The AgBiz Today *E-Magazine* Vol. -3 Issue-1, January 2026: 006 -010
ISSN: 3049-2491 (Online)
https://sabm.scholics.in/

Climate-Resilient Agriculture in Dimoria Block, Assam: Integrating Indigenous Knowledge and Modern Innovations

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ABSTRACT

Dimoria Block in Kamrup (Metropolitan), Assam, is an agriculturally dependent region where several tribal communities, including Karbi, Tiwa, and Boro, practice traditional farming systems closely connected to the natural environment. Rapid climate change has led to unpredictable weather patterns such as intense monsoon rainfall, prolonged dry spells, and increased pest incidences, making agriculture highly vulnerable. This article explores climate-resilient agriculture in Dimoria by integrating traditional ecological knowledge and scientifically validated practices. The paper also highlights local biodiversity, socio-economic challenges, government interventions, and pathways for sustainable development. Drawing from authentic academic studies, institutional reports, and regional climate observations, this article argues for a synergistic approach to strengthen food security and livelihoods.

Keywords: *Climate-resilient agriculture, Traditional ecological knowledge (TEK), Indigenous farming systems, Agro-biodiversity conservation, Sustainable rural livelihoods.*

1. Introduction

Agriculture forms the backbone of livelihoods in Dimoria Block. The region's fertile alluvial soils and humid subtropical climate support paddy cultivation as the primary cropping system. However, agricultural productivity has become increasingly unstable due to the adverse impacts of climate change. Farmers report delayed monsoons, sudden floods, erratic rainfall distribution, and drought-like situations, all affecting crop growth and yields (Goswami et al., 2020). Dimoria's farming communities are largely small and marginal farmers, dependent on monsoon-fed rice cultivation. Climate-induced risks not only reduce food production but also drive youth migration and increase poverty. The tribal communities of the region possess deep-rooted indigenous knowledge that enhances their adaptability to changing climatic conditions. Yet, modernization pressures, market dependency, and environmental degradation are slowly reducing the application of such practices. Recognizing the potential of combining traditional knowledge with climate-resilient scientific methods is necessary for sustainable agricultural transitions. This academic article provides a detailed understanding of the agricultural context of Dimoria Block and proposes evidence-based strategies to strengthen climate resilience.

1.1 Study Area: Dimoria Block, Kamrup (Metro), Assam

Dimoria Block lies approximately 25–35 km southeast of Guwahati city. Administratively, it comprises villages around Khetri, Sonapur, and neighbouring rural belts. The region falls within the Brahmaputra Valley and is influenced by a monsoon-dominated climate, receiving annual rainfall ranging between 1800–2600 mm (Assam State Climate Data Centre, 2023). Major water bodies, including rivulets like Digaru and Myntriang, support irrigation but are also responsible for seasonal floods.Agricultural land is typically fragmented, with average holdings less than 1 hectare per household (Borah & Sharma, 2021). Most farmers practice subsistence farming with limited access to irrigation technology, farm mechanization, and credit facilities. Soil erosion, loss of organic matter, and increased siltation are gradually reducing soil productivity.

1.2 Tribal Communities and Socio-Cultural Context

Dimoria Block is home to culturally rich indigenous communities such as Karbi, Tiwa, and Boro people. Tribal knowledge systems foster harmonious relationships between people, land, and forests. Women hold essential roles in seed conservation, indigenous vegetable cultivation, and home gardening (Teronpi et al., 2022). Community-led labour

exchange activities create a strong support network during agricultural operations such as sowing and harvesting.Traditional rituals and festivals like *Domahi*, *Bihu*, and *Chomangkan* connect farming activities to seasonal cycles, reinforcing a culture of ecological respect. The tribal food system relies on natural resources such as bamboo shoots, wild leafy vegetables, medicinal plants, and forest mushrooms, contributing to nutrition security. However, modernization and market influences are gradually replacing indigenous foods, leading to reduced dietary diversity.

2. Traditional Indigenous Agricultural Knowledge

Indigenous knowledge systems in Dimoria emphasize sustainable land use, low chemical input, and risk minimization through diversity. Traditional paddy cultivation often integrates vegetables and pulses to ensure soil health and reduce complete crop failure during climatic shocks. Home gardens (*Bari*) typically include banana, arecanut, papaya, jackfruit, drumstick, and local medicinal plants, supporting year-round food availability.

Tribal farmers rely heavily on organic soil management practices such as green leaf manure, cow dung, rice husk ash, and compost produced from household waste. These enhance soil carbon content, protect water retention capacity, and reduce nutrient leaching (Deka & Neog, 2020). Use of bamboo drip irrigation in sloped lands improves water distribution without machinery.

Seed saving and exchange customs among farmers ensure preservation of climate-resilient landraces. Traditional rice varieties like *Bao dhan* (deep-water paddy), *Ahu* (autumn rice), and short-duration *Sali* strains demonstrate tolerance to floods and droughts, making them crucial for future adaption strategies (Saikia et al., 2019).

Spiritual beliefs and environmental ethics discourage excessive extraction of natural resources. Forest patches adjacent to farmland act as protective ecological buffers, regulating microclimates essential for agriculture.

3. Ecological Significance and Biodiversity in Dimoria

Dimoria Block is part of an ecologically sensitive landscape rich in flora, fauna, and agroforestry species. The forests surrounding Khetri provide wild edible plants, fodder, firewood, traditional medicines, and water regulation services. Research on local floristic diversity indicates that Dimoria hosts significant orchid species richness due to humid climatic conditions and shaded canopies (Bordoloi et al., 2021). These forests support beneficial insects, pollinators, and soil microorganisms vital for crop production.

Agroforestry practices help stabilize soil, minimize runoff, and enhance carbon sequestration. Livestock grazing also plays a crucial role in nutrient cycling within agricultural systems. However, deforestation for fuelwood, settlement expansion, and illegal timber harvesting continue to threaten biodiversity in the region. Conservation of indigenous trees and ethnomedicinal plants such as *Litsea cubeba*, *Zanthoxylum armatum*, and *Cymbopogon spp.* holds considerable importance for both livelihoods and climate adaptation.

4. Local Research and Field-Based Evidence

Academic and extension institutions such as **Dimoria College**, **Assam Agricultural University**, and **KVK Kamrup** have documented ecological and agricultural features of the region. Field surveys indicate common soil issues including nutrient deficiency, increased sand deposition, and invasion by fast-spreading weeds such as *Chromolaena odorata* (Baruah & Nath, 2020). These invasive species outcompete native vegetation and reduce available nutrients for crops.

Socio-economic assessments show that limited irrigation access, high labor costs, and poor market connectivity are major constraints for farmers (Kalita & Dutta, 2021). Many farming households depend on livestock such as goats and poultry for supplementary income.

Climate-related crop failures have contributed to seasonal out-migration of youth in search of urban employment, weakening agricultural manpower locally. These findings reinforce the urgent need for adaptation approaches grounded in local realities.

5. Modern Interventions and Climate-Smart Agriculture in Dimoria

The Government of India and agricultural research organizations have been promoting modern climate-resilient

farming strategies intended to improve productivity and reduce vulnerability to weather extremes. Climate-smart agriculture (CSA) in Dimoria includes a combination of improved crop varieties, scientific soil and water management, and integrated pest management practices. Flood-tolerant and short-duration paddy varieties such as *Swarna Sub-1*, *Ranjit-Sub-1*, and *Bahadur* are being introduced to help minimize crop losses during flash floods (ICAR, 2022). These varieties recover more efficiently following submergence compared to traditional long-duration rice.

Water management is another key intervention. Rainwater harvesting structures—including small farm ponds and field bunding help store excess monsoon water for later use during dry spells. Mulching with rice straw reduces evaporation and enhances soil structure. Bio-fertilizers and vermicomposting are encouraged to rebuild soil organic carbon depleted by erosion and runoff. Farmers also receive training to shift towards integrated pest management, reducing over-reliance on synthetic pesticides that harm beneficial soil organisms (Deka & Neog, 2020). Extension services are increasingly using mobile-based weather apps and SMS advisories to increase farmer awareness of upcoming climate conditions and disease outbreaks (KVK Kamrup, 2023). Farmers in Khetri and Sonapur areas have adopted these advisories with positive feedback regarding timely sowing decisions, fertilizer scheduling, and flood preparedness.

6. Integration of Indigenous Knowledge with Scientific Practices

While modern innovations offer promising solutions, their success depends significantly on cultural acceptance and practical compatibility with existing farming systems. Indigenous farming practices already offer resilience through crop diversity, low-cost organic soil management, and seed heritage conservation. When these practices are combined with scientific improvements such as high-yielding climate-tolerant varieties, precision irrigation, and improved post-harvest handling, farmers gain a multi-layered defence against climate impacts (Saikia et al., 2019). For example, keeping traditional *Ahu* rice in upland areas while introducing drought-tolerant HYVs on small demonstration plots allows farmers to evaluate performance without risking their full harvest. Bamboo-based irrigation channels can coexist with motorized pumps where accessible, ensuring water availability across topographies. Local seed exchanges can integrate certified seeds to strengthen genetic diversity and maintain disease resistance. Therefore, integration ensures that farmers continue to benefit from their ecological heritage while adopting new opportunities.

7. Technology Adoption Challenges

Despite the availability of climate-smart options, technology adoption in Dimoria remains uneven. Several sociocultural and economic challenges persist. Small landholdings reduce the feasibility of investment-heavy technologies such as micro-irrigation systems or polyhouses. Poverty and limited access to formal credit restrict farmers' ability to purchase improved seeds or inputs, especially when climate-related risk already threatens income stability (Kalita & Dutta, 2021).

Information dissemination also faces barriers due to literacy limitations and language gaps. Many farmers prefer demonstration-based learning rather than theoretical training. Additionally, rural youth migration toward urban employment causes labor shortages and reduces the continuity of farm innovation. Women, who play a crucial role in seed conservation and household food systems, often lack institutional recognition and decision-making power in land investments (Teronpi et al., 2022). Overcoming these constraints requires inclusive planning and community-driven strategies.

8. Government Policies and Institutional Support

Multiple Indian and Assam state schemes can accelerate the adoption of climate-resilient agricultural methods in Dimoria:

- **PMKSY (Pradhan Mantri Krishi Sinchai Yojana)**: Supports water conservation, drip irrigation subsidies, and farm pond construction (MoAFW, 2021).
- **NICRA (National Innovations in Climate Resilient Agriculture)**: Demonstrates adaptive farming models in flood-prone and drought-prone regions.
- **RKVY (Rashtriya Krishi Vikas Yojana)**: Provides funding for local value-addition and infrastructure.
- **Soil Health Card Program**: Helps farmers understand nutrient needs and environmentally safe input usage.

Local institutions such as **Krishi Vigyan Kendra Kamrup**, **Assam Agricultural University**, and **Dimoria College** serve as valuable bridges between policy and farmers by conducting trainings, developing resource centers, and preserving ethnobotanical knowledge. Ensuring that tribal farmers especially women are fully aware of eligibility and benefits is essential for conversion of policy efforts into actual resilience on the ground.

9. Data Representation: Climate Variability and Crop Impact

Table 1. Recent Climate Changes and Agricultural Impacts in Dimoria Block (Compiled from Assam State Climate Data Centre, 2023; Goswami et al., 2020; KVK Kamrup, 2023)

Climate Parameter	Observed Change	Impact on Agriculture
Rainfall pattern	More erratic; intense bursts	Flooding and lodging of standing crops
Average temperature	Increasing by ~0.02°C annually	Faster crop maturity; reduced grain filling
Dry spell frequency	Higher during pre-monsoon	Water scarcity during critical growth stages
Flood occurrence	More frequent flash floods	Crop submergence, soil erosion
Pest/disease incidence	Noticeable increasing trend	Higher cost of plant protection

This table demonstrates the direct and escalating threat climate change poses to rice-dominant agricultural systems in Dimoria.

10. Toward an Integrated Climate-Resilient Farming Model for Dimoria

For long-term sustainability, Dimoria requires an integrated climate-adaptive farming strategy that supports both economic security and ecological protection. Such a model includes:

- **Diversified cropping systems** incorporating flood-tolerant paddy with legumes and vegetables for nutritional and financial security.
- **Agroforestry corridors** connecting rice fields with local multipurpose tree species to improve soil health and microclimate regulation.
- **Livestock fish crop integration**, utilizing manure as fertilizer and pond water as an irrigation buffer.
- **Community-based seed banks** for the preservation of indigenous climate-resilient varieties.
- **Women-inclusive innovation groups** as key agents in knowledge preservation and technology transfer.

Successful transformation requires participatory planning where farmers are decision-makers, not just beneficiaries. Youth engagement in climate-smart entrepreneurship such as mushroom farming, value-added processing, and ecotourism can reduce rural migration and reinforce community resilience.

11. Conclusion

Agriculture in Dimoria Block stands at a critical juncture. While climate change threatens traditional food systems, the region also holds remarkable ecological strengths and indigenous wisdom that can be harnessed for a more resilient future. The integration of traditional agricultural knowledge with scientifically validated climate-smart practices offers a sustainable pathway to improve productivity, food security, and livelihood stability.

The role of institutions like KVK Kamrup and Dimoria College is crucial in facilitating technology adoption that respects tribal values and cultural landscapes. Government policies must strengthen accessibility for indigenous communities and ensure credit and resource delivery reach smallholder farmers. By embracing cooperation, innovation, and conservation together, Dimoria can become a model for climate-resilient agriculture in Assam and the broader Eastern Himalayan region.

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