NUST
Defining futures

NIPS
NUST INSTITUTE OF POLICY STUDIES

# Climate Change

## Impact on Economy, Governance, and Livelihoods

# Report of the Expert Lecture

# on

# Climate Change

# Impact on Economy, Governance, and Livelihoods

NUST Institute of Policy Studies (NIPS)

NUST | Islamabad

**Report prepared by**

Daniya Gardezi

Management Trainee Officer, NUST Institute of Policy Studies

**Cover page designed by**

Daniya Gardezi

Management Trainee Officer, NUST Institute of Policy Studies

**Prepared and printed in Pakistan by**

NUST Institute of Policy Studies

National University of Sciences and Technology (NUST)

H-12, Islamabad

www.nips.nust.edu.pk

**Disclaimer**

The views published in this report are solely of the participants of the session and do not represent the position of NUST and NIPS.

## Participants

*Speaker*

- Dr. Muhammad Fahim Khokhar, Head of Department, Environmental Sciences, Institute of Environmental Sciences and Engineering, NUST.

*Moderator*

- Mr. Amir Yaqub, Director, Operations & Collaboration, NIPS.

*Discussants*

- Lieutenant General (Retd) Naeem Khalid Lodhi HI(M), Former Caretaker Defense Minister of Pakistan & Former Defense Secretary of Pakistan.
- Dr. Ashfaque Hassan Khan, Principal, NUST School of Social Sciences & Humanities (S3H) Director General, NIPS.
- Ambassador Fauzia Nasreen, Former Ambassador of Pakistan to Poland and Australia.
- Air Marshal (Retd) Farhat Hussain Khan HI(M), SBt, President, Centre for Aerospace and Security Studies (CASS).
- Mr. Saquib Atta Ul Noor, Founder & Director, Unicon Green Solutions (Pvt) Ltd.
- Dr. Umer Khayyam, Head of Department, Development Studies, S3H NUST.
- Dr. Farah Naz, Assistant Professor, S3H, NUST.
- Mr. Ali Shah, Head of Research, NIPS.
- Online Participants.
- NIPS Staff.

## About the Speaker

Professor Dr. Muhammad Fahim Khokhar is a tenured professor at the Institute of Environmental Sciences and Engineering, School of Civil and Environmental Engineering, National University of Sciences and Technology in Islamabad, Pakistan. He holds a Doctoral degree from Germany and has completed three post-doctorates in Germany and France. His areas of expertise include satellite remote sensing, air quality monitoring, climate change, DOAS technique, and data retrieval algorithm. He has worked on several European research projects such as NOVAAC, GEMS, and MACC under the 6th and 7th frameworks of the European Commission. Recently, he has been selected as a member of Pakistan's Climate Change Council, Ministry of Climate Change, Government of Pakistan.

## Contents

## 1. Introduction

The NUST Institute of Policy Studies organized an expert lecture on "Climate Change: Impact on Economy, Governance, and Livelihoods" on April 19, 2023. Delivered by Dr. Muhammad Fahim Khokhar, Head of Department, Institute of Environmental Sciences and Engineering, NUST, the expert lecture emphasized the need to recognize climate risks and to take proactive measures towards climate-resilient development.

Dr. Khokhar emphasized the urgent need for climate-resilient development due to the significant surge in greenhouse gas emissions resulting from the exponential growth of the global population, which has led to devastating impacts on various sectors in the Asian region.

Dr. Khokhar also highlighted the governance failures and the low knowledge capacity that are major barriers to addressing climate risks. He cited the SASCOF report of April 2022, which predicted above-normal rainfall in Pakistan that year, but appropriate preventive measures were not taken, leading to severe flooding.

He stressed the economic implications of climate change, with the 2022 floods expected to severely stall economic progress. He mentioned the profound impact of changing climate patterns on agriculture and its direct influence on livelihoods.

The expert lecture concluded with a call for a proactive approach, leveraging emerging technologies, better risk awareness, and improved forecasting capabilities. Dr. Khokhar emphasized the need

to declare a climate emergency in Pakistan and for all stakeholders to work together towards a climate-resilient future.

Dr. Ashfaque Hasan Khan, in his closing remarks, emphasized the need to develop an understanding of the importance of climate change as a step towards achieving sustainable development, and to build capacity in government institutions to deal with the threat of climate change. He highlighted the importance of educating small farmers as they make up a significant proportion of our agricultural sector. He also suggested the establishment of a specialized Climate Change Center of Excellence as a hub of expertise to develop innovative solutions to mitigate the impacts of climate change.

The expert lecture was moderated by Mr. Amir Yaqub, Director Operations and Collaboration, NIPS, and attended by NIPS officials, industry personnel, students, veteran statesmen, think tank experts, and researchers.

## 2. Climate Change:

## Impact on Economy, Governance, and Livelihoods

## Expert Lecture by Dr. Muhammad Fahim Khokhar

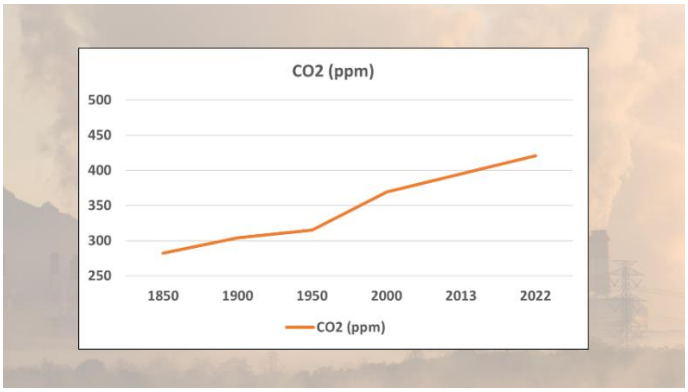
### 2.1. World of Exponential Growth

The world's population has experienced a significant increase from 0.9 billion people in the year 1800 to 7.95 billion in 2022. This exponential growth has resulted in a considerable utilization of natural resources and a release of greenhouse gases (GHGs) and other harmful pollutants into the environment, leading to damages such as global warming. The primary source of these emissions is the burning of fossil fuels, which produces four principal GHGs: Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), and Chlorofluorocarbons (CFCs)[1]. Over the past 250 years, the amount of carbon released into

[1] The 5th and 6th Annual Reports of the Intergovernmental Panel on Climate Change (IPCC)

the atmosphere is equivalent to what nature took 600 million years to sequester.

Figure 1: CO2 emissions released into the atmosphere (ppm)




## 2.2. From Climate Risk to Climate Resilient Development

Climate change poses significant risks to human society and the environment, and urgent action is necessary to move towards climate resilient development. The interactions between climate, human society, and the ecosystem form a complex nexus that can lead to emerging risks. Addressing these risks requires a coordinated and integrated approach that takes into account the complex interactions between these elements.

Climate risks refer to the potential adverse effects of climate change. These risks emerge from the interaction of climate hazards, vulnerability, and exposure. Climate hazards refer to the physical impacts of climate change, such as floods, droughts, and heatwaves. "Vulnerability" is the susceptibility of communities, ecosystems, and infrastructure to these hazards, and exposure refers to the extent to which they are affected. The combination of these factors can result in

the emergence of new risks that may not have been relevant before. For instance, rising sea levels due to climate change can increase the vulnerability of coastal communities to flooding. However, the interactions between climate, human society, and ecosystems also offer opportunities for the future. By recognizing climate risks, we can strengthen adaptation and mitigation actions that reduce risk.

Moving towards climate resilient development requires governments to take the lead in promoting sustainable development and reducing greenhouse gas emissions through ambitious policies and regulations. They should invest significantly in innovative financing mechanisms to achieve a low-carbon economy. Building capacity and knowledge is also essential. This includes investing in education and training programs that enable individuals and organizations to develop the skills and knowledge necessary to address climate change effectively. Creating catalyzing conditions is crucial to ensure that climate action is embedded within broader development objectives. This includes fostering public awareness and engagement on climate issues and promoting cross-sectoral collaboration between different stakeholders.

### 2.3. Climate Risk and Asia

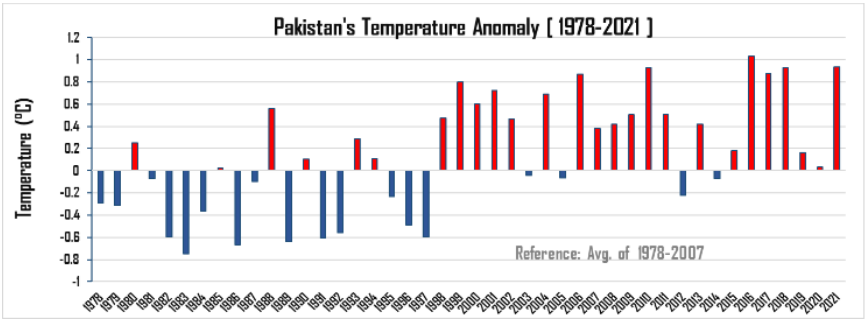
The 6th Annual Report of the Intergovernmental Panel on Climate Change (IPCC) reveals that Asia is experiencing rising temperatures, leading to a higher risk of heatwaves across the continent, droughts in arid and semi-arid regions of West, Central, and South Asia, floods in monsoon regions of South, Southeast, and East Asia, and glacier melting in the Hindukush Himalaya region. The impact of these

changes is evident in various aspects of life. Ecosystems are suffering from flora and fauna loss due to wildfires that arise during heatwaves, while the cryosphere is affected as drought conditions are projected to increase by 5-20% by the end of this century, causing water scarcity in many parts of Asia. The health of individuals is being affected, as vector-borne and water-borne diseases are on the rise, changes in rainfall patterns are leading to bacterial and viral infections, and a lack of drainage systems exacerbates the problem. Migration from rural areas to cities has also changed the dynamics of settlements, and this is playing a significant role in the enhanced impacts of climate change in urban areas. Furthermore, the adverse effects of increased floods and droughts, together with heat stress, are leading to reduced food availability and higher prices, resulting in increased undernourishment in South and Southeast Asia. Energy demand has also increased due to hotter summers, as there is a greater requirement of energy for cooling and pumping more water from the aquifers.

### 2.3.1. Warming Trends in Pakistan

The Pakistan Meteorological Department (PMD) operates a monitoring network of 97 stations across the country that provide daily and monthly average data. This data is compared to a 30-year baseline (1978-2007) to monitor changes in temperature in Pakistan. Pakistan recorded the year 2016 as the warmest year since 1978.

Figure 2: Temperature Trends in Pakistan (1978-2021)



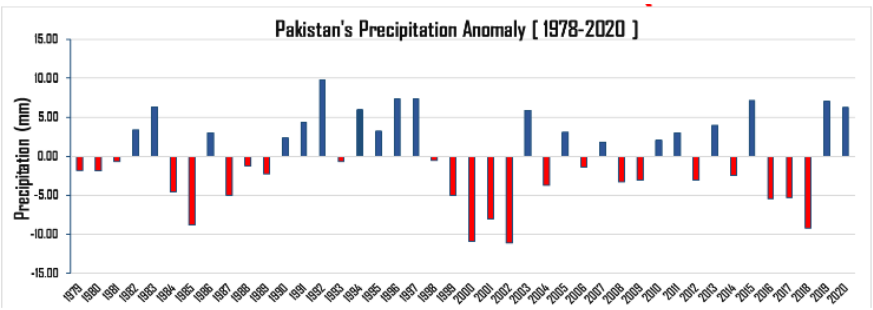

Source: Pakistan Meteorological Department (PMD)

### 2.3.2. Precipitation Changes in Pakistan

Pakistan Meteorological Department (PMD) monitoring network also provides daily and monthly average precipitation data. This data is compared to a 30-year baseline (1978-2007) to monitor changes in precipitation in Pakistan.

The data shows that Pakistan has recorded large internal variability in terms of precipitation patterns over the years. There is a strong linkage between precipitation in Pakistan and large-scale global circulations, such as the El Nino Southern Oscillation (ENSO), particularly La Nina and El Nino events. These global climate phenomena have significant impacts on precipitation patterns in Pakistan. For instance, during La Nina events, Pakistan tends to experience wetter-than-average conditions, while during El Nino events, it experiences drier-than-average conditions.

Figure 3: Precipitation Trends in Pakistan (1978-2021)




Source: Pakistan Meteorological Department (PMD)

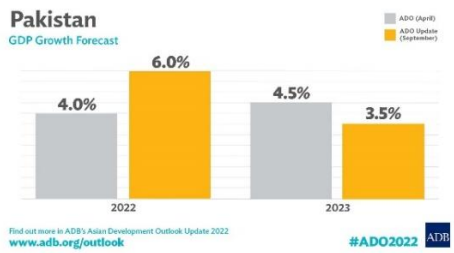
In another analysis, The Pakistan Meteorological Department (PMD) monitoring network that covers 12 stations, provided daily and monthly average data for precipitation patterns. The baseline for this data is from 1998-2009, and the analysis was conducted from 2010-2016. During this period of analysis, a shift in precipitation patterns was observed in the southern and southeastern regions of Pakistan. The data showed an increase in rainfall of 2.5 mm/day in the southern and southeastern regions. Moreover, there was an increase in rainfall of 4 mm/day in the southeastward direction. This data was obtained from the PMD monitoring network as well as TRMM (Tropical Rainfall Measuring Mission) observations.

### 2.4. Economic Implications of Climate Change

The economic consequences of climate change are numerous and complex, ranging from the direct costs of natural disasters to the indirect costs of resource scarcity and climate-driven migration. As the impacts of climate change become increasingly severe and widespread, it is critical that we understand and address the economic dimensions

of this global challenge. Climate change has a profound impact on agriculture, with erratic weather patterns, extreme temperatures, and changes in natural resources threatening farmers' ability to sustainably produce and maintain quality crops. Excessive heat, in particular, can have a detrimental effect on agricultural production. It reduces surface water and depletes aquifers, disrupts the flowering and pollination of crops. Furthermore, climate change also leads to the loss of natural resources, drought, excessive precipitation, and the emergence of new pests and diseases that can further exacerbate the challenges facing agriculture. According to the Asian Development Bank, Pakistan's economy is expected to slow down to 3.5% in the fiscal year 2023[2].

Figure 4: GDP Growth Forecast




Source: Asian Development Bank

This is primarily due to a combination of factors which also includes devastating floods in the country. Moreover, the Asian Development Bank (ADB) and World Bank (WB) have estimated that Pakistan could

[2] Asian Development Bank. 2022. "Pakistan's Economy to Slow in 2023 amid Strong Climate Headwinds: ADB." Asian Development Bank. January 7, 2022. https://www.adb.org/news/pakistan-economy-slow-2023-amid-strong-climate-headwinds-adb.

face up to $3.8 billion in annual economic losses due to climate change in the next two decades.

### 2.5. Climate Change and Livelihoods

In the past two decades, Pakistan has experienced severe climate disasters such as floods, heatwaves, and droughts. The 2022 floods submerged one-third of the country, affecting around 33 million people. The reconstruction and recovery efforts required after the catastrophe are estimated to be 1.6 times the national development expenditure budgeted for the year 2023, according to the World Bank. Estimated needs for rehabilitation and reconstruction in a resilient way are at least USD 16.3 billion.

In 2014 and 2016, Tharparkar district in Sindh province of Pakistan faced severe drought resulting in the death of many children and reduced harvest and livestock. In 2014, 99 children and 67 adults died, while in 2016, 190 children died and 22,000 were hospitalized. The crop failure due to low rainfall and loss of small animals significantly impacted the purchasing power of impoverished communities.

Similarly, In June 2015, Karachi experienced a severe heatwave resulting in an estimated death toll of 1200 and affecting more than 80,000 people. The deaths were caused by the extreme heat and a lack of preparedness, including power outages and water shortages.

Time and again, these events have proven that climate change has a significant impact on livelihoods, particularly for vulnerable populations, affecting agricultural productivity, human health, and

overall economic stability. Efforts to mitigate and adapt to climate change are crucial for sustainability and resilience of livelihoods.

### 2.6. Climate Change and Governance

Pakistan has been taking steps to address climate change, beginning with the proposal of the first National Climate Change Policy (NCCP) in 2012. A more precise follow-up framework was developed in 2014, with strategies to achieve the objectives of the NCCP. In 2017, the NCCP was revised and the Pakistan's Climate Change Council (PCCC) was constituted in July 2022. In line with these efforts, Pakistan has set ambitious conditional targets for the reduction of its projected emissions by 2030, aiming for an overall reduction of 50%, with 15% from the country's own resources and 35% subject to international grant finance that would require USD 101 billion for energy transition. However, years of poor governance have exacerbated the devastating impacts of climate change. The current climate challenges faced by Pakistan suggest the urgent need to declare a national climate emergency.

Effective action on climate change requires sound governance and decision-making, but there are several barriers that can hinder progress. One of the main barriers is poor governance, where governments lack the capacity, resources, and political will to implement policies and programs to address climate change. In the floods of 2022, poor governance was evident as the South Asian

Climate Outlook Forum (SASCOF) report[3] had forecasted potential floods in April 2022, but no effective measures were taken. The actual monsoon intensity exceeded the predictions significantly. Another barrier is inadequate evidence to prioritize actions. The scientific consensus on the causes and impacts of climate change is well-established, but there is often a lack of evidence to support specific policy interventions or to determine the most effective course of action.

To address the barriers of incompetent governance and inadequate evidence in climate change governance, it is necessary to implement evidence-based policies and programs and improve decision-making processes. A collaborative effort between governments, civil society, and the private sector is crucial to prioritize actions and effectively address climate change.

[3] 22nd Session of South Asian Climate Outlook Forum (SASCOF-22) for the Summer Season and Climate Services User Forum (CSUF)

## 3. Discussion

The subject of climate change-induced disasters frequently leads to discussions about whether these catastrophes are artificially engineered or not. This idea that climate change-induced disasters are created artificially for political agenda is a myth. The reality is that climate change is causing an increase in extreme weather events, and while it is true that some groups or organizations may try to use climate change-induced disasters for political or geostrategic gain, this does not mean that the disaster itself was created artificially.

Climate change is generally not considered positive as it has far-reaching negative impacts on the planet and human societies. However, there may be some potential positive effects of climate change in certain regions and contexts. For example, in colder regions, a warmer climate may lead to longer growing seasons and increased agricultural productivity.

It is widely recognized that the current generation is the first to be experiencing the effects of climate change, and the last one which can

do something about it. The longer we delay taking action, the more severe and irreversible the impacts of climate change will become.

Pakistan must balance its short-term economic needs, such as foreign investment in fossil fuel plants, with its long-term climate change mitigation goals. While Pakistan has a low global carbon footprint, it should still take compensatory measures such as investing in renewable energy and afforestation and reforestation projects. By prioritizing sustainable practices, Pakistan can promote economic growth while minimizing its contribution to climate change.

It is important to consider India's level of commitment to climate action as it directly impacts neighboring countries like Pakistan. India has recognized the changing global dynamics, including the climate crisis, and has adopted multi-faceted strategies that benefit its economy. These strategies involve utilizing the full potential of fossil fuels while also taking a significant share of the renewable energy market.

A senior professional with broad experience in the Oil and Gas, Heavy Industries, Wind Power, and Electric Vehicles industry was in attendance. A constructive conversation took place, where they identified the governance obstacles in adopting environmentally friendly options and discussed potential solutions. They were also introduced to climate tech projects developed at NUST, and funding opportunities were explored. This led to the development of an industry-academia partnership, and future discussions were planned to explore potential opportunities further.

## 4. Recommendations

- To effectively address the impacts of climate change, it is recommended that governments adopt proactive measures rather than reactive ones. Such measures could include investing in renewable energy, promoting sustainable agriculture, and integrating climate change adaptation strategies into urban planning.
- Promote the use of advanced technologies such as artificial intelligence, remote sensing, and satellite imagery to monitor and mitigate the impacts of climate change.
- Prioritize research and data collection to inform evidence-based decision making on climate change mitigation strategies.
- Increase awareness of climate change risks and promote community resilience-building efforts.
- Invest in improving forecasting capabilities to better predict the impacts of climate change.
- Foster regional partnerships to share knowledge, resources, and expertise on climate change mitigation.
- Prioritize disaster risk reduction and preparedness efforts to mitigate the impacts of climate change-related disasters.
- Identify and address barriers and constraints to effective climate change mitigation, including addressing regulatory and policy gaps, promoting public-private partnerships, and providing support to vulnerable communities and regions.

## 5. Concluding Remarks

**Dr. Ashfaque Hasan Khan, Principal NUST School of Social Sciences and Humanities (S3H) & Director General NIPS**

In the concluding statements, the necessity of recognizing the importance of climate change as a vital step towards achieving sustainable development was emphasized. The significance of building institutional capacity to effectively deal with the threat of climate change was also highlighted.

Educating small farmers, who constitute a significant proportion of the agricultural sector, about the impact of climate change on their livelihoods was also noted. The adoption of sustainable agricultural practices to mitigate the impacts of climate change was proposed as a possible solution.

Additionally, the establishment of a Climate Change Center of Excellence was suggested as a hub of expertise for developing

innovative solutions to address the challenges posed by climate change. Collaboration among government institutions, civil society organizations, and the private sector was emphasized as a critical component of any effective strategy to mitigate the adverse effects of climate change.


# Climate Change: Impact on Economy, Governance, and Livelihoods

NUST Institute of Policy Studies

Printed by NUST Press