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ON THE THEME OF

"ACCELERATING LAND RESTORATION, DROUGHT RESILIENCE & DESERTIFICATION PROGRESS"

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Engr. Najam Waheed obtained his Bachelor's Degree from University of Engineering & Technology, Lahore in Civil Engineering. He has over thirty years of multifaceted professional experience leading and pursuing development and engineering projects which includes planning, project management, preparation of technical reports and contract documents. He is well-versed in various national and international codes, regulation, quality standards and their implementation. He worked on various prestigious and technically complex projects.

Engr. Najam Waheed has been a Council Member of Pakistan Engineering Congress for more than two decades. He has been an active member of the Congress serving as Secretary, Joint Secretary, Treasurer, and convener of all important Committees of the Congress, and was elected as the President of the Pakistan Engineering Congress in December 2021. His vision has been manifested in an digital transformation of the Congress's services and has laid a strong foundation for future growth and developments of Engineers Communities.

His dedication to engineering development and the Pakistan Engineering Congress played a significant role in developing effective synergies with important professional bodies in the country, which would significantly contribute to engineer's professional competence in a challenging environment of disruptive technologies and sustainable development.



Engr. Najam Waheed
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Table of Contents

Ser. No.	Paper No.	Title of Paper	Author's Name	Page No.
1		WELCOME ADDRESS ON WORLD ENVIRONMENT DAY-2024	Engr. Najam Waheed, President Pakistan Engineering Congress	01
2	146	NAVIGATING CLIMATE CHALLENGES: THE MULTIFACETED IMPACT OF CLIMATE CHANGE ON PAKISTAN (REVIEW PAPER)	Qurat ul Ain, Azka Tauseef, Arsal Imtaiz	5
3	147	ASSESSING THE ENVIRONMENTAL IMPACTS OF DROUGHTS AND DESERTIFICATION IN PAKISTAN: CHALLENGES AND MITIGATION STRATEGIES	Rimsha Azhar, Muhammad Asif, Sajid Rashid Ahmad, Abdul Qadir	15
4	148	COMPREHENSIVE STRATEGIES FOR LAND RESTORATION, DROUGHT RESILIENCE, AND COMBATING DESERTIFICATION IN PAKISTAN	Ghulam Murtaza, Naqshe Zuhra, Muhammad Moaz Khursheed	45
5	149	ROLE OF SALINITY MAPPING IN CONTROL OF DESERTIFICATION PROGRESS AND ACCELERATING LAND RESTORATION	Raheel Mustafa Gondal, Muhammad Basharat, Shakeel Ahmad, Muhammad Masood Ahmed Soomro	59
6	150	INNOVATIVE TREND ANALYSIS PRECIPITATION, TEMPERATURES AND SPI DROUGHT INDEX OF LAHORE	Hafiz Raziullah, Sohail Ali Naqvi, Masood Arshad, Muhammad Ahmad, Muhammad Imran Azam	87
7	151	ASSESSING THE IMPACTS OF TIDAL INUNDATION AND SEAWATER INTRUSION ON AGRICULTURE AND WATER RESOURCES IN DISTRICT BADIN, SINDH	Ibrahim Zia, Tehreem Zafar, Rizwan Akhtar, Bassam Nasir	99

8	152	ROLE OF AFFORESTATION INITIATIVES IN RESTORATION AND SUSTAINABILITY OF LAND ECOSYSTEMS AND CLIMATE MITIGATION IN PAKISTAN	Khadija Aslam, Waqas Ahmad, Nimra Ashraf, Abdul Qadir	115
LISTING OF PAPERS PRESENTED AT VARIOUS WORLD ENVIRONMENT DAY(S) BY PAKISTAN ENGINEERING CONGRESS				123

Welcome Adress
By
Engr. Najam Waheed

President
Pakistan Engineering Congress

Welcome Address

By

Engr. Najam Waheed

President Pakistan Engineering Congress

On World Environment Day, 2024

On the theme of "Accelerating Land Restoration, Drought Resilience & Desertification Progress"

Honorable Chief Guest
Distinguished Delegates,
Executive Council Members,
Fellow Engineers, Ladies & Gentlemen,

Assalam-o-Alaikum!

It is a matter of great honor and pleasure for me to welcome you all over here on the World Environment Day 2024. This year's theme, "Accelerating Land Restoration, Drought Resilience & Desertification Progress," calls for urgent action to combat the degradation of our land and build resilience in the face of drought and desertification.

Ladies & Gentlemen!

The degradation of our lands, the increasing frequency and severity of droughts, and the relentless march of desertification threaten not only the health of our planet but also the well-being and livelihoods of millions of people around the world. As we gather here today, let us reaffirm our commitment to taking bold and decisive action to reverse these alarming trends and pave the way for a more sustainable and prosperous future for all. Land restoration is a cornerstone of our efforts to combat environmental degradation and promote sustainable development. The degradation of our lands through deforestation, overgrazing, unsustainable farming practices, and urbanization has far-reaching consequences for biodiversity, water resources, food security, and climate stability. Restoring degraded lands through reforestation, sustainable land management practices, and ecosystem restoration not only helps to mitigate climate change but also enhances soil fertility, water retention, and biodiversity.

Ladies & Gentlemen!

Drought resilience is another critical area that requires our immediate attention and action. The increasing frequency and intensity of droughts, aggravated by climate change and unsustainable water management

practices, pose a significant threat to food security, water availability, and livelihoods around the world. Drought-prone regions are particularly vulnerable to the impacts of water scarcity, crop failures, and food insecurity, which can lead to widespread poverty, displacement, and social unrest. Building drought resilience requires a multifaceted approach that combines improved water management, climate-smart agriculture, early warning systems, and community-based adaptation measures.

Ladies & Gentlemen!

Desertification, the process of land degradation in arid, semi-arid, and dry sub-humid areas, is a global challenge that undermines the productivity of ecosystems, threatens biodiversity, and displaces communities. Desertification is driven by a combination of factors, including unsustainable land use practices, overexploitation of natural resources, climate change, and population growth. The expansion of deserts and the degradation of drylands have severe consequences for food security, water availability, and ecosystem health, particularly in vulnerable regions of the world.

Ladies & Gentlemen!

Pakistan, like many countries around the world, faces significant environmental challenges that threaten the health and well-being of our people and the sustainability of our natural resources. From air and water pollution to deforestation and habitat degradation, the stakes have never been higher.

As members of the engineering community, we have a moral obligation to lead by example and drive positive change in our society. Whether it's through sustainable infrastructure projects, renewable energy solutions, or innovative waste management practices, engineers have the power to make a tangible difference in the fight against environmental degradation.

Let us commit ourselves to embracing innovation, collaboration, and solidarity in our efforts to restore our lands, enhance our resilience, and combat desertification. Together, we can make a meaningful difference and leave a positive legacy for the planet and future generations.

I would like to thank you all once again for being with us. May peace and blessings be upon you all.

Thank you.

-: Pakistan Paindabad :-

Paper No.146

NAVIGATING CLIMATE CHALLENGES: THE MULTIFACETED IMPACT OF CLIMATE CHANGE ON PAKISTAN (REVIEW PAPER)

Qurat ul Ain,
Azka Tauseef,
Arsal Imtaiz

NAVIGATING CLIMATE CHALLENGES: THE MULTIFACETED IMPACT OF CLIMATE CHANGE ON PAKISTAN (REVIEW PAPER)

By

Qurat ul Ain[1], Azka Tauseef[1], Arsal Imtiaz[1]

Abstract

Climate change has wreaked havoc globally, particularly in South Asia, where residents face high vulnerability but low awareness of adaptation and mitigation measures. Pakistan's limited resources, high poverty rate, and recurrent extreme weather events, continuously endanger ecosystems, biodiversity, and human communities. These threats persistently jeopardize various aspects of life, including animal habitats, forests, and water sources, with potential for further harm in the future. Current paper focuses on Pakistan, a developing country acutely vulnerable to climate-induced hazards **[1]**. This study examines the multifaceted effects of climate change on Pakistan's environment, economy, and society, through an extensive review of existing literature and empirical data. Pakistan's unique geographical and climatic features make it susceptible to various climate impacts, including glacial melt, altered monsoon patterns, and increased frequency of extreme weather events. These changes threaten water resources, agriculture, and public health, exacerbating existing socio-economic challenges. The paper highlights significant governmental and international efforts to address these challenges while identifying gaps and proposing strategies for effective mitigation and adaptation. The findings underscore the urgent need for comprehensive, multi-sectoral approaches to enhance resilience and sustainable development in Pakistan.

Introduction

Climate change, driven by anthropogenic activities such as deforestation and the burning of fossil fuels **[2]**, leads to significant long-term changes in global temperature, precipitation, and weather patterns. The consequences of climate change are pervasive, impacting ecosystems, economies, and communities worldwide. Developing countries are particularly vulnerable due to their geographic locations, economic dependencies, and limited adaptive capacities. Pakistan, with its diverse topography and climate zones, exemplifies these vulnerabilities.

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Pakistan faces a range of climate-related challenges. Rising temperatures, changing precipitation patterns, and the retreat of glaciers in the Himalayas and Hindu Kush regions are causing severe water shortages. The Indus River, which is crucial for Pakistan's agriculture and water supply, is heavily reliant on glacial melt and monsoon rains, both of which are becoming increasingly unpredictable. This unpredictability poses a significant threat to agriculture, which is a major component of Pakistan's economy and a source of livelihood for a large portion of its population.

Furthermore, Pakistan experiences frequent extreme weather events, including floods, droughts, and heatwaves. The 2022 floods, which were among the worst in Pakistan's history, affected over 33 million people and caused an estimated $30 billion in damages **[3]**, highlighting the devastating impact of such events. These disasters exacerbate poverty, displace communities, and strain the country's already limited resources and infrastructure.

Health impacts are also significant, with rising temperatures contributing to the spread of vector-borne diseases such as malaria and dengue fever **[4]**. Additionally, climate-induced displacement and migration are emerging issues, adding pressure on urban areas and social services.

Addressing climate change in Pakistan requires comprehensive and integrated strategies that involve governmental policies, international cooperation, and community-level initiatives. Efforts such as the National Climate Change Policy and reforestation projects like the Billion Tree Tsunami are steps in the right direction. However, there is a critical need for sustained and enhanced action to build resilience and ensure sustainable development. This paper aims to provide an in-depth analysis of the impacts of climate change on Pakistan, reviewing existing literature and empirical data, and suggesting pathways for effective mitigation and adaptation.

Methodology

This study adopts a qualitative research methodology to explore the impacts of climate change in Pakistan. The methodology involves a systematic review of existing literature, including academic journals, government reports, and publications from international organizations such as the Intergovernmental Panel on Climate Change (IPCC), the World Bank, and the United Nations Development Programme (UNDP). The selection of sources ensures a comprehensive understanding of the multifaceted impacts of climate change on Pakistan.

Literature Review

The literature review process involved identifying and analyzing relevant publications that discuss the environmental, economic, and social impacts of climate change in Pakistan. Key databases such as Google Scholar, JSTOR, and PubMed were used to source peer-reviewed articles. Government reports and policy documents from Pakistan's Ministry of Climate Change were also reviewed to understand national strategies and initiatives. International reports from the IPCC and UNDP provided a global context and comparative analysis.

Data Collection

Empirical data was collected from various sources to illustrate the real-world impacts of climate change in Pakistan. This included climate data from the Pakistan Meteorological Department, economic impact assessments from the World Bank, and health statistics from the World Health Organization (WHO). The data was used to support the qualitative analysis and provide a factual basis for the discussion.

Analysis

The collected data and literature were analyzed using thematic analysis to identify key themes and trends. The analysis focused on understanding the direct and indirect impacts of climate change on Pakistan's environment, economy, and society. Comparative analysis with other developing countries was also conducted to highlight unique challenges and opportunities for Pakistan. The findings were synthesized to provide an integrated perspective on the issue and inform recommendations for policy and practice.

Limitations

The study acknowledges certain limitations, including the reliance on secondary data, which may have inherent biases. Additionally, the rapidly evolving nature of climate change impacts means that some data may become outdated. Efforts were made to include the most recent and relevant information available at the time of the study.

Literature Review

Global Context of Climate Change

Climate change is a global phenomenon with profound impacts on natural and human systems. According to the IPCC, the Earth's average surface temperature has increased by approximately 1.5°C since the late 19th century **[5]**, with significant implications for weather patterns, sea levels,

and biodiversity. Developing countries, due to their geographic and socio-economic vulnerabilities, are disproportionately affected by these changes.

Environmental Impacts in Pakistan

Pakistan's environmental landscape is highly susceptible to climate change. The country has experienced a notable rise in average temperatures, with studies indicating a 0.6°C increase over the past century **[6]**. This rise has contributed to intensified heatwaves and altered precipitation patterns. Glacial retreat in the Himalayas and Hindu Kush regions **[7]**, which are crucial sources of water for the Indus River, poses a severe threat to water security. Reports indicate that glaciers in these regions are melting at an alarming rate, reducing the flow of water into the river system, which is vital for agriculture and drinking water.

Economic Impacts in Pakistan

The economic impacts of climate change in Pakistan are profound, particularly in the agricultural sector. Agriculture, which employs a significant portion of the population and contributes substantially to the GDP, is highly sensitive to climate variability. Changes in temperature and precipitation have resulted in reduced crop yields, threatening food security. For example, wheat and rice, the staple crops, are projected to see yield reductions of 10-30% by 2050 due to climate change **[8]**.

Furthermore, climate-induced disasters such as floods and droughts have substantial economic costs. The 2022 floods, which were among the worst in Pakistan's history, caused extensive damage to infrastructure, agriculture, and homes, resulting in economic losses estimated at $30 billion. Such events not only strain the economy but also push vulnerable communities further into poverty.

The energy sector is also affected, with hydropower production being particularly vulnerable to changes in water availability. Hydropower constitutes about 27% of Pakistan's energy mix **[9]**, and fluctuations in river flow due to glacial melt and altered rainfall patterns can disrupt electricity production, impacting industries and households.

Social Impacts in Pakistan

The social impacts of climate change in Pakistan are equally significant. Health is a major concern, with rising temperatures contributing to the increased prevalence of vector-borne diseases such as malaria and dengue fever. The WHO reports a notable rise in these diseases, linked to changing climate conditions that favor the breeding of vectors.

Climate-induced displacement is another critical issue. Extreme weather events such as floods and droughts force communities to migrate **[10]**, leading to urban overcrowding and increased pressure on social services. The internal displacement exacerbates existing social inequalities, with marginalized groups bearing the brunt of climate impacts.

Education and livelihood opportunities are also affected. Schools are often disrupted during extreme weather events, affecting children's education. Agricultural workers, who form a significant portion of the workforce, face uncertain employment prospects due to the impact of climate change on crop yields.

Government and International Response

The Pakistani government has recognized the urgency of addressing climate change and has initiated various policies and programs aimed at mitigation and adaptation. The National Climate Change Policy (NCCP) and the National Disaster Risk Management Framework (NDRMF) provide strategic direction for addressing climate-related issues. Reforestation projects like the Billion Tree Tsunami are aimed at enhancing environmental resilience.

International cooperation is crucial for supporting Pakistan's climate change initiatives. Financial and technical assistance from international organizations, such as the Green Climate Fund (GCF) and the UNDP, has been instrumental in building local capacities and implementing climate adaptation projects. Collaborative efforts are essential for developing sustainable solutions and sharing best practices.

Analysis

Vulnerability and Adaptation

Pakistan's vulnerability to climate change is evident in its geographic and socio-economic conditions. The country's high population growth, widespread poverty, and limited institutional capacity exacerbate its susceptibility to climate impacts **[11]**. The adaptive capacity is further hindered by insufficient infrastructure, lack of public awareness, and inadequate policy implementation.

Government Initiatives

The Pakistani government has undertaken several initiatives to address climate change. The National Climate Change Policy (NCCP), established in 2012, provides a comprehensive framework for climate action. The policy emphasizes the need for integrating climate change considerations into

national planning and development processes. It addresses various sectors, including water resources, agriculture, forestry, coastal areas, and biodiversity **[12]**.

The Billion Tree Tsunami

A notable initiative is the Billion Tree Tsunami project, launched in Khyber Pakhtunkhwa province. This large-scale reforestation effort aimed to combat deforestation, soil erosion, and loss of biodiversity by planting one billion trees. By 2018, the project had exceeded its target, significantly contributing to carbon sequestration and environmental restoration **[13]**. The success of this project has led to its expansion at the national level under the "10 Billion Tree Tsunami" initiative.

International Support and Collaboration

International support and collaboration are vital for enhancing Pakistan's capacity to combat climate change. The Green Climate Fund (GCF) has approved several projects in Pakistan, focusing on enhancing water security, promoting renewable energy, and improving disaster resilience **[14]**. These projects aim to strengthen the country's adaptive capacity and reduce greenhouse gas emissions.

The UNDP has been actively involved in supporting various climate-related projects in Pakistan. These include initiatives on disaster risk reduction, sustainable land management, and capacity building for climate resilience. The UNDP's efforts align with Pakistan's national priorities and international commitments, providing crucial technical and financial support.

Facts and Figures

Temperature Rise: Pakistan has experienced a 0.6°C increase in average temperature over the past century, leading to intensified heatwaves and changing precipitation patterns.

Glacial Melt: Glaciers in the Himalayas and Hindu Kush are retreating at an alarming rate, affecting the Indus River system, which provides water to over 200 million people.

Flooding: The 2022 floods affected over 33 million people, caused approximately 1,800 deaths, and resulted in economic losses estimated at $30 billion.

Agriculture: Climate change is projected to reduce the yield of major crops like wheat and rice by 10-30% by 2050, threatening food security.

Energy Sector: Hydropower, which constitutes about 27% of Pakistan's energy mix, is vulnerable to changes in water flow due to glacial melt and altered rainfall patterns.

Health: The incidence of vector-borne diseases, such as malaria and dengue, has increased, with climate change being a significant contributing factor.

Conclusion

Climate change poses a significant threat to developing countries, with Pakistan exemplifying the severe and multifaceted impacts. The country faces environmental, economic, and social challenges exacerbated by climate change, necessitating comprehensive and coordinated efforts to build resilience. While significant steps have been taken by the government and international community, further action is required to strengthen adaptive capacities and mitigate risks. Enhancing public awareness, improving infrastructure, and ensuring effective policy implementation are critical for Pakistan to navigate the challenges of climate change and safeguard its future.

Addressing climate change in Pakistan demands a multi-dimensional approach involving robust policy frameworks, sustainable development practices, and active international collaboration. By prioritizing climate resilience, Pakistan can better manage its vulnerabilities and work towards a more sustainable and secure future. This includes leveraging technology and innovation, improving governance structures, and fostering community engagement. As climate change continues to evolve, Pakistan must remain proactive in its efforts to adapt and mitigate its impacts, ensuring a resilient and prosperous future for its people.

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