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## **THE DREADED KNOCK OF DROUGHT ON THE DOOR OF NORTH-EAST INDIA**

### **Solutions lie in water resource management, sustainable land use, and climate adaptation measures**

*Drought is threatening the North-Eastern states of India as climate change, deforestation, and land degradation take their toll. The author recommends a slew of measures to combat the approaching disaster, such as better water resource management, sustainable land use practices, climate adaptation measures, and community-based resilience building.*

**A** large and diverse country, India is rapidly experiencing climate change (World Bank 2013) in the form of escalating temperature often characterized by extreme heat and changing rainfall patterns with a general decline in its monsoon rainfall but registering increase in the frequency of heavy rainfall events. Consequently, India is increasingly experiencing the devastating impacts of climate change. With its large population, diverse geography, and significant reliance on agriculture,

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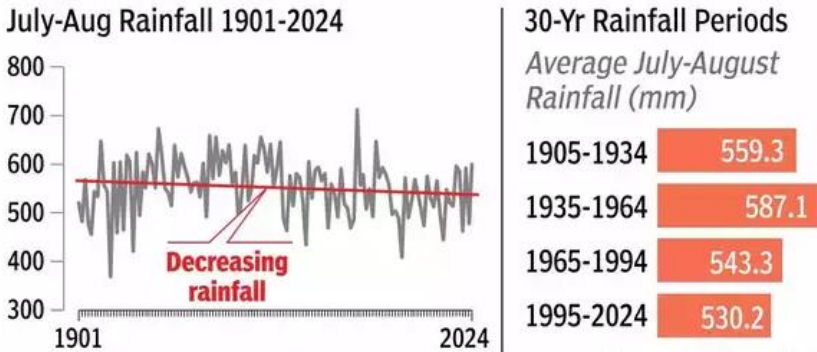
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India is particularly vulnerable to the effects of rising temperatures, changing rainfall patterns, and extreme weather events.

## Figure 1. Decreasing Rainfall Pattern in India



Source: IMD as reported by *The Times of India*, Sept 2, 2024, <https://bit.ly/3YT05cc>

## Drought and its Changing Geography in India

Droughts are hydroclimatic extreme events that lead to prolonged periods of water scarcity and impact the overall ecological security (Chuphal, Kushwaha et al. 2024). Drought is a slow process characterized by the lack of precipitation, resulting in a water shortage. It is a slow-onset, creeping natural hazard with a potential to turn into disaster if not tackled on time. Drought can have a serious impact on health, agriculture, economies, energy, and the environment. Its effects often accumulate slowly over a considerable period of time and may linger for years after the termination of the event.

Major parts of India have become drier in the last five decades with increase in the number of drought events. About two-thirds of the country is vulnerable or prone to drought. With agriculture as its backbone, droughts in India profoundly impact agricultural productivity, water resource management, and socio-economic well-being. The

southwest monsoon rainfall accounts for 80 percent of the total annual rainfall in India and, therefore, is the primary source of agricultural water and groundwater recharge.

India has witnessed a rise in the frequency, severity, and duration of droughts over the recent decades—projected to be further exacerbated by climate change. The impact of droughts is expected to become more severe in the future. Crop yields are expected to fall significantly because of extreme heat in the coming decades. Understanding droughts and their patterns is, therefore, crucial to reduce the vulnerability of India's population to future drought events. Reportedly, we are witnessing increasing intensity and frequency of droughts in India due to the weakening of the southwest monsoon (closely linked to Indian Ocean warming and El Niño/Southern Oscillation or ENSO). Further, diverse physiographic conditions and significant variability in rainfall patterns across India contribute to the varying intensities of drought events.

Some regions of India are relatively more vulnerable and witness drought like conditions more frequently than others. In a monsoon-dominated India, droughts have also been the major driver of famines, historically. More importantly, the geographical distribution and severity of drought in India has been changing and evolving due to various factors, primarily climate change (Nandi 2024). It is essential for India to continue its efforts to adapt to the changing geography of drought and ensure the well-being of its population in the face of climate change.

### **Increasing Risks of Drought in North-East India**

North-East India, comprising the states of Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim, and Tripura, represents 7.9 percent of the country's total geographical area and 3.8



percent of its total population. The region, characterized by its unique physical and human geographies, is both strategically located and geopolitically sensitive. While North-East India is a recognized global biodiversity hotspot, it is also, reportedly, among the backward regions of India and, therefore, has been a fertile ground for hostilities and insurgencies.

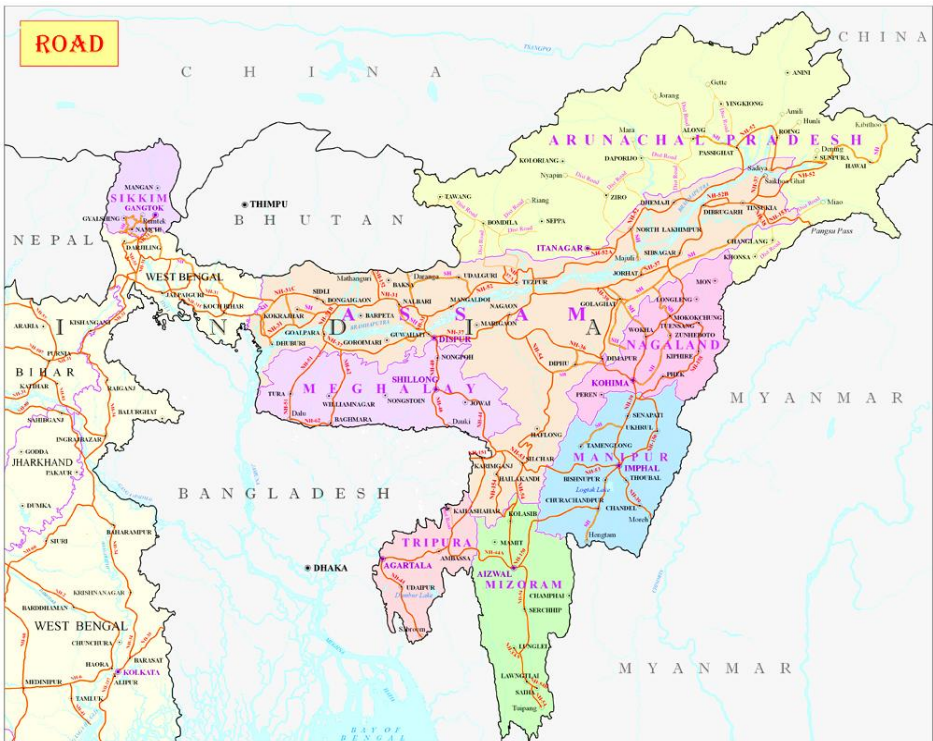
Interestingly, over 70 percent of the region is a part of the Brahmaputra River Basin. Renowned for its lush landscapes and abundant rainfall, North-East India is increasingly grappling with the specter of drought in recent decades. This paradoxical situation, a stark contrast to the region's historical climate patterns, is a testament to the far-reaching impact of global climate change. The rising frequency and severity of droughts in this region pose a significant threat to its agriculture, economy, and overall well-being.

North-East India usually receives heavy rainfall during the monsoon (June-September), and that replenishes the rivers every year. It is traditionally characterized by a monsoon-dominated climate. Heavy rainfall during the monsoon season is a defining feature of the region, sustaining its agriculture, forests, and water resources. The rain and snow fed mountain springs feed the tributaries and join either the Brahmaputra, Barak, or other smaller rivers and together they water the region. Consequently, the percentage share of water of North-East Region represents 32.25 percent of the total water resources available in the country (GoI 2022).

Over the past century, however, rainfall in the region, along with the flood-drought cycle, has been changing in character for the worse. In recent years, there has been a discernible shift in the rainfall patterns. Irregular rainfall, delayed monsoon onset, and prolonged dry spells have become more frequent, leading to drought-like conditions in many parts

of the North-East region. The flood-drought cycle now has begun to happen within a year, particularly during the monsoon. The rains come in quick bursts and flood the region, followed by elongated dry periods that border on drought (Sangomla and Amarnath 2020). If the rainfall decreases, the flow of the springs diminishes and the rest of the water systems also get disturbed, highlighting clear ecological linkages. The high dependency on rainfall, therefore, makes the North-East region highly vulnerable to climate change.

**Figure 2. North-East India**



Source: <https://mdoner.gov.in/road-map-only-nh-> (accessed on November 2, 2024).



Both long- and short-term data analyses show an overall decline of rainfall in the North-East. The India Meteorological Department's (IMD) mean rainfall linear trend 1951–2022 clearly shows a significant decrease in monsoon rains in most of the area of the North-Eastern states in the last 72 years (Soni, Tripathi et al. 2023). Further, the whole North-Eastern region's drought index is shifting towards the dry side, making it prone to drought occurrences similar to the decreasing rainfall trend. Reportedly, the number of drought weeks during monsoon months in Arunachal Pradesh, parts of Assam, Meghalaya, Mizoram, Tripura and Manipur, will increase by 25 percent in the future. According to a paper published in *Current Science* in January 2015, the probability of drought occurrence in the region was 54 percent during 2000–2014. In short, the North-East region of India has been drying up with time. Scientists have predicted that climate change will significantly affect agriculture, water availability, and forests in North-East India.

Several factors contribute to the increasing risk of drought in North-East India. Climate change, driven by anthropogenic activities such as greenhouse gas emissions, is a primary culprit. Rising global temperatures are altering precipitation patterns, leading to more extreme weather events, including droughts. The Himalayan region, which acts as a natural water tower for the North-East, is also experiencing accelerated glacial melting due to climate change (Khawas 2024). This melt is affecting the flow of rivers and streams, reducing water availability in downstream areas.

Deforestation and land degradation are further exacerbating the drought situation in North-East India. Forests play a crucial role in regulating water cycles and preventing soil erosion. Deforestation, driven by factors such as illegal logging, land conversion for agriculture and infrastructure development, reduces the region's capacity to retain



moisture and absorb rainfall. This, in turn, leads to increased runoff and reduced groundwater recharge, contributing to water scarcity and drought.

### **Impact on Environment and Economy**

The impact of drought in North-East India is far-reaching and can have severe consequences for the region's economy, agriculture, and society. Drought poses a significant threat to crop yields and food security to the agriculture sector which is the mainstay of the region's economy. Rice, a staple crop in the region, is particularly vulnerable to drought as it requires abundant water for cultivation. Drought can also lead to livestock shortages and reduced agricultural incomes, affecting the livelihoods of millions of people.

Water scarcity is another major consequence of drought in North-East India. Many communities in the region rely on springs, rivers, and groundwater for their water needs. As drought conditions worsen, these water sources become depleted, leading to water shortages for drinking, irrigation, and domestic use. This can have serious health implications, particularly for vulnerable populations such as children, the elderly, and the poor.

The increasing risk of drought in North-East India is a pressing environmental and socio-economic challenge. Climate change, deforestation, and land degradation are the primary drivers of this phenomenon. The impact of drought on the region's agriculture, economy, and society is far-reaching and can have severe consequences. Addressing this issue requires a comprehensive approach that involves water resource management, sustainable land use practices, climate adaptation measures, and community-based resilience building. Effective water resource management strategies, including rainwater harvest-



ing, irrigation efficiency improvements, and groundwater recharge initiatives, are essential to address the water scarcity issue. Afforestation and reforestation efforts can help restore forest cover and improve the region's water retention capacity. Additionally, sustainable land use practices and climate-smart agriculture can help reduce the vulnerability of the region's agriculture to drought. Further, the following policy suggestions may be considered:

- Regularly monitoring and evaluating drought events in the region.
- Conducting serious research on drought and its drivers in collaboration with relevant institutions located within and outside the region.
- Policymakers need to consider “re-regionalization” of droughts because the traditionally defined drought-prone regions no longer hold true, as droughts are increasingly shifting towards the north and north-east of the country.
- Exploring the possibility of establishing a dedicated South Asia-level Research Centre to study, monitor, and manage drought hazards. Creating a critical mass of professionals through education, training, and capacity-building, with expertise to monitor and manage the drought hazard.

### ***Note on the Author***

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