

Climate Change and Its Impact on Agriculture in Karbi Anglong District, Assam: Challenges, Vulnerability and Adaptation

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ABSTRACT

Climate change has emerged as one of the most significant environmental challenges to agricultural production worldwide. In the hill district of Karbi Anglong, Assam, agriculture remains the primary livelihood for most of the population. The district's dependence on rainfall, the prevalence of shifting cultivation (jhum), and fragile hill ecosystems make it particularly vulnerable to climatic variations. This paper examines the impact of climate change on agriculture in Karbi Anglong by analyzing changes in temperature, rainfall variability, agricultural practices, and farmers' vulnerability. The study highlights the challenges farmers face due to changing climatic conditions and discusses adaptation measures for sustainable agricultural development. The findings reveal that rising temperatures, erratic rainfall, soil degradation, and extreme weather events are adversely affecting crop productivity and food security in the district.

Keywords: *Climate Change, Agriculture, Karbi Anglong, Assam, Rainfall Variability, Agricultural Vulnerability, Adaptation.*

Introduction

Agriculture is one of the most climate-sensitive sectors of the economy and is directly influenced by temperature, rainfall, humidity, and extreme weather events. Climate change has significantly altered these climatic parameters, thereby affecting

agricultural productivity across the world. According to the Intergovernmental Panel on Climate Change (IPCC, 2023), increasing global temperatures and changing precipitation patterns have become major threats to food security and sustainable agriculture.

Karbi Anglong, located in central Assam, is the largest district of the state by area and is characterized by rugged topography, dense forests, and a predominantly tribal population. Agriculture supports nearly 80 percent of the district's population, while more than 70 percent of the workforce depends directly or indirectly on farming activities (District Agriculture Office, Diphu). Paddy remains the dominant crop, while maize, ginger, turmeric, sugarcane, banana, pineapple, cotton, and vegetables are important agricultural products. Traditional shifting cultivation continues to be practiced in many hill areas.

The dependence of agriculture on monsoon rainfall and natural ecosystems makes Karbi Anglong highly vulnerable to climate change. Recent climatic variability has increased uncertainty in agricultural production, threatening rural livelihoods and food security.

Methods and Methodology

Study Area

Karbi Anglong is situated between 25°33'N to 26°35'N latitude and 92°10'E to 93°50'E longitude in Assam. The district covers approximately 10,434 km² and is characterized by hilly terrain with elevations ranging from 80 m to more than 1,300 m above sea level. The climate is tropical

3 monsoonal with warm summers and mild winters. Average annual rainfall ranges between 1,500 mm and 2,500 mm, while some studies report district averages around 2,416 mm.

Agriculture remains the backbone of the district economy, employing more than 70% of the workforce and supporting nearly 80% of the population. The dominant agricultural systems include paddy cultivation, horticulture, and traditional jhum cultivation practiced in hill regions.

Agriculture in the district includes both settled cultivation and shifting cultivation. Rice is the staple crop, while ginger and turmeric serve as important commercial crops. Karbi Anglong is also recognized as one of Assam's leading organic ginger-producing regions.

Climate Change Trends in Karbi Anglong

Recent studies indicate significant changes in climatic conditions across Karbi Anglong. Research by Datta and Bose (2020) found noticeable changes in climate extremes, including increasing frequency of heavy rainfall events and variations in temperature patterns. These changes have implications for drought occurrence, floods, soil erosion, and agricultural sustainability.

Parameter	Value
Area	10,434 km ²
Average Annual Rainfall	1,500–2,500 mm
Reported Mean Annual Rainfall	~2,416 mm
Summer Temperature	23–32°C
Winter Temperature	6–12°C
Dominant Farming System	Jhum and Settled Agriculture

Table 1: Climatic Characteristics of Karbi Anglong

Sources: *Assam Climate Change Knowledge Portal; Climate Studies on Karbi Anglong*

Recent reports from Assam indicate increasing rainfall irregularities and drought-like conditions across several districts, including Karbi Anglong. Farmers have reported delayed monsoon onset, prolonged dry spells, and sudden heavy rainfall events affecting agricultural operations.

1. Impact of Climate Change on Agriculture

Rice cultivation is highly dependent on monsoon rainfall. Delayed rainfall often affects sowing operations, while excessive rainfall causes waterlogging and crop damage. Variability in rainfall distribution has increased uncertainty in agricultural

production and reduced crop yields. Traditional jhum cultivation systems are particularly vulnerable because they depend heavily on natural rainfall and soil fertility. Reduced fallow periods combined with climatic stress have contributed to declining productivity.

Commercial crops such as ginger and turmeric are also affected by rainfall fluctuations. Karbi Anglong produces over 200,000 tonnes of raw ginger annually from the broader production region, making climate stability important for farmer incomes and regional markets.

The hilly terrain of Karbi Anglong makes agricultural land susceptible to erosion. Intense rainfall events increase surface runoff, resulting in soil nutrient loss and reduced agricultural productivity. Changes in rainfall intensity have accelerated land degradation in several parts of the district. Shifting cultivation, when combined with increasing climatic stress, further exposes soil to erosion and fertility decline. This has significant implications for long-term agricultural sustainability.

Although the district receives substantial rainfall annually, much of the agricultural land remains dependent on rainfall rather than irrigation. A large proportion of the net

sown area is unirrigated, increasing vulnerability during periods of rainfall deficit. Climate variability has intensified water stress during critical crop growth stages.

Rising temperatures and humidity create favourable conditions for the spread of pests and crop diseases. Farmers in the district have reported increasing incidences of pest attacks on paddy, maize, and vegetable crops, resulting in yield losses and increased production costs.

Karbi Anglong has been identified as a highly climate-vulnerable district. Studies conducted by agricultural and climate research institutions classify the district as one of the areas facing high risks from climate variability due to dependence on rain-fed agriculture, limited irrigation facilities, low mechanization, and socio-economic constraints.

Challenge	Agricultural Impact
Delayed Monsoon	Late sowing and reduced yield
Erratic Rainfall	Crop failure and production instability
Heavy Rainfall Events	Soil erosion and nutrient loss
Temperature Increase	Heat stress and moisture loss

Challenge	Agricultural Impact
Drought Conditions	Reduced crop productivity
Pest Outbreaks	Increased crop damage

Table 2: Major Climate-Related Agricultural Challenges

The tribal farming communities are particularly vulnerable because of their dependence on natural resources and limited adaptive capacity. To reduce agricultural vulnerability, several adaptation measures can be adopted: Climate-smart agricultural practices such as conservation tillage, crop rotation, integrated nutrient management, and water-efficient farming can improve resilience. Introducing drought-tolerant and climate-resilient crop varieties can reduce production risks. Diversification into horticultural crops, spices, and agroforestry systems can enhance income security. Rainwater harvesting, check dams, and micro-irrigation systems can help farmers manage rainfall variability and reduce dependence on monsoon precipitation. Given the forest-rich environment of Karbi Anglong, agro-forestry offers a sustainable alternative by improving soil fertility, reducing erosion, and enhancing carbon sequestration.

Access to weather forecasts and early warning systems can help farmers make

informed decisions regarding sowing, irrigation, and harvesting.

Conclusion

Climate change is increasingly affecting agricultural systems in Karbi Anglong. Variations in temperature and rainfall patterns, combined with extreme weather events, are contributing to declining agricultural productivity and increasing livelihood vulnerability. The district's dependence on rain-fed agriculture, prevalence of shifting cultivation, and fragile hill ecosystems further increase climate-related risks.

The study highlights the need for climate-resilient agricultural strategies, improved irrigation infrastructure, crop diversification, and sustainable land management practices. Strengthening institutional support, agricultural extension services, and climate adaptation policies will be essential for ensuring food security and sustainable rural development in Karbi Anglong.

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