REPORT

WORKSHOP ON

AGRO-FORESTRY MODELING FOR DIFFERENT AGRO-CLIMATIC REGIONS OF MEGHALAYA

Enhancing income generation and carbon financing to communities



(Jointly organised by the Centre of Excellence, CLLMP, IORA and GIL)















BACKGROUND

The Meghalaya Basin Development Authority (MBDA), IORA Ecological Solutions, and Rabobank Acorn are together implementing a carbon finance project across the state of Meghalaya – Meghalaya Carbon Agroforestry for Community Resilience and Ecosystems (MegCare). The Rabobank Acorn initiative, an acronym for Agroforestry Carbon removal units for the Organic Restoration of Nature, marks a ground-breaking effort towards supporting smallholder farmers and promoting sustainable agricultural practices. The programme aims to unlock the international voluntary carbon market for smallholder farmers by assisting their transition from monoculture or subsistence farming to sustainable agroforestry practices. This transition will not only improve farmers' livelihood but also contribute significantly to environmental conservation and carbon sequestration efforts.

As a vital step in this initiative, existing agroforestry plantations established over the past five years under the State's various externally aided projects, such as the JICA-funded Project for Community-Based Forest Management and Livelihoods Improvement in Meghalaya (MegLIFE) and World Bank-funded Meghalaya Community-Led Landscape Management Project (CLLMP), and schemes under MGNREGA and the Soil and Water Conservation Department, will be adopted as existing agroforestry. Additionally, necessary infrastructure, such as nursery establishment and technical support will also be provided across the state to interested farmers to establish and maintain new agroforestry systems on their farms.

To ensure the success and efficacy of this programme in Meghalaya, MBDA, IORA and Acorn, along with the State Government jointly organized a consultative workshop on Agroforestry Modeling for different Agro-Climatic Regions of Meghalaya on 23 April 2024 at the MBDA Office in Jingkieng, Shillong.

The primary objective of the workshop was to identify the most suitable agroforestry models for different agroclimatic regions in the state that can be implemented at scale. These models should be beneficial for both the farmer and the ecology of the region, contributing towards not only climate mitigation but also helping in building resilience, improving biodiversity, and offering an income generation opportunity to farmers.

Discussions included the existing agroforestry models that have been developed under different programmes and implemented over the past few years. Since these models have undergone implementation, at this stage, it is imperative to gather insights into their performance and suitability, particularly considering the diverse agro-climate zones within Meghalaya. The experiences and challenges encountered in previous plantations and agroforestry models will be carefully incorporated into the design and implementation of new plantations. This iterative approach ensures that lessons learned from past endeavours inform and enhance future agroforestry initiatives.

The workshop brought together various institutions and stakeholders involved in agroforestry and environmental conservation to contribute to the finalization and refinement of the Agroforestry model. Through interactive discussions, presentations, and practical exercises, participants were given the opportunity to provide valuable insights, feedback, and recommendations for further optimizing the new Agroforestry models to be implemented under the MegCare programme. By leveraging the collective expertise and experiences of diverse stakeholders, including researchers, practitioners, policymakers, and community representatives, the workshop aimed to ensure that the agroforestry models are tailored to the specific socio-economic, agro-climatic and ecological contexts of Meghalaya, thereby maximizing their impact on both smallholder farmers and the environment.

Post the workshop, the models will be validated with farmers and communities across the state, to gather their inputs and understand their needs. The models will then be finalised for implementation incorporating community feedback.

Through this collaborative effort, the programme seeks to harness the potential of agroforestry to address pressing socio-economic and environmental challenges while fostering resilience and prosperity in Meghalaya. The programme also aligns closely with the United Nations Sustainable Development Goals, notably contributing to Goals 1, 2, 6, 8, 9, 13, 15, and 17.



CARBON AGROFORESTRY FOR RESILIENCE OF ECOSYSTEMS

The programme works by measuring CO2 that is sequestered through agroforestry, into carbon credits to be sold on the voluntary carbon market. The Acorn Framework involves an innovative and scalable method for measuring, certifying, and monetizing the biomass growth of planted trees and turning that growth into Carbon Removal Units (CRUs). The CRUs (or carbon credits) are sold to organizations with strong emission reduction commitments. To close the loop, 80% of the income of every sold CRU flows back to the original smallholder.

ABBREVIATIONS AND ACRONYMS

ACORN	Agroforestry Carbon Removal Units for the Organic Restoration of Nature	
AF	Agroforestry	
ВТ	Bacillus thuringiensis	
CLLMP	Community-Led Landscape Management Project	
СоЕ	Centre of Excellence for NRM and Sustainable Livelihoods	
CRU	Carbon Removal Unit (s)	
DoH	Directorate of Horticulture	
GIL		
GoI	Government of India	
GoM	Government of Meghalaya	
На	Hectare (s)	
IORA	Indian Ocean Rim Association	
ICAR	Indian Council of Agricultural Research	
IVCS	Integrated Village Cooperative Societies Ltd.	
JICA	Japanese International Cooperation Agency	
MBDA	Meghalaya Basin Development Authority	
MBMA	Meghalaya Basin Management Agency	
MegCare	Meghalaya Carbon Agroforestry for Community Resilience and Ecosystems	
Megha-LAMP	Meghalaya Livelihoods and Access to Markets Project	
MegLIFE	Project for Community-Based Forest Management and Livelihoods Improvement in Meghalaya	
MIDC	Meghalaya Industrial Development Corporation Ltd	
MSRLS	Meghalaya State Rural Livelihoods Society	
NECTAR	North East Centre for Technology Application and Reach	
NEHU	North Eastern Hill University	
NRM	Natural Resource Management	
SALT	Sloping Agriculture Land Technology	
SWCD	Soil and Water Conservation Department	

PROGRAMME SCHEDULE

OPENING SESSION			
Welcome Address	Shri Gunanka DB, IFS, Executive Director, MBDA & APD - CLLMP and MegLIFE		
Opening Remarks	Dr. Subhash Ashutosh, IFS, Co-chairman & Director, Centre of Excellence (NRM & Sustainable Livelihoods), Government of Meghalaya		
Brief Introduction to Agroforestry based Carbon Financing in Meghalaya	Mr. Swapan Mehra, CEO, Iora Ecological Solutions & Ms. Anne-Lot Kemna, RM Partnerships India, Acorn		
Keynote Address	Shri Sampath Kumar, IAS, Principal Secretary & Development Commissioner, Government of Meghalaya		
Participants' Introduction	IORA + GIL + COE		
SESSION 1: Assessing existing agroforestry models + identification of suitable species			
 Meghalaya's experiences with Agroforestry: Agroforestry under MegLIFE (JICA) Agroforestry initiatives under Soil and Water Conservation Department Agroforestry Initiatives under Horticulture, Agriculture & Farmers Welfare Department SALT as an AF Model in Meghalaya 	 MC: Dr. Lavinia Dkhar Presenters: 1. Mr. Samuel Raju Geddam (PMC, MegLIFE) 2. Mr. Nigel Kharmalki (Soil and Water Conservation Department) 3. Directorate of Horticulture 4. Mr Wankit Swer, DPD, MegLIFE 		
Presentation on Agroforestry based Carbon Financing in Meghalaya	Mr. Swapan Mehra, CEO, Iora Ecological Solutions		
GROUP DISCUSSION			
 Review of Successes and Challenges to scale up of existing models with emphasis on - 1. Areca nut-based agroforestry models 2. Broom Grass based agroforestry models 3. Other fruit and commercial species-based agroforestry models. 4. Forestry tree species-based agroforestry models Sharing of Ideas and Insights from Participants 	Moderator: Dr. Subhash Ashutosh - Participants: All Invitees and Participants		

EXERCISE/INTERACTIVE ACTIVITY

Moderator: Prof Dr B.K. Tiwari, Former Professor, Dept of Environmental Science, NEHU

Participants: All Invitees and Participants

Mapping Preferred Species based on Local Knowledge and Ecological Suitability that can be included along with main species:

- Species (trees and crops)
- Suitable agro-climatic zone
- Time of planting
- Potential Applications/Benefits in Agroforestry Systems

The following components should be kept inmind while mapping:

- Soil and Water Conservation Capacity
- Fertility Management capacity
- Dual-purpose production for both food and market
- Selection of tree species with high carbon sequestration capacity

Step 1: Laying context by Moderator

Step 2: Map Species on the Actual Map of Meghalaya using sticky notes

Step 3: Moderator to ask participants to fill the table in Annexure 1 based on the species identified in the map Step 4: Summary of discussions mind while mapping:

- Soil and Water Conservation Capacity
- Fertility Management capacity
- Dual-purpose production for both food and market
- Selection of tree species with high carbon sequestration capacity

Step 1: Laying context by Moderator

Step 2: Map Species on the Actual Map of Meghalaya using sticky notes

Step 3: Moderator to ask participants to fill the table in Annexure 1 based on the species identified in the map Step 4: Summary of discussions

SESSION 2: Agroforestry Implementation			
EXERCISE/INTERACTIVE ACTIVITY Stakeholder consultation for identifying roles of different departments, institutions and community organisations.	IORA + GIL + MBDA		
 FACILITATED GROUP DISCUSSION/ BRAINSTORMING Preparing plan/strategy for- 1. Planting Material for Agroforestry 2. Extension Services for Agroforestry (Eg: Integration of livestock- goats, piggery, poultry, fishery, honey bees) 3. Capacity Building Needs for Agroforestry 	Moderators: • Mr Samuel Raju Geddam, IFS, PMC (MegLife) • Dr. Subhash Ashutosh		
CONCLUDING SESSION			
Sharing of key takeaways by participants	 Dr. Lavinia Dkhar, CoE Dr Aakriti Wanchoo, IORA 		

OPENING SESSION

Welcome Address:

Shri. Gunanka DB (IFS) Executive Director, MBDA and APD, MegLIFE and CLLMP



Shri Gunanka DB (IFS) the Additional Project Director (APD) of MegLIFE, and CLLMP highlighted that 2787 hectares (ha) of plantation areas have been established under the MegLIFE project. He emphasized the significant community mobilization and participation during the project's early stages. All agroforestry models were carefully developed in consultation with the communities to build trust. The APD mentioned that MegLIFE piloted 5 models in 2023 and is now progressing with 12 models. This year, the project aims to target about 8,500 ha of land for plantation activities, with a strong focus on agroforestry interventions.

In line with modern project practices, he stressed that it is essential not to impose activities; instead, activities should be demand-driven by the community. The goal is to facilitate a transition from traditional methods that have negative environmental impacts. The project plans to establish new plantations and identify new farmers to participate in these initiatives.

Regarding workshops, the APD informed that a similar workshop on

agroforestry was conducted in 2023, which led to the development of various models. To advance the process, the "Workshop on Agroforestry Modeling for different Agro-Climatic Regions of Meghalaya" will emphasize shifting cultivation and monocropping and leverage ACORN's best practices in agroforestry to enhance approaches in Meghalaya.

Suggestions were sought from participants during the course of the workshop on how best to further support the communities in Meghalaya.

Opening Remarks:

Dr. Subhash Ashutosh (IFS)

Co-chairman & Director, Centre of Excellence (NRM & Sustainable Livelihoods), GoM.



In his opening remarks, Dr. Subhash Ashutosh (IFS), Co-chairman & Director of the Centre of Excellence (NRM & Sustainable Livelihoods), highlighted the workshop's focus on delving deeper into the realms of agroforestry and carbon financing. He aimed to reassess the agroforestry model in Meghalaya, ensuring active community involvement and benefit. A concise presentation provided an overview of the project's imperative to strengthen and reimagine agroforestry in the state, emphasizing four key benefits: enhanced soil health, biodiversity improvement, increased productivity, and diversified income for farmers. Notably, agroforestry aligns with 9 out of 17 Sustainable Development Goals (SDGs), making it a pivotal strategy for holistic development in Meghalaya.

Given Meghalaya's susceptibility to climate change and soil erosion due to intense rainfall, agroforestry has emerged as a crucial natural-based solution for soil and water conservation, mitigating water stress, and adapting to climate change impacts. Dr. Ashutosh referred to reports highlighting significant soil erosion rates, with approximately 14 tonnes per hectare per year washed

away annually in the Khasi and Jaintia regions, underlining the pressing need for conservation measures. Additionally, according to the FSI report, Meghalaya is experiencing a significant decline in forest cover over the past decade, further emphasizing the urgency of sustainable land management practices.

Dr. Ashutosh discussed a recent report titled 'Greening and Restoration of Wastelands with Agroforestry (G.R.O.W),' published by Niti Aayog, which identified approximately 2,100 hectares suitable for agroforestry greening in Meghalaya, accounting for nearly 17% of the state's area. Envisioning agroforestry's potential has prompted the state government to

consider further actions, particularly amidst the persisting challenge of monocropping plantations. Moreover, enhancing value addition and market linkages could amplify profitability for farmers, with sample studies indicating improved Internal Rate of Return (IRR) when diversifying crops alongside arecanut cultivation.

He added that agroforestry holds promise in diversifying income sources for farmers, steering them away from unsustainable practices like sand mining and quarrying. He emphasized addressing the dominance of monoculture plantations while respecting and integrating traditional practices. Additionally, leveraging carbon financing presents a strategic avenue to combat climate change in Meghalaya.

Suggestions were sought to propel agroforestry to new heights, with several key issues that need to be addressed:

- Identifying suitable species and agroforestry models, incorporating community perspectives.
- Facilitating value addition and market linkages through government initiatives.
- Strengthening extension services to disseminate technical knowledge to farmers.
- Establishing community nurseries for high-quality planting materials.
- Conducting comprehensive training programmes on various aspects of agroforestry.

Addressing these challenges will prompt consideration of a new agroforestry policy in the state, ensuring a cohesive and sustainable approach to agroforestry development.

Brief Introduction to Agroforestry based Carbon Financing in Meghalaya:

Shri. Swapan Mehra, CEO, Iora Ecological Solutions &Ms. Anne-Lot Kemna, RM Partnerships India, Acorn





In their opening remarks, Shri. Swapan Mehra and Ms. Anne-Lot Kemna elaborated on the overarching objectives of Agroforestry financing, with a focus on highlighting the strategic utilization of carbon markets to attract resources and investments to Meghalaya. The pivotal role of IORA (Indian Ocean Rim Association) in supporting the initiatives of the Government of India, particularly in the realm of sustainable land management, was emphasized. Further, the significance of collaboration with Meghalaya was underscored, noting its transition into a broader partnership with larger implications. A central aspect of the

discussion centered around ACORN, a pivotal component of Rabobank, dedicated to supporting diverse farming models before transitioning into comprehensive Agroforestry practices.

ACORN's primary goal was outlined as facilitating carbon financing for Agroforestry projects, ensuring that the highest value of carbon benefits farmers directly. The mandate of ACORN dictates that a minimum of 80% of carbon financing be allocated to farmers, with a cap of 20% for transaction costs. Moreover, ACORN's innovative approach of selling carbon credits directly to end-users rather than intermediaries was emphasized, resulting in higher prices. Recent transactions have seen ACORN credits fetching over 30 Euros per ton. In Meghalaya, a landmark initiative named "MegCARE" is underway, representing one of the largest initial investments on the ACORN platform.

The ambitious MegCARE project aims to cover 100,000 hectares over the next two years, with 43 field members deployed across different districts of the state. Currently, 3700 hectares has been onboarded, with plans to expand to 5000 hectares imminently. This year, the project aims to finance an additional 30,000 hectares of new Agroforestry projects. The commitment was reiterated by Shri. Mehra and Ms. Kemna to ensure that 80% of all carbon financing benefits vulnerable farmers. The collaboration between the Meghalaya Basin Development Authority (MBDA) and IORA is dedicated to securing financing for Agroforestry initiatives, thereby supporting sustainable forest conservation, livelihood development, and investments in value chains and processing.

A proposal was made to conduct a specialized case study on the "Valuation of Agroforestry Systems in Meghalaya," encompassing both the Khasi and Garo Hills regions.

Workshop on Agroforestry Modeling for different Agro-Climatic Regions of Meghalaya

Keynote Address:



Shri. Sampath Kumar (IAS)

Principal Secretary & Development Commissioner, Government of Meghalaya

In his keynote address, Shri. Sampath Kumar (IAS) Principal Secretary & Development Commissioner, Government of Meghalaya, emphasized the critical role of conserving natural resources as an additional measure to mitigate climate change, highlighting the substantial benefits that farmers could derive from such endeavors. Various line departments were urged to actively participate in or align themselves with the carbon finance project, underscoring its immense advantages in the long run.

He added that it is important to integrate conservation efforts with climate change mitigation strategies, with a focus on collaborative action across multiple sectors. The potential of the carbon finance project extends beyond addressing environmental challenges to fostering socio-economic development, particularly for rural communities.

Shri. Kumar then highlighted the transformative potential of the project in enhancing resilience to climate change impacts and promoting sustainable land management practices. Stakeholders are encouraged to seize the opportunity presented by carbon finance initiatives, emphasizing their potential to catalyze positive change at both local and global scales.

The need to understand the importance of collective action and collaboration in realizing the full potential of carbon finance projects was emphasized. Stakeholders should embrace a holistic approach that considers both environmental conservation and socio-economic development objectives, thereby maximizing the benefits for all stakeholders involved

SESSION 1:

Assessing existing agroforestry models + identification of suitable species

Agroforestry under MegLIFE Shri. Samuel Raju Geddam (PMC,MegLIFE)



Shri. Samuel Raju Geddam (PMC, MegLIFE) stated that the implementation plan for agroforestry models under MegLIFE is to restore degraded forests, rehabilitate shifting cultivation lands, and create sustainable land-based income generation activities that contribute to ecological, economic, and social benefits.

Under the MEgLIFe project, key models for agroforestry implementation have been identified, which are as follows:

- 1. Restoration of Timber Species by ANR with Enrichment Plantations (1600 hectares): This model focuses on restoring timber species through the Agroforestry and Natural Resource (ANR) approach, incorporating enrichment plantations over an area of 1600 hectares.
- 2. Restoration of Natural Vegetation: Wherever gaps exist, seedlings will be introduced and focus will be on stocking forests, afforestation of barren land, and rehabilitation of shifting cultivation areas.
- **3.** Revisitation of Shifting Cultivation Areas: Shifting cultivation areas will be revisited every three to four years where efforts will be concentrated within the project area.

Shri. Geddam added that the objectives of these models include ecological, economic, and social benefits. Ecologically, they aim to reduce pressure on forests, enhance nutrient recycling efficiency, and mitigate micro-climatic changes such as reducing soil surface temperatures. Economically, the focus is on improving rural living standards by offering sustained income opportunities. Socially, the aim is to restore degraded forests and rehabilitate shifting cultivation lands to foster community resilience and enhance livelihood opportunities within the affected areas.

He further stated that key principles guiding the design of these models include prioritizing species selection based on agro-climatic zones and local demand, ensuring alignment with community needs. The approach is demand-driven rather than supply-led, considering the status of land use and local preferences. There is also a potential for integrating agroforestry with livestock farming, water storage for aquaculture, and other income-generating activities like Integrated Village Cooperative Societies (IVCS), Self-Help Groups (SHGs), and Producer Groups (PGs). The aim is to align these agroforestry models with existing schemes and projects in the state to maximize impact and resource utilization.

Agroforestry initiatives under the Soil and Water Conservation Department (SWCD) Shri. Nigel Kharmalki, Planning Officer, SWCD



In his presentation, Shri. Nigel Kharmalki, Planning Officer, SWCD stated that the Department has embarked on several agroforestry-related interventions, although a comprehensive model has yet to be established. Initially, efforts were directed towards introducing hedge groups and commencing the plantation of arecanut. In subsequent years, additional interventions were made within the arecanut plantations. For instance, in the years 2021 and 2022, black pepper and cocoa were introduced, with significant growth observed in cocoa cultivation by the year 2023-2024. The availability of sufficient planting materials facilitated this growth.

Shri. Kharmalki added that farmers have independently introduced other plants into the arecanut plantations, such as pineapple, while options like banana and black pepper have been suggested to farmers as complementary crops within the arecanut plantations, aimed at enhancing moisture retention and augmenting income streams.

He informed that a pilot project was initiated in the West Garo Hills (WGH)

and East Garo Hills (EGH) districts that focuses on leveraging the Sloping Agricultural Land Technology (SALT) technology in jhum cultivation areas. This pilot, currently in its third year, is being evaluated for its potential benefits and its implications for farmers in the regions of Rongram and Samada. Analysis of its outcomes will provide insights into its effectiveness and its ability to support local farmers.

Agroforestry Initiatives under Horticulture, Directorate of Horticulture under the Agriculture & Farmers' Welfare Department Smt. D. Synjri, Horticulture Officer (G)



Smt. D. Synjri, Horticulture Officer (G) cited the Land Use Statistics (2020-21) report by the Directorate of Economics and Statistics, Meghalaya, which stated that the geographical area of Meghalaya spans 22,42,900 hectares, with a reporting area for land utilization statistics of 21,95,719 hectares. The recorded forest area stands at 9,13,428 hectares, while the net area sown is approximately 2,53,296 hectares. Fallow land totals around 2,12,020 hectares, with uncultivated land (excluding fallow land) at about 5,44,907 hectares. The portion of land unavailable for conservation measures is estimated at 2,72,067 hectares.

Regarding initiatives under Horticulture, Smt. Synjri stated that the focus is on promoting mixed cropping for economic benefits in both short and long terms. Efforts are made to encourage farmers to intercrop plantation crops with short-duration crops such as vegetables, pineapple, and banana. However, monocropping, particularly in areas like the Garo region, has led to increased incidences of pest diseases, necessitating the introduction of short-duration crops to mitigate these issues. While some regions, like the Khasi region, prefer crops like black pepper or little leaf, the maximum horticulture area already

practices mixed cropping, reducing issues in the region.

She stressed on the significance of agroforestry and the Directorate's role in producing quality planting materials. Initiatives like chestnut plantation have been undertaken to meet rising demand, with 468 hectares covered and 3,69,500 trees planted during the Submission on Agroforestry, 2017-18. Chestnut cultivation is poised for expansion due to increased demand for products like cocoa chips and block chips. Additionally, various other tree species were planted during this period.

SALT as an AF Model in Meghalaya Shri. David Gandhi, SALT Practitioner and Consultant, MBDA



In his presentation, Shri David Gandhi, Consultant MBDA stated that the concept of agroforestry involves integrating trees, crops, and often livestock to produce multiple outputs while safeguarding the resource base, with a focus on indigenous trees and shrubs suitable for low-input conditions and fragile environments. It also emphasizes acknowledging socio-cultural values, highlighting the importance of local customs and practices in agricultural systems.

He informed that SALT integrates vegetative hedgerows for in-situ soil and water conservation, utilizing nitrogen-fixing plants grown as hedgerows to improve soil organic matter and act as natural fertilizers. Principles of integrated natural farming are incorporated into SALT to promote sustainable agriculture practices. In degraded jhum areas, SALT aims to transition from traditional shifting cultivation (Jhum agriculture) to settled agriculture gradually, providing farmers with training and seeds for implementing SALT methodologies. For example, in Manipur, hedgerows have been successfully utilized within jhum cultivation areas.

Shri. Gandhi added that in specific regions like the North Garo Hills district, where traditional jhum practices are prevalent, SALT implementation involves introducing hedgerows alongside existing crops, supporting farmers in adopting SALT practices through training and seed provision. This approach focuses on alternatives to the slash-and-burn method, such as pruning and composting, while integrating livestock into the system. Mixed cropping, emphasized within the SALT framework, promotes diversity and resilience within agricultural systems to enhance productivity and sustainability. In existing arecanut plantations, SALT envisions introducing nitrogen-fixing hedgerows alongside crops like pineapple and pepper to enhance soil and water conservation. Progress reports indicate successful hedgerow establishment in arecanut plantations, with plans to further diversify crops in subsequent years.

He concluded by stating that SALT is also implemented in commercial agriculture zones, utilizing raised beds and furrows to optimize water management and soil health. Sloping agricultural lands are transformed into homestead gardens through SALT interventions, enhancing productivity and resilience in these landscapes.

GROUP DISCUSSION

The key discussion points are summarised below:

A. BROOM GRASS

Shri. David Gandhi:

- 1. Awareness and Education: Stressed the necessity of raising awareness about cultivation practices, particularly in agroforestry, to ensure informed decision-making and understanding among farmers.
- 2. Understanding Detrimental Effects: Highlighted the importance of educating people about the harmful effects of certain crop cultivation methods, emphasizing the need for a comprehensive understanding of agricultural impacts.
- **3. Realistic Timeframes:** Acknowledged the challenge of expecting immediate change in agricultural practices, advocating for patience and a realistic approach considering the time required for transition.
- 4. **Practical Demonstrations:** Proposed the initiation of the agroforestry process through practical demonstrations, providing tangible examples of alternative methods to facilitate learning and adoption among farmers.
- 5. Utilisation of Demonstration Sites: Advocated for the use of demonstration sites as platforms for exposure and learning, enabling farmers to observe and engage with alternative techniques firsthand.
- 6. Gradual Implementation and Phased Approach: Suggested the gradual implementation of sustainable cultivation techniques with project support, emphasizing the importance of a phased approach to ensure a smooth transition towards more sustainable practices over time.

Shri. Samuel Raju Geddam:

- 1. Balancing Long-Term Goals with Short-Term Needs: Highlighted the challenge of reconciling the long-term growth plan required for forestry crops with the shorter-term income potential of horticultural crops.
- 2. **Preserving Broom Grass:** Acknowledged the difficulty in preserving broom grass while simultaneously cultivating trees, emphasizing the need for a strategic approach.
- **3.** Selection of Citrus Fruits: Suggested the use of locally adapted citrus fruits such as lemon or orange, including the possibility of agave lemons, due to their light crop yield, which minimizes disruption to broom grass.
- 4. Strategic Planting of Forestry Species: Advocated for the strategic planting of forestry species along farm boundaries to serve as shelterbelts and windbreaks, ensuring soil integrity and facilitating tree growth.
- 5. Community-Driven Efforts: Emphasized the importance of community demand in driving these efforts, underscoring the need to balance agricultural productivity with environmental preservation.

Shri. Nigel Kharmalki:

- 1. Volatility in Broom Grass Market: Highlighted the significant fluctuations in broom grass prices, leading to exploration of alternative options due to economic uncertainties.
- 2. Long-Term Drawbacks of Broom Grass Cultivation: Addressed the adverse effects of annual burning on soil health and microbial populations, prompting farmers to reconsider the sustainability of broom grass cultivation.
- **3. Diversification of Agricultural Practices:** Advocated for the exploration of alternative agroforestry systems, such as intercropping with green grass, to diversify agricultural practices and mitigate risks associated with declining broom grass production.
- 4. **Importance of Farmer Awareness:** Emphasized the growing self-realization among farmers regarding the negative impacts of broom grass cultivation and the need for sustainable agricultural practices.
- 5. Individual Farmer Willingness: Acknowledged that the transition to alternative systems depends on the willingness of individual farmers and suggested that convincing them to embrace change should stem from their own recognition of the need for sustainability.







Prof. Dr. B.K. Tiwari:

- 1. Extensive Research Findings: Highlighted the comprehensive research conducted by a PhD student on broom grass, covering economic aspects, Golgi and plantation growth technology, resulting in several published research papers.
- 2. Quality Decline and Market Dynamics: Addressed the decline in broom grass quality over time, noting that highest prices are typically achieved within the first few years of cultivation, with diminishing market demand thereafter, necessitating replanting or costly burning processes.
- 3. Challenges of Sustainability: Raised concerns about the sustainability of broom grass cultivation due to its cyclical nature and the labor-intensive and costly processes involved in replanting or burning, with additional complications affecting adjacent micro-forestry systems.
- 4. Comparative Economic Viability: Highlighted the interest in comparing the economic viability of naturally growing broom grass versus planted varieties, particularly in different geographical regions like Garo Hills and Khasi Hills.
- 5. Feasibility of Hedgerows: Discussed the feasibility of incorporating hedgerows, as suggested by Mr. Gandhi, noting its primary suitability for large plantations rather than naturally occurring growth areas, where economic benefits may be limited.

B. CITRONELLA

Shri. David Gandhi:

- 1. Mentioned the initiation of operations on farms in 2023 and emphasized the current focus on soil cultivation testing and assessing farmer acceptance, highlighting their significance.
- 2. Noted MINR's potential plans to establish micro-processing plants widely if there is enough volume available for supply, indicating openness to exploring value addition opportunities.

C. BUCK WHEAT

Shri. B.K. Sohliya:

- Emphasised on exploring buckwheat cultivation opportunities due to growing demand 1 and export potential to Japan.
- Highlighted collaboration with Japan International Cooperation Agency (JICA), 2 securing a substantial market order and plans for a dedicated processing center in Upper Shillong.

D. FOOD SECURITY

Dr. Subhash Ashutosh, IFS:

- 1. Acknowledged the natural decrease in agricultural crop yield during agroforestry implementation, emphasizing the economic benefits derived from tree-based produce.
- 2. Highlighted agroforestry's role in addressing food security concerns through sustainable farming practices, organic enrichment and improved biodiversity of microflora and fauna
- 3. Stressed the offsetting of agricultural crop loss by the myriad benefits of agroforestry, including diverse cash crops, fruits, and condiments.
- Emphasized the importance of developing agroforestry models that align with local needs, including cultural 4. traditions and nutritional requirements, to ensure positive contributions to food security and sustainable agriculture.









E. DUABANGA MODEL

Participant:

- 1. Highlighted the feasibility of incorporating low and medium-chilling trees, tropical/sub-tropical crops, and legumes into the agroforestry model due to favorable growth conditions in the state.
- 2. Suggested to reduce the extensive list of proposed species from 1100 to 400 in the normal plantation to streamline and optimize the agroforestry model.

Shri. B.K. Sohliya:

- 1. Proposed to include Moringa in all Garo Hills regions due to its thriving growth in the area, enhancing the species list for agroforestry.
- 2. Highlighted the presence of "Blood Fruit" or "Tepacani" in Garo Hills, renowned for its exceptional wine-making potential and robust growth, suggesting its incorporation into the species list for agroforestry.

F. AGAR MODEL

Shri. Fabian Chacko:

- 1. Highlighted issues with Agar trees in Garo Hills, where low financial value leads to frequent cutting down, emphasizing the need for sensitizing farmers to address this dilemma.
- 2. Noted challenges in pepper cultivation, attributed to fears of its impact on areca nut tree growth, suggesting farmer education as a solution.
- 3. Mentioned the suggestion from an Agriculture Department consultant in Tamil Nadu to consider including "Nutmeg" by dealing with high-potential saplings, expanding the scope of potential tree species for cultivation.

G. NUTMEG

Shri. B.K. Sohliya:

- 1. Highlighted the feasibility of incorporating tree and nut spices like nutmeg and cloves into the agroforestry model, enhancing income diversification for farmers.
- 2. Emphasised on introducing "Long Pepper" in Garo Hills due to its higher market value compared to black pepper, encouraging farmers to take advantage of upcoming sapling distribution by the horticulture department.
- 3. Recommending avoiding fruit trees like litchi and focusing on cultivating niche crops with high market demand, optimizing agricultural practices for economic benefit.

H. CONCERN ON LAND TENURE/OWNERSHIP

Participant:

Expressed concern about implementing Agroforestry models in the Khasi-Jaintia region due to the complex land ownership system, primarily owned by individuals.

Prof. Dr. B.K. Tiwari:

Suggested a tri-party agreement between the Clan, Individual, and Government as a potential solution to resolve the complexities of land ownership in the region.







Member from KHADC

Highlighted the importance of understanding the diverse land tenure systems across different areas and districts before proceeding with Agroforestry model implementation, acknowledging the unique challenges posed by each area's land ownership structure.

I. PINUS KESIYA

Shri. B.K. Sohliya:

Expressed concerns regarding the Pinus Kesiya model, citing potential issues such as widespread felling for charcoal production and the impact of pine resin on water penetration.

Dr. Subhash Ashutosh, IFS:

Acknowledged the negative impacts associated with Pinus Kesiya but emphasized the importance of considering it as a climatic climax species, suggesting that exclusion may not be advisable.



The session focused on exploring agroforestry strategies in Meghalaya with an emphasis on mapping preferred species and assessing suitable models based on geographical factors like altitude, soil type, and rainfall patterns. The goal was to analyze approaches that prioritize soil and water conservation while maximizing carbon sequestration and product yields.

The following summarizes key discussions and suggestions:

- **Mapping Preferred Species and Models:** Identifying species and agroforestry models best suited for Meghalaya's diverse landscape while considering factors like soil quality, water conservation, and cultural significance.
- Agroclimatic Zone Considerations: Identifying suitable agroclimatic zones beyond altitude and emphasizing the importance of adaptable crops like millet for cash income and food security.
- **Transitioning to Agroforestry:** Exploring strategies for transitioning existing agricultural plantations into agroforestry systems and the need for mixed cropping and integrating forestry species for carbon sequestration and soil conservation.
- **Tailoring Models:** Tailoring agroforestry models to different agroclimatic zones including the introduction of diverse species like neem trees to enhance biodiversity and agricultural sustainability.
- Integration and Biodiversity Conservation: Integrating forestry and agriculture to promote biodiversity conservation and utilizing trees like neem for biopesticide purposes and incorporating millet and leguminous crops for nitrogen fixation and crop rotation.



Arecanut Agroforestry System: East Khasi Hills Dr Lavinia Dkhar, Technical Specialist, CoE



Dr Lavinia Dkhar, Technical Specialist, CoE, presented a case study that was initiated a month ago in the Khasi Hills and Ri Bhoi district aimed to assess the viability and benefits of arecanut agroforestry systems. Sampling was conducted in various locations, with five sites in East Khasi Hills (EKH) and four in Ri Bhoi (RB). Analysis revealed promising net benefits associated with each site. However, challenges were identified, particularly in EKH, where labour-intensive practices were observed.

She stated that despite the potential for higher value crops like jackfruit, farmers faced constraints such as biotic stresses, including pests and diseases, which led to low survival rates and delayed incomes due to longer maturation periods. Moreover, limited awareness regarding the economic and ecological significance of agroforestry systems, coupled with weather aberrations and climatic variations, hindered establishment efforts.

She stressed that addressing these challenges requires technical guidance on cultivation, domestication, and product marketing. The establishment of

processing units could also enhance the value chain for promoting the sustainable adoption of arecanut agroforestry systems in the region.

Arecanut agroforestry systems in Garo Hills A case study by Dr. Tremie Sangma, Technical Specialist, CoE



Dr. Tremie Sangma, Technical Specialist, CoE presented a case study focused on exploring the potential of agroforestry in the Garo Hills region and its positive impacts on soil health, biodiversity, and farmers' incomes. The study covered all five districts of Garo Hills, with plot sizes ranging from 1 to 10 hectares and varying plant spacings of 1.5 to 2.5 meters. Across these districts, key plant species such as litchi, pepper, betel leaf, oranges, cashews, and Burmese grapes were cultivated based on altitude and microclimatic conditions to generate additional income for landowners.

The case study highlighted that income generation from areca nut cultivation exhibited a wide range, from Rs. 5,000 to Rs. 7,00,000 per annum. Higher incomes were often associated with self-farming practices that required no hired labour. However, crops like jackfruit, mango, and tamarind were primarily grown for self-consumption due to limited local market distribution and low value addition.

Agroforestry activities were supported by apiculture and livestock farming

within the plantation sites. Despite these benefits, the spread of pests and diseases has adversely affected areca nut production in parts of South and West Garo Hills, which was further compounded by a lack of awareness regarding scientific cultivation methods.

She concluded by stating the recommendations stemming from the study, which include emphasizing the practice of intercropping to boost productivity and income per unit area, developing economically and environmentally viable cropping models to empower farmers, optimizing the utilization of natural resources (soil, space, light) by diversifying beyond sole areca nut cultivation, and providing market information support and linkages for high-earning species to enhance profitability.

Developing a Green Economy in Meghalaya Shri. Swapan Mehra, CEO, IORA Ecological Solutions



Shri. Swapan Mehra, CEO, IORA Ecological Solutions, stated that in the context of the project, the collaboration between MBDA, IORA, and Acorn-Rabobank aims to support forest conservation and restoration by facilitating sustainable management of community forests. This initiative incorporates both existing and new plantations and covers a total of 150,000 hectares. The project's goals are multifaceted and focus on enhancing the green cover of Meghalaya, promoting organic farming, and creating green income-generating opportunities to reduce forest exploitation. Key activities include nursery development, stakeholder consultations, soil and moisture conservation, native agroforestry, livelihood and enterprise development, value addition, and ecology restoration.

In alignment with India's ambitious climate targets, driven by the urgent need to combat climate change, Shri. Mehra highlighted India's commitments to substantial carbon sequestration and land restoration goals by 2030. These commitments are integral to India's Nationally Determined Contributions (NDCs), with aims to create additional carbon sinks and increase forest and

tree cover across the country. To achieve these targets, India is implementing initiatives such as the Green India Mission and the National Agroforestry Mission by leveraging nature-based solutions to mitigate global emissions.

To support India's climate commitments, there is a shift towards exploring new market instruments, particularly naturebased carbon credits. Projects like the one in Meghalaya focus on transitioning communities to green agroforestry systems, ensuring transparency, fair compensation, and financial security for farmers through the sale of carbon credits. Shri. Mehra highlighted that this project engages thousands of farmers, offering advanced financing against future carbon credits to minimize financial risks and prioritize community involvement.

The project's scope is expansive, covering 100,000 hectares in the coming years, with a tailored approach to adapt agroforestry models to local contexts and preferences. However, challenges and opportunities must be addressed to ensure success. He added that by leveraging stakeholder expertise and insights, the project team should aim to overcome obstacles and capitalize on opportunities, ultimately contributing to India's broader climate objectives and promoting sustainable development.

EXERCISE/ INTERACTIVE ACTIVITY: Potential Obstacles/ Opportunity for project implementation

In the collaborative session aimed at uncovering challenges and prospects for executing the project, attendees engaged in thorough dialogues to identify critical elements that could affect the project's efficacy in the following areas:

- 1. Social Land Availability: Participants expressed concern over the accessibility of land for plantation, with particular emphasis on the complexities of social ownership and community involvement. The group grappled with the tension between private and communal land tenure, identifying it as a significant barrier encountered by communities. An additional widespread issue is the protracted process of land document verification by local authorities, which tends to cause delays. Moreover, there's a prevalent issue of misinformation and rumors; a frequent concern among community members is the apprehension that government involvement in local schemes and projects could lead to the expropriation of their lands.
- 2. Policy: During the discussion, emphasis was placed on the necessity of establishing a clear policy framework to actualize the agroforestry initiative. It was highlighted that the creation of well-defined policies is imperative to set essential standards and articulate the objectives of the project. In particular, the formulation of such policies, including those similar to the Forest Conservation Act, was discussed for their potential to ensure enduring community engagement.
- **3.** Climate and Ecology: Emphasis was placed on the scale of the project, with 5000 hectares already onboarded and a target of 500,000 hectares in the next five years. Concerns were raised about the potential ecological consequences of such large-scale implementation. It was warned about the potential ecosystem changes and biodiversity impacts, highlighting the need for careful consideration of species selection and biodiversity preservation.

- 4. Soil Moisture Conservation: Strong emphasis was placed on the significance of employing techniques like swales, crescent moon terracing and capacity-building initiatives to enhance soil moisture conservation which are vital for mitigating the effects of climate variability and increasing the survival rates of plantations.
- 5. Sustainable Planting Practices: Advocacy for sustainable planting practices was emphasized, focusing on using high-quality planting material and considering social factors in project planning. Suggestions included starting with less ambitious goals in the first year and gradually scaling up, while also emphasizing the importance of avoiding the use of toxic fertilizers and instead using biocontrol agents like Bacillus thuringiensis (BT) to manage pest infestations.
- 6. Value Chain: It was pinpointed that there is a significant gap in the established value chains. Emphasis was placed on the need to anticipate and forge these chains in preparation for market development since it's crucial for sustainability. It was also stressed to align investments with this foresight, thus ensuring that production is effectively linked to the market through public procurement linkages.
- 7. Tech capacity: Emphasis was placed on ensuring that tech capacity was brought into sharp focus and the critical need to develop technical expertise in horticulture since it is understood that advancing technical expertise in horticulture is of utmost importance. Therefore, offering comprehensive technical support and ensuring the availability of high-quality planting materials are essential steps to bolster the technical foundation crucial for the project's success.

The session concluded with the recognition of the necessity of involving additional stakeholders from both the private sector and government entities. The participants proposed collaborations with the following organizations:

PRIME Meghalaya
 MSRLS
 MIDC
 MCAR
 MIDC
 Minor
 Minor
 Minor
 Minor
 Minor
 Meghalaya Industrial Development Corporation Ltd
 Indian Council of Agricultural Research

FACILITATED GROUP DISCUSSION/ BRAINSTORMING

The final session involved discussions on planning and strategy preparation for procuring planting materials, delivering extension services (e.g., integrating livestock such as goats, piggery, poultry, fishery, and honey bees), and meeting capacity-building needs for agroforestry. The summary is as follows:

- 1. Planting Material for Agroforestry: It was emphasized that the discussion during the workshop goes beyond merely considering forestry, horticulture, or agricultural species, focusing instead on the precise varieties required for the region. Given the scale of the project, it was noted that the demand for planting materials would be significant. One option proposed was to encourage local communities to establish nurseries for potentially creating a business model for them. This approach is proven, with some community nurseries evolving into profitable enterprises. Alternatively, leveraging existing government schemes or outsourcing to departments like Forestry, Soil & Water Conservation, or Agriculture was suggested. However, ensuring both quality and quantity of planting material was highlighted as crucial for the long-term success of the project. Therefore, prioritizing training for those involved in nursery operations was emphasized for ensuring production of high-quality materials.
- 2. Seed procurement: Challenges arose in sourcing adequate quantities of viable seeds. Despite utilizing local suppliers and contractors, concerns persisted regarding seed viability and quality. To mitigate these issues, a seed calendar system was implemented for coordinating seed collection with retired forestry experts. This strategy aimed to ensure the availability of locally sourced seeds known for their higher likelihood of successful germination. However, limitations emerged, particularly concerning the availability of specific species. Consequently, exploring alternative procurement methods and investing in seed testing infrastructure may prove necessary to effectively meet project requirements.
- **3. Integrating Tech and Partnerships:** In addressing extension services for agroforestry and integrated farming, establishing a resilient outreach network emerges as a pivotal need. While conventional approaches such as on-site training and demonstrations retain their significance, leveraging technology for broader dissemination of information becomes imperative. Artificial Intelligence holds promise in crafting tailored media content, while digital tools and blockchain technology offer avenues for enhancing value chain transparency and market accessibility. Furthermore, partnerships with established entities like Sadhana Forest present opportunities for villagers to receive hands-on training, which could then support skill enhancement and knowledge transfer.
- 4. Capacity Building: In terms of capacity building, prioritizing training needs assessment is viewed as an important step to pinpoint pertinent topics and stakeholders. By collaborating with government departments such as Forestry and Agriculture, existing training resources can be leveraged while customizing programmes to align with the specific requirements of the project. Embracing a "train the trainer" methodology can additionally amplify training endeavours and can guarantee sustainability and scalability throughout the project.
- 5. Agroforestry Policy: The group underscored the significance of incorporating key points discussed in the presentation into the recommendations, with a particular emphasis on the imperative need for an Agroforestry Policy in Meghalaya. This policy should transcend the confines of the present project and strive for wider advantages covering communities, ecology, environment, and economy, while ensuring sustained continuity and guiding pertinent departments.

CONCLUSIONS

A comprehensive overview of the brainstorming session was provided, focusing on the unique challenges encountered in Meghalaya, particularly related to the complexities of existing land tenure systems that could impact implementation success. Suggestions were made on how to effectively conduct awareness programmes where the use of creative initiatives such as street plays can be explored to build trust and overcome communication barriers. Lessons learned from related projects in Meghalaya underscored the importance of community participation and stakeholder engagement, while potential synergy with other initiatives was discussed to maximize resources and enhance project outcomes.

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GALLERY

















Workshop on Agroforestry Modeling for different Agro-Climatic Regions of Meghalaya

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