships of non-resident Indian agricultural scientists with Indian scientists.

National Consultation on

Scaling Agroforestry

18-19 September, 2025

NAAS Conference Hall, NASC, Pusa Campus, New Delhi 110 012

Proceedings and Recommendations

Organizers

Indian Council of Agricultural Research (ICAR), New Delhi
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World Agroforestry Center (CIFOR-ICRAF) - India Office, New Delhi
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Foreword

India has long been a pioneer in agroforestry, demonstrating remarkable success since the adoption of the world's first National Agroforestry Policy (NAP) in 2014. Agroforestry has proven its immense socioeconomic value, notably by meeting nearly 90 per cent of the industrial timber requirements and significantly boosting our 'Trees outside Forest' cover. Importantly, agroforestry will also help in achieving nationally determined component for carbon sequestration to meet the Paris Agreement through additional carbon sink of 2.5–3.0 billion tons of CO_2 equivalent by 2030 and for attaining the land degradation neutrality targets.

Despite this profound potential and demonstrated profitability across diverse agroclimatic zones—from rehabilitating degraded lands to securing food and nutrition security—the pace of adoption of agroforestry has not been as per the expectations.

Hence, the concerned experts meticulously discussed the constraints hindering widespread scaling of agroforestry and identified the major structural impediments, including fragmented inter-ministerial coordination, persistent policy bottlenecks concerning the felling and transport of tree produce, and the lack of quality planting material (QPM), with less than 10 per cent currently meeting quality standards. Furthermore, the neglect of the holistic tree-crop-livestock web, and the absence of an incentive-based framework, such as guaranteeing the minimum support price (MSP) for agroforestry produce, discourage vulnerable small landholders.

The two-day consultation was, therefore, organised to deliberate in depth and seek answers as to how do we scale-up agroforestry successfully. The resulting Strategic Road Map, detailed in this document, offers concrete recommendations. It calls for immediate action to establish robust QPM certification systems, develop a dedicated agroforestry extension network, assure justified higher budget allocation for R&D, and institutionalise mechanisms for compensating farmers for the environmental services they render, akin to the principles of Reducing Emissions from Deforestation and Forest Degradation (REDD+) with financial incentives, which is an initiative developed under the United Nations Framework Convention on Climate Change (UNFCCC) to mitigate climate change.

This timely publication based on the National Consultation on Scaling Agroforestry held on 18-19 September 2025 at the NAAS Conference Hall, NASC Complex, New Delhi, synthesises the collective wisdom of India's leading scientists, policymakers, development partners, and industry leaders in agroforestry. It is a blueprint for actions that recognises agroforestry as an important option in our nation's sustainable development strategy.

I urge all the stakeholders—from government system to private sector investors—to embrace the recommendations that emerged from this national consultation. By fostering authentic partnerships and implementing these measures in a mission mode approach, we can unlock the full potential of agroforestry, ensuring ecological resilience and sustained prosperity for our smallholder farmers. I take this opportunity to congratulate the Editors for their meticulous efforts in bringing out this very useful publication.

RS Paroda

(*Padma Bhushan Awardee*)
Chairman, TAAS, and
Former Secretary, DARE & DG, ICAR

Contents

Acronyms and Abbreviations

AAU	Assam Agricultural University
AF	Agroforestry
AFDB	Agroforestry Development Board
AFS	Agroforestry System
AI	Artificial Intelligence
AICRP	All India Coordinated Research Project
AMAA	Agroforestry Mission under Atmanirbhar Bharat
ASRB	Agricultural Scientists Recruitment Board
ATARI	Agricultural Technical Application Research Institute
ATMA	Agricultural Technology Management Agency
BAIF	Bharatiya Agro-Industries Foundation
BCKV	Bidhan Chandra Krishi Viswavidyalaya
CAFRI	Central Agroforestry Research Institute
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CCS HAU	Chaudhary Charan Singh Haryana Agricultural University
CEO	Chief Executive Officer
CESCRA	Centre for Environmental Science and Climate Resilient Agriculture
CFI	Centre for Fruitful India
CIAH	Central Institute for Arid Horticulture
CIFOR	Center for International Forestry Research
CIPHET	Central Institute of Post Harvest Engineering & Technology
CoP21	21st Conference of Parties
CSA	Climate-Smart Agriculture
CSR	Corporate Social Responsibility
CSSRI	Central Soil Salinity Research Institute

DA&FW	Department of Agriculture and Farmer Welfare
DARE	Department of Agricultural Research and Education
DDG	Deputy Director General
DG	Director General
DRDO	Defence Research and Development Organisation
DSS	Decision Support System
e-NAM	electronic National Agriculture Market
ETS	Emission Trading System
FAO	Food and Agriculture Organization of the United Nations
FPOs	Farmer Producer Organizations
GBPUAT	Govind Ballabh Pant University of Agriculture and Technology
GCP	Green Credit Program
GHG	Greenhouse Gas
GIS	Geographic Information System
GST	Goods and Services Tax
HMPP	Horticulture Mission for Plantation Produce
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICRAF	International Centre for Research in Agroforestry
ICRAF	World Agroforestry Center
IFS	Integrated Farming System
IGFRI	Indian Grassland and Fodder Research Institute
INDC	Intended Nationally Determined Contribution
INR	Indian Rupee
IoT	Internet of Things
JCM	Joint Credit Mechanism
KCC	Kisan Credit Card
KVKs	Krishi Vigyan Kendras
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MKIS	Market Knowledge Information System

MoA&FW	Ministry of Agriculture & Farmers Welfare
MoEFCC	Ministry of Environment, Forest and Climate Change
MRV	Measurement, Reporting, and Verification
MSP	Minimum Support Price
mt	Million Ton
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agriculture and Rural Development
NADB	National Agroforestry Development Board
NAFM	National Agroforestry Mission
NAP	National Agroforestry Policy
NBPGR	National Bureau of Plant Genetic Resources
NBS	Nature-Based Solutions
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organization
NMSA	National Mission for Sustainable Agriculture
NRAK	National Repository of Agroforestry Knowledge
NREGA	National Rural Employment Guarantee Act
NTFPs	Non-Timber Forest Products
NTMS	National Timber Management System
ODOP	One-District One-Product
PAU	Punjab Agricultural University
PES	Payment of Ecosystem Services
PFSC	Partner Farm Service Centre
PKVY	Paramparagat Krishi Vikas Yojana
PPPP	Public–Private–Peasant Partnership
PPPP	Public–Private–Producer farmer-Partnership
PPP	Public-Private Partnership
QPM	Quality Planting Material
R&D	Research and Development
REDD+	Reducing Emissions from Deforestation and Forest Degradation

RKVY	Rashtriya Krishi Vikas Yojana
RLCAU	Rani Lakshmibai Central Agricultural University
SAPCC	State Action Plans on Climate Change
SDGs	Sustainable Development Goals
SHG	Self-Help Group
SKAUST-K	Sher-e-Kashmir University of Agricultural Sciences and Technology - Kashmir
SLHs	Small Land Holders
SMAF	Sub-Mission on Agroforestry
SMS	Subject Matter Specialists
SOC	Soil Organic Carbon
SRT	Saguna Rice Technology
TAAS	Trust for Advancement of Agricultural Sciences
TERI	The Energy and Resources Institute
ToF	Trees Outside Forests
TOFI	Trees Outside Forests in India
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VB-G Ram G	Viksit Bharat-Guarantee for Rojgar and Ajeevika (Gramin) Act 2025
VER	Voluntary Emissions Reducing
WADI	Backyard Orchard (in tribal dialect of Gujarat)
YSPUHF	Dr YS Parmar University of Horticulture & Forestry

National Consultation on Scaling Agroforestry

BACKGROUND AND RATIONALE

Agroforestry is well-recognized to significantly reduce the risk of climate change, and make the environment more conducive to humans, livestock, and agriculture. As natural forest cover across the globe is decreasing and agriculture is facing the challenges of sustainability, the only effective way to meet these challenges is to promote and mainstream agroforestry. Globally, about 1.2 billion people practice agroforestry on 10 per cent of the total agricultural cover, comprising over 1 billion hectares, and depend upon its products and the ecosystem services. Thus, growing forest and fruit trees on agricultural fields is the way to compensate the lost forest cover; provide the benefits that otherwise will be obtained from already over-exploited forests; increase environmental sustainability; enhance the production of nutrition-rich food (fruits and vegetables) fodder, phyto-medicines, fuel wood, and timber; reduce soil erosion and degradation; assist in rehabilitation of degraded lands; enhance soil organic matter and microbial diversity; remove atmospheric carbon through sequestration; support biodiversity; and provide many other social, religious, and aesthetic benefits. Agroforestry also reduces farmers' risks due to crop failure.

The rapid urbanization of past decades created scarcity of vegetables, fruits and dairy products in urban areas. The problem became more serious during the COVID-19 epidemic when along with health and nutrition crisis, food security also faced a crisis. Therefore, urban and peri-urban agroforestry systems using treated poor-quality waters judiciously may help in solving food and nutrition security, greening the landscapes, mitigating the micro-climate of the cities and towns, and also sequestering the carbon from air.

Agroforestry provides immense socioeconomic and environmental benefits. India implemented the world's first National Agroforestry Policy (NAP) in 2014. The NAP led to — establishing the Sub-Mission on Agroforestry with allocation of USD 146.3 million to facilitate its implementation; and removing bottlenecks of on growing, felling and transporting 650 agroforestry species in 25 Indian States and Union Territories. Inclusion of agroforestry in the portfolio of corporate social responsibility (CSR) opened a new window of investment. In recent years, USD

3.5 billion were invested for tree planting through CSR schemes. Not surprisingly, agroforestry boosted the supply of industrial timber as about 90 per cent of the industrial requirements of timber are met from agroforestry sector, and during 2015-2019 tree cover out- of- forest' increased by 1.8 per cent, out of which 86 per cent is credited to agroforestry. To mainstream agroforestry into their policy landscapes, Indian states are working with partners to develop state specific policies. Government of India in 2023, under the *Krishi Vikas Yojana* (RKVY-National Agriculture Development Plan), proposed an agroforestry component that focuses on production of quality planting material (QPM). This is supported by a proposed budget of USD 54 million, including investment by the states.

Globally, agroforestry is recognized as the ultimate approach to enhance the resilience to climate change and reduce the carbon footprint of the developmental activities. To achieve their Intended Nationally Determined Contributions (INDCs), 23 countries recognize agroforestry as a priority for mitigation, and 29 countries for adaptation, and India is a major player in this consortium. A recent meta-analysis of carbon sequestration potential of agroforestry systems in Indian landscape indicated that the agroforestry systems are technically feasible and economically profitable. Such successes caused ripple effects in the region and beyond.

In India, opportunities prevail over the climate mitigation due to carbon sequestration thereby contributing to achieving the national commitment of greenhouse gas (GHG) reduction as per Paris Agreement creating additional sink of 2.5–3.0 billion tons of carbon dioxide equivalent by 2030 *vis-à-vis* United Nations Convention to Combat Desertification (UNCCD) target of reclamation of 26 mha of wastelands. India developed agroforestry models for all the agro-climatic zones. With global manifesto of carbon neutrality, agroforestry R&D is expected to expand substantially. Intensive research is being done to identify elite germplasm including fast-growing clones of trees like eucalyptus, poplar and bamboo to augment future demand for industrial raw materials. With India having set the standards for agroforestry nursery infrastructure and QPM standards for seedling certification, it is imperative that adequate financial allocations are provisioned in the government schemes to realize the ecosystem services of agroforestry as envisaged in the agroforestry policy. With the spinning wheels of agro-ecology, land degradation neutrality, carbon neutrality and the livelihood options, there is an urgent need to promote agroforestry in a mission mode.

CONSTRAINTS

India made significant transformational changes for increasing tree cover out-side forests. It developed several technologies for— tree plantation, rehabilitation of degraded/deserted landscapes, judicious utilisation of saline waters for developing

agroforestry systems, improving live-stock-based silvo-pastoral systems, water harvesting technologies for dry regions, and developing commercial agroforestry (AF) models for high income. However, despite substantial progress and demonstrated success in various agro-climatic zones, untapped potential still persists due to several challenges and as the agroforestry could not be adopted to the extent of its potential. Despite the fact that several global, national and state level programs of tree plantations were initiated and technological knowhow made available but the adoption of agroforestry at a desired scale is not happening. The inconsistencies across states and a lack of inter-ministerial and inter-departmental coordination hinder effective implementation of the programs and policies including National Agroforestry Policy (NAP). The policy bottlenecks regarding growing, felling, and transportation of agroforestry species in certain regions still persist. Strict regulations and legal restrictions on harvesting and transporting trees planted on farmlands hinder the adoption of agroforestry. The mandate of agroforestry falls under the purview of various ministries, departments, and state governments. There are inconsistencies across states creating diverse problems but are not widely known to the farmers. The entire agroforestry mission must be under the Ministry of Agriculture and Farmers Welfare alone. It must not be based only on tree but also on tree-crop-livestock including fish culture, and need to be dealt under agroforestry.

Despite increased investment by DA&FW, adequate financial allocations in government schemes are still lacking to fully realize the potential of ecosystem services envisioned by the agroforestry policy. Farmers who are chronically-food-insecure and rely on irregular cash income are not in a position to adopt agroforestry. While economically profitable in many cases, enhancing economic viability and mitigating risks for farmers are important for widespread adoption, especially considering potential market fluctuations. Market infrastructure and price information mechanisms are lacking. There is no separate budget for R&D and implementation of AF, and the methodology of allotment and expenditure lack transparency.

Among the main constraints for adoption of agroforestry include— land holding and ownership issues, lack of land and tree tenure in many areas e.g. NEH region, rules and regulation of harvesting timber, transportation cost, long gestation period of trees, livestock being a neglected component of agroforestry, gender empowerment, limited access to incentives and market support mechanisms, fluctuating prices and lack of minimum support price (MSP) for agroforestry produce; and lack of incentive-based framework.

Strengthening capacity at all levels – from farmers to policymakers – is lacking but crucial for successful adoption and mainstreaming of agroforestry practices.

This includes training on sustainable practices, quality planting material (QPM) production and marketing, and access to relevant technologies. However, research results on agroforestry do not regularly reach the farmers because of the lack of a dedicated extension system and absence of an effective communication and knowledge sharing mechanism. Awareness is lacking on the ground, with farmers sometimes fearing that too many trees on the farm may lead to change in land use. There must not be any radar on cultivation and harvesting of the tree and agroforestry products. There is always a shortage of quality planting material and improved seed varieties. Only about 10 per cent of planting material is of good quality but the rest is without any guarantee for quality standard.

Proper funding, lack of proper insurance facilities including of livestock, poor source of information/ knowledge sharing mechanism, age and level of education of farmers, capacity building of different stakeholders, lack of storage facilities, lack of proper cottage industries, negligible extension framework, lack of budgetary allocations, and transparency in the expenditure guidelines are some of the major constraints for scaling agroforestry.

OPPORTUNITIES

India, despite the challenges, has ample opportunities to scale-up the agroforestry to —mitigate climate changes, enhance incomes, improve livelihoods of farmers and soil health through the application of appropriate technologies and enabling policies, which are outlined here.

Agroforestry plays a crucial role in rehabilitating degraded lands and improving soil health. It assists in the rehabilitation of degraded lands and improvement of soil organic matter. Agroforestry offers significant carbon sequestration potential, contributing to India's national commitments under the Paris Agreement and UNCCD targets. Globally, agroforestry is recognized as an ultimate tool to enhance the resilience to climate change and reduce the carbon footprint of the developmental activities. Agroforestry provides diverse livelihood options for rural communities, including food, fodder, fuelwood, timber, and non-timber forest products. It offers both economically and ecologically viable options to farmers and rural people for large-scale diversification in agriculture to supplement fuel, fodder, fruits and fibres on one hand and on the other hand environmental amelioration. The sector can significantly contribute to meeting the growing demand for industrial timber, reducing reliance on natural forests. Agroforestry boosts the supply of industrial timber.

Research in elite germplasm identification and varietal development can further enhance the productivity and economic viability of agroforestry systems. Concerted R&D efforts mean that India has promising agroforestry models for all

the agro-climatic zones. India has numerous traditional tree-based land use systems such as tropical home-gardens, agri-silviculture, silvo-pastoralism, etc. which are time-tested community-based agroforestry systems with strong socio-cultural ethos that need to be promoted.

The adoption of the National Agroforestry Policy by the government of India in 2014 is expected to remove challenges as well as increase the farm productivity and the livelihood of the small and marginal farmers substantially in the future. The growing interest of corporations in corporate social responsibility (CSR) initiatives presents a substantial opportunity for increased investment in agroforestry projects. Inclusion of agroforestry in the portfolio of corporate social responsibility opened a new window of investment. It is desirable to establish a trained cadre of extension in agroforestry, besides establishing Centre(s) for Excellence in Agroforestry for capacity building.

Present Status of Agroforestry in India

Agroforestry, a land-use system that integrates trees/livestock in farming systems to enhance productivity, profitability, diversity, and ecosystem sustainability, is increasingly gaining global importance, particularly in the context of climate change. Currently, agroforestry is recognized as a vital science for reclaiming and rehabilitating degraded lands, conserving water, preserving biodiversity, ensuring livelihood security, enhancing the microclimate, and mitigating climate change. Several global initiatives, such as the UN Convention to Combat Desertification (UNCCD), the G20 Global Land Initiative, the UN Decade on Ecosystem Restoration, and the Great Green Wall Program (in Africa and China), along with national programs like the National Action Plan to Combat Desertification, the Integrated Watershed Management Program, and the National Green India Mission, were implemented to arrest desertification and mitigating climate change. Agroforestry played a significant role in these efforts, resulting in the successful establishment of about 1 billion hectare tree cover (with more than 10% tree cover) globally and 28.427 mha under agroforestry practices in India. The country took the lead in bringing out the National Agroforestry Policy (NAP) in 2014; The National Action Program to Combat Desertification; and National and State Action Plans on Climate Change (SAPCC) where the agroforestry is the main stay. These plans represent a potentially potent policy tools for driving the expansion of AF at the sub-national level. To meet international obligations to mitigate climate change the "4 per Thousand" aspiration proposed during the 21st Conference of Parties (CoP21) in Paris which was aimed at agricultural solution to address climate change by increasing SOC by 0.4 per cent per year; India pledged to achieve the Land Degradation Neutrality Targets of 26 mha by 2030, increasing the share of non-fossil fuel based power generation capacity to 40 per cent, as well as creating an additional carbon sink

of 2.5 to 3.0 billion tons of CO_2 eq. through afforestation. India's 117 million small land holders (SLHs), which are 86 per cent of the total operational holdings, are cultivating over 72 mha of land and meeting more than half of India's food requirement. Soils of these SLHs is very low in SOC (1,370-1,770 Tg C), which can be increased to 2,460 - 2,650 Tg C by 2050 through large scale adoption of best practices of cultivation such as conservation agriculture and agroforestry. With these practices, we can enhance carbon sequestration by 70-130 Tg CO_2 eq per annum and can produce 410-440 million tons (mt) of food grains accounting for 80-85 per cent of total food requirement by 2050.

Specific technologies were developed in India to rehabilitate degraded lands and halt desertification. Many adoptable, profitable and successful tree species were identified. Climate resilient agroforestry systems were developed in different agro-ecological zones such as sand dunes stabilization; watershed management; afforestation of ravines and gullies; indigenous sustainable agroforestry practices as alternatives to shifting cultivation; rehabilitation of salt-affected lands; bio-drainage for waterlogged areas and controlling seepage along canals; alley cropping for sloping lands; shelter belts and windbreaks; commercial plantations in irrigated ecologies, and multi-tiered plantation-based systems in humid regions. Despite having a diverse range of high-value species, along with sustainable and scalable plantation technologies and viable farming systems, the adoption of agroforestry is not to the extent as desired. We need focused attention and strategic planning to expand agroforestry at both the regional and national levels. There is a significant potential to increase the area dedicated to agroforestry-based farming systems and to enhance tree plantations outside forests. We have witnessed the success of poplar and eucalyptus as boundary as well as on crop fields in the Indo-Gangetic plains in irrigated ecologies, and casuarina, bamboo and many other soft-wood and timber species in central and southern India, which may further be enhanced with appropriate policy initiatives in a researcher-industry-farmer partnership mode, making sure that farmers get the right price, including of the environmental services rendered by the agroforestry systems.

In dry regions, livestock is the lifeline of rural communities, and degraded grazing lands may be brought under productive economies involving elite fodder trees, shrubs, grasses and local climate resilient livestock breeds. Most of these regions have saline aquifers, which, along with harvested rainwater, may be used judiciously, applying micro-irrigation methods to develop sustainable climate-resilient agroforestry systems. Agroforestry practices using potential trees (including fruit trees) and salt-tolerant conventional and non-conventional crops like barley, mustard, cluster bean, beet-root, pearl millet, quinoa, grain amaranths, grasses, fodder shrubs and high-value medicinal plants were successfully developed utilizing saline

groundwater and stored rainwater. These practices require financial and technical support for further upscaling.

Land modification in saline waterlogged areas represents a significant technological advancement. This approach aims to improve agricultural productivity and sustainability in challenging environments where high salinity and waterlogging hinder crop growth. In coastal areas, fish and shrimp cultivation along with rice in furrows, vegetables and fruits on raised beds and trees on the boundary, is quite profitable. Multi-enterprise farming systems involving livestock, fish, fruit, vegetables, poultry and dairy are quite profitable innovations and may be supported further.

Approximately, 50 per cent of India's population resides in urban areas. To maintain pollution-free urban and peri-urban areas, agroforestry should be prioritized, especially in peri-urban zones, by using treated sewage water wisely, which provides nutritional benefits for plants. Landscapes with proper selection of avenue trees and lawn grasses can be developed using water harvested from rooftops and sewage. Floriculture and cultivation of aromatic plants irrigated with sewage water have the potential for significant expansion and development on a larger scale, offering a wide range of opportunities in the plant and flower industry. Vertical gardens, roof cultivation, and indoor plants play a significant role in enhancing the microclimate of their surroundings and contribute to carbon sequestration. This aspect needs more in-depth research and policy initiatives.

We have more than 6 million km roads, about 135 thousand km railway track and about 20 thousand km long canals and rivers in the country, which is very large area for tree plantations. If planned properly with the participation of farmers whose fields fall along these habitats and having the proper choice of tree species beneficial for the rural communities, a large number of trees outside forest can be grown. The farmers must be made partners in these stands and paid for the protection of the trees and the environmental services gained.

The upscaling of agroforestry practices needs research-based meta-analysis of traditional as well as modern practices keeping in view— the fine scale variation in social, economic and ecological context and how this creates a need for adoption of a particular practice. The analysis must reflect the importance of developing appropriate mechanisms, markets and institutional context, and appropriate research design be formulated to cover success as well as failure of a practice adopted within the scaling process, that enables co-learning amongst research, development and private sector stakeholders. The use of modern technological tools such as GIS and remote sensing and micro-irrigation and climate-smart conservation agriculture with tree component, and judicious use of microbial consortia may play a significant role in rehabilitating the degraded lands and

developing climate-resilient agroforestry systems. Important agroforestry systems must be scientifically evaluated so that the farmers are paid as per environmental services rendered by these systems, following incentive-based frameworks such as REDD+.

India's approach to agroforestry is an effective strategy in the context of climate change and its mitigation. National Policy on Agroforestry, National Action Plan on Climate Change and the State Action Plans on Climate Change along with many other initiatives are the mile stones for promoting agroforestry in the country. The National Agroforestry Policy needs to be more effective and adoptable having strategies and action plans that acknowledge the importance of trees and tree-based systems including livestock component in rural development, provide distinct guidance for the scaling-up process, and organize cross-sectorial coordination across ministries responsible for agroforestry. Most of the above-mentioned plans are tree-based with insufficient attention given to the crop-tree-livestock matrix, which could offer greater scope for reducing agricultural emissions; existing constraints to the expansion of agroforestry are yet to be adequately addressed; strategies lack necessary precision to enable effective implementation on the ground; and absence of transparent, activity-wise accurate accountable budget estimates, hence hindering the meaningful action plans at ground level. Most of the policy initiatives need to answer three questions i.e., WHY (we require the initiative), WHAT (will be done) and HOW (the program must be implemented). Somehow, often we get the answer of first two questions but the third question, which is the key of successful implementation of a program often remains ignored. We need effective analysis with adaptability and profitability parameters at system level and the exact measures of implementation. We must also look into the scope of agroforestry on all kinds of lands, extent of degraded/ waste land, and further strengthening agroforestry on existing stands.

The successful scaling of adoption necessitates information sharing, financial involvement from public and private sectors, sufficient market facilities and infrastructure, value addition, and authentic partnerships and cooperation among relevant stakeholders. Several national and global programs were initiated but for the actual implementation of agroforestry, convergence and dovetailing with a number of these programs at global, national and state level are wanting and we need to develop a mechanism for that. There is a need for scaling-up of site-specific technologies already developed for different situations and selection of the most suitable species (preferably nitrogen fixing, nutrition providing and indigenous trees including some fruit trees) and adoptable and profitable agroforestry practices under the guidance of Working Group of Experts. Approachable market and guarantee of minimum support price (MSP) for AF commodities, including livestock products must be assured through legislation or a policy. Availability of quality germplasm of elite

trees and crop cultivars is still an issue to be resolved for which a certification and accreditation system must be in place. Value addition and capacity building at the level of different stakeholders and strengthening extension net-work must get priority. Incentives for innovations and entrepreneurship must be given and involvement of educated youth, including women's self-help groups is the key to adopt modern tools in agriculture. Any project must be handled in a participatory mode involving researchers, extension workers, industry and farmers. The investment of public and private sectors in AF research, development and education must be encouraged at policy level and investment in establishment of value-added chain of small industries in rural areas for agroforestry products including dairy and other animal products must be assured. A policy for scaling-up agroforestry should address local contexts, develop supportive institutional frameworks and markets, and embed research into development practices through participatory and co-learning approaches.

ABOUT THE NATIONAL CONSULTATION

The success of the NAP and the growing global recognition of agroforestry as a crucial climate change mitigation and adaptation strategy necessitates a comprehensive review and strategic planning for future growth and to leverage India's experience and learnings to develop national policies and strategies for accelerating the adoption of agroforestry. There is an immediate need of conducting meta-analysis of existing agroforestry systems, operational parts and budget allocations and proper expenditure methodologies of on-going projects, international collaborations, inter-departmental and institutional collaborations, and policy implementation issues. In view of the above, a National Consultation on Scaling Agroforestry, was organized jointly by the Trust for Advancement of Agricultural Sciences (TAAS), New Delhi; Indian Council of Agricultural Research (ICAR), New Delhi; ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi; and World Agroforestry Center (CIFOR-ICRAF)–India Office, New Delhi.

OBJECTIVES

- To assess the current status of agroforestry implementation in India, and identify the constraints, challenges, and potential
- To identify policy, economic, and capacity-related bottlenecks hindering the wider adoption and scaling-up of agroforestry
- To develop a strategic road map for scaling-up agroforestry in India, aligning with national development policies and global climate commitments
- To foster collaboration and coordination among stakeholders, including government agencies, research institutions, private sector, NGOs, and farmer communities.

EXPECTED OUTCOMES

- Major challenges and constraints identified and suitable measures for promoting the use of agroforestry suggested.
- Strategies for strengthening agroforestry research, development, and capacity building along with increased investment suggested.
- Appropriate mechanism developed for collaboration and coordination among stakeholders, including government agencies, research institutions, private sector, NGOs, and farmer communities.
- A road map for upscaling adoption of agroforestry aligning with national development policies and global climate commitments developed.

INAUGURAL SESSION

A warm welcome was extended by **Dr Bhag Mal**, Secretary, TAAS to the Chairman of the Inaugural Session, Dr RS Paroda, Founder President, Trust for Advancement of Agricultural Sciences (TAAS), and the former Secretary, DARE & DG, ICAR; and the Guests of Honour, Dr Rajbir Singh, Deputy Director General (DDG; Agricultural Extension), Indian Council of Agricultural Research (ICAR); Dr AK Nayak, DDG (NRM), ICAR; and Dr Ravi Prabhu, former DDG, International Centre for Research in Agroforestry (ICRAF). He expressed his gratitude to Dr Eliane Ubalijoro, CEO, Center for International Forestry Research and International Centre for Research in Agroforestry CIFOR-ICRAF, and Director General, ICRAF, Nairobi, Kenya, for sending his message as the Guest of Honour. Dr Bhag Mal also welcomed Mr Manoj Dabas, Country Director ICRAF, and all the eminent experts from various organizations, distinguished invitees, and the participants. While setting the context, Dr Bhag Mal highlighted the importance of agroforestry in reducing the risk of climate change and making the environment more conducive to humans, livestock, and agriculture. As natural forest cover is decreasing in most of the countries, the only effective way to increase the green cover is to promote and mainstream agroforestry. A Sub-Mission on Agroforestry was established with an allocation of US $146.3 million to facilitate the implementation of the national agroforestry policy, which has addressed the bottlenecks of growing, felling, and transporting 650 agroforestry species in 25 Indian states and union territories, and the inclusion of agroforestry in the portfolio of Corporate Social Responsibility (CSR). In recent years, US $3.5 billion were invested for tree planting through CSR schemes.

The Government of India in 2023, under the *Krishi Vikas Yojana*, proposed an agroforestry component that focuses on production of quality planting material. This is supported by a budget of US $54 million, including investment by the states. India has the national commitment of greenhouse gas reduction as per the Paris

Agreement, creating an additional sink of 2.5 to 3 billion tons of carbon dioxide, for which improved agroforestry models need to be developed and scaled in all the agro-climatic zones of the country. He emphasised that currently, scaling agroforestry is facing challenges and constraints such as inconsistency across states, lack of inter-ministerial and inter-departmental coordination, legal restrictions on harvesting and transporting trees, and the mandate of agroforestry falling under the purview of various ministries, departments, and state governments.

There is also a problem of inadequate financial allocations in government schemes, lack of market infrastructure, and price information mechanisms. The research results on agroforestry do not regularly reach the farmers owing to lack of awareness, lack of a dedicated extension system, and lack of effective communication and knowledge sharing mechanisms. There is a shortage of superior planting material and improved varieties, as only about 10 per cent of the planting material is of high quality. Despite these challenges, India has ample opportunities to scale up agroforestry to mitigate climate change, enhancing incomes and improving livelihoods of farmers and soil health through the application of appropriate technologies and enabling policies. The sector can significantly contribute to meeting the growing demand for industrial timber and reducing reliance on natural forest. Research on elite germplasm identification and varietal development can further enhance the productivity and variability of agroforestry systems. Identification and promotion of priority agroforestry species tailored to specific eco-regions would be highly beneficial. Fortunately, India has institutions on agroforestry both under the ICAR in the Ministry of Agriculture and Farmers Welfare (MoA&FW) and also in the Ministry of Environment, Forest, and Climate Change (MoEFCC), including an All India Coordinated Project on Agroforestry. These institutions have come out with very useful information identifying trees and technologies that need to be scaled-up. He expressed hope that the two-day program, which primarily comprises three well-structured technical sessions with keynote and invited lectures, an evening lecture, and a roundtable discussion in four different groups on research and innovation, enabling policies, value chains and market increases, and capacity building and extension for developing the road map for the future will bring useful recommendations for the way forward.

Dr Ravi Prabhu, Former DDG, ICRAF mentioned that before the advent of modern era, agriculture in India was agroforestry. India's traditions in agroforestry go back 3,000-4,000 years**.** Indeed, one of the oldest cultures that understood that integrating trees, crops, and livestock was both productive and resilient. Pottery excavations from Harappa and Mohenjo-daro, were found to carry spices, some of which came from Kerala and other parts of the country, suggesting that, these products were being trans-traded across ancient India, and these could only have

come from mixed farming systems which included trees. Indeed, so successful was black pepper farming in Kerala, that it was traded all across the ancient world. He mentioned that in Egypt the mummification required black pepper. The Roman Empire was bleeding gold to Kerala for the black pepper. There is no way that pepper can be produced without an agroforestry system, and this is just one example. He emphasised that, in fact, we are rethinking of our traditional agroforestry systems to understand how we reintegrate trees, crops, and livestock from a period where we were pushed to separate everything. And if we are looking for climate-resilient and productive solutions, we must look to this system. The breeding programs are focused on open-field agriculture. We have under-invested in looking at which varieties or clones, can be produced so that they can be productive together with trees and *vice versa*. What trees are best, and what is our breeding program for those trees to support crop and livestock agriculture? Quite apart from increasing tree cover, we should look into increasing the biotic pump, which regulates rainfall and mitigates excessive rainfall. So, agroforestry has major role in future. India continues to lead the world in investments in agroforestry and its research. But a lot more can and must be done if we are to support our food security, timber security, and increase the livelihoods of our farmers because agroforestry can increase farmer income as well.

Dr AK Nayak, DDG (NRM), ICAR, New Delhi, mentioned that the agroforestry is not only a part of our civilization but also of our life and agriculture. In fact, no single other crop provides the kind of benefit that agroforestry plants provide. Be it food and nutritional security, reducing the impact of climate change, medicine, fodder, soil fertility, addressing land degradation—in every aspect, agroforestry has an important role to play. Besides having 28 million hectares (mha) of area under agroforestry, we need to fix a target for the year 2047 or 2050 to address the problems related to climate change and our commitments to the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). We have committed that under the Intended Nationally Determined Contributions (INDC), we shall have to reduce the carbon dioxide concentration from the atmosphere through various means. Through tree plantations we will have to reduce around 2 billion tons of carbon dioxide by 2030. Agroforestry is an important component to fulfil those targets in the future. Similarly, under UNCCCD, we have committed for 26 mha land for land-degradation neutrality. In Rajasthan and Gujarat—agroforestry tree species have stabilized the sand dunes and arrested the progress of desertification. The agroforestry species stabilized many of the salt-affected soils and also eroded lands.

Dr Nayak reiterated that CAFRI worked out and fixed a target 53 mha of land under agroforestry by 2050. We will have to check out in which agro-climatic zone

and for what purpose these agroforestry species have to be disaggregated. We would have to find out how much we can harness from farm forestry, industrial forestry, and roadside plantations?

He highlighted that a key area of study is assessing agroforestry through surveys. Although India promotes important species such as willow, poplar, and neem, there is no reliable data on how these species have expanded under agroforestry over the past 20 years. With the availability of technologies such as spectral signatures and high-resolution satellite imagery, a methodology can be developed to track their temporal growth and monitor progress. Equally important is ensuring that agroforestry benefits reach small and marginal farmers. Research is ongoing to determine optimal tree densities that allow agricultural crops to maintain acceptable yields while providing additional benefits. New mechanisms such as Green Credits and Carbon Credits offer income opportunities, and the government has already initiated a Green Credit platform. However, clear standards, methodologies, and monitoring and reporting protocols are essential to ensure farmer participation, investment, and effective implementation.

Dr Nayak noted that while Green Credits are government-led and Carbon Credits attract private investment, the lack of standardized methodologies and monitoring systems limits their effectiveness, especially for small and marginal farmers in agroforestry systems like silvi-pastoral models. He also stressed the need to strengthen tree breeding and genomic research, particularly for bamboo, to support trade-oriented agroforestry and carbon markets.

Dr Rajbir Singh, DDG (Agricultural Extension), ICAR, while addressing the National Consultation highlighted the timeliness of the event and reflected on India's agroforestry journey. He recalled the World Agroforestry Conference held in Delhi nearly a decade ago, where the then Hon'ble President of India, late Shri Pranab Mukherjee, announced the National Agroforestry Policy. India was the first country in the world to adopt a National Agroforestry Policy.

Dr Singh noted the traditional five Fs of agroforestry—Food, Fodder, Fibre, Feed, and Fuel—and highlighted a newly added dimension: Fund or Credit in the form of Carbon Credits. His central concern was to define a road map to upscale the adoption of agroforestry and identify how best to leverage available opportunities for farmers' welfare. He paid tribute to farmer leader Sardar Manmohan Singh but noted that the successful agroforestry models in Punjab are primarily found with resourceful farmers having large land holdings, often those who have migrated abroad and manage their farms remotely. The key challenge, Dr Singh stated, is how to translate these models for the benefit of small and marginal farmers, who constitute 86 per cent of the farming community.

In Haryana and Uttar Pradesh, particularly in the Yamunanagar and Saharanpur belt, agroforestry has flourished mainly due to industry support, specifically the plywood industry. This highlights a crucial question: What model can suit the farms of small and marginal landholders? He mentioned that while the agroforestry area in the country is estimated at 28 mha, there is a need for debate on its growth over the last decade and projections for the next ten years. The biggest bottleneck is the pathway to reach small and marginal farmers.

Dr Singh argued that the basic extension tool of a demonstration plot is inadequate for agroforestry because it takes five to seven years to show real results. He proposed a fundamental change in thinking: moving from demonstration plot to a model farm of agroforestry. These model farms should be established in *Krishi Vigyan Kendras* (KVKs) and on farmers' fields to showcase a pathway of income generation and resilience against climate change. He suggested designing a five-year road map targeting 5 mha, focusing on five suitable species across different regions. Resources are now more readily available, but a research methodology is lacking to calculate and assure farmers of the financial benefit from carbon credits over specific time phases. He stressed the simultaneous need for a plan so that farmers can be benefited with carbon credits associated with agroforestry.

Dr Singh outlined several important points for promoting agroforestry: (i) participatory and market-led approach is important and the farmers, as the best judges of species and planting material, must be involved in selection process; (ii) only 8 to 10 per cent of the current agroforestry area use quality planting material (QPM). He called for establishing registered QPM nurseries to convince farmers and ensure better market returns five years down the line. The CAFRI was accredited by national nurseries for the supply of high quality planting material. (iii) extension efforts must align with schemes from agriculture, forestry, environment, and climate sectors, specifically mentioning NREGA, watershed programs, and NMSA as components that can provide financial and institutional support; and (iv) capacity building should go beyond mere training to encompass confidence building, consensus building, and the formation of communities of practices. Capacity building is needed for farmers, extension agents, and researchers, as well as for the institutionalization of issues within agricultural universities, KVKs, NGOs, and the private sector.

Dr Singh strongly advocated for roping in the private sector in a big way for contract farming, market linkage, and technical support. He cited the growth of poplar due to early intervention by the private company WIMCO in North India, while also cautioning that the subsequent entry of agencies selling low-quality planting material resulted in market fluctuations and poor returns for farmers. This necessitates better planning and policy support to prevent such issues.

Finally, he underlined the role of gender and youth, noting that the inclusion of women would have a catalysing impact, especially as they significantly contribute to farm level production of fuel, food, and fodder, and play a vital role when the animals are integrated into the farm system. He concluded by sharing two observations: firstly, the role of trees as a partner in village life is acknowledged, but there is a lack of scientific knowledge on cultivation and planting material availability; secondly, a division exists where some farmers are unaware of agroforestry practices and its benefits, while others are aware and have developed highly profitable, multi-layered model farms.

Dr Eliance Ubalijoro CEO, CIFOR-ICRAF, Nairobi, Kenya, through her recorded message highlighted that— we are united in our shared goal of advancing agroforestry as a cornerstone for resilient food systems, sustainable landscapes, and thriving rural communities. Agroforestry, the integration of trees into agricultural landscapes, is a science-based approach that strengthens the connection between ecological health and human prosperity, delivering benefits across food security and climate action. Globally, over 900 million people practice agroforestry on more than 1 billion hectares, enhancing soil health, improving water retention, providing shade and fodder for livestock, and supplying food, fuel, and timber. Agroforestry reduces pressure on forests, offering resilience by diversifying income streams and improving microclimates in the face of climate volatility.

Dr Ubalijoro emphasized that India has emerged as a global leader in agroforestry and is the first country to adopt a National Agroforestry Policy, which relaxed regulatory barriers, enabling farmers to cultivate, harvest, and transport trees on agricultural lands. It streamlined harvesting and transport rules, mobilized USD 146 million in government funding through the Sub-Mission on Agroforestry, and attracted significant Corporate Social Responsibility (CSR) investments. The National Research Centre on Agroforestry was elevated to a full-fledged institute i.e. ICAR-CAFRI, enhancing research, innovation, and technology transfer capacity. Today, 90 per cent of India's industrial timber comes from agroforestry, and between 2013 and 2022, tree cover expanded by 3.1 mha. A 2024 report credits the policy with catalysing over 2 mha of forest area growth between 2010 and 2020, ranking India third globally for forest area gains. India's policy has inspired agroforestry strategies in countries like Nepal, Rwanda, The Gambia, Malawi, and Kenya. For over 20 years, CIFOR-ICRAF has partnered with the Government of India, ICAR, CAFRI, state agencies, and farming communities to strengthen seed and seedling systems, develop state-level policies, expand markets, and build farmer capacity. As India's economy grows, demand for wood products is projected to rise by 70 per cent by 2030, with imports currently at USD 6.8 billion annually. Scaling agroforestry can meet this demand sustainably while creating carbon sinks

to achieve India's Paris Agreement target of sequestering 2.5–3.0 billion tons of carbon dioxide by 2030.

Challenges remain, including modernizing policies across states, improving farmer access to finance and markets, building capacity, and expanding quality planting material. CIFOR-ICRAF is committed to supporting India through research, policy advocacy, digital tools, and regional cooperation. Our global initiatives, such as planting 2 million trees in the Democratic Republic of Congo, integrating shade-grown coffee in Peru, promoting fast-growing tree species in Rwanda, and establishing 6,465 agroforestry demonstration farms in the Philippines, demonstrate the transformative potential of agroforestry.

Dr Ubalijoro informed that TreeScapes 2026 – 1st South Asian Agroforestry and Trees Outside Forests Congress, co-organized by CIFOR-ICRAF, ICAR, and TAAS, will be held in New Delhi from 5–7 February 2026. This event will highlight India's leadership and foster regional cooperation. CIFOR-ICRAF stands ready to translate policy into practice, science into solutions, and vision into action. Together, we can transform landscapes and livelihoods, inspiring global regions facing similar choices.

Dr RS Paroda, Chairman, TAAS, in his inaugural address, focussed on the immediate need for action. He mentioned that many recommendations formulated ten years ago, in October 2015, also remain relevant today, which need to be implemented. India is a global leader in agroforestry, with a dedicated institution, an All India Coordinated Research Project, and a National Agroforestry Policy. Our Prime Minister and the Minister of Agriculture & Farmers Welfare (MoA&FW) actively supported tree planting, with the latter recently planting 75 trees in a single day, reflecting the adage that charity begins at home. Agroforestry has deep roots in India's history, particularly in silvi-pastoral systems. In desert regions, the integration of trees, crops, livestock, and grasses like *Cenchrus ciliaris,* supports dense populations despite harsh conditions. However, over-exploitation, such as replacing silvi-pastoral systems with wheat, rice, and cotton in Rajasthan's canal-irrigated areas, caused environmental harm. Research identified fast-growing, economically viable tree species for different ecoregions, yet past efforts, like introducing eucalyptus or *Prosopis juliflora* in Rajasthan, have had mixed results. While *Prosopis* provides fuelwood and fodder, its spread has raised concerns about invasiveness.

Dr Paroda reminded that India's Paris Agreement commitment to sequester 2.5–3 billion tons of carbon dioxide requires agroforestry expansion, as forest cover has remained stagnant at 24 per cent for decades, far below the 33 per cent target. Agroforestry meets 80 per cent of timber needs outside forests, but policies must treat trees as crops under the Ministry of Agriculture and Farmers Welfare (MoA&FW), not the Ministry of Environment, Forestry and Climate Change (MoEFCC). Recent guidelines from the latter need a critical review to avoid jurisdictional overlap.

Farmers adopting agroforestry provide environmental services and should receive incentives, such as carbon credits, yet CSR funds often prioritize planting over farmer benefits.

Dr Paroda advocated that actions are needed in three major areas: (i) identifying region-specific tree species, (ii) ensuring supply of quality planting material, and (iii) establishing market linkages and price transparency. Successful farmers like Major Manmohan Singh and Mr Chandra Shekhar Bhadsavle demonstrated agroforestry's potential, but challenges like price volatility and regulatory hurdles for tree harvesting still persist. A National Agroforestry Development Board, similar to the Rubber or Silk Boards, could address commercial aspects and support farmers. India's progress in clean energy and methane reduction is commendable, but agroforestry must also become a National Mission to achieve climate, livelihood, and sustainability goals.

The following key points emerged from the discussion during the Inaugural Session:

- Establish agroforestry as a National Mission and consider creating a National Agroforestry Development Board to address commercial aspects and support farmers, while also working out and classifying time-bound targets for increasing agroforestry area (e.g., the 53 mha target by 2050) to meet food security and climate mitigation goals.
- Prioritize climate-resilient research by revisiting and documenting traditional agroforestry practices and articulating tree-breeding programs to ensure suitability for resilient crops and livestock; this must be supported by strengthening regional and global research partnerships.
- Overcome adoption constraints and modernize policy by identifying major constraints like price volatility and regulatory hurdles for tree harvesting, and taking appropriate action to modernize policies across states, specifically to improve farmer's access to finance and markets.
- Enhance data and measurement through time-bound regular surveys of agroforestry species performance across agro-climatic regions, and by developing exact research methodology for the credible estimation of carbon credits or green credit benefits.
- Enhance value chain development by promoting public-private partnerships (PPP) and contract farming models to create strong market linkages, ensure transparent pricing, and deliver necessary technical support.
- Focus on stakeholder capacity and quality inputs by involving farmers in species selection, ensuring the availability of quality planting material through improved nursery management, and implementing comprehensive capacity building for all stakeholders.

TECHNICAL SESSION I: CURRENT STATUS OF AGROFORESTRY RESEARCH AND INNOVATION

Co-Chairs: **Dr AK Nayak**, DDG, NRM, ICAR, New Delhi
Dr JC Dagar, Former, ADG, ICAR, New Delhi

Convener: **Dr AK Handa**, Principal Scientist, ICAR-CAFRI

Rapporteur: **Dr Rakesh Banyal**, Principal Scientist, ICAR-CSSRI, Karnal

Dr A Arunachalam, Director, ICAR-CAFRI, Jhansi, delivered a keynote lecture on Scaling of Agroforestry Initiatives: Achievements and Potential, aiming to evaluate the progress of agroforestry in India, identify key challenges, and suggest pathways for future expansion. The critical gaps and transformative potential of agroforestry systems in India were highlighted. It was emphasized that livestock integration remains one of the most un-explored components in agroforestry systems, despite its immense potential to enhance system sustainability, improve farm incomes, and provide year-round returns. The silvo-pastoral models need to be mainstreamed, particularly those focusing on tree-fodder based systems. It was proudly shared that ICAR-CAFRI was designated as the National Repository of Agroforestry Knowledge (NRAK) and recognized as Nodal Agency for Accreditation of quality planting material (QPM) nurseries in the country. Its role in ensuring the availability of certified, genetically superior planting materials is expected to boost productivity and promote quality driven agroforestry expansion.

Poplar and eucalyptus-based systems identified as the successful bankable models by the National Bank for Agriculture and Rural Development (NABARD), particularly in the northern plains, showed remarkable performance across ecological and economic dimensions. However, there is a need for diversification with emerging species like *Melia dubia*, which is fast expanding and shows potential to replace *Eucalyptus*. It was also informed that ICAR-CAFRI maintains the National Gene Bank of *Neem* at Jhansi, contributing to the *in situ* and *ex situ* conservation of this vital tree species. Further, ICAR-CAFRI has reviewed the National Agroforestry Policy (2014) in the year 2024, with the aim of addressing policy level bottlenecks and enabling more holistic implementation in the country for multifarious benefits of agroforestry. Mainstreaming agroforestry under the existing government schemes like Horticulture Mission for Plantation Produce (HMPP), Agroforestry Mission under *Atmanirbhar Bharat* (AMAA), and *Paramparagat Krishi Vikas Yojana* (PKVY) is important for scaling-up agroforestry. The need was felt to establish agroforestry business incubation centres to support start-ups and entrepreneurs. Leveraging digital agriculture tools including internet of things (IoT), remote sensing, artificial intelligence (AI), and GIS-based systems to enable precision agroforestry planning, monitoring, and decision-making is also important. He proposed that select Farmer

Producer Organizations (FPOs) and progressive farmers be identified as Agroforestry Ambassadors to lead community level dissemination of best practices.

A highly ambitious national target was put forth by ICAR-CAFRI to increase the area under agroforestry from 28.4 mha to 53.5 mha by 2050. The interlinking of All India Coordinated Research Project (AICRP) on Agroforestry and AICRP on Bamboo for maximizing synergies and outputs was realised and aligning agroforestry models with the One-District One-Product (ODOP) initiative, proposing a One District – One Model – One Product strategy for targeted development was emphasised. It was noted that agroforestry has a policy but no national mission, while bamboo has a national mission but lacks a formal policy. This paradox, highlighted the need for integrated and coherent policy frameworks to ensure that agroforestry realizes its full potential. Until then, agroforestry remains a low-hanging fruit, offering immense benefits yet to be fully harnessed.

Dr OP Yadav, Former Director, ICAR-CAZRI, Jodhpur**,** made a presentation on "Scaling Agroforestry Innovations in Arid Regions", and applauded the scaling of agroforestry in arid region of the country, which covers almost > 12.0 per cent area sustaining higher number of livestock than human beings. Five main factors responsible highlighted for changing the arid zone perspectives towards production were — new crops, road networks, increasing wetter days, aspiring farmers, and education. He mentioned that rainfall pattern regulates the type of flora in any geographic area. If the rainfall is up to 200-250 mm, then we should go for grasses and if it increases beyond 200-400 mm then plants may be added in the landscapes. If it goes beyond 400 mm then there is full scope of adding crops with the trees in the form of agroforestry systems. *Khejri* (*Prosopis cineraria*) and *rohida* (*Tecomella undulata*) - based traditional agroforestry systems are commonly seen in the area. In such systems pearl millet, cluster bean, *moth*, sesame, green gram with grasses like *Cenchrus, Lasirus* and *Panicum* can be cultivated successfully. Dr Yadav advocated that in dry ecologies livestock must be added as a part of production system, which is not considered in present day system valuation. Currently, the main problem is that the farmer only needs income, hence, the traditional agroforestry systems are challenging. *Khejri* mortality due to disease and insect (gall formation) is a serious issue, which needs to be addressed effectively. Some issues exist with the cultivation of *Tecomella*, a slow growing species. The new upcoming agroforestry systems in the arid region are *Melia dubia*, *Gmelina arborea*, *Ailanthus excelsa* and *Dalbergia sissoo*. *Rohida* (*Tecomella undulata*) is an important member of arid ecosystem, which needs immediate attention for its conservation and improvement. This plant needs relaxation in rules for its propagation and area coverage. He emphasized that there should be clear cut delineation for agricultural and wastelands for effective management with better

outputs. There is a concern regarding the dearth of research in saline areas for bringing such areas under green cover. Research in tree breeding and tissue culture is very important in dry regions.

Dr Jagdish Rane, Director, ICAR-CIAH, Bikaner, Rajasthan**,** delivered lecture on "Status of Research and Innovation in *Khejri* (*Prosopis cineraria*) and Other Species in Arid Region". He discussed the process of converting wild tree species into established horticultural landscapes in arid and semi-arid ecosystems was detailed in the presentation, reviewing the current status, challenges, and potential of this expansion. Institutional interventions by research bodies, specifically the ICAR-Central Institute for Arid Horticulture (CIAH) and the AICRP-AZF, were crucial. Through these efforts, the germplasm of key arid zone fruit crops like *ber, bael*, *khejri*, and pomegranate, was actively surveyed, collected, conserved, and characterized, successfully elevating the total collection to 776 accessions by 2021-2022. This research led to the development of nine climate-resilient varieties. He explained that the traditional and sacred *bael* (*Aegle marmelos*) was transformed into a commercial crop, with the demand for the improved juice variety, Goma Yashi, demonstrating a five-fold increase following successful awareness programs. Similarly, the thornless *khejri* (*Prosopis cineraria*) variety, Thar Shobha, was found popular for its nutritious pods (*sangri*), and *khejri*-based cropping systems were developed to ensure year-round availability of vegetables and fodder.

Dr Rane mentioned that several constraints are hindering wider adoption of useful agroforestry trees. A significant lack of optimized and efficient plant propagation protocols was noted, and the crucial contribution of these systems to climate change mitigation is yet to be accurately quantified. Furthermore, severe challenges were identified in managing disease and insect pest incidence, with the ber crop being severely affected by fruit flies (up to 52%) and white grubs (up to 76.1%). Damage from wild animals and birds, such as fruit bats (45% incidence), was also cited. Finally, the absence of organized markets and fully functional value chains was noted as a crucial challenge. To address these issues, a strategic roadmap for scaling-up was proposed. This involves promoting remunerative fruit species, enhancing production technologies, and supporting research into propagation techniques for tree species and desert shrubs. The integration of advanced technologies like sensors, IoT, and AI was suggested for the effective management of wild animals and birds. Most importantly, the quantification of carbon sequestration potential and other eco-system services must be prioritized. It is expected that following this roadmap will ultimately lead to enhanced remuneration for farmers, improved livelihoods, and strengthened agro-ecosystems.

The following key points emerged from the deliberations during the session:

- Establish a National Agroforestry Mission (NAFM), not a Sub-Mission on Agroforestry (SMAF), to complement the National Agroforestry Policy. This should include the creation of a regulatory board or committee at the national and/or state levels for regulating wood prices.
- Integrate livestock into agroforestry models for nutritional and livelihood security and sustainability. Tree biomass must be considered a central component in system valuation, not just crops.
- Develop a clear-cut agroforestry road map with categorization into farm forestry, household forestry, and industrial forestry for targeted interventions and policy advocacy. This should include a One - District, One - Model, One - Product approach aligned with the ODOP initiative.
- Scale-up the agroforestry using digital tools, Internet of Things (IoT), and remote sensing for precision planning and monitoring. This expansion should be supported by establishing business incubation centres to foster agroforestry entrepreneurship and innovation.
- Intensify research and conservation of native species, including research on saline land reclamation, sand dune stabilisation, tree breeding, and the improvement of slow-growing native species (e.g. *khejri, kair, kumuth, lasura*). Special focus is needed on conservation and propagation (using tissue culture or other techniques) of species like *rohida* (*Tecomella undulata*) and *phog* (*Calligonum polygonoides*).

TECHNICAL SESSION II: CHALLENGES AND OPPORTUNITIES IN SCALING AGROFORESTRY

Co-Chairs: **Dr Ravi Prabhu**, Former DDG, ICRAF
Dr A Arunachalam, Director CAFRI, Jhansi

Convener: **Dr Rishi Tyagi**, Senior Consultant, TAAS, New Delhi

Rapporteur: **Dr Dinesh Sharma**, Principal Scientist, CESCRA, ICAR-IARI, New Delhi

Dr SK Dhyani, Senior Agroforestry Specialist, World Agroforestry (ICRAF), India Office, New Delhi**,** delivered a keynote lecture on "Policy and Regulatory Issues- Felling, Transport and Land Use Issues". He addressed the history, policy, and regulatory challenges surrounding agroforestry in India, advocating for its expansion to meet national goals. The history of forest governance in India shifted from community management in the pre-British era to strict state control under the British, culminating in the Indian Forest Act of 1927. After independence, the initial focus was on forest revenue, which later shifted to conservation. The

National Forest Policy of 1988 brought focus on 'Trees outside Forests (ToF)' and agroforestry to reduce pressure on forests. He mentioned that the Indian National Agroforestry Policy (NAP) of 2014 was a landmark step. Key recommendations included: (i) mainstreaming agroforestry in agriculture policies; (ii) de-notifying tree species from felling, transit, and processing regulations; (iii) facilitating the removal or relaxation of the legal ban on sawmills in non-forest areas; and (iv) promoting R&D and value chain development. Following the NAP, the Ministry of Environment, Forest and Climate Change (MoEFCC) issued guidelines in 2014 and an amendment in 2017 to relax felling and transit regulations for farm-grown tree species, with two categories established: List A (exempt from permits) and List B (under limited restrictive provisions). The Indian Forest Act was also amended in 2017 to classify bamboo as a grass, removing the need for felling and transit permits for private land cultivation. As a result, 23 states and UTs have since relaxed these regulations. He further emphasized that despite the policy, the sector faces critical constraints, including multiple governing laws and departments for felling permission, the cumbersome process of obtaining permits, and the restriction on harvesting native high-value species. These issues discourage farmers, increase pressure on native forests, and contribute to high timber imports (over USD 2.7 billion in 2023). He also discussed that recent initiatives include the MoEFCC's Model Rules for Felling of Trees in Agricultural Land to streamline regulations through a unified, technology-driven framework like the National Timber Management System (NTMS).

The presentation concluded with key recommendations to strengthen the enabling policy environment: (i) deregulation of high-value native timber species; (ii) changing the mandate from proving land ownership to tree ownership using tracking technologies; (iii) creating a single-window clearance system, potentially by expanding NTMS to include felling permits; and (iv) economically incentivizing farmers for tree planting.

Mr Umang Agarwal, Chief Operating Officer Grow-Indigo, New Delhi**,** talked on Grow Indigo's Agroforestry-Led Carbon Program, highlighting its role as both a climate and a livelihood solution. The program is a joint venture between Mahyco (India) and Indigo Ag (USA), and Grow Indigo works with over 5 million farmers across 14 states in India, focusing on bringing microbial innovations, carbon markets, and sustainability programs to smallholder farmers. The company's carbon program had successfully reduced and removed over 400 thousand tons CO_2 by 2024, with a significant portion of the carbon credit sales (60–75%) being returned to the farmers. The presentation underscored why agroforestry is a crucial approach, as it integrates trees with crops and livestock to improve soil health, enhance biodiversity, regulate water, and increase resilience to climate stress. For farmers,

this system offers multiple income streams from fruits, nuts, timber, and carbon credits. To maximize these benefits, Grow Indigo has developed region-specific agroforestry models, including the Fruit & Nut Model with a carbon potential of 5–25 tCO_2e/ha/year, and the Fast-Rotation Timber Model with a potential of 8–10 tCO_2e/ha/year. The program also uses integrated systems like horti-silvi, silvo-pastoral, agri-horti, and agri-silvi to ensure that the right plants are cultivated in the right place. The program's strong technological foundation and commitment to integrity is supported by a digital Measurement, Reporting, and Verification (MRV) platform that utilizes remote sensing, bio-geo-chemical modelling, and multi-season data. An in-house mobile application facilitates farmer registration, field mapping, and quality checks. The program's transparency and trust are further ensured through continuous monitoring and validation by a third party. The experiences on carbon credits in eucalyptus plantations in western Uttar Pradesh were shared and the importance of carbon-literacy through CARBON-KAKSHA- a collection of farmer-friendly videos delving into everything from carbon fundamentals to credit systems and markets were highlighted. It was emphasized that agroforestry is a powerful tool for empowering smallholder farmers to become climate champions. By scaling these nature-based solutions, Grow Indigo's program demonstrates a pathway to deliver both environmental restoration and economic growth, thereby securing a more resilient future for India.

Dr PN Mathur, Consultant, Centre for Fruitful India (CFI), New Delhi**,** delivered a talk on "Agri-horticulture for Enhancing Rural Livelihood, Food and Nutritional Security: Focus on Fruit Trees Cultivation", highlighting the significant benefits of integrating fruit tree cultivation with traditional agriculture and how this approach contributes to India's national and international commitments, including the Sustainable Development Goals (SDGs). Agri-horticulture is a sustainable and diversified system improving farmers' income by diversifying farm outputs, efficiently utilizing land, and conserving resources. This integrated system also enhances ecological balance and reduces reliance on single crops, while increasing the availability of diverse and nutritious food sources for communities. The presentation emphasized the system's role in employment generation and rural development, and it creates jobs in cultivation, processing, and marketing, thereby strengthening rural economies and helping to reduce poverty. Furthermore, integrated agri-horticulture systems ensure year-round income and availability of a variety of foods, which supports healthier, balanced diets and strengthens food security for vulnerable populations.

Several common barriers faced by poor communities, including limited access to essential inputs, a lack of knowledge and training, and market and financial constraints were highlighted. The challenges posed by poor infrastructure and

adverse climatic conditions were mentioned. The presentation provided two case studies to illustrate successful models: the Wadi System from Gujarat which combines fruit trees, intercrops, and water harvesting to improve income and nutrition, and the homestead garden system, predominantly used by tribal and smallholder communities, which features multi-layered cropping and livestock integration for high household sustainability.

Dr Sharda Rani Gupta, Professor in Botany, Kururkshetra University, Kurukshetra, made a recorded presentation on "Agroforestry for Climate Change Mitigation and Adaptation". She discussed the crucial role of agroforestry as a key strategy to address the urgent threats of climate change and environmental degradation. Her presentation highlighted that human activities have already pushed six of the nine planetary boundaries beyond their safe operating space, with CO_2 levels (426.6 ppm as of August 2025) at unprecedented highs. Climate change is severely impacting agriculture through extreme weather and altered crop cycles, necessitating urgent, integrated action on adaptation and mitigation. The presentation defined agroforestry as a system integrating trees with crops and/or livestock, emphasizing its multifunctional nature and numerous agronomic, economic, and environmental advantages. In India, agroforestry is practiced across 28.4 mha, providing 65 per cent of the country's timber and wood-fuel, and is backed by policies like the National Agroforestry Policy (2014). Dr Gupta detailed the contribution of agroforestry to climate change resilience, noting that these systems are generally more robust against environmental shocks than traditional agriculture. They function as both adaptation mechanisms (creating microclimates, improving soil health, and reducing crop stress) and mitigation mechanisms (sequestering carbon in both biomass and soil). Owing to dual benefits, agroforestry is recognized in the nationally determined contributions (NDCs) of many developing nations. In terms of carbon sequestration, research indicated that switching to agroforestry systems results in a 25.34 per cent increase in carbon sequestration compared to conventional practices. Agro-silvo-pastoral systems and those in humid zones were noted to have the highest carbon stocks, reaching 73.4 Mg C/ha in biomass and 53.0 Mg C/ha in soil, respectively. Scaling-up agroforestry has the potential to sequester carbon at a rate comparable to, or even exceeding, India's projected emissions by 2050.

Dr Gupta highlighted key research needs: (i) giving priority to robust agroforestry system (AFS) designs that are zone-specific (e.g. alder-based AFS in the Himalayas, silvo-pasture in drylands, and windbreaks on coastlines); (ii) analysing economic feasibility of various AFS value chains (wood, NTFPs, bamboo, M&APs, fruits, and feed); (iii) evaluating the contribution of women and tribal communities to maintaining agroforestry; (iv) considering entry-level incentive programs (carbon

payments, insurance, credit, and payment of ecosystem services (PES); (v) evaluating soil biodiversity and investigate co-benefits such as reduced residue burning, improved water quality, and landscape connectivity; (vi) evaluating the effectiveness of the National Agroforestry Policy (2014) for climate change adaptation and livelihood security; and (vii) integrating agroforestry in State Action Plans on Climate Change (SAPCC) and district climate plans.

The following key points emerged from the deliberations during the session:

- Create a unified national policy to simplify felling and transport regulations for trees grown outside forests. This policy should mandate a single-window clearance system and green channel processes to eliminate cumbersome permits and encourage wider adoption by farmers.
- Introduce targeted incentives, including financial and technical support, for small and marginal farmers. More critically, simplify the process for securing land titles for traditional forest-dwelling communities to remove legal barriers that currently prevent them from fully participating in and benefiting from agroforestry.
- Expand the use of the digital MRV platform to improve transparency and efficiency in generating carbon credits, while also providing valuable data to optimize models and demonstrate environmental impact.
- Strengthen on-the-ground support by establishing targeted programs to provide technical training, quality planting materials, and financial aid to smallholder farmers. This support should focus on navigating the complexities of managing multiple income streams from crops, timber, and carbon credits, while also promoting indigenous fruits to build nutritional resilience.
- Support community-led initiatives for post-harvest management and value addition by creating local processing units, storage facilities, and farmer cooperatives to help farmers to secure better prices.
- Increase investment in research and development to create climate-resilient fruit varieties and sustainable cultivation practices for long-term productivity and stability, while also specifically evaluating soil biodiversity and its importance in increasing the overall productivity of the system.
- Improve management strategies and prioritize zone-specific, robust designs for AFS, particularly by focusing on the humid and sub-humid regions of India, which have high potential for biomass and carbon storage but currently exhibit lower storage capacity compared to global standards. This necessitates giving priority to robust, zone-specific AFS designs such as alder-based AFS in the Himalayas, silvo-pasture in drylands, and windbreaks on coastlines.

TECHNICAL SESSION III: FARMERS' PERSPECTIVES ON AGROFORESTRY-SUCCESSES AND CHALLENGES

Co-Chairs: **Dr Rajbir Singh**, DDG (Agricultural Extension), ICAR, New Delhi
Dr SK Dhyani, Senior Agroforestry Specialist, World Agroforestry (ICRAF), India Office, New Delhi

Convener: **Dr BP Bhatt**, OSD to DG ICAR, New Delhi

Dr ML Jat, Secretary DARE and DG ICAR, New Delhi**,** who attended the Session for a short period**,** shared his concerns about promotion and scaling of agroforestry. Based on the points shared by him, the focus for scaling agroforestry in India should be on two immediate, interlinked priorities. Firstly, a genetic-based solution for tree improvement is immediately needed because the current lack of quality planting material is a critical constraint. Addressing this is crucial for ensuring that the trees used in agroforestry systems are high-yielding, climate-resilient, and profitable for farmers. Secondly, a reliable methodology of estimation of environmental services by AF systems rather than isolated tree must be put in place. This is essential so that the farmers are appropriately paid the carbon they sequester in above and below ground biomass. Furthermore, carbon trading is another important issue to be looked into as a mechanism for monetizing these environmental services, thereby providing a significant financial incentive for wider adoption of agroforestry.

Dr Arun Jyoti Nath, Professor Ecology and Environment Science, Assam Agricultural University (AAU), Jorhat made a presentation on "Cinderella Agroforestry Systems as Nature-based Solutions for Land Degradation, Biodiversity Loss, and Regional Climate and Societal Challenges". He detailed the escalating ecological crisis in the Eastern Himalayan region, home to over 200 ethnic communities traditionally dependent on shifting cultivation (slash-and-burn agriculture). He mentioned that the critical challenge lies in the drastic reduction of fallow periods from 20 years to 3–5 years, which has severely jeopardized the ecological balance, and is exacerbating climate-related deprivation. Studies indicated that a 3°C increase in global temperature could increase soil erosion in these areas by over 60 per cent. Dr Nath highlighted the successful transition by some indigenous communities away from shifting cultivation to traditional agroforestry systems, which they term Cinderella systems. These systems are so named because they are localized, often overlooked, yet function as highly effective, cost-efficient, and culturally appropriate nature-based solutions (NBS). These systems enhance farmers' resilience to climate risks while delivering significant biophysical and socioeconomic benefits. Two notable examples were presented. The Piper Agroforestry System, practiced by the Pnar tribe, is an organic method involving

the cultivation of betel (*Piper betle*) vines supported by selectively pollarded, fast-growing trees. The system achieves a substantial soil organic carbon (SOC) stock of 110.74 Mg/ha and high biodiversity that supports rare and threatened primate species. It also provides high cash returns, with betel leaves selling for up to INR 7,500 per 6,720 leaves. The pineapple agroforestry system, practiced by the Hmar community, incorporates multipurpose trees like *Albizia* species with pine apple (*Ananas comosus*). This system demonstrates significant ecological advantages, recording high ecosystem carbon storage of 247.46 Mg/ha and SOC stocks ranging from 169.7 to 177 Mg C/ha, comparable to native forests. Such systems are effective in arresting land degradation and sequestering carbon. The role and participation of local people (mainly tribal people) who have tremendous knowledge of plants, is very important.

The presentation concluded with discussion on the vulnerability of farmers to factors like erratic rainfall and temperature variation. Key challenges include addressing land tenure issues, complex market structure problems, and knowledge erosion. Nevertheless, the opportunities presented by these Cinderella systems—including integration with natural farming, establishing a green credit fund, and expanding global market access for their organic produce—offer a clear pathway for sustainable development.

Mr Chandrasekhar Bhadsalve, Founder President of SRT, Malegaon, Pune**,** shared a long-standing experience on natural regeneration of silvo-pastoral system. He explained that in dry hilly regions fire/burning of vegetation is a common but harmful practice that causes serious land degradation, particularly soil erosion. Preventing grazing and fire can help restore these landscapes more rapidly, especially when beneficial tree species are planted. By managing initial irrigation through rainwater harvesting or stored water, a strong vegetation cover can be established. This vegetation helps protect the soil, conserve biodiversity, and enhance carbon sequestration. Further, he advocated that the benefits accrued through such crop diversification, soil water conservation, agro-tourism at landscape level with integration of different components production systems in agroforestry and Integrated Farming System (IFS) models, are immense. The impact of afforestation and reforestation on community land in the hills was effective in checking the forest fire, and helped in restoration of degraded lands.

Dr Yogesh G Sawant, BAIF, Pune, talked on "Success Story of Agroforestry Systems (Wadi) for Carbon Sequestration and Livelihoods of Small and Marginal Farmers", mainly the concept of agri-silvo-horticultural farming system. Besides research institutes many NGOs are engaged in developing profitable and sustainable agroforestry models in participation with local rural people. BAIF developed Wadi (backyard orchard in tribal dialect of Gujarat) model, which is NABARD-supported

family-centric agroforestry approach for tribal development, focusing on creating small orchards, each to provide sustainable, long-term livelihoods through multi-tiered cultivation of fruits, vegetables, cereals and fodder for livestock. Small land holdings, integration of agri-horticulture, trees and livestock, sustainability, regular income, holistic approach, participatory development (also involve FPOs), and focus on women and children are main characteristics of these Wadis. These integrated farming systems protect soil by increasing SOC and micro-biodiversity and sequester carbon (average 23 t C/ha), thus, being resilient against climate are helping in mitigating climate change and ensuring livelihood and nutritional security. As a result of adopting these practices there is a drastic reduction in distress migration from dry ecologies. Besides Gujarat, this system is being followed in many other states like Rajasthan, Karnataka, and Madhya Pradesh.

Ms Nikki Pilania Chaudhary, Founder, Mango Dairies, Pilibhit, Uttar Pradesh**,** delivered talk on "Farmers' Perspectives on Agro-forestry: Successes and Challenges". She discussed the farmers' perspective on the successes and operational challenges of implementing integrated agroforestry. The core of her work is an intensively managed, over 60-acre farm operation based on Poplar Tree-Crop-Livestock integration model. This system integrates food crops like sugarcane and wheat with various winter fodders (e.g. oats, rye grass) grown under poplar trees, which are winter deciduous and increase soil carbon content by shedding biomass, thereby reducing the need for outside inputs. The system is governed by three fundamental principles. First, the tree-crop-livestock integration *via* poplar-based agroforestry. Second, a circular systems approach ensures that all dairy manure and liquids are pumped back into the fields and agricultural by-products like paddy straw are utilized as silage for the animals, reducing outside inputs. Third, the farm prioritizes climate resilience in its dairy operations, emphasizing the central role of buffaloes, which are viewed as one of the most resilient entities in Indian agriculture, crucial for farmer profitability and food security in the context of global warming. Dr Chaudhary mentioned that this robust integration model is agro-ecologically highly sound, meeting seven of the 13 principles of agro-ecology set by the FAO. The tree-forage-livestock combination focuses on low carbon dairying, with the potential to make the dairy activity carbon neutral by sequestering CO_2 in the soil. Economically, the system provides a model for a fourfold increase in farmer income compared to traditional grain farming. Mango Dairies, through its Partner Farm Service Centre (PFSC), processes the milk and helps other farmers adopt this sustainable model.

The path forward involves knowledge sharing to advance the integration model and build a sustainable dairy brand. However, the presentation underscored a significant external challenge: the difficulty in diversifying agroforestry. This is

primarily due to endemic corruption in the Social Forestry Department, which makes planting and subsequently harvesting trees like teak or *jamun*, which require felling permission, totally unviable for farmers.

Major Manmohan Singh Verka, Progressive Farmer, Amritsar, Punjab**,** shared the Success Stories of Agroforestry and Transformative Agriculture in Punjab. He mentioned that Green Revolution was successful in Punjab because the government assured regular availability and distribution of quality seeds and other inputs. If we have to succeed in agroforestry, we would have to make sure the availability in sufficient quantity of the quality germplasm of forest and fruit trees. The major point is the year-round stable and reasonable prices of wood and fruits. There is also need of some research on the effect of spacing on yield and quality of wood so that plantation may be done on optimum distance and farmer may get good price of his produce. It was reported that currently the standing trees of poplar having 21-inch (53 cm) girth fetches premium price in the market. Farmers need to be educated about the methods of pruning and the impact of pruning on the quality of wood.

Mr Rohit Kansay, Kisan Tree, Jagadhari**,** made a presentation on "Revolutionizing the Farm-Grown Wood Market". The presentation centred on the potential of agroforestry for climate action and a sustainable economy, underpinned by the belief that over 80 billion trees could be grown on the unused boundaries of agricultural land in India, provided farmers receive good returns for their tree crops. Mr Kansay identified the key impediment to this vision as the highly unorganised timber supply chain. The sector is characterized by a lack of transparency, mistrust, and inefficiency, with *adhati* (middlemen) often capitalizing on huge margins. The core problems faced by tree farmers include struggling with tree valuation, disputes over quality, and significant information asymmetry between buyers and sellers due to cartelisation. To address these challenges, his company developed Tree Kisan, an AI-based platform designed for tree farmers seeking better profits. The platform provides three main solutions: (i) a tree value calculator, which offers a valuation in one minute; (ii) a quality report, generated in two minutes using AI/ML; and (iii) an E-Marketplace, which acts as an AI-based match-making platform connecting buyers and sellers directly.

The effectiveness of this model was highlighted by citing the case of Mr Arvind, a tree farmer from Bijnor, Uttar Pradesh. Mr Arvind initially agreed to sell his standing poplar trees to a local contractor for INR 8.0 lakh. After using the Tree Kisan App, he discovered the market valuation was INR 18 lakh. He ultimately sold the trees for INR 15 lakh, achieving an 87 per cent increase in income compared to the initial offer. This successful transition demonstrates the platform's ability to drive farmer profitability as they are linking farmers with

companies to facilitate farmers to sell their products directly to the companies, thereby reducing the involvement of middlemen. Such intervention has helped farmers to realize better revenue from their agroforestry produce.

The following key points emerged from the deliberation during the session:

- Simplify the cumbersome regulations related to transit, felling permits, and harvesting of farm-grown timber and non-timber forest products (NTFPs). The tenure issues among tribal people of remote areas must be settled. A mechanism of knowledge sharing and capacity building, particularly in remote areas must be in place.
- Dedicated e-commerce platforms tailored to agroforestry can help farmers bypass middlemen, reach wider consumer bases, and secure better prices. Integration of digital payment systems, transparent logistics, and farmer-to-consumer models can further strengthen market confidence. Mobile applications offering real-time price information, weather updates, and buyer–seller linkages would empower farmers and promote transparency in trade.
- Establishing public–private–peasant partnerships (PPPPs) can help smallholder farmers to access assured markets, technological support, and fair pricing mechanisms. Such collaborations foster value addition at the local level, generate rural employment, and ensure a steady flow of raw materials for industries, thereby creating a mutually beneficial ecosystem.
- Farmers should be encouraged to integrate species such as teak, bamboo, fruit trees, medicinal plants, and spice crops like black pepper or turmeric with traditional farming systems. Aligning species selection with both domestic and export market demand ensures better returns, reduces risks of market saturation, and helps farmers diversify their income sources.
- There is a need for a detailed meta-analysis of traditional agroforestry practices and species used by the farmers. The study may include biomass (above- and below-ground) production rate, growth, impact on crops, SOC, role of soil microbial population on soil improvement and carbon sequestration, and impact of system on climate change needs to be undertaken.

EVENING LECTURE ON AGROFORESTRY: A VISION FOR INDIA'S GREEN FUTURE

Co-Chairs: **Dr RB Singh**, Former President, NAAS, New Delhi
Dr Gurbachan Singh, Former Chairman, ASRB, New Delhi

Convenor: **Dr Khajanchi Lal**, Principal Scientist, WTC, IARI, New Delhi

Rapporteur: **Dr Suresh Ramanan**, Senior Scientist (Agroforestry), ICAR-CAFRI, Jhansi

Dr Jagdish Chander Dagar, Former Assistant Director General (Agroforestry and Agronomy), ICAR, New Delhi, delivered an evening lecture titled "Agroforestry: A Vision for India's Green Future." He emphasized that agroforestry is not merely a land-use system but a comprehensive, problem-solving science that integrates trees, crops, and livestock to enhance productivity, profitability, diversity, and long-term ecosystem sustainability, particularly in the context of climate change. He highlighted its growing global importance as an effective approach for reclaiming and rehabilitating degraded lands, conserving water resources, preserving biodiversity, ensuring livelihood security, improving microclimates, and mitigating climate change.

Referring to major global and national initiatives—including the UN Convention to Combat Desertification (UNCCD), the UN Decade on Ecosystem Restoration, the G20 Global Land Initiative, the Great Green Wall Program (in Africa and China), the National Action Plan to Combat Desertification, the Integrated Watershed Management Program, and the National Green India Mission, Dr Dagar noted that agroforestry has played a significant role in addressing desertification and land degradation. These efforts have contributed to the successful establishment of nearly one billion hectares of land globally with more than 10 per cent tree cover, and about 28.427 mha under agroforestry practices in India, highlighting agroforestry's vital contribution to India's and the world's vision for a greener and more sustainable future.

Dr Dagar discussed the wide range of agroforestry technologies developed in India for different agro-ecological regions, including sand dune stabilization, watershed management, afforestation of ravines and gullies, rehabilitation of salt-affected and waterlogged lands, bio-drainage, shelterbelts, alley cropping on sloping lands, and multi-tier plantation systems in humid regions. He highlighted the success of species such as poplar and eucalyptus in irrigated Indo-Gangetic plains, casuarina and bamboo in southern and central India, and the growing potential of fruit trees, fodder species, and medicinal plants. Emphasizing that livestock is the backbone of dryland economies, he stressed integrated crop–tree–livestock systems using climate-resilient species, saline groundwater, harvested rainwater, and micro-irrigation. He also discussed profitable innovations such as coastal agroforestry combining rice, fish, vegetables, and trees, multi-enterprise farming systems, and the expanding role of agroforestry in urban and peri-urban areas through the use of treated wastewater, landscaping, floriculture, and vertical and rooftop gardens.

Concluding his lecture, Dr Dagar underscored the need for focused policy support, strategic planning, and effective implementation mechanisms for scaling up agroforestry. He called for research-based evaluations, fair valuation of

environmental services, assured markets and MSP for agroforestry products, quality planting material, stronger extension networks, and participatory partnerships among researchers, industry, extension agencies, and farmers. He emphasized that with appropriate institutional frameworks, modern technologies, and coordinated action across sectors, agroforestry can become a cornerstone of India's climate-resilient, sustainable, and inclusive rural development.

Key Highlights of the Lecture

- Agroforestry is a science-based, multi-enterprise system addressing climate change, biodiversity loss, and food security by integrating trees, crops, and livestock.
- Distinct from "Trees Outside Forests (ToF)", agroforestry creates synergistic systems aligned with farmer aspirations for profitability and ecological sustainability.
- Economic viability is proven through models like WADI, poplar-based systems, contract farming, and location-specific interventions (e.g. moringa in Haryana, pearl millet–*khejri*, coastal homegardens, silvo-pastoral systems).
- Comparative studies of 25 systems show benefit–cost ratios of 1.01–4.17 and employment generation up to 450 man-days/ha/year; meta-analysis needed to understand adoption barriers.
- Agroforestry aids soil and water reclamation *via* sub-surface drainage, bio-drainage, and bio-amelioration using species like *Prosopis* and *Acacia*; site-specific technologies can be scaled-up.
- Policy support needed, including minimum support price (MSP) for agroforestry produce and carbon credit mechanisms, to prevent price crashes and encourage adoption.
- India has vast species diversity for agroforestry: 213 trees, 17 palms, 128 shrubs, 116 herbs, 15 edible fungi, and 1,560 salt-tolerant species, offering large potential for climate-resilient expansion.

Way Forward Suggested

- Recognize agroforestry as a national mission beyond SMAF, with clear goals, measurable outcomes, and implementation strategies.
- Establish a National Agroforestry Coordination Mechanism, with ICAR-CAFRI as the nodal agency, and strengthen existing institutions with adequate manpower and budget.
- Develop region- and system-specific species portfolios, distinguishing between traditional orchards/forestry and agroforestry, including climate-resilient tree and crop species and local livestock breeds.

- Build farmers' capacity to participate in carbon markets and incorporate agroforestry into India's INDC targets.
- Promote agroforestry across irrigated and rain-fed areas, with specific site-based packages, and along roads, canals, and railway tracks.
- Adapt large-scale landscape restoration programs like Africa's and China's Green Wall to Indian contexts, such as the Aravalli–Panipat belt.
- Conduct meta-analyses of traditional and improved practices to understand adoption barriers and document field-applicable systems.
- Prioritize research on adaptation mechanisms, improvement of germplasm, and genetic enhancement of elite tree species, including tissue culture.
- Promote value addition for agroforestry products, including dairy, fruit processing, juice extraction, wood products, and small-scale industries to increase rural employment and farmer income.
- Identify region- and site-specific tree species preferred by local communities, ensure quality planting material, establish market linkages, and maintain transparent, accountable budgeting for upscaling.
- Involve farmers, private stakeholders, and researchers in species selection, nursery management, capacity building, and institutional convergence through public-private-farmer partnerships and contract farming models.

Co-Chairs' Remarks

In his remarks as Co-Chair, **Dr Gurbachan Singh** emphasized that a road map for scaling agroforestry is needed, stressing that 21st-century agriculture will be unsustainable without trees. He further emphasized wasteland reclamation, carbon credit opportunities, and the integration of fodder-based agroforestry models along with certain initiatives like the cactus promotion by the Ministry of Rural Development for promoting the establishment of *Gaushalas*.

Dr RB Singh, the Co-Chair of the Session emphasised on the need for decentralised approach to upscale agroforestry in the country. The future agroforestry must be location-specific (adapted to agro-climatic zones and stakeholders' aspirations), market-centric (linked to trade and value chains must be accounted for agroforestry promotion), and private-sector oriented (network projects with industries and stakeholders). Overall, the session advocated for surgical recommendations to upscale agroforestry in mission mode.

The Session concluded with a consensus that agroforestry is not merely about combining trees with agriculture, but is a transformative approach for climate resilience, resource optimization, and livelihood security. With strong

institutional support, policy innovation (MSP, carbon credits), and participatory scaling, agroforestry can emerge as a national priority for sustainable and resilient agriculture.

PARALLEL ROUND TABLE GROUP DISCUSSION FOR BUILDING ROAD MAP FOR THE FUTURE

Parallel Round Table Discussion was organized in four groups each with a Convener, rapporteurs and five Panelists, specialized in their own fields. The following salient points emerged from the group discussions:

Group 1: Research and Innovation

Convener: **Dr B Mohan Kumar**, Former Vice Chancellor, Arunachalam University of Studies, Namsai, Arunachal Pradesh

Rapporteurs: **Dr Raj Kumar**, ICAR-CSSRI, Karnal and
Dr ML Soni, ICAR-CAZRI, Jodhpur

Panelists: **Dr Sanjeev Chauhan**, Director Research, YSPUHF, Solan
Dr AK Shukla, Head, Grassland and Silvipasture Management Division, ICAR-IGFRI, Jhansi
Dr Rakesh Banyal, Principal Scientist (Agroforestry), ICAR-CSSRI, Karnal
Dr GM Bhat, Professor & Head, SAF, SKAUST-K, Srinagar
Dr Dheeraj Singh, Head, Division of Integrated Farming System, ICAR-CAZRI, Jodhpur

This group focused on identifying priority agroforestry species, promoting technological innovations, and disseminating the research findings. The following key points emerged from the deliberation during the group discussion:

- Agro-region-wise (arid, semiarid, temperate, tropical, etc.) suitable species and agroforestry models were identified, but greater thrust needs to be given to their upscaling and dissemination at the farm level.
- Research on genetic improvement (molecular and genomic approaches) and germplasm of important trees for producing quality healthy material and establishing region-wise nurseries need priority.
- Development of farmers' participatory agroforestry models for enhancing farm income and mitigating climate change is required.
- Species suitability mapping for different agro-ecological zones needs to be undertaken by ICAR-CAFRI.
- Develop methodology for quantification of ecosystem services at the national level.

- Conduct research on valorization/value addition in agroforestry trees.
- Greater focus is needed on developing traditional agroforestry systems (e.g. home gardens, apatani, etc.), similar to the Satoyama initiative of Japan.

Group 2: Enabling Policies for Agroforestry Development

Convener: **Dr Anil K Dixit**, ADG (PIM), ICAR, New Delhi

Rapporteurs: **Dr Babita Bohra**, CIFOR, India Office, New Delhi
Dr Jaya Prakash, CIFOR, India Office, New Delhi

Panellists: **Dr Pritha Datta**, Department of Policy & Management Studies, TERI, New Delhi
Dr AK Handa, Principal Scientists, ICAR-CAFRI, Jhansi
Dr Ramakrishna Hegde, Professor and Head, Department of Silviculture and Agroforestry, Ponnampet
Dr Sandeep Arya, Professor, Department of Forestry, CCS HAU, Hisar

This group had the focused discussion on policy interventions for addressing the challenges and promoting agroforestry development. The following key points emerged from the deliberations:

- Create Agroforestry Development Board (AFDB) to coordinate agroforestry initiatives across 7 key Ministries, aligning policies, programs, and resources. It will promote sustainable practices, support research and capacity building, and provide incentives to enhance climate resilience, livelihoods, and integrated land management.
- Define agroforestry produce-tradable parameters (timber, bamboo, NTFPs, carbon credits) to standardize these products for trade, and integrate them into e-NAM (electronic National Agriculture Market) to ensure better market access and pricing.
- Launch NAM 2.0 with INR 5,000 crore CSS budget, establishing a significant financial scheme for agroforestry, and ensuring converging with MGNREGA, Compensatory Afforestation Fund Management and Planning Authority (CAMPA), and watershed programs to pool resources and maximize impact.
- Merge the National Bamboo Mission with Sub-Mission on Agroforestry for synergy, frame carbon farming guidelines to monetize carbon sequestration by farmers, and promote PPPs (Public-Private Partnerships) to leverage private sector investment and efficiency.
- Focus on tree-deficient states with tailored incentives and tree insurance, directing resources and specific schemes to regions most in need of increasing tree cover and providing financial security to farmers adopting agroforestry.

- Develop Land Use Modelling, Agroforestry Atlas, and Decision Support System tools (DSS), utilizing digital and research capabilities to improve planning, monitoring, and decision-making for agroforestry implementation.
- Promote capacity building, youth and women incentives, to empower stakeholders and drive adoption, and integrate with Green Credit initiatives to recognize and reward the environmental services provided by agroforestry.

Group 3: *Value Chain and Market Linkages*

Convener: **Dr Arun Jyoti Nath**, Associate Professor of Ecology & Environmental Sciences, Assam University, Silchar

Rapporteurs: **Dr Maharishi Tomar**, Senior Scientist, CIPHET, Ludhiana
Dr RP Yadav, Principal Scientist, ICAR-CAFRI, Jhansi

Panellists: **Dr RC Dhiman**, Sustainable Agroforestry Initiatives, Greenlam Industries Ltd., New Delhi
Dr Sandeep Mann, Head, ICAR-CIPHET Ludhiana
Dr RS Dhillon, Professor, CCS HAU, Hisar
Dr RIS Gill, Principal Scientist (Forestry), PAU, Ludhiana
Dr MJ Dobriyal, Professor & Head, Department of Silviculture & Agroforestry, RLCAU, Jhansi

This group focused on improving market access, promoting value addition, and linking farmers to markets. The following key points emerged from the deliberation during the group discussion:

- Strengthening the value chain requires optimizing harvesting and processing, ensuring timely access to quality planting material, enforcing product standards and certifications, promoting small-scale agroforestry and NTFP industries with local youth involvement, expanding wood- and medicinal plant-based industries with assured prices for farmers, and encouraging diversification of high-value trees and crops to meet market demand.
- Market linkages are essential for connecting producers to consumers, which can be achieved by organising smallholders into Farmer cooperatives/producer companies for bulk marketing to reduce dependence on intermediaries. This also requires Public–private–peasant - partnerships to connect producers with food, wood, and pharmaceutical industries. Lastly, export facilitation is necessary to simplify procedures for international trade, especially for bamboo, oleoresins, timber, and medicinal plants.
- Digital and direct marketing to promote sales through E-commerce (online marketplaces and mobile apps tailored to agroforestry products)

and include tree-based products under eNAM to enhance outreach and transparency.

- Policy measures should focus on easing transit and felling permits and relaxing harvest restrictions for farm-grown timber and non-timber forest products. Incentives and subsidies should support storage, cold-chain, and transport infrastructure, the minimum support price (MSP) should be extended to agroforestry produce (e.g. fruits, vegetables, pineapple, ginger, turmeric, gums, resin, raw medicinal drugs, and dairy products). The wood and wood-based products be exempted from GST and risk management through insurance and credit facilities must be provided, and niche markets for carbon credits from agroforestry should be promoted.
- Capacity building and branding is necessary to equip farmers and consumers with knowledge, involving (i) training to educate farmers on grading, packaging, and related practices, and Brand development to promote the eco-friendly, sustainable branding of agroforestry products, and (iii) awareness campaigns to increase consumer awareness of the nutritional, medicinal, and environmental benefits of agroforestry products.

Group 4: Capacity Building and Extension

Convener: **Dr Randhir Singh**, Former ADG (Agric. Extension), ICAR, New Delhi

Rapporteurs: **Dr Gopal Krishnan**, ICT & Geospatial Scientist, CIFOR-ICRAF India Office, New Delhi
Dr Priyabrata Santra, Head (NRM), ICAR-CAZRI, Jodhpur

Panellists: **Dr Parvender Sheoran**, Director, ICAR-ATARI, Ludhiana
Dr JP Mishra, Director, ICAR-ATARI, Jodhpur
Dr Baljit Singh, Principal Scientist (Soil Conservation), PAU, Ludhiana
Dr Salil Tiwari, Professor, GBPUAT, Pantnagar
Dr Benukar Biswas, Professor & OIC AICRP, BCKV, Jhargram

This group focused on developing training programs, strengthening extension services, and promoting knowledge sharing at the level of different stakeholders. The following key points emerged from the deliberations:

- Establish Agroforestry Resource Centres at *Krishi Vigyan Kendras* (KVKs)/ SAUs/ ICAR institutes and develop knowledge sharing and training facilities. Three levels of training: (i) Basic (for farmers and SHGs—focus on planting techniques, NTFPs, value addition, branding, and certification e.g. organic, fair trade, and soil health; (ii) Intermediate (for extension workers—cover policy literacy, carbon credits, and market linkages); and (iii) Advanced (for agri-entrepreneurs and

planners—include GIS mapping, carbon sequestration modelling, and business incubation) need to be conducted. Training modules should be customised on the basis of agro-climatic zones/ situations, integrating local species, cropping systems, and climate vulnerabilities.

- Document and validate indigenous agroforestry systems to systematically record, study, and scientifically confirm the efficacy, productivity, and sustainability of traditional agroforestry systems (such as home gardens, or specific local practices like those of the *Apatani* tribe in India). Validation ensures that successful, time-tested practices are understood, preserved, and can be formally integrated into modern extension and development programs.
- Recognize innovative farmers who have developed and successfully implemented novel or highly effective agroforestry practices on their own. This recognition encourages peer learning, incentivizes innovation, and helps bring promising, field-tested techniques to the attention of researchers and policymakers for potential wider adoption and upscaling.
- Use WhatsApp and YouTube to share agroforestry knowledge widely, showcasing innovations, business models, and collective efforts by entrepreneurs, start-ups, and community organizations. Highlight proven success stories, like Saguna Farm's no-till rice-fish model, through videos and messages to inspire farmers and demonstrate profitability and sustainability. Serve as a virtual extension of farm schools by delivering training content, best practices, and practical demonstrations directly to farmers.
- Develop evidence-based scaling framework having justification, optimality (right pace and scale), coordination (institutions) and dynamic evaluation on cluster basis must be developed. Involve community organizations for scaling-up and survival mechanisms of plants.
- Develop impact dashboards tracking adoption rates, income changes, biodiversity gains, and soil health.
- Encourage inter-ministerial coordination (MoEFCC, MoA&FW, Tribal Affairs) for holistic support; partnership with FPOs, panchayats, para professionals, and NGOs for knowledge sharing, delivery, trust-building; and align with different schemes (SMAF, TOFI, RKVY, and Green Credit Program (GCP)) to pool resources, knowledge sharing and avoid duplication.

Concluding Session

Co-Chairs: **Dr RS Paroda**, Chairman TAAS, New Delhi
Dr Manoj Dabas, CIFOR, ICRAF, New Delhi

Convener: **Dr Bhag Mal**, Secretary TAAS, New Delhi

Rapporteurs: **Dr AK Handa**, Principal Scientist, ICAR-CAFRI, Jhansi
Dr Seema Mishra, Professor, Department of Applied & Basic Sciences, GD Goenka University, Sohna, Gurugram

During the Concluding Session, session-wise reports embracing the key points emanated from the intense deliberations, were presented by the Session Conveners. Additionally, based on the deliberations during the 2-day consultation, Delhi Plan of Action was presented by Dr JC Dagar, Former ADG (Agroforestry & Agronomy), ICAR, New Delhi. The salient features of Delhi Plan of Action outlining a clear path to scale agroforestry, addressing research, policy, markets, and extension were embraced in the Policy Brief including major recommendations relating to: (i) enabling policies, (ii) research and innovation, (iii) value chain and market linkages, and (iv) **s**trengthening extension, capacity building.

Dr RS Paroda, Chairman of the National Consultation concluded the National Consultation on Scaling Agroforestry by expressing his satisfaction with the event's outcome and the strong commitment demonstrated by the participants. Dr Paroda appreciated that strengths and weaknesses of the current agroforestry system were identified which will help in developing a road map for scaling agroforestry for the younger generation to carry forward. He specifically acknowledged that Dr Dagar and Dr Arunachalam had taken on significant responsibilities in leading the next steps of this initiative by documenting the road map. Furthermore, he appreciated the partners — ICAR, CAFRI, and ICRAF for their support in making this event successful. Finally, Dr Paroda concluded on an inspirational note, mentioning that the presence of stalwarts like Prof. RB Singh, Dr SK Vasal, and farmers like Major Manmohan Singh encouraged everyone involved to continue this important task. Dr Paroda expressed his confidence that with deep commitment of all stakeholders for scaling the agroforestry, we will be able to contribute significantly to achieving the targets of *Viksit Bharat* by 2047.

Dr Rishi Tyagi, Senior Consultant, TAAS, proposed a vote of thanks to the chairs, co-chairs, speakers, panellists, conveners, rapporteurs, committee members and all the delegates. He also acknowledged the logistic support provided by National Academy of Agricultural Sciences (NAAS), and financial support provided by co-organizers and sponsors.

RECOMMENDATIONS

All stakeholders were unanimous to reaffirm that agroforestry has to be a central strategy for *Viksit Bharat@2047* and India's climate/net-zero pathways. There is need to elevate agroforestry as a core national land-use paradigm—integrated across major missions on agriculture, climate, environment, rural development, and urban planning. Agroforestry needs to be reframed as a holistic production system combining trees, crops, and livestock, rather than limiting it to the current Trees outside Forests (ToF) category. Also, adoption of agroforestry needs to be promoted in rural, peri-urban, and urban settings as a flagship Climate-Smart Agriculture (CSA) solution that enhances productivity, resilience, carbon sequestration, and ecosystem services.

The following key recommendations emerged based on in-depth deliberations during the National Consultation on Scaling Agroforestry:

I. Enabling Policies

1. It was unanimously affirmed that an aggressive approach is now needed to scale innovations related to agroforestry for which the Ministry of Agriculture and Farmers Welfare needs to create a strong administrative wing headed by a Joint Secretary (Agroforestry) and the current Sub-Mission on Agroforestry and the National Bamboo Mission be unified with additional budget allocation of INR 1,000 crore annually for the next five years. Under the Mission, area be doubled from current 28.42 mha to 57 mha and issues related to revision of guidelines issued on agroforestry by the Ministry of Environment, Forest and Climate Change, land tenure, NTFP regulations, availability of credit at low interest rates, and the incentives to farmers through carbon credit, etc. be addressed on top priority in the best national interest.
2. The existing National Agroforestry Policy, adopted in 2014; the State Action Plans on Climate Change; and the agroforestry guidelines issued in June 2025 by the Ministry of Environment, Forests and Climate Change (MoEFCC) need to resolve inconsistencies, clarify institutional mandates and align them with emerging climate, market, and ecological conditions. These need to reframe strategies with actionable plans with specific, measurable, achievable, relevant and time-bound targets. A clean and well-defined budget allocation must be made for each action plan with a phased implementation road map delineating responsibilities, transparency, time-frame, monitoring mechanism and evaluation criteria.
3. There is an urgent need to have a successful agroforestry carbon finance strategy as an integrated framework centred around incentives, market access, and

digital transparency having three important components. First, an incentive-based mechanism, akin to REDD+, must provide direct financial rewards and rightful carbon revenues to farmers for sequestration, making participation economically viable while also protecting biodiversity and ecosystem services. Second, the nation must develop a robust carbon market strategy that fully integrates the agroforestry sector, enabling access to international finance under the Paris Agreement's Article 6 (NDC) and establishing domestic goals *via* programs like Emission Trading System (ETS), Joint Credit Mechanism (JCM), and Voluntary Emissions Reducing (VER) programs. Finally, the structure must be underpinned by an expansion of digital Measurement, Reporting, and Verification (MRV) platforms to improve the transparency and efficiency of generating agroforestry carbon credits, utilizing the data to optimize sequestration models and provide verifiable evidence, thereby increasing credit value and marketability.

4. There is full justification to establish a National Agroforestry Development Board (NADB) under the Ministry of Agriculture & Farmers Welfare, Government of India, as a central coordinating body to accelerate "*Har Med Par Ped*" call by the Prime Minister, with an aggressive agroforestry approach national-wide.
5. The States need to be encouraged to adopt state-specific agroforestry policies, create farm bunds using Viksit Bharat - Guarantee for Rojgar and Ajeevika Mission (Gramin) (VB-G RAM G) Act 2025 (previously Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) resources, and leverage *Rashtriya Krishi Vikas Yojana* (RKVY)-Agroforestry funds along with carbon markets, climate finance, and Corporate Social Responsibility (CSR) contributions for mission's sustainability.
6. There is an urgent need to have strong agroforestry research coordination mechanism between ICAR, Ministry of Environment and Forests and Defence Research and Development Organisation (DRDO) to ensure convergence and avoid duplication across schemes. Strengthen ICAR-CAFRI, Jhansi with at least 50 research scientists, well trained, and funded to undertake resourced, and empowered Centre of Excellence for national agroforestry research, training, and extension and to effectively coordinate frontline extension, nursery accreditation, monitoring and evaluation of agroforestry programs and serve as a national hub for knowledge generation, dissemination, and policy support.
7. There is an urgent need to increase investments in R&D for genetic improvement of tree crops. This would ensure genetic enhancement, developing much needed robust tissue culture protocols, agroforestry modelling, and developing region-

specific agroforestry systems (tree + understory crops + livestock). There is a definite need to increase investment in both public and private sectors for agroforestry research, development and education, and assure investment in establishing value-added chain of small industries in rural areas.

8. Provide specialized insurance schemes for tree-crop combinations, acknowledging longer gestation periods compared to annual crops coupled with accessible credit facilities to safeguard investments by farmers and build confidence. The farm-grown wood and related agroforestry products must be exempted from GST to encourage farmers to invest in agroforestry-based farming systems.

II. Research and Development

9. Evaluate and assess the potential of agroforestry practices with respect to their production potential, profitability, environmental services and adaptability, especially for their resilience to climate change and contributions to reversing biodiversity and soil fertility loss. Explore the cost-effectiveness and efficiency of modern technological tools such as GIS, remote sensing, micro-irrigation and climate-smart conservation agriculture and develop an agroforestry atlas with species suitability maps for different agro-ecological zones.
10. Conduct a comprehensive meta-analysis of both traditional and modern practices to identify fine scale variations across social, economic and ecological contexts. This will determine the conditions under which specific practices are most suitable. Research designs should be structured to assess both successes and failures, providing robust insights to guide the scaling of agroforestry practices effectively.
11. Develop integrated, climate-resilient and market-oriented agroforestry systems ensuring raising of high-value trees with stress-tolerant crops, grasses and legumes and resilient livestock. Microbial consortia must be explored for developing stress-tolerant trees and crops. Indigenous trees, fruits, nuts, potential halophytes and grasses must be domesticated with strong institutional support to rehabilitate degraded lands.
12. Strengthen germplasm conservation systems at the specialised institutions—the field collection of species and their evaluation at ICAR-Central Agroforestry Research Institute (ICAR-CAFRI), Jhansi and tissue culture and cryopreservation and seed conservation at ICAR- National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi.
13. There is an urgent need to strengthen the accredited nurseries for quality planting material (QPM) accessible to the stakeholders. The linkages with

research organisations, nursery owners, state departments and farmer-producer organizations (FPOs) to scale-up delivery of quality QPM must be strengthened.

III. Value Chain and Market Linkages

14. Create enabling frameworks including digital marketing intelligence for marketing, branding, certification, and processing of agroforestry products, including timber, non-timber forestry products (NTFPs), fruits, dairy products, and bioenergy. Support storage, cold-chain, and transport infrastructure in rural areas.
15. Promote small-scale agroforestry-based industries for semi- processing and value addition of products and reduce intermediaries to improve farmer income and reduce market risks. For this, a national Market Knowledge Information System (MKIS) must be in place to deliver real-time, transparent information on prices, demand, supply, and trading volumes for key agroforestry species and empower farmers to make informed choices on tree species and intercrops, improve price realization, and enhance the overall commercial viability of agroforestry systems.
16. Launch a dedicated, multilingual National Agroforestry Call Centre under the proposed Mission on Agroforestry for Trees outside Forests (ToF) and agroforestry farming system, accessible *via* basic keypad phones, to provide essential, on-demand support for farmers. The Call Centre may be inter-linked with existing government platforms such as Kisan Credit Card (KCC), Agricultural Technology Management Agency (ATMA), *Krishi Vigyan Kendras* (KVKs) and SAUs to ensure region-specific, reliable, and on-demand guidance relating to farm operational know-how and market related information.
17. Establish Public–Private–Producer farmer-Partnerships (PPPPs) to connect producers with industries (food processing, pharmaceutical, timber) and establish small cottage industries of specific agroforestry products in rural areas involving educated youth, FPOs and women's self-help groups.

IV. Strengthening Extension and Capacity Building

18. There is a need to strengthen private extension system involving youth through capacity-building framework at SAUs to promote and commercialize agroforestry. Also, a dedicated cadre of Subject Matter Specialists (SMS) for agroforestry in all KVKs is highly justified to ensure last-mile technical support to farmers interested in agroforestry.
19. There is a need to demonstrate and replicate successful agroforestry models developed by the research institutes, SAUs, NGOs, and entrepreneur farmers

[e.g. WADI model (by BAIF), Poplar-Industry-Farmer partnership (WIMCO-NABARD), etc.

20. Organize targeted training for farmers and field workers on carbon credit initiatives, including an understanding of market rules, monitoring requirements, and the financial structure of the deals.
21. Foster public–private partnerships (PPPs) with industries and financial institutions (e.g. NABARD) to support value-chain development and contract farming arrangements to promote agroforestry.
22. It is necessary that SAUs reorient their course curricula to include agroforestry practices so as to create interest among agricultural graduates to embrace agroforestry and become successful entrepreneurs.

Annexure I

Technical Program

DAY 1: 18 SEPTEMBER 2025

09:00-10.00	**Registration**	
10:00-11:30	**Inaugural Session**	
10:00-10:10	**Arrival of Dignitaries and Lighting of Lamp**	
10:10-10:20	Welcome and Setting the Context	**Bhag Mal**, Secretary, TAAS, New Delhi
10:20-10:30	Remarks by Guests of Honour	**Ravi Prabhu**, Former DDG, ICRAF
10:30-10:40		**AK Nayak**, DDG (NRM), ICAR, New Delhi
10:40-10:50		**Rajbir Singh**, DDG (Ag. Extension), ICAR, New Delhi
10:50-11:00		**Eliane Ubalijoro**, CEO CIFOR-ICRAF and DG, ICRAF, Nairobi, Kenya
11:00-11:20	Address by Chairman	**RS Paroda**, Chairman, TAAS, New Delhi
11:20-11:30	Vote of Thanks	**Manoj Dabas**, Country Director, Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF)-India office, New Delhi
11:30-12:00	***Group Photo and Tea/Coffee***	

12:00-13:30	***Technical Session I*** **Current Status of Agroforestry Research and Innovation**	
	Co-Chairs : **AK Nayak**, DDG (NRM), ICAR, New Delhi : **JC Dagar**, Former ADG (Agroforestry), ICAR, Karnal	
	Convener : **AK Handa**, Principal Scientist, ICAR-CAFRI, Jhansi	
	Rapporteur : **Rakesh Banyal**, Principal Scientist, ICAR-CSSRI, Karnal	
	Keynote Lecture	
12:00-12:20	Scaling of Agroforestry Initiatives – Achievements and Potential	**A Arunachalam**, Director, ICAR-CAFRI, Jhansi
	Invited Lectures	
12:20-12:35	Scaling Agroforestry Innovations in Arid Regions	**OP Yadav**, Former Director, ICAR-CAZRI, Jodhpur
12:35-12:50	Status of Research and Innovation in *Khejri* (*Prosopis cineraria*) and other species in Arid Region	**Jagdish Rane**, Director, ICAR-CIAH, Bikaner
12:50-13:30	General Discussion and Co-Chairs' Remarks	
13:30-14:30	***Lunch***	
14:30-16:30	***Technical Session II*** **Challenges and Opportunities in Scaling Agroforestry**	
	Co-Chairs : **Ravi Prabhu**, Former DDG, ICRAF and A Arunachalam, CAFRI	
	Convener : **Rishi Tyagi**, Senior Consultant, TAAS	
	Rapporteur : **Dinesh Sharma**, Principal Scientist, CESCRA, IARI	
	Keynote Lecture	
14:30-14:50	Policy and Regulatory Issues: Felling, Transport, and Land Use Issues	**SK Dhyani**, Senior Agroforestry Specialist World Agroforestry (ICRAF), India Office, New Delhi
	Invited Lectures	
14:50-15:05	Agroforestry for Carbon Trading	**Umang Agarwal**, Chief Operating Officer – Carbon, IIIT Delhi Innovation and Incubation Center, New Delhi

15:05-15:20	Agri-horticulture for Enhancing Rural Livelihoods, Food and Nutritional Security	**PN Mathur**, Consultant, Centre for Fruitful India (CFI), New Delhi
15:20-15:35	Agroforestry for Climate Change Mitigation and Adaptation	**Sharda Gupta**, Professor, Kurukshetra University, Kurukshetra (Recorded)
15:35-16:30	General Discussion and Co-Chairs' Remarks	
16:30-17:00	***Tea/Coffee***	
17:45-18:40	***Evening Lecture I***	
	Chair : **Gurbachan Singh**, Former Chairman, ASRB, New Delhi	
	Convener : **Khajanchi Lal**, Principal Scientist, WTC, IARI, New Delhi	
	Rapporteur : **Suresh Ramanan**, Senior Scientist, ICAR-CAFRI, Jhansi	
17:45-17:55	Welcome and Introduction of Speaker	**Khajanchi Lal**, Principal Scientist, WTC, IARI, New Delhi
17:55-18:35	Agroforestry: A Vision for India's Green Future	**JC Dagar**, Former ADG (Agroforestry), ICAR, Karnal
18:35-18:50	Chair's Remarks	
18:50-19:00	Vote of Thanks	
19:00	***Dinner***	

DAY 2: 19 SEPTEMBER 2025

09:30-11:00	***Technical Session III***	
	Farmers' Perspectives on Agroforestry: Success and Challenges	
	Co-Chairs : **Rajbir Singh**, DDG (Agri. Extn.), ICAR, New Delhi	
	: **SK Dhyani**, Senior Agroforestry Specialist, World Agroforestry (ICRAF), India Office, New Delhi	
	Convener : **BP Bhatt**, OSD to DG, ICAR, New Delhi	
09:30-09:40	Success Story of Agroforestry Species	**Arun Jyoti Nath**, Professor of Ecology and Environmental Science, Assam University, Silchar
09:40-09:50	Farmers' Perspectives on Agroforestry	**Chandrashekhar Bhadsavle**, Founder President, SRT, Malegaon

09:50-10:00	Farmers' Perspectives on Agroforestry: Success and Challenges	**Nikki Pilania Chaudhary**, Founder, Mango Dairies, Pilibhit
10:00-10:10	Success Story of Agroforestry in Punjab	**Major Manmohan Singh Verka**, Amritsar
10:10-10:20	Agroforestry Initiatives in Haryana	**Rohit Kansay**, KisanTree, Jagadhari
10:20-10:50	General Discussion and Co-Chairs' Remarks	
10:50-11:30	***Tea/Coffee***	
	Parallel Round Table Discussion for Building Road Map for the Future	
11:30-13:30	***Group 1*: Research and Innovation** (Focus on identifying priority agroforestry species, promoting technological innovation, and disseminating research findings). ***Convener* : B Mohan Kumar**, Ex VC Arunachalam Univ. of Studies and Head College of Forestry, KAU ***Rapporteurs* : Raj Kumar**, ICAR-CSSRI, Karnal and **ML Soni**, ICAR CAZRI, Jodhpur	***Panellists*** **Sanjeev Chauhan**, Director Research, YSPUHF, Solan **AK Shukla**, Head, Grassland and Silvipasture Management Division, ICAR-IGFRI, Jhansi **Rakesh Banyal**, Principal Scientist (Agroforestry), ICAR-CSSRI, Karnal **GM Bhat**, Professor and Head, SAF, SKAUST-K, Srinagar **Dheeraj Singh**, Head, Division of Integrated Farming System, ICAR-CAZRI, Jodhpur

11:30-13:30	***Group 2*: Enabling Policies for Agroforestry Development** (Focus on policy interventions for agroforestry development challenges) ***Convener* : Anil K Dixit**, ADG (PIM), ICAR, New Delhi ***Rapporteurs* : Babita Bohra** and **Jaya Prakash**, CIFOR, India Office, New Delhi	***Panellists*** **Pritha Datta**, Department of Policy and Management Studies, School of Advance Studies, TERI, New Delhi **AK Handa**, Principal Scientists, ICAR-CAFRI, Jhansi **Ramakrishna Hegde**, Professor and Head, Department of Silviculture and Agroforestry, Ponnampet **Sandeep e**, Professor and Head, Department of Forestry, CCS HAU, Hisar
11:30-13:30	***Group 3*: Value Chains and Market Linkages** (Focus on improving market access, promoting value addition, and linking farmers to markets) ***Convener*: Arun Tyoti Nath**, Associate Prof. of Ecology and Environmental Sciences, Assam University, Silchar ***Rapporteurs*: Maharishi Tomar**, Senior Scientist, CIPHET Ludhiana and **RP Yadav**, Principal Scientist, ICAR-CAFRI, Jhansi	***Panellists*** **RC Dhiman**, Sustainable Agroforestry Initiatives, Greenlam Industries Ltd, New Delhi **Sandeep Mann**, Head, ICAR-CIPHET, Ludhiana **RS Dhillon**, Professor, CCS HAU, Hisar **RIS Gill**, Principal Scientist (Forestry), PAU, Ludhiana **Manmohan Jagatram Dobriyal**, Professor & Head Department of Silviculture & Agroforestry, RLCAU, Jhansi
11:30-13:30	***Group 4*: Capacity Building and Extension** (Focus on developing training programs, strengthening extension services, and promoting knowledge sharing) ***Convener*: Randhir Singh**, Former ADG (Agric. Extension), ICAR, New Delhi	***Panellists*** **Parvender Sheoran**, Director, ICAR-ATARI, Ludhiana **JP Mishra**, Director, ICAR-ATARI, Jodhpur **Baljit Singh**, Principal Scientists (Soil Conservation), PAU, Ludhiana

	***Rapporteurs*: Gopal Krishnan**, ICT & Geospatial Scientist, CIFOR-ICRAF India Office, New Delhi and **Priyabrata Santra**, Head (NRM), ICAR-CAZRI, Jodhpur	**Benukar Biswas**, Professor, and OIC AICRP, BVKV, Jhargram
13:30-14:20	***Lunch***	
14:20-16:00	***Concluding Session*** **Presentation of Session-wise Outcomes**	
	Co-Chairs	**: RS Paroda**, Chairman, TAAS **: AK Nayak**, DDG (NRM), ICAR **: Manoj Dabas**, Country Director, CIFOR-ICRAF
	Convener	**: Bhag Mal**, Secretary, TAAS
	Rapporteur	**: AK Handa**, Principal Scientist, ICAR-CAFRI, Jhansi **: Seema Mishra**, GD Goenka University, Sohna, Gurugram
14:20-15:00:	Group 1 Group 2 Group 3 Group 4	Convener of each working group will present the key recommendations and action plans (10 min each)
15:00-15:20	Presentation of Delhi Plan of Action and Recommendations	**JC Dagar**, Former ADG (Agroforestry), ICAR
15:20-15:30	Discussion	
15:30-15:50	Chairs' Remarks	
15:50-16:00	Vote of Thanks	**Rishi Tyagi**, Senior Consultant, TAAS, New Delhi

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