

The Struggle Against Climate Change-Induced Natural Disasters in India SDG 13: “Climate Change”

Krishna Khetani

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The world has witnessed climate change and its profound effects on the daily lives of mankind, but action against climate change is still met with ignorance. In modern-day society, the impact of climate change has become more dramatic with each passing day. Greenhouse gases, specifically carbon dioxide, have made the atmosphere so thick that heat is trapped on the Earth, increasing the planet's temperature. The concentration of carbon dioxide in the atmosphere is 412 parts per million and continues to rise. This was a dramatic 47 percent increase from 280 parts per million during the Industrial Age in the 19th century.¹ If temperatures keep rising, glaciers will melt, and sea levels will increase. This has resulted in floods and land submerging, especially in low-lying areas in various nations worldwide. Rising temperatures have also increased evaporation, causing droughts to occur more frequently and extensively in almost any region. These greenhouse gases have come from one source: humans. From driving gas vehicles to heating homes, humans are the cause for polluting the Earth and can be blamed for increased droughts, air pollution, and floods. Around the world, climate change needs more government involvement and awareness in the world. The consequences of rapid industrialization and consistent carbon emissions must be addressed by nations worldwide. Government ignorance cannot be a practical solution to climate change as the severity of climate-induced natural disasters increases every day.

This paper will focus on the causes and effects of climate change-induced natural disasters in India, specifically in the states of Assam and Uttar Pradesh, and how the government has worked to solve this issue. The paper will address the UNSDG Goal 13.1, which states, “Strengthen resilience and adaptive capacity to climate-related hazard and natural disasters in all

¹ Alan Buis, "The Atmosphere: Getting a Handle on Carbon Dioxide," NASA, Last modified October 9, 2019, (Accessed April 29, 2023).

countries.”² The information provided will portray how resilience in both states is needed due to natural disasters. Assam, a northeastern state, and Uttar Pradesh, a northern state, have experienced severe deterioration in the livelihood of their citizens in the past years. These two states share similar horrifying natural disasters due to climate change; however, the effects on their respective populations vary. In Assam, floods from the Brahmaputra River have devastated wildlife and homes, urbanization has led to air pollution, and a lack of rainfall has caused droughts. Similarly, Uttar Pradesh has faced severe floodings from the Ganges River that have devastated the livelihood of farmers while also experiencing severe air pollution from urbanization and droughts from a lack of rainfall. Resistance in these two states has been met with the development of constructions of infrastructure, compensations, and the planning of long-term solutions. Still, climate change is never really the primary goal of an Indian politician's political agenda.

Floodings in India have created havoc amongst civilians living near bodies of water or low-lying lands. In Assam, floods have severely impacted Assam's diverse wildlife. It has also created a refugee crisis as many homes have been washed away in the floods. In Uttar Pradesh, farmers have witnessed the severe effects of flooding as powerful currents destroy agricultural land. Unlike Assam, flooding in Uttar Pradesh has not created a severe refugee crisis or profoundly affected wildlife. Although floods have impacted Assamese farmers, their situation falls into the category of the refugee crisis. The state government has attempted to combat this issue in both states, but the problem still needs to be addressed more efficiently and sincerely. Assam and Uttar Pradesh have seen severe flooding caused by climate change and the adverse effects on the states' civilians.

² “Goal 13 | Department of Economic and Social Affairs Sustainable Development,” United Nations, (Accessed April 29, 2023).

Climate change-induced flooding of the Brahmaputra River is one of the leading natural disasters the Assamese people fight against every year. This river originates in the Himalayan region in Tibet (or present-day China), and its source comes from the Chemayungdung Glacier. Glaciers on the Qinghai-Tibetan plateau, like the Chemayungdung Glacier, have been melting at rapid speeds. According to Yang Yon, an independent geologist, "The Chemayungdong glacier has retreated by about 400 meters since our last visit in 1998, and a lake has formed."³ The melting of this glacier due to global warming has increased water levels in all the tributaries of the Brahmaputra River. The river stretches across the entire state of Assam, leaving every flood-prone area devastated when it comes to flooding. An official state assessment done by the Rashtriya Barh Ayog showed that 39.58% of the total land area of Assam is flood-prone and makes up about 9.40% of India's flood-prone areas.⁴ The overflowing of the Brahmaputra River has caused these devastating floods to hit prone Assam regions annually.

Another factor that causes flooding in Assam is the monsoon season, whose patterns have been affected by climate change. The monsoon season brings winds from the Bay of Bengal annually. However, climate change has caused moisture and humidity to remain in the air. This has increased droughts and caused the monsoon season to become more erratic. When monsoon rains finally come, all the moisture is dumped in a short period. For example, a month's rainfall can take place in only a few days.⁵ In 2020, Assam experienced a terrible monsoon season with a series of deadly floods that resulted in 1,282 casualties. The 2020 monsoon was particularly

³ Li Jing, "China's glaciers shrink by a fifth since the 1950s," South China Morning Post, Last modified December 14, 2023, (Accessed April 29, 2023).

⁴ "Flood & Erosion Problems," Government of Assam, Last modified May 11, 2023, (Accessed May 13, 2023).

⁵ Henry Fountain and Saumya Khandelwal, "The South Asia Monsoon Is Becoming More Extreme," New York Times, Last modified October 12, 2022, (Accessed April 29, 2023).

devastating as the state had to face both Covid-19 and the floods.⁶ Climate change-induced monsoons are becoming more extreme and erratic, causing deadly floods in Assam.

Assam's floods have led to a refugee crisis as the Assamese people have lost their homes in these devastating floods. River erosion, caused by flooding, has made agricultural land for farmers challenging to maintain for farming, especially paddy farms. This has forced farmers to move to unfamiliar territories in southern states, such as Karnataka, Kerala, and Tamil Nadu, to look for jobs. These farmers face language barriers in these states as the local language differs from the Assamese farmers. In an agricultural state, the loss of land translates to the loss of livelihood.⁷ In addition to these farmers, thousands of families have been forced to bear the title of climate refugees. Like the farmers, they are forced to move to new areas where they are seen as "intruders" and foreigners. These refugees lack basic necessities, such as transportation and access to health facilities. Photik Chandra Mondal, a member of a village body, states, "When the world is moving forward with technology, we are going backward in isolation because of our geographical location, with erosion pushing us towards lack of health amenities, education, transport." With all this refugee chaos, Assam has faced severe economic desperation, leading to increased child and women trafficking.⁸ The flood crisis has become even more critical in Assam as climate refugees are deprived of basic necessities and are struggling to make an income in the new places they are moving to.

Assam floods have caused vulnerable wildlife species to be endangered. According to *India 2022: An Assessment of Extreme Weather Events*, destructive monsoon floods have caused

⁶ Dipu Rai, "Monsoon floods devastate Assam again: Here's why this happens and will likely get much worse," India Today, Last modified June 27, 2022, (Accessed April 29, 2023).

⁷ Sumir Karmarkar, "Floods force Assam farmers to migrate to southern states for jobs," Deccan Herald, Last modified October 17, 2022, (Accessed April 29, 2023).

⁸ Chandrani Sinha, "Climate refugees stripped of citizenship in Assam," The Third Pole, Last modified November 19, 2019, (Accessed April 29, 2023).

Assam to be home to the highest number of animal casualties.⁹ Assam is home to the Kaziranga National Park, a UNESCO World Heritage Site. This park famously hosts the world's largest population of the greater one-horned rhinoceros or the Indian rhinoceros. However, the national park lies in the floodplains of the Brahmaputra River, and two-thirds of the park is submerged annually during monsoon season. In 2021, 24 animals, consisting of rhinos, deer, and buffalos, died due to the floodings. There have been initiatives by

NGOs, such as the Centre for Wildlife Rehabilitation and Conservation, who attempt to save the animals from drowning in floods by training villagers to rescue animals. In addition, authorities have created temporary highlands with adequate grass and fruits to provide shelter to wildlife during floods.¹⁰ Although authorities have provided temporary solutions, animal casualties still occur in the national park, endangering Assam's diverse wildlife.

With all climate change's devastating and deathly effects, the state government has provided solutions and relief for these floods as early as the 1960s. Embankments or dams have been constructed to confine the course of the Brahmaputra River and help control floods.

However, these dams are in bad condition or have been washed away as monsoon floods breach these barriers. Despite its ineffectiveness, the state government in Assam has spent approximately 3.6 billion US dollars (30,000 crore rupees) building these embankments in the past six decades.¹¹ In addition to embankments, the Water Resources Department of Assam has attempted to develop the rural sector and protect towns in the Brahmaputra valley through many schemes. The department wants to provide increased flood zoning, flood forecasting, and

⁹ Preetha Banerjee, "India saw natural disasters almost every day in first 9 months of 2022: CSE report," DownToEarth, Last modified November 1, 2022, (Accessed January 23, 2022).

¹⁰ FP Explainers, "Explained: How Assam floods have endangered animals at Kaziranga National Park," Firstpost, Last modified June 24, 2022, (Accessed April 29, 2023).

¹¹ Sumeda, "Explained | Assam's annual tryst with devastating floods," The Hindu, Last modified June 25, 2022, (Accessed April 29, 2023).

warning, raised platforms, and bank and town protection works.¹² Flood warnings and flood zoning can help mitigate the refugee crisis by giving the affected people time to evacuate and settle elsewhere. Raised platforms and bank and town protection works are helpful solutions to prevent flooding. Raised platforms can shelter animals and people on higher ground, while bank and town protection works can help control the river and protect towns. However, these solutions can only become long-term if the state government properly maintains them. As proven by the current ineffectiveness of the state government, stronger long-term solutions are desperately needed to mitigate the Assamese flooding crisis.

The overflowing of the Ganges River has caused Uttar Pradesh floods. Although several rivers are present in Uttar Pradesh, the Ganges River will be the main focus as it is the biggest floodier in the state. The Ganges River originates in the Himalayan region of the northern Indian state of Uttarakhand in the Gangotri Glacier. The rapid increase of industrialization, the burning of fossil fuels, and deforestation are reasons the Gangotri glacier is melting. Research has shown that the glacier has shrunk by 1700 meters since 1935.¹³ This increase in the water level of the

Ganges has caused unprecedented flooding in Uttar Pradesh, especially in the districts of Barabanki, Ballia, Ghazipur, Prayagraj, and Varanasi. In these districts, India's Central Water Commission reported the Ganges was above Severe Flood Level in 2022 as they lie on the banks of the Ganges River. These types of unprecedented floods are called flash floods, which are known to devastate many houses and cause many casualties. For example, in just a couple of days in 2022, 245,000 people were affected by flash floods.¹⁴ Flooding has also occurred due to monsoon rains. However, it is not as major of a cause as the overflowing of the Ganges, as Uttar

¹² "Flood Management | Water Resources," Government of Assam, (Accessed April 29, 2023).

¹³ Santoshi, Neeraj, "Gangotri glacier retreated by 1,700m since '35: Study," The Hindustan Times, Last modified September 22, 2022, (Accessed April 29, 2023).

¹⁴ Richard Davies, "India – Floods in Uttar Pradesh Affect 245,000," Floodlist, Last modified September 1, 2022, (Accessed April 29, 2023).

Pradesh is inland and landlocked, unlike Assam. Overall, the overflowing of the Ganges River has caused Uttar Pradesh to witness devastating flash floods.

Uttar Pradesh's floods have affected farmers as agricultural lands and crops have been devastated. Monsoon floods have ruined crops such as paddy, vegetables, potatoes, and wheat, and mustard and sugarcane can no longer be sown. Anil Yadav, a farmer in Uttar Pradesh, stated, "It did not rain when it was needed. Now, it has rained such that my entire field has been destroyed." With what little crops are left in the aftermath of these floods, farmers want to ensure that all perishable food is sold. As a result, they sell crops at lower prices and suffer losses per monsoon season.¹⁵ Farmers are disappointed in the late response of the government to their situation. After demand, a fair government assessment of the losses of farmers, but locals accuse the state

government of being indifferent to their situation and complain that the survey is of no use now, months after the damage was done.¹⁵ Uttar Pradesh flash floods have caused poor conditions for farmers as they are left with ruined crops and insufficient support from the government.

Although the state government ignores the farmers' plight, the Uttar Pradesh state government has addressed its shortcomings in controlling flooding and has experienced success with the new government. Uttar Pradesh Chief Minister Yogi Adityanath has taken the lead in addressing flooding issues in the state. Under his leadership, the 38 districts that had been affected by floods have been reduced to only four. He successfully tackled this issue by refusing to sign an approximately 12 million US dollars (100 crore Rupees) expenditure bill for a matter related to the Elgin Bridge, which lies over the Ghaghra River. Adityanath later surveyed the

¹⁵ Vivek Mishra, "North India rains: Crops ruined in Uttar Pradesh; over half a million affected by floods," DownToEarth, Last modified October 11, 2022, (Accessed April 29, 2023).

¹⁶ Ankit Rathore, "Farmers in Uttar Pradesh crushed by drought and drowning fields," Gaon Connection, Last modified September 14, 2022, (Accessed April 29, 2023).

area and decided to dredge the Ghaghra or remove sediments and debris from the bottom of the lake. This prevented flooding because it increased the river's depth and allowed them to contain more water and not overflow. With this, the Chief Minister was able to carry out the construction for approximately 600,000 US dollars (5 crore rupees) and prevent flooding in 34 districts.¹⁷ In addition, Adityanath has laid out hopes and plans for better management in the future. He has assigned inter-departmental coordination for the protection of public life from floods. These departments manage irrigation, water resources, and health in flood-prone areas. Adityanath has stressed the need to maintain adequate food stock and equipment in vulnerable, flood-prone areas to keep these areas secure and stable in hard times.¹⁸ The success of the Uttar Pradesh government has given hope for implementing Yogi Adityanath's plans and for effective long-term solutions.

Climate change has caused severe flooding from the overflowing of essential rivers and heavy rainfall from monsoon season in Assam and Uttar Pradesh, which has impacted the livelihood of the states' citizens. In Assam, the overflowing of the Brahmaputra River caused by the melting of the Chemayungdung Glacier and severe monsoons caused increased humidity in the atmosphere, leading to floods throughout the state. This has created a refugee crisis in the state, forcing many civilians to leave their homes and move to unfamiliar states. Assam floods have also caused animal casualties in the state, particularly affecting the Kaziranga National Park and its population of greater one-horned rhinoceros. Like Assam, Uttar Pradesh flooding has been impacted by the overflowing of the Ganges River due to the melting of the Gangotri Glacier and severe monsoons caused by humidity. However, unlike Assam, Uttar Pradesh floods have

¹⁷ PTI, "UP Making Efforts to Find Permanent Solution to Flood Problem, Says CM Adityanath," Outlook, Last modified November 13, 2022, (Accessed April 29, 2023).

¹⁸ "Uttar Pradesh has found permanent solution to decades old flood calamity: CM Adityanath," Times of India, Last modified June 30, 2022, (Accessed April 29, 2023).

not created a severe climate refugee crisis or significantly affected animals. Both state

governments have attempted to tackle this issue, but the Uttar Pradesh government, under Yogi Adityanath, has experienced more success than the state government of Assam. A solution to control the floods for both governments would be to implement long-term solutions by building efficient and robust embankments, establishing better communication systems, and keeping dredging rivers.

Air pollution has seriously impacted the livelihoods of Assam and Uttar Pradesh citizens as it has become hard to breathe in polluted atmospheres. As India navigates its way through urbanization with a rapidly increasing population, citizens have contributed to pollution in the air. In Assam, air pollution originates from urbanization. In Uttar Pradesh, urbanization and rampant construction cause poor air quality. In both states, increased vehicle emissions due to urbanization remain the leading cause of air pollution. Although climate change is not a significant factor in air pollution, public emissions have worsened climate change. However, public health has deteriorated in both states due to an unsafe atmosphere. The respective state governments have enacted initiatives to combat this urgent crisis. Climate change-induced air pollution in Uttar Pradesh and Assam has led to the deterioration of public health and initiatives from state governments.

The cause of air pollution in Assam is rapid urbanization. Guwahati, a major city in Assam, has been one of India's most rapidly growing cities in the past decade and has significantly contributed to Assam's air pollution crisis. In Guwahati, a very poor public transportation system with only two major roads has caused traffic congestion and has increased black carbon emissions from stationary vehicles. Black carbon is a black material emitted from gas or diesel engines and coal power plants. Guwahati is one of the world's largest cities

that emit black carbon.¹⁹ This city has also experienced a population increase that has caused more people to purchase vehicles, contributing to fossil fuel consumption and increased emissions. There were more than 637,946 two-wheeler vehicles and 377,211 four-wheeler vehicles in Guwahati alone.²⁰ Road dust has contributed to air pollution in Assam, and aerosols have worsened climate change-induced natural disasters in Assam. Road dust comes from the formation of puddles if a road surface has poor drainage. The water in these puddles contains fine particles that spread into the wind as dust with traffic.²¹ All these causes for air pollution have originated from humans as they quickly crowd and settle in cities and pollute the air.

From vehicle emissions, burning toxic waste, and road dust, aerosols flow into Assam's atmosphere, increasing the effects of climate change. Aerosols are tiny solid particles or liquid droplets in the air or other gasses. For example, black carbon is a type of aerosol that pollutes Assam. It comes from smoke from biomass burning, urban or industrial emissions, and natural pollutants such as dust. When someone breathes in aerosols, lung tissue can be torn or destroyed, leading to lung and respiratory diseases. Aerosols can also decrease visibility in a city, which contributes to the hazy fog that can be seen in India's atmosphere.²² Aerosols have also led to changes in monsoons as they induce "cloud invigoration." This means that cloud thickness increases because of the smaller size of cloud droplets. Inside a cloud, water droplets cling to aerosol particles and create a larger water droplet, but when the droplet pops, it forms smaller water droplets with aerosol particles inside.²³ A change in cloud structures is linked to increased

¹⁹ "Air Pollution," ENVIS Centre: Assam, Last modified May 2015, (Accessed April 29, 2023)

²⁰ "Fast deteriorating air quality in Assam and its impacts," Northeast Now, Last modified February 11, 2023, (Accessed April 29, 2023).

²¹ "Fast deteriorating air quality in Assam and its impacts," Northeast Now, Last modified February 11, 2023, (Accessed April 29, 2023).

²² "Aerosols," World Meteorological Organization, Last modified April 4, 2023, (Accessed April 29, 2023)

²³ Farhana Ahmed, "Air Pollution and Assam Floods," Scoop, Last modified September 9, 2019, (Accessed April 29, 2023).

rainfall since increased cloud thickness facilitates thunderstorm clouds. Therefore, air pollution can worsen climate change through the spread of aerosols.

Air pollution has caused changes in public health and schedules for the Assamese people.

Currently, 31,205,576 people in Assam are breathing toxic air defined by the WHO's clean air guideline. Lung cancer, asthma, chronic obstructive pulmonary disease, and respiratory and cardiovascular diseases are caused by air pollution.²⁴ In Assam, air quality always peaks in the evening, affecting citizens' daily schedules. People usually return home from work or school or walk in the marketplaces during this time. This has prevented them from enjoying the outdoors when they are free during the day and have caused people to sleep poorly due to poor ventilation.²⁵ Air pollution in Assam is affecting millions of people as it is becoming harder to breathe and even walk outside in the polluted atmosphere.

The Assam state government has joined many initiatives and has attempted to educate the public about preventing the severe effects of air pollution. Doctors of Assam have joined the movement of Doctors for Clean Air, which was a campaign that raised awareness for air pollution and its health impacts.²⁶ The Assam State Disaster Management Authority issued a list of do's and don'ts for the public, which include staying indoors in the evening, using air purifiers, and wearing face coverings.²⁷ Although the state government has attempted to raise awareness of air pollution, it has not faced much success in controlling the crisis. Northeastern states, such as Assam, are seeking support under the National Clean Air Programme. This program aims to improve air quality through education of the public and the building of

²⁴ "Fast deteriorating air quality in Assam and its impacts," Northeast Now, Last modified February 11, 2023, (Accessed April 29, 2023).

²⁵ Shikar Verma, "Assam Air Pollution is at an all time high," AQI. Last modified February 7, 2019, (Accessed April 29, 2023).

²⁶ "Fast deteriorating air quality in Assam and its impacts," Northeast Now, Last modified February 11, 2023, (Accessed April 29, 2023).

²⁷ India TodayNE, "How to combat air pollution in Guwahati, Assam government issues Do's and Dont's," India Today, Last modified February 8, 2023, (Accessed April 29, 2023).

infrastructure such as a robust air quality monitoring network.²⁸ If these solutions are implemented in Assam, air pollution can be reduced, and a healthier environment can be created for the Assamese people.

Uttar Pradesh air pollution has also been caused by urbanization, especially increased construction and unchecked vehicle emissions. Usually, the air pollution crisis of Uttar Pradesh is gone noticed as Delhi's poor air quality takes the headlines of mainstream media. However,

Uttar Pradesh's capital, Lucknow, is ranked the ninth most polluted city in the world, and 15 out of 20 of India's most polluted cities are in Uttar Pradesh.²⁹ The state has witnessed an increase in construction activity to improve transportation and the standard of residence. Transportation construction includes metro railways, roads, and bridges, while housing construction consists of a private apartments, multi-story apartments, and several buildings. The construction of apartments and buildings alone has increased 300 percent in Uttar Pradesh during the past two years. Like Assam, increasing vehicle emissions due to urbanization have also contributed to air pollutants. Lucknow has more than 180,000 vehicles, and this number is growing at an average rate of change every 9 percent each year. The city has recorded a growth of 25 percent in population and a 160 percent growth in the number of vehicles from 2001 to 2011.³⁰ The increase in vehicles, transportation, and housing are all accommodations for the growing population and is causing that same population to breathe in poor air.

Air pollution in Uttar Pradesh has led to concerns about the public health and safety of the citizens. In Uttar Pradesh, 99.4% of the state's population lives in areas where the air quality is categorized as poor and below the allowed limit. This has resulted in respiratory diseases such

²⁸ "Fast deteriorating air quality in Assam and its impacts," Northeast Now, Last modified February 11, 2023, (Accessed April 29, 2023).

²⁹ "Lucknow ranked ninth most polluted city in the world, says report," The Hindustan Times, Last modified March 6, 2019, (Accessed April 29, 2023).

³⁰ Sucheta Chaurasia, "How Lucknow Became One of India's Most Polluted Cities," YKA, Last modified June 7, 2021, (Accessed April 29, 2023).

as lung cancer and asthma and neurological ailments such as strokes, dementia risk, and Parkinson's disease. Poor air quality is also known to lower life spans as these diseases affect people of all ages. This air pollution also contains aerosols, such as black carbon, which were seen in the atmosphere for Assam.³¹ Young citizens, such as Sharma, worry about their future if air pollution keeps deteriorating. He claims, "The air pollution is going to impact everything. We will have health issues, breathing issues, and our life span will be cut short."³² Citizens like Rohit have the full right to be concerned for their safety and demand that the government addresses these issues. Their future, contaminated with air pollution, will only lead to unwanted diseases and a shorter life span if the government does not implement long-term solutions.

Under Chief Minister Yogi Adityanath, the Uttar Pradesh state government has laid out a plan to reduce air pollution and improve air quality. The government's plan for managing air pollution is currently developing but addresses the need for more attention given to air pollution in previous years. Ashish Tiwari, Secretary of the Department of Environment, Forest and

Climate Change in Uttar Pradesh, explains, "Our state action plan will give us a roadmap for tackling long-range pollutants as well so citizens across the airshed can breathe clean air. The plan will provide the foundation for a robust air pollution mitigation strategy based on regional cooperation."³³ In this plan, Adityanath emphasized finding pollution sources to limit emissions, planting grass and trees to provide clean air, and strictly preventing illegal disposal of construction waste that flies in the air. Plants will help purify the air as they take in carbon dioxide and release oxygen as a result of photosynthesis.³⁴ Although these ideas in the plan are

³¹ TNN, "99.4% of Uttar Pradesh lives in high pollution areas," Times of India, Last modified September 8, 2021, (Accessed April 29, 2023).

³² Tara Subramaniam, "India and climate change: Can Modi deliver?," CNN, Last modified November 8, 2022, (Accessed January 23, 2023).

³³ "India's States Take Action Against Regional Air Pollution," The World Bank, Last modified December 1, 2021, (Accessed April 29, 2023).

³⁴ IANS, "UP says will take steps for air pollution, but won't lock down cities," Business Standard, Last modified November 17, 2021, (Accessed April 29, 2023).

yet to be strictly enforced, this roadmap of ideas can be inspirational to other regions facing poor air quality.

Assam and Uttar Pradesh have dealt with air pollution that has endangered the public health of citizens. In Assam, Guwahati has been the most affected by air pollution through urbanization. The rapid increase in population and the moving to cities have caused more vehicle emissions and traffic, which has caused road dust particles to fly into the air and people burning more toxic waste. These dangerous particles, or aerosols, can lead to severe diseases such as lung cancer and asthma. In Uttar Pradesh, urbanization has also caused poor quality. The rapid construction of more buildings due to the increasing population has emitted pollutants into the air. In addition, Uttar Pradesh also faces a similar problem to that of Assam, with more vehicle emissions. Both state governments have addressed this situation in different ways. In Assam, doctors have joined the Doctors for Clean Air movement, and the state government has tried to educate the population. However, the state seeks shelter and support under the National Clean Air Programme. On the other hand, Uttar Pradesh has laid a roadmap for a long-term solution that will eradicate the sources of pollution and plant greenery to clean the atmosphere. Both of these states should begin implementing long-term solutions. In Uttar Pradesh, the government should start strictly enforcing its roadmap. Assam should take inspiration from the roadmap of Uttar Pradesh and begin eradicating or limiting the sources of pollution. Both states face severe vehicle emissions, so that a possible solution could be using more electric-powered vehicles and creating better transportation systems.

Droughts caused by climate change have become more severe and longer, especially during the monsoon season. Even though droughts can sometimes be associated with arid and barren lands, they can happen anywhere in the world, but frequent occurrences can happen in some places more than others. Before the dangerous floods of the monsoon season hit Assam and Uttar Pradesh, droughts can cause panic as land dries up. Global warming has led to water evaporation in both states, causing prolonged and severe droughts even in regions with fertile land. Longer droughts and floods have significantly impacted farmers and their livelihoods. The government of both states must take more measures to prevent droughts and their serious effects. In Assam and Uttar Pradesh, climate change-induced droughts have led to a crisis that has impacted the everyday life of civilians, especially farmers.

Assam has been unexpectedly hit by severe droughts caused by evaporation and erratic rainfall in the past years. Rising temperatures have led to evaporation of surface water and the drying of soils and vegetation. The Regional Meteorological Centre in Borhar announced that Assam had received 16% less rainfall during the monsoon of 2022.³⁵ Assam's drought crisis has been exceptionally shocking because the state holds the title of wet state. Dipantor Soh, a farmer from a drought-hit village, stated, "Never before have I seen drought in this region."³⁶ Farmers like Soh have witnessed devastating droughts that have ruined their crops. These severe droughts have surprised the Assamese population as the Brahmaputra River in Assam is known to produce fertile soil, and the region has many paddy fields requiring wetlands.

Farmers in Assam have been the majority of the people who are affected by these unprecedented droughts. The increasingly longer droughts have severely threatened the state's paddy cultivation. Paddy fields are small, flooded fields that are used to cultivate rice. Therefore, droughts that dry up the land and make the soil uninhabitable for crops can severely affect rice paddy farmers. In fear of the unpredictable weather, farmers are plowing the soil immediately

³⁵ Bondita Baruah, "Abrupt floods and drought-like situations in Assam disrupt farming practices," Mongabay, Last modified March 30, 2023, (Accessed April 29, 2023).

³⁶ Aatreyee Dhar, "Climate change is real: Severe drought hits Assam's wet regions," DownToEarth, Last modified July 30, 2021, (Accessed April 29, 2023).

after sowing the seeds when they should typically wait a month before plowing. They do this so that when the rain arrives, more rainwater will soak in the dry soil.³⁷ Paddy fields are not the only crops that are affected. Crops are turning yellow due to the hot climate and lack of rainfall. Mustard, for example, has become hard to plant in dry fields.³⁸ Assamese farmers await rainfall during the pre-monsoon droughts to nourish their withering crops and to reflood the paddy fields.

In Assam, the state government has tried to recompensate farmers for their losses to make the effects of droughts less harsh. Ajanta Neog, Finance Minister of Assam, announced a compensation of an input subsidy for crops, horticultural crops, and perennial crops. Farmers that have lost 33% of their crops were eligible for compensation. The compensation amount would range from approximately 83 US dollars (6,800 rupees) per hectare of lost crops.³⁹ However, compensation is a short-term solution. Suggestions have been made to the state's agricultural department to begin irrigation systems, but the government has yet to start these projects. Some compensations have not even been properly delivered to those affected by droughts. As a result, farmers have even been trying to find other sources of income, such as small-scale businesses, which are not affected by natural disasters.⁴⁰ Due to the lack of proper government solutions,

farmers still accuse the government of indifference towards the farmers despite compensations. The leader of a farmers' rights organization, Pranab Doley, claimed, "The government gives importance to big companies and corporations, not farmers or micro-producers,"⁴¹ The

³⁷ Aatreyee Dhar, "Climate change is real: Severe drought hits Assam's wet regions," DownToEarth, Last modified July 30, 2021, (Accessed April 29, 2023).

³⁸ Bondita Baruah, "Abrupt floods and drought-like situations in Assam disrupt farming practices," Mongabay, Last modified March 30, 2023, (Accessed April 29, 2023).

³⁹ Aatreyee Dhar, "Climate change is real: Severe drought hits Assam's wet regions," DownToEarth, Last modified July 30, 2021, (Accessed April 29, 2023).

⁴⁰ Bondita Baruah, "Abrupt floods and drought-like situations in Assam disrupt farming practices," Mongabay, Last modified March 30, 2023, (Accessed April 29, 2023).

⁴¹ Aatreyee Dhar, "Climate change is real: Severe drought hits Assam's wet regions," DownToEarth, Last modified July 30, 2021, (Accessed April 29, 2023).

government of Assam needs to begin implementing a proper irrigation system and to help uplift struggling farmers more before agricultural farms suffer unrecoverable losses.

Uttar Pradesh has also faced droughts due to a severe shortage of rainfall. The extreme temperatures and shortage of rain have been caused by climate change, which has caused the evaporation of surface water. This has dried the land in many places in Uttar Pradesh. According to the Indian Meteorological Department, 41 out of 42 districts, except Varanasi, in eastern Uttar Pradesh, have suffered from little rainfall. In western Uttar Pradesh, there was a 55% rain deficit in 2022.⁴² This rain deficit has created severe drought throughout the state. In 2022, the state had only received 346.5 millimeters, which was below the average of 348.5 millimeters.⁴³ This shortage of rainfall has led to longer and more severe droughts, which has not been beneficial to the people of Uttar Pradesh, especially farmers.

Drought seriously affects the agricultural land in Uttar Pradesh and has significantly impacted the livelihood of farmers. Most agriculture in Uttar Pradesh is based on kharif, crops grown during the monsoon season as they require lots of water, such as paddy. In 2022, 1 million hectares of paddy crops dried up in the state.⁴⁴ The dried land has severely impacted Paddy farmers as they cannot sow their crops. These farmers are waiting for the rain to sow their crops, but they can only wait for 130-140 days before the window for sowing the crops close, and it becomes too late for crops. Other farmers have changed their main khariff crop from paddy to soybean as they require less water than other khariff crops.⁴⁵ However, most farmers still stick

⁴² Shagun, "Scanty rain in India's largest state; khariff sowing hit in eastern UP," DownToEarth, Last modified July 15, 2022, (Accessed April 29, 2023).

⁴³ Raju Sajwan, "Monsoon 2022: Why a drought wasn't declared in 4 states with drought-like conditions," DownToEarth, Last modified September 12, 2022, (Accessed April 29, 2023).

⁴⁴ Raju Sajwan, "Monsoon 2022: Why a drought wasn't declared in 4 states with drought-like conditions," DownToEarth, Last modified September 12, 2022, (Accessed April 29, 2023).

⁴⁵ Shagun, "Scanty rain in India's largest state; khariff sowing hit in eastern UP," DownToEarth, Last modified July 15, 2022, (Accessed April 29, 2023).

with paddy crops and sometimes cannot plant them. This causes severe yearly losses as they cannot sell or grow crops during the monsoon seasons.

Like the Assam state government, the Uttar Pradesh state government has done nothing much to reduce the effects of droughts. Irrigation systems need to be properly created or taken care of by the government. Although Yogi Adityanath has stated that irrigation systems are crucial for farmers facing droughts, there have yet to be any advances by the government to construct more irrigation systems. There have been many teams that have assessed each of Uttar Pradesh's 75 districts and their drought crisis, yet not much has been done on behalf of the government.⁴⁶ In addition, canals are also dry in the state as government officials have not released water from abundant sources. Farmers have also stated that they have received no warning about the monsoon season and rain expectancy. This causes farmers to base their sowing and harvesting schedules on intuition.⁴⁷ More government involvement is necessary as farmers suffer from a lack of rainfall. Irrigation systems and canals should be fixed and built to help water reach the farmers' fields and reduce agricultural losses.

Climate change-induced droughts in Assam and Uttar Pradesh have caused much trouble in both states, especially affecting farmers. In Assam, droughts unexpectedly hit the state, known for its rainy climate. Assamese paddy farmers have especially suffered from these droughts.

Although the government has compensated farmers, A lack of infrastructure, such as irrigation systems,

has caused agitation amongst the farmers, who believe that the government is indifferent toward their struggles. In Uttar Pradesh, droughts are mainly caused by the severe shortage of rain. Khariff farmers have suffered during the monsoon season as they cannot plant

⁴⁶ HT Correspondent, "Drought situation in each UP district to be assessed," Hindustan Times, Last modified September 7, 2022, (Accessed April 29, 2023).

⁴⁷ Shagun, "Scanty rain in India's largest state; khariff sowing hit in eastern UP," DownToEarth, Last modified July 15, 2022, (Accessed April 29, 2023).

their crops. Like Assam, the Uttar Pradesh government has not built proper irrigation systems or established drought warning systems for farmers. Both governments need to address these issues immediately as the need for irrigation systems, canals, and warning systems increases every monsoon season when droughts are the most severe. In addition to building and fixing infrastructure, the government can also consider planting drought-tolerant grasses and trees and using mulch to preserve the moisture in the soil.

The effects of climate change have hit India, specifically Assam, and Uttar Pradesh, in the form of natural disasters and severe air pollution. In Assam and Uttar Pradesh, climate-induced floods, air pollution, and droughts have impacted the citizens of the states.

Floods are caused by the overflowing of major rivers and more moisture in the air. Air pollution is caused by rapid urbanization, especially vehicle emissions. Droughts are caused by the evaporation of surface water and a lack of rain. The government has attempted to solve these issues in both states, but action is still needed. Long-term solutions are necessary to prevent severe consequences. If the flood crisis is not adequately addressed, many low-lying regions and coastal districts risk being submerged. To solve this, the government should build better embankments and a robust communication system to reduce the severity of floods, and the refugee crisis could follow. Air pollution and extremely poor air quality can lead to a shorter life span for the upcoming generation, and more diseases may be prevalent. The consequences of not solving the drought crisis might cause more farmer agitation or even lead to rebellion. The state government should consider listening to farmers' demands, building infrastructure, and growing drought-tolerant greenery. In Assam and Uttar Pradesh, floods, air pollution, and droughts are natural disasters that have occurred in these states, and if nothing is done, they will continue to cause problems.

Climate change and its dangerous and intense effects have proved to the world that this issue needs addressing and cannot be met with ignorance. The world must unite together under this cause of climate change, as mankind cannot hope for a future if there is not a healthy environment to live in. Governments must come together to form alliances and strictly implement pragmatic solutions. No one country or region can be blamed for starting climate change because humans, as a species, have caused climate change through vehicle emissions, burning toxic waste, heating homes, deforestation, and many more. Even though a country is not a significant contributor to climate change or global warming, it has most likely seen the effects of climate change in one way or another. Countries must try and eradicate the causes of pollution and start making the lives of citizens more environment-friendly, such as solar-powered energy, electric vehicles, banning plastic, and planting more greenery. Climate change and the natural disasters that follow will affect every country and every person equally. Therefore, the world must face climate change head-on and try to reduce the severe future consequences of the actions of mankind.

Bibliography

- [1]. "Aerosols." World Meteorological Organization. Last modified April 4, 2023. (Accessed April 29, 2023).
- [2]. Ahmed, Farhana. "Air Pollution and Assam Floods." Scoop. Last modified September 9, 2019. (Accessed April 29, 2023).
- [3]. "Air Pollution." ENVIS Centre: Assam. Last modified May 2015. Accessed April 29, 2023.
- [4]. Banerjee, Preetha. "India saw natural disasters almost every day in first 9 months of 2022: CSE report" DownToEarth. Last modified November 1, 2022. (Accessed April 29, 2023).
- [5]. Baruah, Bondita. "Abrupt floods and drought-like situations in Assam disrupt farming practices." Mongabay. Last modified March 30, 2023. (Accessed April 29, 2023).
- [6]. Buis, Alan. "The Atmosphere: Getting a Handle on Carbon Dioxide." NASA. Last modified October 9, 2019. (Accessed April 29, 2023).
- [7]. Chaurasia, Sucheta. "How Lucknow Became One of India's Most Polluted Cities." YKA. Last modified June 7, 2021. (Accessed April 29, 2023).
- [8]. Davies, Richard. "India – Floods in Uttar Pradesh Affect 245,000." Floodlist. Last modified September 1, 2022. (Accessed April 29, 2023).
- [9]. Dhar, Aatreyee. "Climate change is real: Severe drought hits Assam's wet regions." DownToEarth. Last modified July 30, 2021. (Accessed April 29, 2023).
- [10]. "Fast deteriorating air quality in Assam and its impacts." Northeast Now. Last modified February 11, 2023. (Accessed April 29, 2023).
- [11]. "Flood & Erosion Problems." Government of Assam. Last modified May 11, 2023. (Accessed May 13, 2023).

- [12]. "Flood Management | Water Resources." Government of Assam. (Accessed April 29, 2023). Fountain, Henry, and Saumya Khandelwal. "The South Asia Monsoon Is Becoming More
- [13]. Extreme." New York Times. Last modified October 12, 2022. (Accessed April 29, 2023).
- [14]. FP Explainers. "Explained: How Assam floods have endangered animals at Kaziranga National Park." Firstpost. Last modified June 24, 2022. (Accessed April 29, 2023).
- [15]. "Goal 13 | Department of Economic and Social Affairs Sustainable Development." United Nations. (Accessed April 29, 2023).
- [16]. HT Correspondent. "Drought situation in each UP district to be assessed." Hindustan Times. Last modified September 7, 2022. (Accessed April 29, 2023).
- [17]. IANS. "UP says will take steps for air pollution, but won't lock down cities." Business Standard.
- [18]. Last modified November 17, 2021. (Accessed April 29, 2023).
- [19]. "India's States Take Action Against Regional Air Pollution." The World Bank. Last modified December 1, 2021. (Accessed April 29, 2023).
- [20]. India TodayNE. "How to combat air pollution in Guwahati, Assam government issues Do's and Dont's." India Today. Last modified February 8, 2023. (Accessed April 29, 2023).
- [21]. Jing, Li. "China's glaciers shrink by a fifth since the 1950s." South China Morning Post. Last modified December 14, 2023. (Accessed April 29, 2023).
- [22]. Karmarkar, Sumir. "Floods force Assam farmers to migrate to southern states for jobs." Deccan Herald. Last modified October 17, 2022. (Accessed April 29, 2023).
- [23]. "Lucknow ranked ninth most polluted city in the world, says report." The Hindustan Times. Last modified March 6, 2019. (Accessed April 29, 2023).
- [24]. Mishra, Vivek. "North India rains: Crops ruined in Uttar Pradesh; over half a million affected by floods." DownToEarth. Last modified October 11, 2022. (Accessed April 29, 2023).
- [25]. PTL. "UP Making Efforts to Find Permanent Solution to Flood Problem, Says CM Adityanath." Outlook. Last modified November 13, 2022. (Accessed April 29, 2023).
- [26]. Rai, Dipu. "Monsoon floods devastate Assam again: Here's why this happens and will likely get much worse." India Today. Last modified June 27, 2022. (Accessed April 29, 2023).
- [27]. Rathore, Ankit. "Farmers in Uttar Pradesh crushed by drought and drowning fields." Gaon Connection. Last modified September 14, 2022. (Accessed April 29, 2023).
- [28]. Sajwan, Raju. "Monsoon 2022: Why a drought wasn't declared in 4 states with drought-like conditions." DownToEarth. Last modified September 12, 2022. (Accessed April 29, 2023).
- [29]. Santoshi, Neeraj. "Gangotri glacier retreated by 1,700m since '35: Study." The Hindustan Times.
- [30]. Last modified September 22, 2022. (Accessed April 29, 2023).
- [31]. Shagun. "Scanty rain in India's largest state; khariff sowing hit in eastern UP." DownToEarth.
- [32]. Last modified July 15, 2022. (Accessed April 29, 2023).
- [33]. Sinha, Chandrani. "Climate refugees stripped of citizenship in Assam." The Third Pole. Last modified November 19, 2019. Accessed April 29, 2023.
- [34]. Subramaniam, Tara. "India and climate change: Can Modi deliver?," CNN. Last modified November 8, 2022. (Accessed January 23, 2023).
- [35]. Sumeda. "Explained | Assam's annual tryst with devastating floods." The Hindu. Last modified June 25, 2022. (Accessed April 29, 2023).
- [36]. TNN. "99.4% of Uttar Pradesh lives in high pollution areas." Times of India. Last modified September 8, 2021. (Accessed April 29, 2023).
- [37]. "Uttar Pradesh has found permanent solution to decades old flood calamity: CM Adityanath." Times of India. Last modified June 30, 2022. (Accessed April 29, 2023).
- [38]. Verma, Shikhar. "Assam Air Pollution is at an all time high." AQI. Last modified February 7, 2019. (Accessed April 29, 2023).