

# Impacts of Climate Change on Mango Production in India

By Srinidhi Gubba



## Introduction

India is one of the largest exporters of mangoes in the entire world. In 2000, about 57.2% of the world's mango production was from India (Negi, 2000). Mangoes are produced in several states throughout the country, with Uttar Pradesh leading in mango yields. As climate factors, such as monsoon patterns and temperature, are altering due to global warming, the production of mangoes is impacted. It is critical to understand these patterns to better prepare farmers and other stakeholders about how to react to their changing environmental conditions.

Recently, India conducted a nationwide climate assessment to predict crop yields in 2050 and 2080. A lot of the yields for different types of crops are expected to drastically decrease; for example, it is estimated that wheat yields will decrease by about 40% in 2080 (Nanditha et al., 2020). For mangoes, this change is already occurring. In 2022, Uttar Pradesh was predicted to have a 62.5% decline in mango yields due to changes in climate factors (Sengar, 2022). This fact sheet will explore two of the main climate factors impacting mango production: temperature and monsoon patterns.

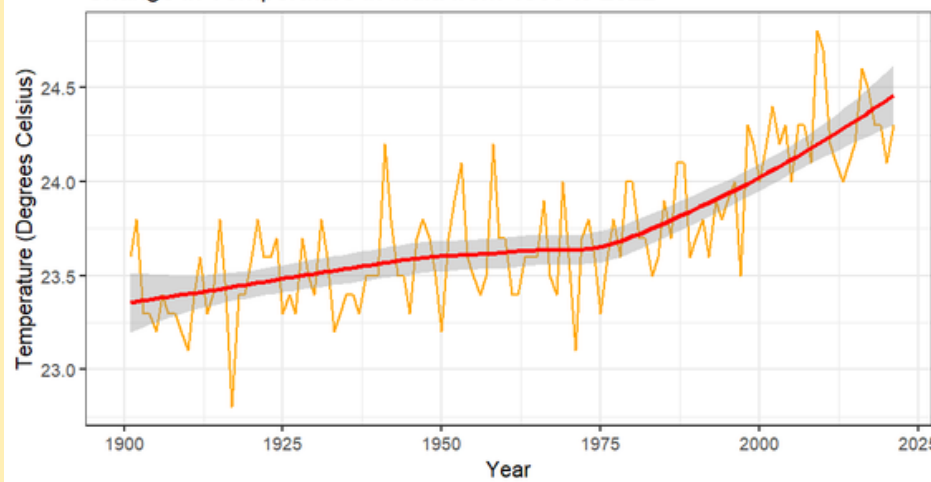


**Image 1:** Original photo of orchard in Telangana, India.

## Temperature in India

One of the main climate factors impacting India's public health and agriculture is temperature. The Indian Meteorological Department determined that out of 15 of the warmest years in India, 11 of them were recorded between 2004 and 2018 (Nanditha et al., 2020). The rising temperature is also causing a rise in sea levels, which is dangerous for the 310 million Indians living in lower elevations in the country (Leiserowitz et al., 2022). For agriculture, the temperature changes are causing water shortages and sporadic monsoon patterns.

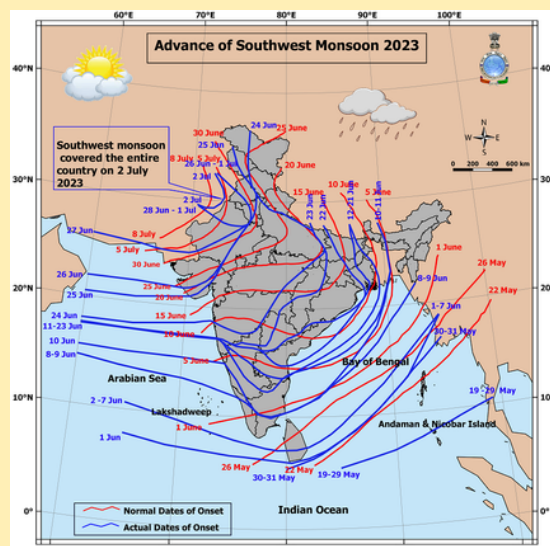
**Change in Temperature in India from 1900 to 2022**



**Image 2:** Original plot showing changes in temperature in India from 1900 to 2022. The graph shows a strong positive correlation between time and temperature. The rate of change tends to increase, especially after 1975.

## Monsoon Patterns in India

Monsoons are a wind pattern found in South Asia. One of these patterns is a wet monsoon, which is a large contributor to the rainfall in India. This traditionally occurs in the summer months. Another pattern is dry and, together, these wind patterns have played a fundamental role in the culture and agricultural economy of India. The rain during the wet monsoon season contributes up to 75% of the water for agriculture in India (Fountain, 2022).

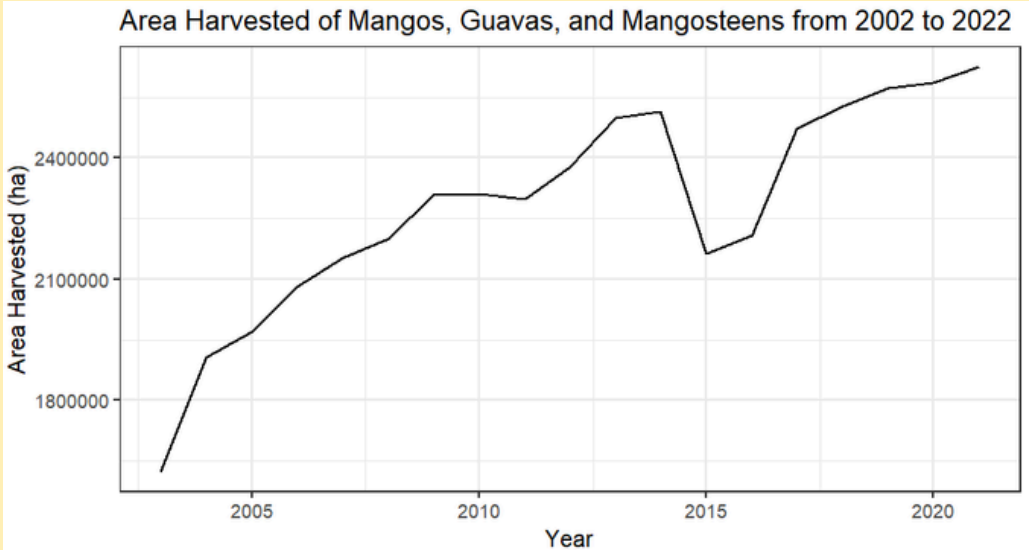


**Image 3:** Map of southwest monsoons (summer monsoons) from India Meteorological Department. The blue lines represent the actual monsoon pattern of 2023, while the red represent the predicted pattern. Compared to the past few decades, there has been more variation between the two.

Due to climate change, the monsoon patterns have been altering in many of the states in India. While some regions face immense drought, others are dealing with excessive rainfall. This leads to flooding in the surrounding cities and villages. In a study done on landholders and farmers in Tamil Nadu, India showed that monsoon failures “accounted for around 80 percent of total monetary losses” (Dagdeviren et al., 2021). This unpredictability and the rapid changes in monsoons will only continue to harm Indian farmers, especially lower-income farming households.

### Monsoon and Temperature Impacts on Mangoes

The changes in temperature and monsoon patterns are predicted to impact both the cultivation and growth processes of mangoes in India. High temperatures of 45 degrees Celsius or greater could greatly harm the photosynthetic parts of the mango plant (Normand et al., 2015). Along with this, mango trees tend to flower most in colder temperatures. In fact, 25 degrees Celsius is considered the most optimal temperature for flowering, which is significantly lower than the temperatures recorded during India’s most recent heatwave. Along with changes in temperature, the variation in monsoon patterns can lead to delayed rain in certain regions of India. This is alarming for mango farmers since growth stages such as flowering and vegetative rest occur based on the rain patterns from monsoons. For example, the Mysuru district of India had immense pre-season rainfall in 2023. This caused flower and fruit fall in mango fields throughout the area (Ramesh, 2023). The shift in precipitation can be hard for mango plants to adapt to. If this trend continues, the growth rate of yield will decline for mangoes in India.



**Image 4:** Original plot of area harvested of mangoes, guavas, and mangosteens. The plot is showcases a logarithmic trend in area harvested. This means that the rate of change of area harvested is declining. This could be due to the changes in climate factors described previously.

### Potential Solutions

The Indian Ministry of Agriculture & Farmers Welfare has a set of priorities that are integral to providing climate equity to farmers in India. They are planning on researching and ascertaining the most vulnerable districts within each region in terms of climate impact. To mitigate the current effects of climate change, they plan on supporting more innovation in terms of crop varieties, management practices, and other solutions (Delhi PIB, 2023). To address the root problem, India must increase the rate of transition to sustainable practices in energy and production. In 2015, about 69% of India’s GHG emissions were produced by the energy sector (Delhi PIB, 2023). During this time, it was estimated that about \$2.5 trillion would be needed as an investment to reach sustainability goals based on India’s pledge to the Paris Agreement. (Dubash et al., 2018). With solutions focused on the future of agriculture along with counteractive policies, India can better address mango production and the agriculture sector’s challenges with the environment.

### References

\*\*\*Nanditha, J. S., van der Wiel, K., Bhatia, U., Stone, D., Selson, F., & Mishra, V. (2020). A seven-fold rise in the probability of exceeding the observed hottest summer in India in a 2 °C warmer world. *Environmental Research Letters*, 15(4) doi:<https://doi.org/10.1088/1748-9326/ab7555>

Negi, S.S. (2000). MANGO PRODUCTION IN INDIA. *Acta Hort.* 509, 69-78  
DOI: 10.17660/ActaHortic.2000.509.4 <https://doi.org/10.17660/ActaHortic.2000.509.4>

Sengar, S. (2022, May 18). How Climate Change Is Killing The “King Of Fruits” Mango In India [Review of How Climate Change Is Killing The “King Of Fruits” Mango In India]. *India Times*; *IndiaTimes Lifestyle Network*.  
<https://www.indiatimes.com/news/india/how-climate-change-is-killing-the-king-of-fruits-mango-in-india-569876.html>

Leiserowitz, A., Thaker, J., Carman, J., Neyens, L., Rosenthal, S., Deshmukh, Y., Shukla G., Marlon, J., Sircar, A., & Sekoff, S. (2022). *Climate Change in the Indian Mind*, 2022. Yale University. New Haven, CT: Yale Program on Climate Change Communication.

(n.d.). Monsoon [Review of Monsoon]. *India Meteorological Department*; *Ministry of Earth Sciences*.  
[https://mausam.imd.gov.in/imd\\_latest/contents/monsoon.php](https://mausam.imd.gov.in/imd_latest/contents/monsoon.php)

\*\*\*Dagdeviren, H., Elangovan, A., & Parimalavalli, R. (2021). Climate change, monsoon failures and inequality of impacts in South India. *Journal of Environmental Management*, 299, 113555.  
<https://doi.org/10.1016/j.jenvman.2021.113555>

\*\*\*Dubash, Navroz K., et al. “India and Climate Change: Evolving Ideas and Increasing Policy Engagement.” *Annual Review of Environment and Resources*, vol. 43, no. 1, 17 Oct. 2018, pp. 395–424, <https://doi.org/10.1146/annurev-environ-102017-025809>.

PIB Dehli. (n.d.). Impact of Climate Change on Agriculture [Review of Impact of Climate Change on Agriculture]. *Ministry of Agriculture & Farmers Welfare*. <https://pib.gov.in/PressReleaseSelfFramePage.aspx?PRID=1909206>

Fountain, H., Levitt, Z., & White, J. (2022, October 5). The Monsoon Is Becoming More Extreme. *The New York Times*.  
<https://www.nytimes.com/interactive/2022/10/04/climate/south-asia-monsoon-climate-change.html>

(2023, April 8). Mango yield to drop in Mysuru due to unseasonal rain [Review of Mango yield to drop in Mysuru due to unseasonal rain]. *India Times*; *Bennett, Coleman & Co. Ltd.* <https://timesofindia.indiatimes.com/city/mysuru/mango-yield-to-drop-due-to-unseasonal-rain/articleshow/99350763.cms?from=mdr>

High-resolution gridded datasets. (n.d.). *Crudata.uea.ac.uk*. <https://crudata.uea.ac.uk/cru/data/hrg/>

FAO. (2022). *Crops and Livestock Products*. *Food and Agriculture Organization of the United Nations*.  
<https://www.fao.org/faostat/en/#data/QCL>