31 WHITE PAPERS ON
27 CITIES AND TOWNS

PAKISTAN'S CLIMATE VULNERABILITIES

A COMPREHENSIVE YOUTH-LED ANALYSIS

Compiled by: Mujtaba Baig

Climate Action Skills

Table of Contents

Preface

This comprehensive compendium brings together a gist of a series of 31 insightful white papers on climate change, each focused on the specific challenges and potential solutions for various 27 towns and cities across Pakistan. What distinguishes these analyses is their origin: they are the result of dedicated work undertaken by the participants of our 60-Hour Online Training on Climate Activism.

This intensive training program was conducted free of cost by Climate Action Skills, an online climate change academy committed to empowering youth to combat the urgent crisis of climate change. Our academy firmly believes in the crucial role that informed and engaged young people play in shaping a sustainable future. This training was designed to equip the next generation of climate leaders with the knowledge and skills necessary to understand, analyze, and propose effective responses to the climate challenges facing their local communities.

The authors of the white papers contained within this compendium are all graduates and post-graduates, aged between 22 and 30. Number of marks obtained out of total marks is mentioned against each author's name. Their diverse academic backgrounds and shared passion for environmental stewardship have culminated in these detailed assessments. Each paper represents a significant effort to understand the unique climate vulnerabilities of their chosen city or town, to identify the key challenges hindering effective action, and to propose context-specific adaptation and mitigation strategies.

Through their research and analysis, these young scholars have delved into a range of critical issues, from the impacts of rising temperatures and erratic rainfall to the threats posed by glacial melt and sea-level rise. They have explored the challenges arising from rapid urbanization, inadequate infrastructure, and the complexities of governance and public awareness. Moreover, they have put forward thoughtful and actionable recommendations spanning sustainable agriculture, renewable energy adoption, industrial reforms, afforestation, and public engagement.

This compendium stands as a testament to the dedication and intellectual capacity of these young individuals. Their contributions provide valuable local insights that are essential for formulating effective national and regional climate strategies. We hope that this collection will serve as a vital resource for policymakers, researchers, community leaders, and anyone committed to building a climate-resilient Pakistan. The energy and commitment of these young authors offer a beacon of hope in the face of a global challenge, demonstrating the power of education and youth empowerment in driving meaningful change.

Mujtaba Baig
Editor of this Report &
Founder, Climate Action Skills
climateactionskills@gmail.com

Expert Review

It has been my privilege to review the white papers addressing climate change across Pakistan. I commend the authors for their dedication and the use of data and real-world examples to highlight these critical issues. The focus on adaptation strategies and local contexts is particularly valuable.

However, several areas for improvement have emerged. Firstly, more quantitative data, especially regarding adaptation capacities, emissions, economic impacts, and future projections, would enhance the precision of the analyses. Secondly, detailed, sector-specific emissions breakdowns are needed for targeted mitigation strategies. Thirdly, a deeper exploration of economic dimensions, including financial constraints, would add valuable depth.

Furthermore, clearer implementation strategies for policy recommendations are necessary. More comprehensive future climate projections would provide a clearer picture of potential impacts. A more thorough consideration of biodiversity and ecological impacts would strengthen the analyses. Expanding explanations and incorporating more data would enhance clarity and completeness. In regions with elevated terrain, a deeper exploration of water resource management is warranted. Finally, a more profound inquiry into barriers to public understanding and engagement would be beneficial.

While the papers demonstrate a strong grasp of the challenges, addressing these areas will refine the analyses and amplify their effectiveness. Authors' dedication to this vital work is acknowledged, and these perspectives are offered constructively.

Neehar Rasool
Reviewer of White Papers &
Environmentalist

Executive Summary

Climate Change Impacts and Responses Across Pakistan

This compendium presents the most vital information of a collection of 31 white papers detailing the multifaceted impacts of climate change on various towns and cities across Pakistan. Prepared by participants under the "60-Hour Online Training on Climate Activism" conducted by Climate Action Skills, these briefs highlight the specific climate issues, challenges, adaptation and mitigation measures, and suggestions relevant to each region. This summary provides an overview of the key findings and recurring themes identified in these local assessments, underscoring the widespread vulnerability and the urgent need for comprehensive climate action across the nation.

Observed Climate Change Impacts Across Pakistan

A consistent observation across the white papers is the **increasing trend in average temperatures**, with many regions reporting a rise over the past few decades and projections of further increases by 2050. This warming trend is exacerbating **heatwaves**, leading to health issues and impacting agricultural productivity. Furthermore, **rainfall patterns have become increasingly erratic**, characterized by periods of intense rainfall causing **urban and riverine flooding** often due to inadequate drainage infrastructure, interspersed with **prolonged dry spells and droughts** leading to water scarcity, particularly impacting agriculture. Coastal cities like Karachi face the additional threat of **sea-level rise**, increasing flood risks and degrading agricultural land. In mountainous regions such as Hunza and Baltistan, **faster melting of glaciers** is affecting water supply and escalating the risk of **glacial lake outburst floods (GLOFs)**. Changes in precipitation are also leading to increased landslides and soil erosion in vulnerable areas.

5 most common impacts of climate change on 27 cities and towns in Pakistan

Rank	Climate Change Impact	Number of Cities/Towns Affected
1	Increasing average temperatures and heatwaves	26
2	Erratic rainfall and urban flooding	21
3	Water scarcity and droughts	18
4	Impacts on agriculture (reduced crop yields)	17
5	Increased risk of Glacial Lake Outburst Floods (GLOFs)	4

Key Challenges in Addressing Climate Change

The papers collectively highlight several common challenges hindering effective climate action across Pakistan. **Rapid urbanization and population growth** place immense pressure on infrastructure and natural resources, exacerbating climate vulnerabilities. **Inadequate infrastructure**, particularly drainage systems and water management facilities, is a recurring issue, leading to increased flooding and water scarcity. **Financial constraints** and limited budget allocations often restrict the implementation of large-scale adaptation and mitigation projects. **Low public awareness** about climate risks and the importance of adaptation measures is another significant barrier to community engagement and effective action. **Weak governance, policy implementation gaps, and insufficient inter-departmental coordination** also impede comprehensive climate adaptation efforts. Socio-economic factors like **poverty and economic inequality** increase vulnerability and limit access to resources for adaptation.

Adaptation Strategies Being Implemented

Despite the challenges, various regions across Pakistan are undertaking adaptation measures to build resilience. **Sustainable agriculture practices** are being promoted, including precision farming, organic farming, agroforestry, and the cultivation of drought-resistant

crops. **Water management strategies** include rainwater harvesting, efficient irrigation techniques (drip and sprinkler), construction of water reservoirs, and reviving traditional water management systems. **Renewable energy adoption**, particularly solar power, is being explored and implemented in some areas to reduce reliance on fossil fuels. **Afforestation and reforestation efforts**, including tree plantation drives and urban green spaces, are being undertaken to increase green cover and mitigate the urban heat island effect. The establishment of **early warning systems** for floods and GLOFs, along with heatwave preparedness measures like cooling shelters, are also being implemented. Community-based disaster risk management plans and public awareness campaigns on climate resilience are also gaining traction. But the pace of all these steps is slower than required pace leaving a long gap between actions being taken and that which need to be taken.

Mitigation Strategies and Greenhouse Gas Emission Sources

They identify key sources of greenhouse gas (GHG) emissions across the various districts. The **transportation sector**, often relying on fossil fuel-powered vehicles, is frequently cited as a major contributor. **Agriculture**, particularly livestock farming (methane emissions), traditional farming practices, and fertilizer use (nitrous oxide), is another significant source. **Industrial sectors**, including textiles, food processing, brick kilns, and mining, contribute through fossil fuel combustion and process emissions. **Waste management**, including open landfills and burning, releases methane and carbon dioxide. The **energy sector**, especially reliance on fossil fuel-based power plants and inefficient fuel combustion, is also a major emitter.

Mitigation strategies proposed include a **shift towards renewable energy sources** like solar and wind power. Implementing **stricter industrial emission controls** and promoting cleaner production technologies are also recommended. Promoting **sustainable agricultural practices** to reduce methane and nitrous oxide emissions, such as alternatives to crop residue burning and improved livestock management, is highlighted. Improving **waste management systems** through recycling, composting, and capturing landfill gas are also key mitigation measures. Encouraging the use of **public transport and electric vehicles** is frequently suggested to reduce emissions from the transportation sector. Enhancing **green**

spaces in urban areas through afforestation and developing parks is also seen as a way to absorb pollutants.

Recommendations and the Way Forward

A recurring recommendation across the papers is the need to **develop comprehensive climate action plans** at the district and city levels, outlining specific targets for emission reduction, enhancing resilience, and promoting sustainable development. **Strengthening environmental regulations** and ensuring their strict enforcement are crucial for reducing the environmental impact of industries and other sectors. **Promoting investments in renewable energy projects** by providing incentives and reducing reliance on fossil fuels is consistently highlighted. **Enhancing water management practices** through rainwater harvesting, drip irrigation, and addressing water losses is deemed essential for addressing water scarcity and improving agricultural productivity. **Fostering public-private partnerships** and encouraging collaboration among government, businesses, civil society, and citizens are seen as vital for effective implementation of climate initiatives. **Raising public awareness and education** through community engagement, school programs, and media campaigns is crucial for fostering a sense of responsibility and promoting sustainable practices. **Strengthening disaster risk management** through improved early warning systems and resilient infrastructure is also a key recommendation. **Monitoring and evaluating progress** towards climate goals and ensuring accountability are essential for effective climate governance.

Conclusion

They paint a clear picture of widespread climate vulnerabilities across Pakistan, with rising temperatures, erratic rainfall, and increasing extreme weather events already impacting various sectors and communities. While local adaptation efforts are underway, significant challenges persist, requiring urgent and concerted action. The recommendations consistently emphasize the need for **strong political leadership, effective governance, active community participation, responsible businesses, and international collaboration** to implement comprehensive adaptation and mitigation strategies. **Without proactive and sustainable measures, Pakistan faces worsening environmental conditions, public health**

crises, and infrastructure breakdowns. This compendium serves as a crucial resource for understanding the local nuances of climate change impacts and for guiding the development and implementation of effective climate policies and actions across the nation.

Hafizabad: Climate Impacts, Mitigation Strategies

Muhammad Irfan (Marks obtained: 149/Total Marks: 150)

District Hafizabad, located in Punjab, Pakistan, faces increasing adverse impacts of climate change due to its reliance on agriculture and a growing industrial sector. This White Paper highlights the main climate issues, challenges, adaptation and mitigation measures, and suggestions to manage these impacts.

Climate models project that these trends will continue, with average temperatures expected to rise by **1.5°C to 2.5°C by 2050**, potentially exacerbating heatwaves and reducing agricultural yields. Future rainfall is projected to be more **erratic**, with increased frequency and intensity of extreme weather events like heavy rainfall and droughts, potentially leading to more frequent flooding and water scarcity.

Main Climate Issues

Hafizabad experiences a **semi-arid climate** characterized by hot summers and mild winters, with most rainfall during the monsoon season (July-September).

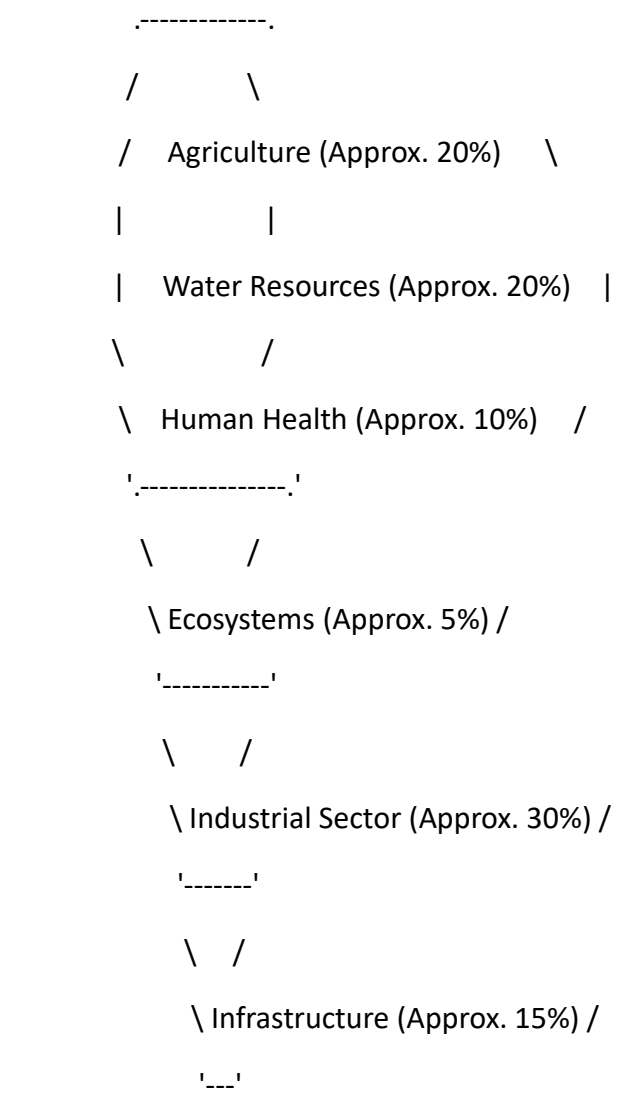
However, historical climate trends indicate a **gradual increase in average temperatures**, with hotter summers (often exceeding 40°C) and milder winters. Rainfall patterns have become **increasingly unpredictable**, featuring periods of intense rainfall followed by prolonged dry spells, leading to challenges in water management and agricultural planning.

Climate models project that these trends will continue, with average temperatures expected to rise by **1.5°C to 2.5°C by 2050**, potentially exacerbating heatwaves and reducing agricultural yields.

Future rainfall is projected to be more **erratic**, with increased frequency and intensity of extreme weather events like heavy rainfall and droughts, potentially leading to more frequent flooding and water scarcity.

Challenges

Climate Change Challenges in District Hafizabad



These climate change impacts pose significant challenges for Hafizabad, particularly in the following areas:

- **Agriculture:** Erratic rainfall and rising temperatures can negatively impact crop yields and water availability for irrigation.
- **Water Resources:** Increased variability in rainfall can lead to both flooding and water scarcity issues, affecting agriculture, industry, and domestic use. The extraction of groundwater for industrial use is already contributing to declining water tables.
- **Human Health:** Rising temperatures can exacerbate heat stress.
- **Ecosystems:** Changing climate patterns can impact local ecosystems.
- **Industrial Sector:** Industries, particularly textiles and food processing, are significant contributors to carbon emissions, water usage, and waste generation, further exacerbating environmental challenges. Small-scale industries often lack resources for sustainable practices.
- **Infrastructure:** Increased frequency of extreme weather events like floods can damage infrastructure.

Adaptation and Mitigation Measures

The white paper outlines several adaptation and mitigation strategies for District Hafizabad:

- **Sustainable Agriculture Practices:**
  - **Precision Farming:** Optimizing fertilizer and water use through technologies like GPS-guided equipment and soil sensors.
  - **Organic Farming:** Reducing reliance on synthetic fertilizers and pesticides.
  - **Agroforestry:** Integrating trees into agricultural landscapes.
- **Renewable Energy Adoption:**
  - **Solar Energy:** Utilizing the ample sunlight for solar power projects.
  - **Wind Energy:** Exploring the potential of small-scale wind turbines, particularly in rural areas.
  - **Energy Efficiency:** Improving energy efficiency in industries, transportation, and residential buildings.
- **Industrial Reforms**
  - **Cleaner Production Technologies:** Adopting technologies that minimize waste and emissions.
  - **Green Certification:** Encouraging industries to obtain certifications like ISO 14001.
  - **Waste Management:** Implementing effective systems for recycling and proper disposal of industrial waste.
- **Afforestation and Reforestation**
  - **Tree Plantation Drives:** Increasing forest cover by planting native tree species.
  - **Urban Green Spaces:** Developing parks and green belts to mitigate the urban heat island effect.
- **Public Awareness and Education**
  - **Community Engagement:** Involving local communities in climate change initiatives.
  - **School Programs:** Integrating climate change education into school curricula.
  - **Media Campaigns:** Utilizing local media to disseminate information about climate change and mitigation strategies.

Suggestions to Manage Climate Change

The white paper provides the following recommendations for effectively managing climate change in District Hafizabad:

- **Develop a Comprehensive Climate Action Plan:** This plan should outline specific targets for reducing carbon emissions, enhancing resilience, and promoting sustainable development.
- **Strengthen Environmental Regulations:** Enforcing compliance with stronger

regulations can reduce the environmental impact of industries.

- **Promote Renewable Energy Investments:** Providing incentives for solar and wind energy projects can reduce reliance on fossil fuels.
- **Enhance Water Management Practices:** Implementing rainwater harvesting and drip irrigation can address water scarcity and improve agricultural productivity.
- **Support Research and Development:** Investing in research to find innovative solutions for climate change mitigation and adaptation.
- **Foster Public-Private Partnerships:** Encouraging collaboration between government and private sectors to implement climate initiatives effectively

***About the author**: Muhammad Irfan, MPhil Gender Studies, drives community engagement in Punjab's PULSE Project. From Jhang, with experience in Hafizabad, he excels in gender advocacy and governance. Passionate about social change, he champions climate action alongside gender equality, fostering stakeholder collaboration for impactful solutions.*

- **Monitor and Evaluate Progress**

  Establishing a framework to track progress towards climate goals and ensure accountability.

  By implementing these measures and fostering a collective effort among all stakeholders, District Hafizabad can strive towards a more sustainable and climate-resilient future.

Hunza: Glaciers Melting, Future Threatened

Safia Kulsoom (Marks obtained: 135/Out of: 150)

Hunza, a geographically significant and ecologically rich valley in Pakistan's Gilgit-Baltistan area, faces **serious threats from climate warming**, impacting its agriculture and water availability. This White Paper (WP) focuses on the climate change issues, challenges, adaptation, and mitigation measures along with suggestions for addressing these pressing concerns.

Key impacts

1) It highlights several **key impacts of climate change** in Hunza. **Rising temperatures**, with an increase of 1.5°C since 1980 and a projected rise of 2.5°C by 2050, are causing **faster melting of glaciers**, affecting water supply and escalating the risk of glacial lake outburst floods (GLOFs). Changes in precipitation patterns are leading to **more intense rainfall, resulting in frequent landslides and floods**, while reduced snowfall negatively impacts glaciers, the primary source of water for agriculture and domestic use. The increased frequency of **extreme weather events**, particularly GLOFs, damages infrastructure and farmland. The agricultural sector is significantly affected, with **wheat production falling by 20% due to changing weather and shorter growing seasons**, threatening food security. Furthermore, increased dust and pollution are contributing to a rise in respiratory diseases, and rising temperatures may lead to more heat-related health issues.

Major Challenges

Hunza faces several **challenges** exacerbated by climate change. The region's heavy dependence on natural resources and seasonal conditions makes its economy vulnerable. **Glacier melting reduces water availability** crucial for agriculture and daily life. **Deforestation and overgrazing contribute to soil erosion**, reducing soil fertility and increasing landslide risks. Climate change also threatens the **tourism sector**, a significant contributor to the local economy,

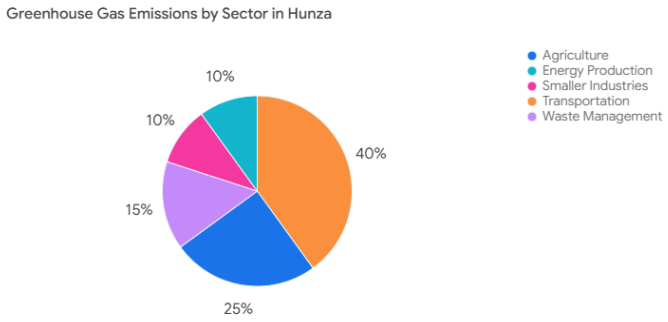
through extreme weather events like GLOFs that can damage infrastructure. The existing **energy crisis**, with reliance on hydropower leading to winter shortages, is compounded by climate-related uncertainties in water flow.

Adaptation Measures

Despite these challenges, Hunza has undertaken several **adaptation measures**. An **early warning system for GLOFs** has been implemented to detect and alert communities. **Reforestation programs** are ongoing to combat deforestation and enhance carbon sequestration. Pilot projects are testing **climate-resilient crops** to support sustainable agriculture. Plans are in place to pursue **renewable energy expansion** through solar and hydropower projects to reduce reliance on fossil fuels. These strategies aim to build resilience against climate risks, ensure food security, and promote environmental sustainability.

Mitigation Steps

In terms of **mitigation**, the White Paper identifies key **sources of greenhouse gas emissions** in Hunza. The **transportation sector is the largest contributor (40%)** due to the increasing use of fossil fuel-powered vehicles and limited public transport options. **Agriculture accounts for 25% of emissions**, primarily from livestock (methane) and traditional farming practices. **Waste management (15%)** contributes through methane emissions from open landfills. Smaller industries and energy production, often relying on inefficient fuel combustion and diesel generators, contribute 10% each. To mitigate these emissions, the WP suggests a **shift towards renewable energy**, sustainable agricultural practices, improved waste management (recycling and composting), and promoting public transport and electric vehicles.



Solutions and Recommendations

The WP provides several **solutions and recommendations** involving various stakeholders. **Political leadership** should develop a climate action plan, strengthen disaster risk management, and incentivize green initiatives. **Government authorities** need to invest in renewable energy, improve transportation infrastructure to minimize emissions, and enforce environmental

regulations. **Civil society and the media** should launch awareness campaigns on sustainable practices and promote ecotourism and community-led conservation.

Rising temperatures, with an increase of 1.5°C since 1980 and a projected rise of 2.5°C by 2050, are causing faster melting of glaciers, affecting water supply and escalating the risk of glacial lake outburst floods (GLOFs).

Businesses are encouraged to support sustainable agriculture, minimize plastic waste, and adopt corporate social responsibility focused on environmental sustainability. Finally, **citizens** should participate in conservation programs, reduce energy and water consumption, recycle, and avoid single-use plastics. An **expanded climate action plan** with specific timeframes includes large-scale reforestation, solar energy deployment, and disaster resilience training.

Conclusion

In conclusion, Hunza is significantly impacted by climate change, facing challenges related to water scarcity, natural disasters, and economic vulnerabilities. While community-driven adaptation strategies are underway, long-term climate resilience requires collaborative efforts from all stakeholders. Implementing a well-structured climate action plan, focusing on renewable energy, disaster preparedness, sustainable agriculture, and improved waste management, is crucial for mitigating the negative impacts of climate change and ensuring a sustainable future for the region. Strong political leadership, policy reforms, and active community engagement will be vital for this transformation, allowing Hunza to balance economic growth with environmental protection.

About the author: *Safia Kulsum, from Hunza, holds a BSc in Environmental Sciences. A climate leader, she's Provincial Youth Leader at YLCC Pakistan and a Global Green Forum Ambassador. Experienced with GLOF projects at the Ministry of Climate Change and ICIMOD, she focuses on community resilience and environmental advocacy.*

Karachi's Climate Crisis: Impacts and Actions

Yasir Hussain Abbasi (Marks obtained: 134/Out of:150)

The devastating 2015 heatwave, with temperatures soaring above 40°C (104°F), resulted in over 1,300 deaths in Karachi, highlighting the intensification due to the urban heat island effect from rapid urbanization and limited green spaces.

Karachi, Pakistan's largest and most populous city, faces significant climate change issues and challenges that demand urgent attention and comprehensive action. Rising temperatures, erratic rainfall, and coastal threats are increasingly impacting the city and its inhabitants.

Climate Change Impacts

- **Rising Temperatures and Heatwaves:** Karachi has experienced a steady increase in temperature trends between 1989 and 2024, contributing to severe climate-related challenges. The devastating 2015 heatwave, with temperatures soaring above 40°C (104°F), resulted in over 1,300 deaths, highlighting the intensification due to the urban heat island effect from rapid urbanization and limited green spaces. Forecasts suggest continued temperature rises, posing greater risks to coastal communities.
- **Heavy Rains and Urban Flooding:** Record-breaking monsoon rainfall in July and August 2022 submerged large parts of Karachi, disrupting daily life due to poor drainage and outdated infrastructure. The unprecedented flooding in August 2020, during two spells, caused extensive damage and socio-economic disruption, exacerbated by inadequate drainage. Meteorological analysis revealed pronounced convective instability and cyclonic circulations as contributing factors to these extreme rainfall events.
- **Sea Level Rise (SLR):** As a coastal city, Karachi is vulnerable to SLR driven by

anthropogenic global warming. The Indus Delta, near Karachi, faces heightened flood risks, degradation of agricultural land, and displacement due to SLR. Projections indicate continued SLR with potentially dramatic elevations by 2100.

- **Impacts on Human Health:** Climate change alters precipitation and temperature patterns, impacting water quality and public health in Karachi. Increased rainfall and flooding transport contaminants into water sources, while poor drainage and untreated wastewater further degrade water quality. Rising temperatures accelerate microbial growth, increasing the risk of waterborne diseases like cholera, typhoid, and hepatitis A. Studies show that pH, TDS, fluoride, chloride, HCO3, sodium, and hardness levels in Karachi's water sources exceed safe limits, with contamination often being human-induced due to improper waste disposal.
- **Impacts on Ecosystems:** Rising sea temperatures have led to coral bleaching, affecting marine biodiversity. Sea-level rise contributes to coastal erosion and habitat loss, threatening ecosystems. Pollution from untreated wastewater in urban water bodies like Chinna Creek and Boat Basin degrades natural flora and fauna, posing risks to marine life. Mangrove forests, vital for coastal protection, have been impacted by land reclamation, although rehabilitation efforts are underway.

Challenges

- Rapid urbanization strains the city's infrastructure and resources.
- Poor urban planning and inadequate drainage systems exacerbate flooding.
- Severe air, water, and plastic pollution damage the environment and public health.
- Governance inefficiencies hinder comprehensive climate adaptation efforts.
- Economic inequality limits access to resources and widens the gap between social classes, increasing vulnerability.
- Frequent power shortages affect industries and daily life.

Adaptation Measures

- Upgrading drainage systems is a key focus to mitigate urban flooding.
- Heatwave preparedness has improved with cooling shelters and early warning systems.
- Afforestation efforts aim to counter the urban heat island effect and increase green cover.
- Mangrove restoration acts as a natural barrier against storm surges and coastal erosion.
- Advocacy for stricter zoning laws and sustainable urban planning is increasing.
- Public awareness campaigns emphasize climate resilience.

Mitigation Measures and Suggestions

- Implement strong green rules and regulations with clear goals to cut pollution and promote green transportation.
- Invest in renewable energy and better disaster plans.
- Improve drainage, build more parks, and ensure buildings can handle extreme weather.
- Encourage solar power and expand public transport.
- Fix the city's trash problem and implement stronger emission control measures.
- Community groups should spread awareness, organize tree plantings, and work with universities for local solutions.
- Businesses need to adopt eco-friendly methods and invest in sustainable development.
- Increase urban green cover by 20% within five years and implement cool pavements and reflective roofs.
- Reduce water losses by 15% and increase rainwater harvesting by 25%.
- Upgrade drainage to handle 100-year floods and expand mangrove cover by 10%.
- Increase renewable energy to 20% and reduce private vehicle use by 15%.

- Conduct annual climate awareness campaigns reaching 50% of the population.
- Establish monitoring systems for tracking progress and strengthen collaboration among government and stakeholders.
- Secure financial resources for project implementation and ensure solutions benefit all communities.

Conclusion

Karachi's climate challenges are critical and require immediate and decisive action. A multi-pronged approach involving strong leadership, good governance, active community involvement, responsible businesses, and international collaboration is essential to build a sustainable and climate-resilient future for the city. Without proactive and sustainable measures, Karachi faces worsening environmental conditions, public health crises, and infrastructure breakdowns.

***About the author**: Yasir Hussain Abbasi is M.Phil Environmental Science student at SMIU, focusing on sustainability and climate change. He has been FAO livestock emergency responder in Sindh, aiding flood-hit areas and associate at Laar Humanitarian Development Program, coordinating flood relief in Qamber Shahdadkot. Passionate about ecological conservation and humanitarian impact.*

Islamabad: Towards a Climate-Resilient Future

Tawseef Khan (Marks obtained: 134/Out of: 150)

Islamabad, despite its initial design as a green city, is facing increasing vulnerability to the impacts of climate change. This White Paper highlights the key climate change issues affecting the capital, the challenges in addressing them, existing and potential adaptation and mitigation measures, and offers suggestions for a more resilient future.

Climate Change Issues

Rapid urbanization has led to a **loss of nearly 10% of tree cover** between 2000 and 2023 in Islamabad, contributing to rising carbon emissions, decreased air quality, and increased soil erosion. Wildfires have also contributed to forest loss, with over 300 acres lost in the past year alone.

Islamabad is experiencing several significant climate change issues:

- **Rising Temperatures and Heatwaves:** The average temperature has increased by approximately 1.5°C in the last two decades, leading to more frequent and intense heatwaves, exacerbated by the **urban heat island effect**. In mid-2024, temperatures soared above 45°C.
- **Erratic Rainfall and Urban Flooding:** Changing climate patterns have resulted in unpredictable monsoon seasons with increased rainfall intensity, overwhelming the existing stormwater drainage system and causing frequent **flash floods**. In 2023, the city received 35% more rainfall than average.
- **Deforestation and Loss of Green Cover:** Rapid urbanization has led to a **loss of nearly 10% of tree cover** between 2000 and 2023, contributing to rising carbon emissions, decreased air quality, and increased soil erosion. Wildfires have also contributed to forest loss, with over 300 acres lost in the past year alone.
- **Declining Air Quality and Pollution:** Air quality is worsening, with the AQI frequently exceeding unhealthy levels, especially in winter. **Vehicular emissions, industrial activity, and**

construction dust are major contributors. The increasing number of vehicles, estimated at over 1 million in 2024, further exacerbates the problem.

Challenges

Addressing these climate change issues presents several challenges for Islamabad:

- **Rapid Urbanization and Population Growth:** As one of the fastest-growing urban centers, with a projected population of 1.3 million by 2025, the increasing demand for housing and infrastructure puts immense pressure on natural resources and green spaces.
- **Inadequate Infrastructure:** Existing infrastructure, particularly the stormwater drainage system, is often insufficient to cope with extreme weather events.
- **High Dependence on Private Vehicles:** Limited public transport options led to high vehicle ownership and increased carbon emissions.
- **Growing Energy Demand:** Increasing population and commercial activity have surged energy demand, with a significant reliance on fossil fuels.
- **Limited Integrated Planning:** The lack of an integrated water management plan contributes to periodic water shortages. Similarly, waste management remains a significant issue.
- **Financial and Political Constraints:** Limited budget allocations and inconsistent government policies can hinder the implementation of large-scale adaptation projects.
- **Low Public Awareness:** Many residents lack sufficient awareness of climate risks and the importance of adaptation measures.

Adaptation and Mitigation Measures

Islamabad has initiated several adaptation measures:

- **Urban Greening Initiatives:** Extensive tree plantation drives have aimed to

counteract deforestation and heatwaves.

- **Improved Flood Management Systems:** Upgrades to drainage infrastructure and the introduction of rainwater harvesting projects seek to manage excessive rainfall.
- **Renewable Energy Expansion:** Some public buildings and streetlights have transitioned to solar power.
- **Public Transport Development:** The expansion of the Islamabad Metrobus and initiatives promoting electric vehicles aim to reduce vehicle emissions.

Mitigation efforts are also underway, though further action is needed:

- Promoting the use of public transport and electric vehicles to reduce emissions from the **transportation sector**, a major contributor to GHG emissions.
- Expanding the adoption of **renewable energy sources** to decrease reliance on fossil fuels in the **energy consumption sector**.
- Efforts to prevent **deforestation** and protect existing green cover, which play a crucial role in carbon absorption.

Solutions and Recommendations

To build a climate-resilient future for Islamabad, the following actions are recommended:

- **Political Leadership:** Develop and implement comprehensive climate action plans with clear targets and allocate sufficient resources for mitigation and adaptation projects. Ensure consistent policy and strict enforcement of environmental laws.
- **Government Departments:** Strengthen urban planning regulations to protect green spaces and enhance resilience. Expand rainwater harvesting and improve stormwater drainage networks. Promote research and data collection on climate trends.
- **Civil Society:** Conduct grassroots environmental initiatives and advocate for stronger climate policies. Educate communities about sustainable living practices.
- **Media:** Raise public awareness about climate change and hold authorities accountable by highlighting both

successes and shortcomings of climate policies.

- **Businesses:** Adopt energy-efficient practices, invest in green technology, support sustainability through CSR, and develop green infrastructure solutions.
- **Citizens:** Adopt sustainable lifestyles, use public transport, participate in community initiatives, and keep demanding stronger action from policymakers.

Conclusion

Islamabad faces significant climate change challenges that necessitate urgent and collective action. By strengthening policy frameworks, increasing public awareness, and fostering community participation, Islamabad can mitigate climate risks and strive towards sustainable urban development in Pakistan.

***About the author**: Tawseef Khan, from Lower Dir, is the Islamabad-based Founder/CEO of the Progressive Climate Foundation (PCF). He also serves as a Master Facilitator for the British Council's PYLI Project. Passionate about climate action and youth development, he drives impactful change.*

Nowshera: Climate Vulnerability and Action

Sidra (Marks obtained: 134/Out of: 150)

Nowshera, located in the Khyber Pakhtunkhwa province of Pakistan, faces significant climate change issues, primarily due to its proximity to the Kabul and Indus rivers, making it highly susceptible to **riverine flooding**. Climate change in Nowshera has intensified monsoon patterns, leading to more frequent and severe flooding events. The catastrophic floods of 2010, with a peak discharge of approximately 221,000 cusecs, and the more recent floods in 2024 (114,200 cusecs) and August 2022 (around 400,000 cusecs) caused **extensive damage to infrastructure, agriculture, and displacement of communities**.

The catastrophic floods of 2010, with a peak discharge of approximately 221,000 cusecs, and the more recent floods in 2024 (114,200 cusecs) and August 2022 (around 400,000 cusecs) caused **extensive damage to infrastructure, agriculture, and displacement of communities**.

Beyond flooding, rising temperatures contribute to **heat-related illnesses**, and flooding events exacerbate the **spread of waterborne diseases** like malaria, dengue, and cholera. Climate change also leads to **shifts in biodiversity and degradation of habitats**, along with **disruptions to agriculture** through irregular rainfall and extreme weather, impacting food security. The 2022 floods nationwide affected thousands of people, highlighting Nowshera's vulnerability with significant displacement and health crises.

Adaptation Measures

Several **adaptation measures** have been implemented in response to these challenges. These include the construction of **flood protection infrastructure** like embankments and walls along the Kabul River, which helped mitigate some damage during the 2022 floods. **Community-based flood early warning systems (FEWS)** have been established to provide timely alerts and facilitate evacuations. Additionally, climate resilience projects, such as the $9.8 million Green Climate Fund initiative in 2024, aim to enhance early warning systems, improve anticipatory actions, and support livelihood diversification.

Gaps Persist

Despite these efforts, **adaptation gaps** persist. **Inadequate urban planning** and construction in flood-prone areas, coupled with **poorly maintained drainage systems**, exacerbate flood risks. **Limited community engagement and awareness** regarding flood risks hinder the effectiveness of early warning systems. Furthermore, **insufficient maintenance of flood protection structures** reduces their efficacy. **Financial constraints**, **political and institutional challenges** including lack of coordination, and **socioeconomic factors** such as poverty forcing residents to live in vulnerable areas contribute to the reasons for inaction.

GHG Emissions

Nowshera also contributes to **greenhouse gas (GHG) emissions** from various sectors, although it does not host coal-fired power plants. The **industrial sector**, including tobacco processing and textile mills, emits GHGs through fossil fuel combustion. The **transportation sector**, relying on fossil fuel-powered vehicles, is a significant contributor. **Agriculture**, particularly livestock farming (methane) and rice cultivation (methane), along with the use of synthetic fertilizers (nitrous oxide), is another major source. **Solid waste disposal** through landfills (methane) and open burning (carbon dioxide) also adds to the emissions.

Solutions and Recommendations

Addressing climate change in Nowshera requires a **multi-stakeholder approach** with defined responsibilities. **Political leadership** should develop and implement a Climate Resilience Action Plan with increased budget allocations and stronger environmental regulations. **Government departments**, such as Disaster Management Authorities, Agriculture & Irrigation Departments, and Urban Development Authorities, need to improve early warning systems, promote climate-smart agriculture, invest in public transport and cleaner energy, and implement

sustainable urban planning. **Civil society** plays a crucial role in conducting awareness campaigns, engaging communities in tree-planting and water management, and introducing climate change education. The **media** should raise public awareness, expose policy gaps, and promote climate success stories. **Businesses** are encouraged to adopt green energy, implement sustainable waste management, support community initiatives, and transition to eco-friendly practices.

***About the author**: Sidra, Agricultural Engineering graduate (UET Peshawar), passionate about climate action. Recent Climate Activism Training by Climate Action Skills fueled her dedication to environmental stewardship. Grateful for the invaluable knowledge gained.*

Finally, **citizens** need to adopt sustainable lifestyles, participate in community resilience projects, and advocate for better environmental policies.

.

Hangu's Climate Crisis: Challenges and Pathways

Shazia Ihsan (Marks obtained: 133/Out of: 150)

District Hangu in Khyber Pakhtunkhwa faces significant climate change vulnerabilities despite its minor contribution to greenhouse gas emissions. **Changing weather patterns, rising temperatures, and increased solid waste** are already exacerbating socio-economic challenges in the region. This White Paper (WP) highlights these critical issues and explores potential adaptation and mitigation strategies while acknowledging existing challenges.

> While not a major industrial center, Hangu contributes to greenhouse gas emissions through energy consumption (reliance on biomass and fossil fuels), transportation (rising use of inefficient vehicles), agriculture and livestock (methane emissions, chemical fertilizers), and waste management (open burning).

Impacts of Climate Change in Hangu

Climate change is manifesting acutely in several key sectors. Agriculture, the backbone of livelihoods due to Hangu's fertile soil, is severely affected by altered rainfall patterns, leading to the conversion of fertile land into barren land and a notable **decline in agricultural yields**. A 1% temperature increase can result in a 5% decrease in maize yields, and local farmers have reported 30-40% reductions in wheat and maize due to heat and water shortages.

Water scarcity is another critical challenge, with groundwater levels dropping by 2-3 meters in the last decade due to over-extraction and reduced rainfall. This forces communities to rely on expensive water tankers, imposing a heavy financial burden, especially on low-income families. Furthermore, altered rainfall patterns increase the risk of **flash floods**, damaging traditional mud houses and causing displacement. Public health is also impacted, with a reported increase in respiratory diseases due to the dry climate. The lack of sustainable infrastructure exacerbates vulnerability to floods, heatwaves, and droughts.

Local Adaptation Measures

Despite these challenges, some local adaptation measures are being implemented. These include **rainwater harvesting at the household and farm levels, afforestation**

initiatives led by the District Youth Organization, and a shift towards solar power in some communities. However, significant **adaptation gaps** remain. There is a **lack of large-scale water management infrastructure**, limited access for farmers to drought-resistant crops and modern irrigation techniques, and insufficient awareness of climate adaptation strategies among residents. Financial constraints further hinder the adoption of necessary measures by small-scale farmers and low-income households.

Mitigation Steps in Hangu

Mitigation efforts in Hangu are nascent but crucial. While not a major industrial center, Hangu contributes to greenhouse gas emissions through **energy consumption (reliance on biomass and fossil fuels), transportation (rising use of inefficient vehicles), agriculture and livestock (methane emissions, chemical fertilizers), and waste management (open burning)**. The paper emphasizes the potential of **nature-based solutions for climate resilience**. These include **reforestation and agroforestry** for carbon sequestration and improved soil moisture, **sustainable water management** through wetland restoration and rainwater harvesting, **soil conservation and regenerative agriculture** to improve soil health, and the development of **urban green spaces and climate-resilient infrastructure**.

Major Challenges

Addressing climate change in Hangu faces several **challenges**. These include **financial constraints due to limited government funding, a lack of policy implementation at the district level despite national policies, and limited coordination among different government departments**. The high poverty rate and low literacy levels further complicate efforts to implement sustainable practices and raise awareness.

Recommendations

The white paper provides several **recommendations** to enhance climate

resilience in Hangu. These include developing a **district-level climate action plan**, improving climate-resilient infrastructure, promoting renewable energy, engaging civil society and local communities through awareness campaigns and disaster preparedness initiatives, encouraging private sector investment in green businesses and microfinance for farmers, leveraging the role of media for public awareness, and fostering citizen engagement in sustainable lifestyles and community-led projects. The way forward emphasizes prioritizing sustainable water management, investing in climate-resilient farming, strengthening disaster preparedness, expanding community engagement, encouraging green business initiatives, and developing and enforcing a district-level climate action plan with support from provincial and national governments.

Conclusion

In conclusion, District Hangu is grappling with significant climate change impacts that threaten its agricultural economy, water security, infrastructure, and public health. While some adaptation measures are underway, substantial gaps and challenges related to funding, policy implementation, coordination, and awareness need to be addressed. Embracing nature-based solutions, fostering multi-stakeholder collaboration, and implementing comprehensive adaptation and mitigation strategies are crucial for building a sustainable and climate-resilient future for Hangu.

***About the author**: Shazia Ihsan, from Hangu, champions sustainability. With an M.Sc in Environmental Sciences, she excels in climate activism. She launched an awareness campaign, engaged youth in eco-projects, and advocates for policy change. She's establishing Eco Vision Hub, mentoring future environmental leaders.*

Peshawar's Climate Crisis: Challenges and Solutions

Maria Noor (Marks obtained: 133/Out of: 150)

Peshawar, a historically significant city in Khyber Pakhtunkhwa, Pakistan, faces escalating climate change issues and environmental challenges stemming from rapid urbanization and industrial growth. This White Paper will focus on the climate change problems and the adaptation and mitigation measures currently in place or proposed.

Population rise due to urbanization

Peshawar is grappling with significant environmental vulnerabilities, primarily driven by rapid urbanization. The city has experienced a substantial increase in population density, reaching approximately 4.3 million with about 3,135.6 people per square kilometer in 2023, and is projected to exceed 6 million by 2030 due to urbanization. This growth has led to the misuse of natural resources, insufficient infrastructure, increased vehicle emissions, and heightened pollution, exacerbating climate problems. Specifically, urban land coverage expanded significantly between 1990 and 2020, often replacing fertile agricultural land.

There is limited evidence of effective flood management implementation despite policy approval. While sustainable water management is emphasized in policy, specific actionable strategies are lacking. Similarly, despite acknowledging climate-related health risks, documented implementation measures to address heat-related illnesses and vector-borne diseases are insufficient.

Climate Change Impacts in Peshawar

The impacts of climate change are already evident in Peshawar. **Rising temperatures** and more frequent heatwaves have been observed. Changes in rainfall patterns include heavier monsoon rains and dry season droughts, leading to **urban flooding** due to poor drainage infrastructure. Furthermore, urbanization and pollution are causing **biodiversity loss** and **agricultural disruptions** due to erratic rainfall and higher temperatures, affecting crop yields.

These environmental changes are significantly impacting **human health**. Air pollution contributes to a substantial burden of disease and economic loss. Cases of respiratory diseases like Chronic Obstructive Pulmonary

Disease (COPD) and asthma have increased. Children and the elderly are particularly vulnerable to air pollution. Rising temperatures and erratic rainfall have also led to an increase in heat-related illnesses and vector-borne diseases like dengue and malaria.

Adaptation Measures

Despite these challenges, Peshawar has initiated some **adaptation measures**. These include reforestation efforts and water conservation programs. The **Climate Change Centre at the University of Agriculture, Peshawar** promotes climate education and research, focusing on adaptation strategies for local farmers. Climate Risk and Vulnerability Assessments (CRVAs) have been conducted to inform infrastructure planning. Additionally, the UNDP has organized training programs on developing Climate Change Adaptation Action Plans for government officials and community members.

Adaptation Gaps

However, **adaptation gaps** remain. There is limited evidence of effective flood management implementation despite policy approval. While sustainable water management is emphasized in policy, specific actionable strategies are lacking. Similarly, despite acknowledging climate-related health risks, documented implementation measures to address heat-related illnesses and vector-borne diseases are insufficient.

Cause of Climate Inaction

Several factors contribute to **reasons for inaction**. These include financial constraints in securing international climate finance, a lack of comprehensive political will to integrate climate change into broader planning, deficiencies in public awareness hindering community engagement, planning challenges in adequately incorporating climate resilience, and potential equity concerns in adaptation efforts as the needs of vulnerable populations are not detailed in policy.

GHG Emissions in Peshawar

Major greenhouse gas (GHG) emission sources in Peshawar include industries (brick kilns, marble, steel) releasing particulate matter and gaseous pollutants. Traditional brick kilns emit CO_2, methane, and black carbon. Unregulated vehicle emissions contribute CO, NO_x, and PM2.5. Agricultural practices like crop residue burning release CO_2, methane, and nitrous oxide. Unmanaged solid waste burning leads to methane and other hazardous pollutants. Household biomass burning emits CO, methane, and PM2.5. Finally, construction and road dust are significant sources of PM10 and PM2.5.

Solutions and Recommendations

The WP proposes several **solutions and recommendations** within a Climate Action Plan. These include targets for reducing carbon emissions and increasing green spaces. Actions involve expanding public transport, urban greenery, and sustainable infrastructure. **Urban green infrastructure** is proposed with a goal of planting 500,000 trees by 2026. **Flood management** strategies focus on upgrading drainage systems. **Water conservation** involves reducing wastage through various methods. **Air quality control** aims to reduce PM 2.5 levels through monitoring and stricter emission standards. **Renewable energy** adoption, targeting 20% electricity generation by 2030, is also recommended. Finally, **public health adaptation** focuses on reducing climate-related diseases through campaigns and improved healthcare infrastructure.

Conclusion

In conclusion, Peshawar faces serious climate and environmental challenges exacerbated by rapid urbanization and inadequate governance. Addressing these issues requires immediate and integrated action involving the government, private sector, and local communities. This includes stricter environmental regulations, sustainable urban planning, investment in green infrastructure, and enhanced climate adaptation strategies.

***About the author**: Maria Noor, from Peshawar, holds a BSc in Environmental Sciences. With WWF experience, she champions conservation. Noor aims to drive environmental sustainability and climate action through impactful research and policy contributions.*

Lahore's Climate Urgency: Challenges and Solutions

Muhammad Arish Saleem (Marks obtained: 131/Out of:150)

This white paper meticulously outlines the pressing climate change issues confronting Lahore, Pakistan's second-largest city. It highlights the **significant greenhouse gas emissions, particularly carbon dioxide, stemming from rapid urbanization, industrial activities, and increasing vehicular traffic**. The paper emphasizes that Lahore's rising average temperature and altered rainfall patterns have already triggered climate-related events like frequent floods and prolonged smog seasons, underscoring the city's extreme vulnerability to climate change.

Lahore also lacks a comprehensive real-time air quality monitoring system, impeding effective pollution management. The economic analysis reveals a decline in ecosystem service value due to urban expansion, impacting waste treatment, biodiversity, soil conservation, and climate regulation.

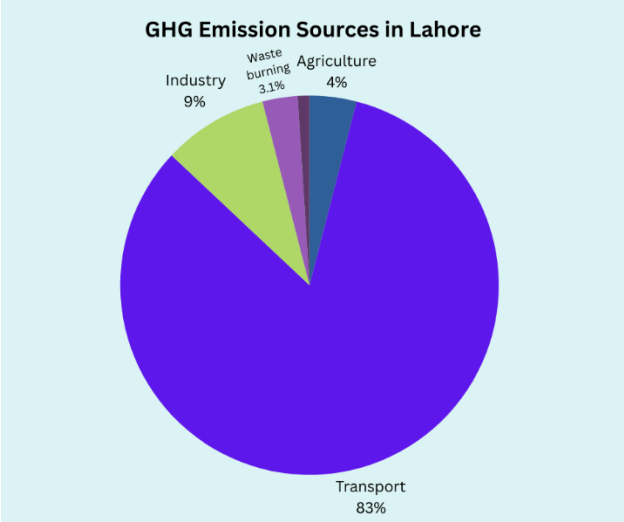
A breakdown of emission sources

Several critical challenges hinder effective climate action in Lahore. The **transport sector emerges as the biggest contributor to air pollution, accounting for 83% of emissions**, followed by industry (9%), agriculture (3.9%), and open waste burning (3.6%). The surge in registered vehicles, especially two-stroke engines, exacerbates the problem. Despite national and provincial climate change policies, the paper points out **challenges in implementation due to limited resources, inadequate infrastructure, and insufficient inter-departmental coordination**. Furthermore, **limited public awareness about climate change remains a concern**. Lahore also lacks a comprehensive real-time air quality monitoring system, impeding effective pollution management. The economic analysis reveals a decline in ecosystem service value due to urban expansion, impacting waste treatment, biodiversity, soil conservation, and climate regulation.

Policy vs Practice

The paper discusses both short-term and long-term adaptation strategies. Short-term measures include masks, traffic restrictions, and limitations on outdoor activities during smog events. **Long-term solutions emphasize a shift towards electric vehicles, expansion**

of public transportation, afforestation, and sustainable industrial practices. The increasing adoption of renewable energy sources like solar power in Pakistan is highlighted as a key adaptation tactic for meeting rising energy demands while reducing greenhouse gas emissions.



For mitigation, the white paper suggests a multifaceted approach:

- **Enhancing Public Transportation:** Investing in and expanding efficient systems like the Bus Rapid Transit (BRT) to reduce reliance on private vehicles. BRT systems are noted for their effectiveness in decreasing emissions, especially in developing countries.
- **Promoting Renewable Energy:** Encouraging the adoption of solar power to lessen dependence on fossil fuels, acknowledging Pakistan's recent progress in solar installations.
- **Implementing Industrial Emission Controls:** Enforcing stricter regulations on industries, including phasing out conventional brick kilns and promoting cleaner technologies.
- **Regulating Agricultural Practices:** Providing alternatives to crop residue burning, such as subsidized machinery for residue management.
- **Enhancing Green Spaces:** Developing urban green belts, parks, and rooftop gardens to absorb pollutants and cool the city, recognizing the crucial role of green spaces in mitigating the urban heat island effect and improving air quality. Public perception of plantation development and increased renewable energy usage is generally favorable.

- **Strengthening Policy and Enforcement:** Establishing dedicated bodies for continuous monitoring and implementation of anti-pollution measures, emphasizing collaborative efforts with neighboring regions to address transboundary pollution. Stricter standards for automobile pollution are also recommended.

In conclusion, the white paper underscores the urgency for coordinated action involving government, businesses, civil society, and individuals to build a climate-resilient Lahore. Prioritizing sustainable urban planning, expanding public transport, adopting renewable energy, enforcing stricter emission controls, and enhancing green spaces are crucial steps.

***About the author**: Driven by new climate change insights, Arish Saleem, M Phil, aims to apply this knowledge for positive impact. He wants to focus on practical application and raising awareness. This enriching experience of Climate Action Skill's training fuels his commitment to addressing climate issues through informed action. He pledges to contributing to a sustainable future.*

Shahdadpur Climate Change Review and Suggestions

Kiran Shahbaz (Marks obtained: 131/Out of: 150)

Shahdadpur, an important urban center in Pakistan's Sindh province, faces significant threats from climate change, impacting its environment, economy, and the livelihoods of its approximately 525,164 residents. This white paper comprehensively examines the demographic, environmental, and economic aspects of Shahdadpur, highlighting climate-related challenges, existing adaptation measures, mitigation strategies, and offering valuable suggestions for a more resilient future.

Power generation, relying on fossil fuels from regional plants, is a significant contributor to CO2 emissions. Local industries, including textile mills and brick kilns, emit GHGs through fuel consumption and inefficient production.

Rising Temperatures, Harsh Heat

The paper identifies several critical **climate change issues** affecting Shahdadpur. The city has experienced **rising temperatures**, with an average increase of 1.2°C over the last 50 years and projections of a further 2-3°C rise by 2050, leading to increasingly frequent and intense heatwaves. **Erratic rainfall patterns**, including increased heavy rainfall events causing flash floods and extended dry spells leading to droughts, disrupt agricultural operations. While inland, Shahdadpur is susceptible to **indirect impacts of sea-level rise** in low-lying Sindh areas, potentially causing saltwater intrusion into groundwater and harming agricultural productivity. The frequency of **extreme weather events** like dust storms and intense monsoon rains has also increased, damaging infrastructure and reducing crop production. These changes have direct **impacts on human health**, increasing heat-related illnesses and the spread of vector-borne diseases like dengue and malaria. **Ecosystems** are also under threat, with altered rainfall and higher temperatures damaging plant and animal life and reducing agricultural output due to poor soil quality and water scarcity.

Multiple Climate-Related Risks

Shahdadpur faces numerous **challenges** in addressing climate change. Major climate-related risks include **rising temperatures**, **water shortages** affecting irrigation and

drinking supplies, and unpredictable **flooding and droughts**. The city's vulnerability is exacerbated by **limited infrastructure** to cope with extreme weather, **inadequate access to climate-resilient agricultural techniques and water conservation methods**, and a **lack of comprehensive urban planning** to address climate vulnerabilities. **Financial constraints** limit the implementation of large-scale adaptation projects, while **political will and governance challenges** slow down climate action. Furthermore, a **lack of awareness and education** on climate change adaptation strategies among local communities hinders effective action. Equity concerns also prevail, with vulnerable populations lacking access to adaptation resources.

Initial Adaptation Efforts

Despite these challenges, Shahdadpur has initiated some **adaptation measures**. These include **improved drainage infrastructure and embankments** for flood management, **afforestation and green initiatives** to combat heatwaves and improve air quality, the **introduction of water-efficient irrigation techniques** for agriculture, **public awareness campaigns** on climate resilience, and the **adoption of solar energy** by some households and businesses. However, significant **adaptation gaps** remain, including a lack of designated cooling centers and emergency heatwave response strategies, limited promotion of climate-resilient crops, vulnerable infrastructure, absence of strong air pollution control regulations, and no large-scale rainwater harvesting or groundwater recharge projects.

Fossil Fuel Power

Regarding **mitigation**, the paper identifies key **greenhouse gas (GHG) emission sources** in Shahdadpur. **Power generation**, relying on fossil fuels from regional plants, is a significant contributor to CO2 emissions. **Local industries**, including textile mills and brick kilns, emit GHGs through fuel consumption and inefficient production. The **transportation sector**, dominated by diesel

and petrol vehicles and lacking public transport infrastructure, contributes substantially to carbon emissions. **Agricultural practices**, such as crop burning and methane emissions from livestock, also contribute to GHGs. Finally, **unregulated solid waste disposal** in open areas and landfills releases methane and other harmful pollutants.

Political Leadership Action

The paper provides comprehensive **solutions and recommendations** categorized by stakeholder responsibilities. **Political leadership** should develop and implement a comprehensive climate action plan and allocate resources for climate-resilient infrastructure. **Government departments**, such as the Municipal Committee and the Agriculture Department, should focus on improving waste management, promoting climate-smart agriculture, enforcing environmental regulations, and developing early warning systems.

Civil society organizations can conduct awareness campaigns, engage youth in environmental initiatives, and advocate for climate education. The **media** plays a crucial role in disseminating information on climate risks and solutions and holding authorities accountable. **Businesses** are encouraged to adopt sustainable practices, invest in green technologies, and implement corporate social responsibility policies focused on climate action. Finally, **citizens** are urged to reduce plastic use, participate in tree planting and recycling, use energy-efficient appliances, and opt for sustainable transportation. The proposed **implementation framework** outlines specific actions, responsible stakeholders, timelines, and expected outcomes for initiatives like developing a climate action plan, improving waste management, promoting solar energy, increasing green spaces, and conducting awareness campaigns.

This comprehensive white paper provides a valuable baseline for understanding climate change impacts and potential responses in Shahdadpur, emphasizing the urgent need for coordinated action across all levels of society.

***Author bio**: Kiran Shahbaz, MSc Public Health, specializes in public health. Jinnah Sindh Medical University graduate. O 10-week climate action training enhanced her expertise in sustainability and environmental health. Passionate about addressing climate-related public health challenges, she's dedicated to creating healthier, sustainable communities.*

Hunza Aliabad's Climate Journey: Challenges and Adaptation

Meher Zadi (Marks obtained: 131/Out of: 150)

This white paper offers a valuable insight into the multifaceted impacts of climate change on Central Hunza, specifically focusing on Aliabad, the region's commercial and administrative hub. The paper highlights that while Hunza is celebrated for its natural beauty and has witnessed a surge in tourism following the transformative Attabad landslide of 2010, it faces significant environmental vulnerabilities, particularly due to climate change.

A noticeable rise in temperature was observed over the past decades, with an average increase of 1.5°C in Gilgit-Baltistan over 50 years. This warming trend contributes to glacial melt and reduced snowfall, critical for the region's water supply. Furthermore, precipitation patterns have become erratic, leading to both intense rainfall and prolonged droughts. The melting glaciers also contribute to sea-level rise globally and increase the risk of Glacial Lake Outburst Floods (GLOFs) locally.

Aliabad's Climate Crisis

The paper meticulously details the **climate change issues** affecting Aliabad. These include a **noticeable rise in temperature** over the past decades, with an average increase of 1.5°C in Gilgit-Baltistan over 50 years. This warming trend contributes to **glacial melt and reduced snowfall**, critical for the region's water supply. Furthermore, **precipitation patterns have become erratic**, leading to both intense rainfall and prolonged droughts. The melting glaciers also contribute to **sea-level rise** globally and increase the risk of **Glacial Lake Outburst Floods (GLOFs)** locally. The frequency of **extreme weather events** like heavy rainfall, landslides, and avalanches has also increased. These climatic changes are already impacting **human health**, with a reported increase in waterborne and respiratory diseases, and threatening the region's unique **biodiversity** through habitat loss.

Agriculture and Tourism Risks

Aliabad faces numerous **challenges** in the face of these climate change impacts. Its economy, historically reliant on agriculture, is increasingly influenced by tourism. However, limited arable land and water resources constrain agricultural expansion, and climate change further exacerbates these limitations. The region's **vulnerability to natural disasters** poses a continuous threat to

infrastructure and livelihoods. While infrastructure development is underway, poor road conditions and inconsistent energy supply remain economic challenges.

Community-Led Solutions

Despite these challenges, the paper outlines various **adaptation** measures being implemented in Aliabad. Farmers are adapting to rising temperatures by shifting to heat-resistant crops and adjusting planting schedules, supported by initiatives like the Aga Khan Rural Support Programme (AKRSP). Communities are reviving traditional water management systems and constructing water storage to cope with erratic precipitation. Early warning systems have been installed to monitor glacial lakes and mitigate GLOF risks. To address extreme weather events, communities are building retaining walls and relocating to safer areas. Biodiversity conservation efforts include community-led initiatives for reforestation and protected areas. Specific examples of adaptation include the adoption of **solar energy projects**, **agroforestry initiatives**, and the formation of **community-based disaster risk management committees**.

Implicit Mitigation Efforts

While the paper primarily focuses on adaptation, it implicitly addresses **mitigation** through the recommendation to "**Expand Renewable Energy Adoption**". This suggests a recognition of the need to reduce reliance on fossil fuels.

Enhancing Aliabad's Resilience

The white paper concludes with several **suggestions** to further enhance resilience in Aliabad. These include: **Strengthening community-based early warning systems, investing in sustainable water management, promoting climate-resilient agriculture, enhancing infrastructure resilience, expanding renewable energy adoption, protecting and restoring ecosystems, empowering local communities through**

education and capacity building, and promoting sustainable tourism.

Conclusion

In conclusion, this white paper effectively portrays Aliabad, Hunza, as a region of immense natural beauty facing significant and growing threats from climate change.

***About the author**: Meher Zadi, a gold medalist in Environmental Science from Karakoram International University, Hunza, specializes in climate change and GLOFs. Her research engaged indigenous communities in environmental restoration. An internship with WWF-Pakistan's WRAP program honed her expertise in Nature-Based Solutions. A climate activist, she's now preparing for the GAT test.*

It highlights the existing vulnerabilities and the proactive adaptation measures being undertaken, while also providing crucial recommendations for a more sustainable and resilient future.

Abbottabad Climate Change: Impacts and Actions

Muhammad Asif Khan (Marks obtained: 130/Out of: 150)

Abbottabad, a city nestled in the Himalayan foothills of Pakistan, renowned for its beauty and temperate climate, faces significant and intensifying climate change challenges due to its unique geographical and environmental context. This review outlines the key climate change issues, associated challenges, current adaptation measures, mitigation strategies, and offers suggestions for future action.

Climate Change Impacts

Abbottabad has witnessed a steady rise in average temperatures, exacerbated by urbanization and deforestation, leading to more frequent and prolonged heatwaves and warmer winters. Changes in precipitation patterns are evident through erratic monsoon rains causing flash floods, prolonged dry spells leading to water shortages, and delayed or unseasonal rainfall disrupting agriculture. The region is increasingly experiencing extreme weather events, including heavy rainfall triggering landslides, more common hailstorms damaging crops, and thunderstorms causing power outages. These climatic shifts are directly impacting human health, with increased cases of heatstroke, respiratory issues due to poor air quality, and the spread of vector-borne and waterborne diseases. The natural environment is also under stress, with accelerating deforestation, biodiversity loss, agricultural decline due to unpredictable weather, and more frequent forest fires. Scientific data confirms a **20% increase in extreme rainfall events** and a **15–20% decline in agricultural yields** in the region.

> Abbottabad has initiated some adaptation strategies, including small-scale flood control measures like embankments and drainage systems. Government-led and community-driven afforestation programs, such as the 10 Billion Tree Tsunami Project, aim to restore degraded forests.

Challenges

Addressing climate change in Abbottabad faces several interconnected challenges. Rapid and often unplanned urbanization is increasing vulnerability to flooding, landslides, and heat stress. The absence of comprehensive water management strategies leads to seasonal water scarcity and inefficient floodwater storage. The local healthcare system is strained by rising

climate-induced health risks, with a lack of specialized facilities and emergency response mechanisms. **Financial constraints** limit the implementation of large-scale adaptation projects, and a **lack of awareness** among policymakers and residents hinders effective climate action. Furthermore, climate adaptation is often deprioritized due to short-term economic and security concerns, coupled with weak governance and enforcement of environmental regulations. Major greenhouse gas (GHG) emission sources in Abbottabad include **fossil fuel-based power plants**, **small-scale industries**, an **increasing number of inefficient vehicles**, **livestock farming**, excessive use of chemical fertilizers, crop residue burning, and **improper solid waste disposal**.

Adaptation Measures

Abbottabad has initiated some adaptation strategies, including small-scale flood control measures like embankments and drainage systems. **Government-led and community-driven afforestation programs**, such as the 10 Billion Tree Tsunami Project, aim to restore degraded forests. Awareness campaigns by NGOs, schools, and government agencies promote climate resilience and sustainable practices. However, significant adaptation gaps remain in urban planning, water management, and healthcare preparedness.

Mitigation and Suggestions

Mitigation efforts require addressing the major GHG emission sources. The source recommends political leadership to develop a Climate Action Plan with clear targets and allocate funds for resilient infrastructure. Government departments should enforce stricter industrial emission regulations and upgrade public transportation. Civil society needs to organize community-based initiatives like tree planting and waste management. The media can raise awareness and highlight local climate action successes. Businesses are encouraged to adopt energy-efficient technologies and support climate-smart agriculture. Finally, citizens should reduce energy consumption and participate in local climate initiatives. **A measurable target**

is to reduce GHG emissions by 20% by 2030 through renewable energy adoption and improved waste management, with the first phase of the Climate Action Plan to be completed by 2025.

Conclusion

In conclusion, Abbottabad is facing significant climate change impacts that demand immediate and comprehensive action. While some adaptation measures are in place, substantial gaps and challenges remain. A concerted effort involving political will, government action, community engagement, and individual responsibility is crucial to mitigate GHG emissions, enhance resilience, and safeguard the future of this vulnerable region.

About the author: *Muhammad Asif Khan, Abbottabad, leads climate action via Nature News Network (46K+). Forestry and Wildlife expert, he champions conservation, youth empowerment, and climate education. He's driven afforestation, trained hundreds in leadership, and spearheads awareness campaigns, fostering community-led environmental sustainability.*

Kharian, A City Confronting Climate Change

Sabeen Ejaz (Marks obtained: 129/Out of: 150)

This white paper provides a comprehensive overview of the critical issue of climate change and its impacts specifically on Kharian, a city in Punjab, Pakistan. The paper meticulously outlines the current climate situation, identifies the primary sources of greenhouse gas (GHG) emissions, and proposes practical solutions for mitigation and adaptation, emphasizing the crucial roles of various stakeholders. It serves as a roadmap for Kharian to become a more climate-conscious and resilient city through measurable and time-bound goals.

Quantifiable impacts of climate change on Kharian over the past 50 years include a 2-3°C increase in average summer temperatures, increased annual rainfall variability, a 10-15% decrease in wheat production over the last decade, and a over 20% rise in heat-related health problems in recent years.

Kharian's Climate Shifts

The paper highlights several significant **climate change issues** already affecting Kharian. **Rising temperatures**, particularly in the summer, with averages frequently exceeding 40°C, and the increasing frequency and intensity of heatwaves are observed and projected. Changes in **precipitation patterns** have led to more unpredictable rainfall, with extended dry spells followed by intense rainstorms, increasing the risk of floods during the monsoon season and water shortages in drier periods.

Consequently, **extreme weather events** like heat waves, torrential rains, and sporadic flooding have become more frequent and severe. These changes have direct **impacts on human health**, with a rise in heat-related illnesses and the spread of waterborne and vector-borne diseases like malaria and dengue.

Furthermore, **ecosystems** are being affected, leading to changes in biodiversity and disrupting **agriculture**, a cornerstone of Kharian's economy, with decreased yields in key crops like rice and wheat due to erratic rainfall and high heat. Quantifiable impacts over the past 50 years include a 2-3°C increase in average summer temperatures, increased annual rainfall variability, a 10-15% decrease in

wheat production over the last decade, and a over 20% rise in heat-related health problems in recent years.

Water, Will, Equity

Despite these pressing issues, Kharian has begun implementing some **existing adaptation measures**. These include **water conservation initiatives** promoting efficient irrigation and rainwater harvesting, **agricultural diversification** encouraging climate-resilient crops and techniques, and improvements in **health infrastructure** with emergency services for heatstroke and public awareness programs for disease prevention.

However, the paper identifies significant **adaptation gaps**, such as unregulated groundwater exploitation and the absence of a systematic water management plan. Several **reasons for inaction** are noted, including **financial constraints**, low **political will**, a **lack of public awareness**, dispersed and ununified **planning challenges**, and **equity concerns** regarding access to adaptation resources for vulnerable populations.

Transportation's CO_2 Load

The white paper clearly identifies the **major greenhouse gas (GHG) emission sources in Kharian**. **Transportation**, with an estimated 1,200 daily vehicles, is a primary contributor, releasing approximately 172.4 metric tons of CO_2 monthly. **Agriculture**, particularly through fertilizer use and rice cultivation, contributes significantly, estimated at 49,537 metric tons of CO_2 equivalent monthly. **Solid waste disposal**, from the 75–105 metric tons of daily waste, adds to the emissions with 450 to 630 metric tons of CO_2 equivalent monthly from landfills and incineration.

Leadership, Policy, Action

To address these challenges, the paper proposes several **solutions and recommendations** that require coordinated action from various stakeholders. **Political leadership** is urged to create and implement a comprehensive climate action plan with prioritized sectors and allocated funding. **Government departments** need to enforce climate-related regulations, conduct

environmental evaluations, and incentivize sustainable practices.

Civil society should promote renewable energy, sustainable agriculture, and waste reduction through community outreach and public education. The **media** plays a vital role in raising public awareness about climate change and encouraging sustainable living. **Citizens** are called upon to adopt sustainable practices, support eco-friendly businesses, and participate in local environmental initiatives. The paper also sets **measurable targets**, including a 20% reduction in GHG emissions within five years, a 30% reduction in landfill waste by 2026, and the adoption of at least 50% sustainable farming practices by 2027.

Conclusion

In conclusion, this white paper effectively highlights the urgency of climate action in Kharian, emphasizing the significant environmental challenges arising from its key sectors. It provides a clear understanding of the impacts, identifies the major emission sources, and offers concrete, actionable solutions involving all levels of society. The paper underscores the importance of collective action and clear responsibilities in building a climate-resilient and environmentally sustainable future for Kharian.

***About the author**: Sabeen Ejaz, a dedicated Social & SDG Impact Leader, holds a BS in Environmental Sciences. A Movers Facilitator and LCOY Pakistan 2024 delegate, she champions SDG 4, focusing on quality education. Driven by a passion for community impact, Sabeen strives for meaningful, sustainable change.*

Islamabad: Climate Impacts and Adaptation Imperatives

Nimra Dawood (Marks obtained: 127/Out of: 150)

This paper focuses on the climate change issues, challenges, adaptation strategies, and mitigation efforts to deal with climate change in the capital city. Islamabad, situated in the Pothohar Plateau with the Margalla Hills as its backdrop, faces a multitude of climate change impacts that are increasingly affecting its ecological and urban environment.

Escalating Climate Impacts

The white paper highlights several significant climate change impacts in Islamabad. The city has experienced an average temperature increase of 3°C between 1961 and 1990, with the mean temperature rising from 22°C in 2013 to 25°C by January 2025.

Projections indicate a further temperature increase of 0.7°C by 2039 and 2.2°C by 2069. This rise contributes to **heatwaves**, which have become more frequent and intense, leading to health issues like heatstroke and decreased productivity.

Furthermore, the **Urban Heat Island (UHI) effect** is growing, with an annual increase in Surface UHI Impact. **Changing precipitation patterns** are evident, characterized by increased variability, leading to both urban flooding (as seen in the 2021 cloudburst in sector E-11) and prolonged dry spells. These erratic patterns exacerbate **water scarcity**, as Islamabad's dams (Rawal, Khanpur, and Simply) face a growing shortfall, and groundwater levels are declining rapidly due to over-extraction.

The largest source of GHG emissions in Islamabad is the transportation sector, with 1.5 million registered vehicles. The energy sector also contributes significantly, with Pakistan's overall energy mix having an emission factor of 834 g CO_2/kWh. Agricultural emissions are relatively low due to limited practices. However, solid waste emissions are substantial, ranging from 249,700 to 535,250 tons CO_2-eq per year, due to a lack of landfill gas capture and proper waste segregation.

The consumption of **contaminated water**, often due to industrial and hospital effluents, is widespread, leading to a rise in waterborne diseases. Air pollution, exacerbated by smog in winter, is contributing to increased

respiratory, skin, and ENT diseases. Finally, **biodiversity is declining** due to urbanization, pollution, and climate disruptions, threatening local flora and fauna, including endangered species, and increasing instances of wildfires in the Margalla Hills National Park.

Implementation Gaps and Policy Deficiencies

The white paper identifies several significant challenges in addressing climate change in Islamabad. A major issue is the **implementation gap** in existing strategies, along with **ineffective coordination** between different agencies and a lack of long-term planning. Despite the evident rise in temperatures, an effective counterstrategy is missing, and enforcement of green building and urban planning regulations is lacking.

Regulations on rain harvesting exist but are not enforced, and groundwater regulations are absent despite the alarming decline in the water table. The city also lacks adequate early warning flood and drainage systems. Ironically, green areas continue to be converted into residential schemes, with little focus on greenery for low-income areas. Existing water dams lack proper cleaning and pollution control, and proper waste management and desalination systems are absent, leading to pollution of water sources. Furthermore, proactive management of wildfires and invasive species in MHNP has been inadequate.

Low budgetary allocation for climate adaptation compared to traditional urban development and infrastructure is a key barrier. **Improper enforcement** and loopholes in existing laws and policies hinder progress. **Frequent government changes** cause program fluctuations, and **conflicts between agencies** over jurisdiction and responsibility create further obstacles. Low public awareness and engagement regarding water scarcity risks also contribute to the challenges.

Adaptive Strategies and Regulatory Efforts

Islamabad has initiated several adaptive strategies. Regulatory frameworks include the **revision of the Islamabad Master Plan (2018)** aimed at addressing urban planning and green spaces. The **CDA's By-Laws and Regulations (2023)** promote sustainable infrastructure with energy-efficient designs and water harvesting. A **plastic bag ban (2019)** was enforced to reduce waste. Efforts towards **Islamabad Air Quality Management** include increased checks on emissions.

Low budgetary allocation for climate adaptation compared to traditional urban development and infrastructure is a key barrier. **Improper enforcement** and loopholes in existing laws and policies hinder progress. **Frequent government changes** cause program fluctuations, and **conflicts between agencies** over jurisdiction and responsibility create further obstacles.

The **Wetland Initiative (2020)** aims at water decontamination. Green infrastructure initiatives include **urban forestry and biodiversity** efforts like Miyawaki forests and tree plantation drives. **Water conservation and management** strategies involve encouraging rain harvesting, installing recharge wells, and planning new dams.

Sustainable transport planning includes the metro bus service and the development of cyclist lanes. For **climate resilience and disaster risk management**, heatwave response centers have been established, and Islamabad benefits from the presence of NDMA. **Public awareness and capacity building** are being promoted through university programs and green school initiatives.

Key Sources of Greenhouse Gas Emissions

The largest source of **GHG emissions** in Islamabad is the **transportation sector**, with 1.5 million registered vehicles. The energy sector also contributes significantly, with Pakistan's overall energy mix having an emission factor of 834 g CO_2/kWh. Agricultural emissions are relatively low due to limited practices. However, **solid waste emissions** are substantial, ranging from 249,700 to 535,250 tons CO_2-eq per year, due to a lack of landfill gas capture and proper waste segregation.

Proposed Adaptation and Mitigation Solutions

The white paper proposes several adaptation solutions. For **air quality**, it suggests creating low-emission zones, increasing electric metro buses, and mandating annual emission testing. A **strategic plantation drive** focusing on native species and community monitoring is recommended to enhance urban forestry. To address the UHI effect, the paper suggests mandating **heat-reflective infrastructure** like cool roofs and heat-resistant asphalts.

For **flooding and storm management**, the installation of flood sensors and permeable pavements is proposed. **Margalla Hills protection** measures include creating animal movement corridors and strict restrictions on illegal construction and tourism. A **smart water initiative** is suggested, involving groundwater extraction regulations, recharge wells, rain harvesting, and greywater treatment plants.

Conclusion

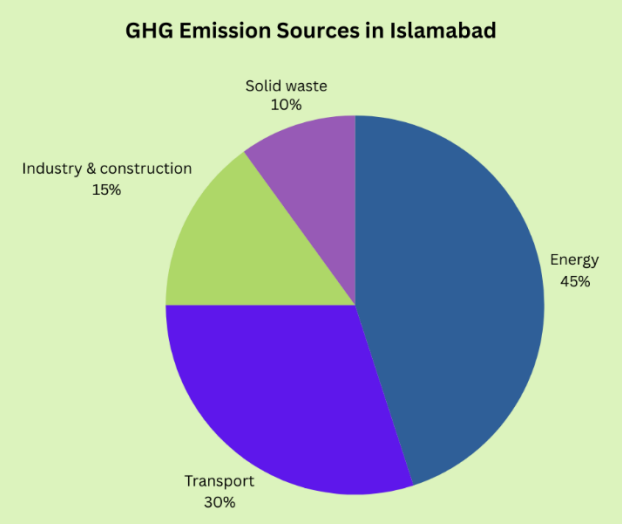
This paper highlights that Islamabad faces significant and interconnected climate change impacts, demanding urgent and well-coordinated adaptation and mitigation efforts as outlined in the white paper. Addressing the identified challenges and implementing the proposed solutions are crucial for building a climate-resilient and sustainable future for the city.

***About the author**: Nimra Dawood, NUST development studies student, blends research with action. Specializing in gender inequality, climate justice, and social mobility, her work bridges research, policy, and practice. With a background in International Relations, she aims to create tangible community improvements through critical research.*

Islamabad: Climate Challenges, Adaptation, and Future

Fatima Ashraf (Marks obtained: 125/Out of: 150)

This white paper provides a comprehensive analysis of climate change impacts, challenges, adaptation strategies, and mitigation measures for Pakistan's capital city. It highlights Islamabad's demographic, economic, and environmental landscape to contextualize the growing threats posed by a changing climate. The paper underscores the urgency for sustainable solutions to protect the city's environment, public health, and overall quality of life.



Climate Change Impacts in Islamabad

The white paper meticulously details the **climate change impacts already affecting Islamabad**. These include a significant **rise in average temperatures** by 1.5°C since 1980, leading to more frequent and intense heatwaves.

Changes in precipitation patterns, characterized by more intense monsoon rains causing urban flooding and increasing droughts affecting water availability, are also evident. Furthermore, the city is experiencing more frequent **extreme weather events** such as dust storms, windstorms, and cloudbursts, resulting in property damage and loss of life.

These climatic shifts have direct consequences on **human health**, with a rise in vector-borne diseases like dengue due to increased humidity and a surge in heat-related illnesses among vulnerable populations. The **city's ecosystems are also under threat**, with biodiversity loss in the Margalla Hills and declining air quality contributing to respiratory diseases.

Greenhouse Gas Emission Sources

A critical aspect of the white paper is its analysis of **Greenhouse Gas (GHG) emissions in Islamabad**, identifying key contributing sectors. The **energy sector** is the largest contributor (45%), heavily reliant on natural

gas and diesel power plants. The **transport sector** accounts for 30% of emissions due to increased vehicle usage and rapid motorization. **Industry and construction** contribute 15% through energy-intensive activities. Finally, **solid waste management** is responsible for 10% of emissions due to open dumping and landfill methane.

Evaluation of Current Adaptation Strategies and Gaps

The paper evaluates existing **adaptation strategies** in Islamabad, such as the "Ten Billion Tree Tsunami" initiative, expansion of public transport including electric buses, and upgrades to flood management systems. However, it also identifies significant **adaptation gaps**, including insufficient local climate policies and limited investment in renewable energy despite its potential. **Barriers to adaptation** include funding constraints and a public awareness deficit regarding sustainable practices and green technologies.

Solutions and Recommendations for Climate Resilience

To address these challenges, the white paper offers several **solutions and recommendations**. It emphasizes **government actions** such as implementing a Local Climate Action Plan (LCAP) and strengthening regulations for sustainable urban planning. **Renewable energy promotion** through the expansion of solar and wind projects and offering incentives for green technology adoption is strongly recommended.

The paper also advocates for **sustainable transport** by introducing electric public transport and expanding cycling and pedestrian infrastructure. **Community engagement** through awareness campaigns on energy conservation and waste recycling initiatives is deemed crucial. The **corporate and private sector** are encouraged to adopt green building practices and conduct carbon footprint audits. Finally, the paper stresses the importance of managing health risks through better urban planning, improved healthcare preparedness, and public awareness.

Reforestation with indigenous species and effective disaster management strategies are also highlighted.

Conclusion

In conclusion, this white paper serves as a vital document highlighting the escalating climate vulnerabilities in Islamabad and providing a roadmap for a more resilient and sustainable future. Its comprehensive analysis and practical recommendations offer valuable insights for policymakers, urban planners, and the community at large to collaboratively address the pressing challenges of climate change in the capital city.

***About the author**: Fatima Ashraf, an environmental scientist, holds a BSc. from IIUI. Her expertise spans GIS, EIA, and sustainability. Research at NARC focused on carbon stocks and food security. Actively involved in GYM and IIHSE, she champions climate action and community resilience, driven by a passion for conservation.*

Climate Resilient Agriculture for Shehr Sultan

Shahid Ur Rehman (Marks Obtained: 124/Out of: 150)

This white paper comprehensively analyzes the impact of climate change on agriculture in Shehr Sultan, Muzaffargarh, Pakistan, and explores potential adaptation and mitigation strategies through climate-smart regenerative agriculture. The region is highly vulnerable, experiencing **rising temperatures**, **erratic rainfall**, and an increase in **extreme weather events** like floods.

Several challenges hinder effective climate action in Muzaffargarh. A significant climate finance gap of an estimated $348 billion by 2030 for Pakistan limits investment in necessary projects.

These changes are severely impacting the two primary crops of the area: wheat and cotton. Wheat yields have already declined by approximately 10% in the last 15 years, and projections suggest a further 20% reduction by 2050 due to rising temperatures. Similarly, cotton production suffers from heat stress, water shortages, and increased pest outbreaks. Farmers face a cycle of declining yields and increased input costs, threatening their livelihoods in a district where **64.8% of the population lives below the poverty line**.

Climate Change Challenges

Several challenges hinder effective climate action in Muzaffargarh. A significant **climate finance gap** of an estimated $348 billion by 2030 for Pakistan limits investment in necessary projects. There is also a **lack of awareness** at the community level regarding climate change impacts and adaptive practices. Furthermore, **policy enforcement is inconsistent**, despite the existence of national policies like the National Climate Change Policy (NCCP). Infrastructure capable of withstanding climate-induced stresses is also significantly lacking.

Climate-Smart Agriculture

The paper emphasizes **adaptation strategies**, particularly the adoption of **climate-smart & regenerative agriculture**. This approach focuses on improving soil health, conserving water through efficient irrigation techniques like drip irrigation and laser land leveling, and reducing input costs by utilizing organic matter enrichment and biological pest control. Quantified benefits of regenerative practices show potential savings of Rs. 27,000 per acre for wheat and Rs. 46,600 per acre for cotton in Muzaffargarh. District-wide, this could translate to an annual economic benefit of Rs. 52.26 billion, along with significant water saving and carbon sequestration potential.

Mitigation Strategies

Mitigation strategies discussed in the paper include the integration of **biogas plants** and the promotion of **Moringa tree plantations**. Biogas plants capture methane from organic waste, providing a clean energy alternative and producing bio-slurry, which enhances soil fertility. A 10 m^3 biogas plant can produce 12–14 tons of organic fertilizer annually. Furthermore, planting Moringa trees on farm boundaries can create a carbon-negative system by absorbing significantly more CO_2 than a biogas plant emits. Moringa also offers additional benefits like acting as a windbreak and providing an income source through leaf harvest and honey production.

Enforcement and Awareness

The white paper suggests a **phased approach** involving short-term awareness programs, medium-term infrastructure development for electric vehicles and enhanced public transport, and long-term policy enforcement. It highlights the crucial roles of various stakeholders, including **political leadership** in enforcing climate policies, **government departments** like NEECA in implementing energy efficiency programs, **civil society** in raising awareness, the **media** in disseminating

information, **businesses** in adopting sustainable practices like solar energy, and individual **citizens** in adopting eco-friendly actions.

Conclusion

In conclusion, the white paper convincingly argues that climate change poses a severe threat to agriculture in Shehr Sultan. However, it also presents a compelling case for the adoption of climate-smart regenerative agriculture, integrated with biogas technology and Moringa plantations, as a viable pathway towards climate resilience, economic survival, and environmental sustainability for the region.

***About the author**: Shahid Ur Rehman, M.Sc. Horticulture, educates on climate change toxicology. Transitioning from organic farming advocacy, he now champions Climate-Smart Regenerative Agriculture. Inspired by the Climate Action Skills, he's a dedicated climate activist, fostering biodiversity and sustainable resilience.*

Charsadda Climate Crisis: Impacts, Actions, Future

Akif Ullah (Marks obtained: 124/Out of: 150)

This white paper provides an insightful overview of **climate change impacts, challenges, adaptation, mitigation, and potential solutions** specific to Charsadda, a district in Khyber Pakhtunkhwa, Pakistan. The study highlights the district's vulnerability due to its geographical location, semi-arid climate, and reliance on agriculture.

Climate Change Impacts on Charsadda

Climate change is significantly affecting Charsadda through **rising temperatures** leading to heatwaves and increased evaporation, **changes in precipitation patterns** causing both intense rainfall and prolonged droughts, and an increase in **extreme weather events** such as floods, windstorms, and cold waves. These climatic shifts are directly impacting **human health**, with a rise in heat-related illnesses, vector-borne diseases, and respiratory issues, as well as **ecosystems** through deforestation, habitat destruction, and disruption of farming cycles, leading to soil erosion and reduced agricultural sustainability.

Charsadda faces numerous challenges in addressing climate change. Despite some existing adaptation measures like riverbank barriers and reforestation initiatives, significant adaptation gaps remain, including the absence of a reliable water management system and inadequate urban planning in flood-prone areas.

Challenges and Adaptation Gaps

Charsadda faces numerous **challenges in addressing climate change**. Despite some existing adaptation measures like riverbank barriers and reforestation initiatives, significant **adaptation gaps** remain, including the absence of a reliable water management system and inadequate urban planning in flood-prone areas. **Reasons for inaction** include resource scarcity, political interference, governance challenges, limited public awareness, and socio-economic disparities.

Greenhouse Gas Emission Sources

The white paper outlines the **major sources of greenhouse gas (GHG) emissions** in Charsadda. These include reliance on the national grid powered by fossil fuels,

emissions from small-scale industries like brick kilns and biomass burning in residential areas, transportation emissions from road traffic with outdated vehicles, agricultural emissions from livestock, fertilizer use, and burning of agricultural waste, and methane and carbon dioxide emissions from improper solid waste disposal.

Proposed Solutions and Recommendations

The study proposes a range of **solutions and recommendations** involving various stakeholders. **Political leadership** needs to formulate and implement climate action plans, fund infrastructure for drought and flood relief, enforce land use regulations, and promote afforestation. **Government departments** should ensure environmental regulation enforcement, support eco-friendly farming methods, improve water management, enhance disaster early warning systems, and build resilient infrastructure.

Reasons for inaction include resource scarcity, political interference, governance challenges, limited public awareness, and socio-economic disparities.

Civil society organizations can play a crucial role in climate education, promoting climate-resilient agriculture, and expanding reforestation programs. The **media** should prioritize climate reporting, raise public awareness on conservation and disaster preparedness, and hold polluting industries accountable.

Businesses are urged to reduce emissions by adopting sustainable energy sources and eco-friendly technologies, promote organic farming, and invest in climate adaptation projects. Finally, **citizens** are encouraged to adopt environment-friendly practices, conserve water, plant trees, avoid open waste burning, diversify crops, and support policymakers prioritizing climate action.

Conclusion

In summary, the white paper effectively diagnoses the climate change situation in Charsadda, highlighting its vulnerabilities and the impacts already being felt across various sectors. It identifies key challenges hindering effective action and provides a comprehensive set of recommendations involving all levels of society to promote both adaptation and mitigation strategies. The emphasis on multi-stakeholder engagement and context-specific solutions is crucial for building climate resilience in the district.

***About the author**: Akif Ullah, CRAF researcher, blends psychology and climate action. He drives policy, empowerment, and community resilience through research and advocacy. His expertise spans climate change, gender, and public health, aiming to bridge research with actionable, sustainable solutions for vulnerable communities.*

Baltistan Climate Crisis: Impacts and Responses

Syed Arif (Marks obtained: 124/Out of: 150)

This white paper, focusing on climate change in Skardu Baltistan, provides a comprehensive overview of the region's susceptibility to environmental shifts, the ensuing challenges, local adaptation strategies, and potential mitigation avenues. It highlights that Gilgit Baltistan, where Skardu is located, is highly vulnerable to climate change impacts in South Asia.

Climate Change Issues in Baltistan

The paper details several significant climate change issues affecting Skardu Baltistan. **Rising temperatures** are a major concern, with climate stations showing an alarming increase in average temperatures from the 1980s to 2006. This warming trend contributes to **glacier melting**, leading to the formation of dangerous glacial lakes and increasing the risk of **glacial lake outburst floods (GLOFs)**, which pose a severe threat to settlements, infrastructure, and agricultural land. Changes in **snowfall patterns**, with a significant decrease in snowfall over the past three decades, are also evident. These changes, along with intense heat waves, are leading to more frequent **extreme weather events** such as blizzards, snowstorms, and heat waves.

Rising temperatures are a major concern, with climate stations showing an alarming increase in average temperatures from the 1980s to 2006. This warming trend contributes to glacier melting, leading to the formation of dangerous glacial lakes and increasing the risk of glacial lake outburst floods (GLOFs), which pose a severe threat to settlements, infrastructure, and agricultural land.

The paper also notes the impacts on human health, including stress and sickness arising from altered weather conditions, and the degradation of ecosystems, evidenced by the declining population of the Markhor. The agricultural sector is particularly affected by these changes, with reduced crop yields due to lack of rainfall and altered glacial melt patterns, impacting the local economy that heavily relies on agriculture and tourism.

Challenges

Addressing climate change in Skardu Baltistan presents numerous challenges. The region's economy is largely dependent on seasonal tourism, livestock, and small-scale agriculture, all of which are highly sensitive to climate variations. The increasing migration

from rural to urban areas due to degraded rural livelihoods strains the poor infrastructure and limited resources in cities like Skardu. High youth unemployment and reduced government subsidies exacerbate poverty levels, making communities more vulnerable to climate shocks.

Furthermore, while climate change is a significant issue, governments in struggling nations may prioritize economic development and other exigencies, potentially overlooking the urgency of climate action. A lack of awareness and understanding of the local consequences of global climate change also hinders the implementation of effective adaptation measures.

Adaptation

The white paper explores existing adaptation measures, including traditional knowledge like the Kalasha people's "Suri Jagek" for weather forecasting. Communities are also adopting new farming methods and technologies to cope with water shortages. Community-based adaptation models are recognized for their potential to enhance local resilience. However, the paper identifies **adaptation gaps**, emphasizing the need to integrate contemporary scientific knowledge with indigenous knowledge for effective climate action. There is a lack of comprehensive research on the specific impacts of climate change and glacier melting on local subsistence patterns in Northern Pakistan.

Mitigation Measure

Regarding mitigation, the paper highlights that **wood burning for heating and cooking** is a major contributor to greenhouse gas emissions in Baltistan, especially during winter. The use of animal dung as a heat source is identified as a primary source of methane. Increased transportation due to growing tourism is also contributing to air pollution. Solid waste disposal in urban areas, due to a lack of technology and management, leads to further environmental degradation. Notably, industrial emissions are considered negligible due to the absence of significant industrial activity.

Suggestions/Recommendations

The white paper offers several recommendations to address climate change in Skardu Baltistan. It emphasizes the crucial role of **political leadership** in developing and implementing comprehensive climate action plans and allocating necessary resources. **Government departments**, along with NGOs and international organizations, should provide support and assistance to communities affected by climate change, such as providing flood-resistant seeds and aid for rebuilding after disasters.

Civil society and citizens should engage in community-level initiatives like afforestation and establishing training institutions. Raising **climate change awareness** through education and information dissemination is also vital to ensure people understand the problem and can implement appropriate adaptation measures.

Conclusion

This paper effectively outlines the severe impacts of climate change on Skardu Baltistan, highlighting the vulnerability of its communities and ecosystems. While local adaptation strategies exist, significant challenges remain in addressing the multifaceted consequences of rising temperatures, glacial melt, and altered weather patterns. The recommendations emphasize the need for coordinated efforts from political leaders, government bodies, civil society, and informed citizens to build resilience and mitigate further environmental damage in this strategically important and ecologically sensitive region.

***About the author**: Syed Arif is B.S in Environmental Sciences and has been associated with the global NGO WWF Pakistan. He's driven to create change. With WWF Pakistan and Ice Stupa Project experience, he aims to establish GB as a climate-resilient community.*

Jhang Climate Action: Challenges and Way Forward

Muhammad Amir (Marks obtained: 123/Out of: 150)

This white paper provides an insightful overview of climate change in Jhang District, Pakistan, highlighting its impacts, existing adaptations, major greenhouse gas emission sources, and offering recommendations for future action. Jhang, characterized by its extreme climate, is already experiencing significant repercussions of a changing climate.

The district faces soaring temperatures, particularly in May and June, often reaching 45 degrees Celsius, with increasing frequency and intensity of heatwaves that pose serious health risks.

Climate Change Issues and Challenges

The district faces soaring temperatures, particularly in May and June, often reaching 45 degrees Celsius, with increasing frequency and intensity of heatwaves that pose serious health risks. **Changes in precipitation patterns** are also evident, with more frequent and intense rainfall events leading to flood risks, alongside prolonged droughts that disrupt agriculture and threaten food security. The variability in rainfall exacerbates water scarcity and affects crop yields.

Jhang has also witnessed an **increase in dust storms and severe winds** during the summer, causing damage to infrastructure and agriculture, and these extreme weather events are projected to become more frequent and severe. Furthermore, rising temperatures and increased humidity create favorable conditions for the spread of infectious diseases, posing threats to human health, especially for vulnerable populations. Local ecosystems and agricultural practices are under threat, leading to shifts in crop viability and economic instability for farmers.

Adaptation Strategies

Jhang District demonstrates a dynamic response to these challenges through various adaptation measures. In the agricultural sector, **farmers are diversifying crops and adopting efficient irrigation techniques like drip and sprinkler systems** to address water scarcity. Economically, there's a shift towards small-scale industries, and microfinance initiatives are empowering local

entrepreneurs and farmers. Socially, efforts in education, health, and women's empowerment are gaining traction. Environmentally, afforestation efforts and community-based flood management programs are being implemented. Technological advancements, including enhanced mobile and internet connectivity and the adoption of agricultural technology, are also playing a crucial role. Culturally, the promotion of local festivals and media fosters community engagement.

Major Greenhouse Gas Emission Sources

The white paper identifies several major contributors to greenhouse gas (GHG) emissions in Jhang City. Power generation, predominantly reliant on coal-fired and natural gas power plants, is a significant source of emissions. Various industrial sectors, including manufacturing and construction, also contribute substantially through fossil fuel combustion and industrial waste gases.

The transportation sector, primarily road transport using diesel and petrol, is another major emitter. Agriculture contributes through methane emissions from livestock and nitrous oxide from fertilized soils, as well as agricultural waste management practices. Finally, solid waste disposal in landfills and through incineration releases methane and CO2.

Solutions and Recommendations

To effectively address climate change in Jhang City, the white paper proposes concrete solutions with defined roles for various stakeholders. **Political leadership** is urged to develop and implement a comprehensive climate action plan with measurable targets and allocate resources for renewable energy. **Government departments** should oversee energy efficiency regulations in industries and promote sustainable agriculture, along with establishing a monitoring framework.

Civil society needs to advocate for climate action through community outreach and facilitate grassroots initiatives. The **media** has a role in raising public awareness and holding

stakeholders accountable. **Businesses** are encouraged to reduce their carbon footprints and invest in clean technologies. Finally, **citizens** are called upon to adopt sustainable lifestyles and support local climate policies.

Conclusion

Jhang District faces significant and multifaceted challenges due to climate change, but it is also demonstrating resilience through various adaptation strategies. Addressing the root causes requires a concerted effort to mitigate greenhouse gas emissions from key sectors. The proposed solutions and recommendations offer a pathway towards a more sustainable and resilient future for Jhang.

***About the author**: Muhammad Amir, BS Hons, is a climate action advocate. Empowered by recent training, he's launching local sustainability projects, collaborating with businesses, and promoting renewable energy. He's passionate about inspiring community-driven change and equipped with practical tools to make a real impact.*

Nagar Valley: Climate Change Impacts and Response

Safdar Hussain (Marks obtained: 122/Out of: 150)

This white paper provides an overview of the climate change situation in Nagar Valley, Gilgit-Baltistan, Pakistan, outlining the observed impacts, challenges, and potential adaptation and mitigation strategies. Situated near China and India, Nagar Valley's environment and socio-economic conditions face threats due to climate change. The region is characterized by high-altitude mountains, glaciers, and biodiversity, heavily reliant on agriculture, glacial water, and tourism.

The mismanagement of the growing tourism industry contributes significantly to land, water, air, and sound pollution, further damaging the environment and impacting the socio-economic well-being of the local communities.

Hunza's Climate Crucible

The paper highlights several critical **climate change issues** impacting Nagar Valley. These include a **rise in temperature, glacial melting, irregular weather patterns, ecosystem and habitat destruction, and irregular precipitation**. The dependency on glacial water makes the valley particularly vulnerable to **water scarcity and pollution** as glaciers retreat and springs shrink. **Anthropogenic activities**, such as drainage and waste disposal, exacerbate water contamination, leading to increased waterborne diseases.

The **agriculture sector** suffers from declining crop yields due to climate-change-induced diseases and pests, affecting food security and market value. Similarly, livestock health and the community's economy are negatively impacted. The mismanagement of the growing **tourism industry** contributes significantly to **land, water, air, and sound pollution**, further damaging the environment and impacting the socio-economic well-being of the local communities. Moreover, the emergence of diseases like cancer, gastric issues, anxiety, and vector-borne diseases, potentially linked to climate change and increased tourism, poses a severe threat to public health. The natural ecosystem's biotic components face diseases, migration, and potential extinction due to these changes.

Adaptation is Must for Survival

Addressing these challenges requires comprehensive **adaptation strategies**. The paper emphasizes the need to **prepare an Integrated Water Resource Management (IWRM) Strategy** for the region, focusing on efficient and judicious water use across domestic, agricultural, power, and industrial sectors. This includes improving water distribution systems. **Implementing adaptation interventions in agriculture, horticulture, livestock, rangelands, and fisheries** is also crucial. Strengthening preparedness and institutional response to **reduce morbidity and mortality from infectious diseases and malnutrition** attributed to climate change is vital, along with establishing surveillance systems for relevant risk factors.

Furthermore, **adaptation in land use and forestry** through mass afforestation, reforestation, and watershed management for soil protection and groundwater recharge are recommended. The importance of understanding and supporting **household-level climate change adaptation** among small landholders in the region is underscored by ongoing research. This research aims to identify effective adaptation strategies and their determinants, providing valuable data for policymakers to develop targeted interventions and resilience measures.

Solutions and Recommendations

The paper also outlines several **solutions and recommendations** for mitigation. It stresses the importance of **strong political leadership** in planning and implementing an effective climate change act with strict enforcement and penalties for violations, alongside incentives for compliance. **Government departments**, particularly the EPA, should have direct involvement in environmental planning, supported by law enforcement.

Civil society organizations should actively engage in climate change mitigation through community involvement, capacity building, awareness campaigns, and expanding green belts. The **media** plays a crucial role in raising

awareness and educating the public about climate change impacts.

Businesses are encouraged to adopt environment-friendly practices, including sustainable packaging and using machinery with lower GHG emissions. **Citizen participation** is deemed essential, with the suggestion of forming community committees to address specific issues like water cleanliness and land management, ensuring accountability at the local level. Finally, the paper recommends **sustainable water management** practices, including proper irrigation and runoff systems, to protect human health and the aquatic ecosystem.

In conclusion, the white paper effectively highlights the significant climate change threats facing Nagar Valley and emphasizes the urgent need for a multi-stakeholder approach involving government, communities, and international organizations. Implementing sustainable adaptation and mitigation strategies is crucial to safeguarding the valley's natural resources and ensuring the well-being of its inhabitants.

About the author: Safdar Hussain, BS Forestry, is an environmental coordinator in District Nagar, Gilgit Baltistan. He leverages his expertise to promote sustainable practices within a local organization, contributing to the region's ecological preservation.

North Waziristan: Climate Change Impacts and Actions

Amir Hussain (Marks obtained: 118/Out of: 150)

This white paper on climate change in North Waziristan Tribal district", provides an overview of climate change issues, challenges, adaptation strategies, mitigation approaches, and recommendations specific to the North Waziristan district of Khyber Pakhtukhwa province in Pakistan.

Climate Change Impacts

The paper highlights that North Waziristan is experiencing the impacts of climate change through **rising temperatures**. The hot season lasts for about 4.4 months with average daily temperatures above 95°F, peaking in July. Changes in **precipitation patterns** are also evident, with a wetter season from February to September and a drier season from September to February. March receives the most precipitation, while November sees the least.

The region is also susceptible to **extreme weather events** such as rainfall-induced flooding, which has caused damage to properties and even fatalities, as reported by news outlets like The Express Tribune and Pakistan Press International News Agency. Furthermore, the paper identifies key **human health concerns** potentially exacerbated by climate change, including diarrheal diseases, malnutrition, respiratory infections, and skin diseases.

Challenges to Climate Action

Several challenges hinder effective climate action in North Waziristan. A significant obstacle is the **lack of awareness** among the public about climate change and adaptation, largely attributed to the high illiteracy rate. There is also **limited access to technology and resources**, preventing the adoption of modern agricultural techniques and efficient irrigation systems due to high poverty levels. **Political disinterest** is another major gap, with political members and leaders showing limited engagement in combating climate change.

There is also limited access to technology and resources, preventing the adoption of modern agricultural techniques and efficient irrigation systems due to high poverty levels. Political disinterest is another major gap, with political members and leaders showing limited engagement in combating climate change.

Poor infrastructure, including improper drainage systems and a lack of flood protection, exacerbates the impacts of extreme weather. Finally, **poverty** drives unsustainable practices like deforestation for fuel.

Adaptation Measures

The white paper outlines several existing and potential adaptation measures for North Waziristan. These include **rainwater harvesting** through the construction of small dams and reservoirs for irrigation, **improved irrigation techniques** such as constructing water channels to reduce wastage, and promoting **water-efficient crops** like wheat and pulses. **Breed selection** for heat and water resistance in crops and animals is also suggested, along with **fodder management** techniques for the dry season. **Tree plantation**, particularly of pine trees, is recognized as a crucial measure. **Community awareness** initiatives through seminars and speeches are underway to educate people about climate change impacts.

Finally, **climate-resilient agriculture training** is deemed important for farmers adapting to changing weather patterns. However, the paper notes adaptation gaps due to a lack of awareness, limited access to technology, political disinterest, and poor infrastructure.

Mitigation and Greenhouse Gas Emission Sources

The paper identifies key sources of greenhouse gas (GHG) emissions in North Waziristan. While there aren't large coal reserves, the extraction of other minerals like copper and gold, along with the operation of power plants and petroleum companies in areas like Spinwam, contribute to emissions due to machinery use. **Industries**, although limited in large-scale construction, involve activities by petroleum companies that significantly emit carbon dioxide. **Transportation** heavily relies on diesel-powered vehicles, which are major sources of CO2. **Agriculture** contributes through the use of plasticizers, leading to methane and nitrous oxide emissions. **Improper solid waste disposal**, including open dumping and burning, also releases methane.

Solutions

The paper recommends several solutions involving **political leadership** developing regulations, **government departments** enforcing rules and providing resources, **civil societies** raising awareness, **media** highlighting the issue, the **business community** adopting emission-reducing practices, and **citizens** adopting sustainable lifestyles. Reasons for inaction include financial constraints, lack of political will, lack of awareness, and planning challenges.

Suggestions

It strongly suggests empowering local government, enforcing environmental regulations, raising public awareness through seminars and media, promoting responsible business practices to reduce emissions, and encouraging citizens to adopt sustainable lifestyles.

About the author: Amir Hussain, a Civil Engineering graduate from North Waziristan, champions regional development. He works with "The League of Waziristan" and "Umar Welfare Foundation," transforming barren lands into agricultural zones and promoting afforestation. He's dedicated to fostering greenery and sustainable growth in his community.

Skardu Climate Change Impacts and Responses

Hamid Hussain (115/150)

The white paper by Hamid Hussain provides a valuable overview of climate change in Skardu, Baltistan, highlighting the region's unique vulnerabilities and the multifaceted challenges it faces. Situated in the Karakoram Range, surrounded by towering peaks and glaciers including K2, Skardu is experiencing significant impacts from a changing climate, posing threats to its environment, economy, and the livelihoods of its inhabitants.

Climate Change Issues and Impacts

The document emphasizes that Gilgit-Baltistan is highly vulnerable to climate change in South Asia. **Rising temperatures** are causing rapid glacier melting, leading to the formation of glacial lakes and increasing the risk of **glacial lake outburst floods (GLOFs)**, which are a major concern in Skardu. These floods have already damaged settlements, infrastructure, and agricultural lands, threatening food security and livelihoods. Changes in snowfall patterns, with a significant decrease over the past three decades, further exacerbate water availability issues.

The increased frequency of **extreme weather events** such as blizzards, snowstorms, and heatwaves are becoming the new normal. These changes contribute to soil erosion, landslides, and negatively impact human health through stress, weather-related illnesses, and food insecurity. Furthermore, the fragile ecosystems are being degraded, threatening local biodiversity, such as the Markhor population. The mountains in the northern areas are warming at twice the rate of the lowlands, signaling an alarming trend.

Several challenges hinder effective responses to climate change in Skardu. There is a lack of comprehensive research quantifying the socioeconomic repercussions of glacier melting on sustenance. Despite the region's reliance on tourism, agriculture, and livestock, these sectors are increasingly threatened by climate variability.

Challenges

Several challenges hinder effective responses to climate change in Skardu. There is a **lack of comprehensive research** quantifying the socioeconomic repercussions of glacier melting on sustenance. Despite the region's reliance on tourism, agriculture, and livestock, these sectors are increasingly threatened by

climate variability. The **high rate of youth unemployment** and poverty, compounded by reduced government subsidies and increased taxes, further diminishes the capacity to cope with climate impacts. While a large portion of the population is under 25, there are issues with literacy rates, particularly among adult women, and a significant number of out-of-school children, potentially hindering the dissemination and understanding of climate change information. The increasing population in urban areas due to rural migration, driven in part by climate-induced degradation of agricultural livelihoods, strains the poor infrastructure and limited resources.

Adaptation

The paper highlights existing local adaptation measures. The Kalasha people's "Suri Jagek" system demonstrates the use of indigenous knowledge for weather forecasting and agricultural planning. Communities affected by climate change are also adopting new farming methods to cope with water shortages. Community-based adaptation models are recognized as crucial for enhancing resilience. However, there is a need to better organize the dissemination of contemporary scientific knowledge alongside indigenous knowledge. The paper identifies a **considerable gap in literature** regarding climate change and glacier melting impacts on local subsistence patterns in Northern Pakistan.

Mitigation

While not a primary focus, the document touches upon sources of greenhouse gas (GHG) emissions in Baltistan. **Wood burning for heating and cooking** is a major contributor in winter, and the use of **animal dung** is a significant source of methane. Increased **transportation** due to tourism is also contributing to air pollution. Issues with **solid waste disposal** in urban areas lead to further environmental concerns. Notably, burning agricultural residue is not prevalent in Baltistan due to single-season cropping.

Solutions and Recommendations

The paper emphasizes the crucial role of **political leadership** in developing and

implementing comprehensive climate action plans with resource allocation and policy coherence. **Government departments**, NGOs, and international organizations should offer support and assistance to affected communities through financial aid, training, and emergency response, as demonstrated by the provision of flood-resistant seeds and post-disaster relief. **Civil society and citizens** can contribute through community clean-up initiatives, cooperatives, and afforestation efforts to combat soil erosion. **Climate change awareness** and education are essential, requiring efforts from governments, NGOs, and local specialists to inform people about the issue, its local relevance, and adaptation measures. Addressing hurdles in information dissemination, especially to vulnerable groups, is also vital.

***About the author**: Hamid Hussain is the student of M. Phil in Environment*

Climate Change in Dihrkot: Impacts & Adaptation

Atta Ur Rehman (Marks obtained: 111/Out of: 150)

This white paper examines the climate change issues affecting Dihrkot, a picturesque region in Azad Jammu and Kashmir. Dihrkot is experiencing the adverse effects of climate change, including rising temperatures, erratic rainfall patterns, and frequent landslides, impacting its population, economy, and environment. The region's dependence on natural resources makes it particularly vulnerable to these environmental changes.

The dependence on agriculture and natural resources for livelihoods makes the local population highly susceptible to these climate-induced challenges, potentially leading to reduced crop yields, food insecurity, and undermining economic stability.

Climate Change Issues and Challenges

Recent studies indicate that Dihrkot is experiencing rising temperatures and erratic precipitation patterns. These climatic shifts are leading to significant ecological and socio-economic consequences. The increased frequency of extreme weather events like floods and landslides poses substantial risks to the region's infrastructure and the livelihoods of its inhabitants. Changes in climate patterns are also affecting the phenology of local plant species, impacting flowering times and distribution patterns.

Furthermore, shifts in climate patterns, including altered precipitation and temperature, are influencing agricultural productivity and the overall health of plant communities in Dihrkot. Deforestation and unsustainable land-use practices exacerbate these environmental challenges, leading to soil erosion, increased risk of landslides, and a loss of biodiversity. Human-wildlife conflict and livestock predation, potentially intensified by environmental degradation, also present challenges to the local communities.

The dependence on agriculture and natural resources for livelihoods makes the local population highly susceptible to these climate-induced challenges, potentially leading to reduced crop yields, food insecurity, and undermining economic stability.

Adaptation Strategies in Dihrkot

The paper suggests several adaptation strategies to address the climate change impacts in Dihrkot. These include **afforestation and reforestation programs** to restore degraded forests and enhance resilience. Promoting **climate-resilient crops and water conservation techniques** within the agricultural sector is crucial for ensuring food security in the face of changing climatic conditions. **Developing early warning systems and emergency response plans** can help mitigate the risks associated with extreme weather events. Investing in **better roads, drainage systems, and resilient housing** is essential for improving infrastructure and protecting communities from climate-related disasters.

Mitigation Measures in Dihrkot

While the paper primarily focuses on the impacts and adaptation strategies, it implicitly suggests that reducing deforestation and promoting sustainable land management practices could contribute to climate change mitigation by preserving carbon sinks and reducing greenhouse gas emissions from land degradation.

Suggestions

The paper underscores the necessity of a **combination of policy measures, community engagement, and sustainable development initiatives** to effectively address the adverse effects of climate change in Dihrkot. It highlights the importance of understanding the region's ecological significance and its vulnerability to climate change to implement effective adaptation strategies. Preserving the region's cultural heritage and traditional knowledge related to natural resource management is also noted as important in the face of modernization and environmental change.

***About the author**: Atta Ur Rehman, an advocate and LLM candidate at International Islamic University, blends academic rigor with practical legal expertise. Specializing in family, civil, and criminal law, he champions justice through research and advocacy. His mission: to bridge legal understanding with societal needs.*

Narowal: Adapting to Climate Change Impacts

Kinza Munir (Marks obtained: 111/Out of: 150)

Narowal district in Pakistan, heavily reliant on agriculture, faces significant challenges due to climate change. The region experiences **temperature extremes**, with rising summer temperatures intensifying heatwaves and increasing water demand. Erratic weather patterns and **reduced rainfall** have led to **water scarcity**, negatively impacting irrigation and resulting in lower agricultural yields.

The district is also prone to **frequent fluctuations between droughts and floods** due to unpredictable monsoon seasons, destroying crops and disrupting infrastructure. These changes in climate are causing **shifting growing seasons and affecting crop viability**, posing difficulties for local farmers. Furthermore, higher temperatures and poor sanitation during floods contribute to an **increase in waterborne diseases**, impacting public health.

Overall, climate change severely impacts Narowal's agrarian economy, leading to economic and social consequences.

Climate Change Adaptation Strategies in Narowal

To address these challenges, Narowal is pursuing various **adaptation strategies** aimed at reducing vulnerability and improving resilience. Key measures focus on **water management and irrigation**, including the implementation of more efficient techniques like drip and sprinkler irrigation, construction of water reservoirs and ponds, and promotion of rainwater harvesting. In **climate-resilient agriculture**, efforts are being made to encourage the cultivation of drought-resistant crops, promote crop diversification, and implement improved farming techniques such as conservation tillage and agroforestry.

Narowal is pursuing various adaptation strategies aimed at reducing vulnerability and improving resilience. Key measures focus on water management and irrigation, including the implementation of more efficient techniques like drip and sprinkler irrigation, construction of water reservoirs and ponds, and promotion of rainwater harvesting.

Flood management strategies involve implementing flood forecasting and early

warning systems, strengthening flood barriers and embankments, and empowering communities with community-based disaster risk management plans. To address **health concerns**, public education on climate risks is being emphasized, alongside the strengthening of healthcare facilities to deal with climate-sensitive diseases. Efforts towards **sustainable livelihoods and economic diversification** include encouraging non-agricultural income sources and supporting community-based adaptation projects. Finally, **forest and ecosystem management** through afforestation and reforestation, as well as the conservation of wetlands, are being undertaken to prevent soil erosion, enhance biodiversity, and regulate the local climate.

Mitigation and Suggestions

While the primary focus of the paper is on climate change impacts and adaptation, certain mentioned strategies can indirectly contribute to mitigation. For instance, **improved farming techniques like agroforestry and organic farming can enhance carbon sequestration in soils**. Promoting **renewable energy projects (solar and wind)** as part of economic diversification would also help in reducing greenhouse gas emissions.

Based on the information provided, the following suggestions can be made:

- **Enhance investment in water-efficient irrigation technologies** to combat water scarcity and reduce energy consumption associated with traditional irrigation methods.
- **Scale up programs supporting the adoption of drought-resistant and climate-smart crop varieties** to ensure food security under changing climatic conditions.
- **Strengthen flood early warning systems** and invest in resilient infrastructure to minimize the damage from extreme rainfall events.

- **Promote widespread adoption of renewable energy sources** at the community and household levels to reduce reliance on fossil fuels.
- **Implement comprehensive public awareness campaigns** on climate change impacts, adaptation strategies, and the importance of sustainable practices.
- **Foster stronger linkages between research institutions and local farmers** to facilitate the development and dissemination of climate-resilient agricultural practices.
- **Support the development of small-scale, climate-resilient non-agricultural livelihoods** to reduce dependence on agriculture and enhance economic stability.

Lahore's Climate Change: Impacts and Actions

Shahid Nawaz (Marks obtained: 109/Total marks: 150)

Lahore, Pakistan's second-largest city and a significant cultural and economic hub, is facing increasing threats from climate change, as detailed in the White Paper dated March 3, 2025. This review summarizes the climate change issues, challenges, adaptation and mitigation efforts, and suggestions outlined in the document.

Climate Change Issues

Lahore is experiencing a clear warming trend, with a **1.5°C increase in average temperature since 1960**, and projections indicating a further 0.8–1.0°C rise by 2050. The city has witnessed intensified heatwaves, with temperatures exceeding 45°C and heat indices reaching 49°C. Rapid urbanization, with the conversion of over 200 square kilometers of farmland and green space since the 1980s, has exacerbated the **urban heat island effect**, making densely populated areas significantly hotter.

Changes in precipitation patterns are also evident, with **increasingly erratic monsoon rainfall leading to urban flooding** and prolonged dry spells causing water scarcity. Extreme weather events are on the rise, including more frequent and intense floods, such as the record-breaking 353 mm of rain in a few hours in July 2024. Dust storms, once rare, have become increasingly common, posing respiratory health risks.

Alarmingly, **climate change is exacerbating Lahore's severe air pollution**, making it one of the world's most polluted cities, with PM2.5 levels reaching dangerously high concentrations, especially during winter. These environmental changes are having significant **human health impacts**, including increases in heat-related illnesses, respiratory and cardiovascular diseases, vector-borne diseases like dengue, waterborne diseases, and even mental health issues. The city's **ecosystem is also suffering**, with loss of tree cover, declining native species, proliferation

Alarmingly, climate change is exacerbating Lahore's severe air pollution, making it one of the world's most polluted cities, with PM2.5 levels reaching dangerously high concentrations, especially during winter.

of invasive species, degradation of wetlands, and reduced agricultural and fisheries yields. The transport sector is identified as the **largest contributor to GHG emissions** in Lahore, followed by industry, waste burning, and agriculture residue burning.

Climate Challenges

Despite some ongoing efforts, Lahore faces significant **adaptation gaps**. These include inadequate drainage systems, unplanned urbanization, lack of heat-resilient infrastructure, overexploitation of groundwater, limited adoption of rainwater harvesting, weak enforcement of emission standards, underdeveloped early warning systems, low public climate literacy, and insufficient ecosystem restoration. Several **barriers to adaptation** hinder progress, including financial constraints, fragmented governance, technical and capacity gaps, socioeconomic challenges (high poverty, informal settlements), cultural and behavioral barriers, and environmental degradation.

Adaptation and Mitigation

Lahore has initiated some **adaptation measures**, such as participation in the 10 Billion Tree Tsunami Program, development of urban parks, implementation of a Smog Action Plan, installation of air quality monitoring stations, promotion of rainwater harvesting, upgrading drainage systems, discussions for a Heat Action Plan, development of the Punjab Climate Change Policy 2024, and establishment of a composting facility. There are also renewable energy initiatives and climate change research being conducted. **Mitigation efforts** are reflected in the Smog Action Plan's attempts to regulate emissions from various sectors and the composting facility's role in reducing landfill waste and GHG emissions.

Suggestions to combat Climate Change

The White Paper emphasizes a **multi-stakeholder approach** to address climate change in Lahore. Key recommendations include political leadership developing a

Climate-Resilient Urban Master Plan and implementing policies for groundwater regulation and low-emission zones. Government departments should establish a Unified Urban Development Authority, implement smart irrigation, and expand electric public transportation. Civil society should advocate for urban greening, water conservation, and disaster preparedness training. Businesses need to invest in green and resilient infrastructure. Citizens should adopt sustainable practices. The media has a crucial role in raising awareness and holding stakeholders accountable.

The report also sets **measurable targets** for increasing green cover and reducing PM2.5 levels. **Financial measures**, including securing climate finance and allocating a portion of the city budget to adaptation, are essential. Finally, **community engagement** is highlighted to ensure equitable and sustainable development.

Conclusion

Climate change presents a significant and multifaceted challenge to Lahore. While some initial steps towards adaptation and mitigation have been taken, substantial and coordinated efforts across all sectors are urgently needed to build resilience and ensure a sustainable future for the city's growing population. Addressing the identified gaps and barriers through strong political will, adequate funding, and active community participation is crucial for effective climate action.

***About the author**: Shahid Nawaz is an Environmental Sciences graduate driving sustainable change. He leads clean-ups, workshops, and renewable campaigns, inspiring eco-action. Tree planting, recycling advocacy, and policy collaboration define his commitment. He empowers communities towards a greener future through NGO volunteering and proactive initiatives.*

Chakwal Climate Impacts and Resilience

Tehreem Khan (Marks obtained: 106/Total marks: 150)

This review summarizes the white paper analyzing climate change impacts in Chakwal, Pakistan. The document highlights the district's vulnerability to evolving climate trends, the resulting challenges across various sectors, and proposes adaptation and mitigation strategies for building resilience. Chakwal, a predominantly rural district in Punjab with an agrarian economy, faces significant threats from rising temperatures, altered rainfall patterns, and increased frequency of extreme weather events.

Climate Change Challenges

These climate changes pose severe challenges to Chakwal's key sectors. **Agriculture**, which employs approximately 60-70% of the workforce and is largely rain-fed, is particularly vulnerable. Decreasing rainfall and heat stress have already led to a 15% decline in wheat yields in the last decade, and overall crop yields of wheat and maize have decreased by about 25% due to water scarcity. Increased livestock mortality due to heatwaves and water shortages, estimated at 10-15% during severe events, further impacts livelihoods.

The climate change poses severe challenges to Chakwal's key sectors. Agriculture, which employs approximately 60-70% of the workforce and is largely rain-fed, is particularly vulnerable. Decreasing rainfall and heat stress have already led to a 15% decline in wheat yields in the last decade, and overall crop yields of wheat and maize have decreased by about 25% due to water scarcity.

Major Climate Change Issues

Historical climate data reveals an average temperature increase of 1.5°C over the last 30 years in Chakwal. Projections indicate a further 2-4°C rise by the end of the century. Rainfall patterns are becoming increasingly erratic, with decreasing annual rainfall and greater variability, leading to both droughts and floods. The average annual rainfall is around 500-700 mm, concentrated in the monsoon season, and has seen a 15% reduction over the past two decades. Furthermore, the frequency and intensity of heatwaves have increased, with a 20% rise in the last decade.

Water resources are under immense pressure due to declining groundwater levels from over-extraction and limited surface water. Water shortages affect 40% of households during peak summer. **Human health** is also at risk, with increased cases of heatstroke and waterborne diseases reported. The rise in waterborne diseases by 30% is linked to contaminated water sources. Moreover, extreme weather events like floods, droughts, and storms damage infrastructure and human settlements. Historical sites and cultural landmarks are also at risk due to increased rainfall intensity causing erosion and degradation. The economic losses due to climate-related events are estimated at $50 million USD annually. Livelihood insecurity is driving out-migration from rural areas, with a 5% increase reported.

Adaptation Strategies

The white paper emphasizes the need for various adaptation strategies to build resilience. **Water conservation** measures are crucial, including promoting rainwater harvesting, drip irrigation, and water-efficient farming practices. Introducing and promoting **drought-resistant crops** like certain varieties of wheat, maize, and pulses, in collaboration with the Punjab Agricultural Research Board, is also recommended. **Climate-smart agriculture** practices, such as crop rotation, conservation tillage, and integrated nutrient management, should be adopted. Furthermore, afforestation and reforestation efforts are necessary to increase forest cover (with a target of a 5% increase by 2030) and reduce soil erosion. Investing in climate-resilient infrastructure, including flood control measures and drought-resistant crops, and strengthening early warning systems for droughts and floods are also vital.

Mitigation Strategies

Regarding mitigation, the paper identifies key **GHG emission sources** in Chakwal, primarily industries like cement factories (Bestway Cement, DG Khan Cement) and traditional brick kilns. Coal-fired power plants in the region also contribute to emissions. The white

paper suggests **investing in renewable energy sources** such as solar and wind power to reduce reliance on fossil fuels. Improving energy efficiency in industries and promoting sustainable transportation are also implicit mitigation measures. Afforestation and reforestation efforts can also contribute to carbon sequestration.

Suggestions and Recommendations

The white paper strongly suggests **collaborative action** among all stakeholders to address climate change in Chakwal. It emphasizes the importance of improved water management and conservation strategies, the adoption of sustainable agricultural practices, and investment in climate-resilient infrastructure and renewable energy. Preservation efforts and sustainable tourism practices are recommended to protect cultural heritage sites from extreme weather impacts.

Conclusion

Addressing climate change in Chakwal is an urgent necessity for ensuring sustainable development and a climate-resilient future. The white paper provides a comprehensive analysis of the challenges and offers valuable recommendations for adaptation and mitigation that require concerted efforts from the government, local communities, and other stakeholders.

Swat's Climate Crisis: Challenges and Solutions

Muhammad Bilal (Marks obtained: 99/Out of: 150)

The paper provides a concise overview of the climate crisis in Swat, a vulnerable hilly valley in Pakistan's Khyber Pakhtunkhwa province with a young and growing population of approximately 2.3 million. The region's economy is heavily reliant on agriculture (65% engaged in farming) and a recovering tourism sector, both susceptible to climate interruptions.

rapidly, losing 22% of their cover since 2000, increasing the risk of glacial lake outburst floods (GLOFs). These environmental changes are also impacting human health, with a 25% increase in heatstroke and an 18% rise in malaria cases. The agricultural sector is suffering, with harvests of key crops like apples and walnuts decreasing by 15% since 2015, exacerbating food insecurity. Deforestation, with a 20% loss of forest cover since 2000, further exacerbates the region's environmental vulnerabilities.

The agricultural sector is suffering, with harvests of key crops like apples and walnuts decreasing by 15% since 2015, exacerbating food insecurity. Deforestation, with a 20% loss of forest cover since 2000, further exacerbates the region's environmental vulnerabilities.

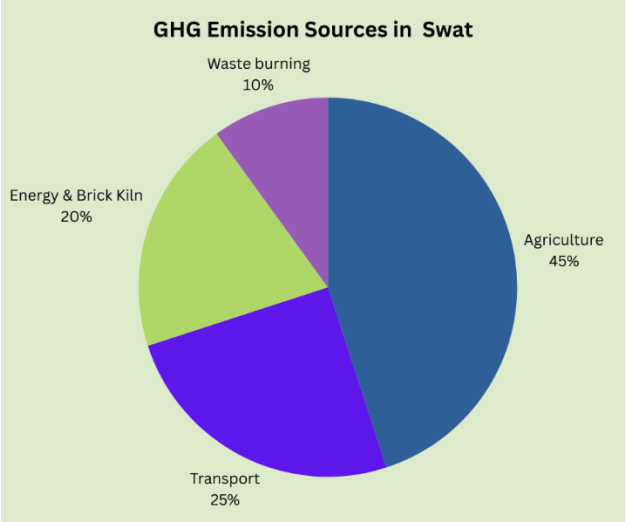
Climate Change Issues

It highlights significant **climate change issues** already impacting Swat. Since 1980, the region has experienced a **1.2°C temperature rise**, leading to more frequent and intense heatwaves. Monsoon rainfall has intensified by 15% in the last decade, culminating in catastrophic floods in 2022 that displaced 300,000 people and caused $1.5 billion in infrastructure damage. Furthermore, winter snowfall has declined by 30%, threatening water security for irrigation and hydropower. The **Hindu Kush glaciers are receding**

Climate Change Challenges

The paper identifies several **challenges** in addressing climate change in Swat. Despite some **adaptation efforts** like early warning systems in limited areas and tree planting initiatives, significant **gaps** remain. Only a small percentage of farmers utilize drought-resistant crops, and there are no official strategies for GLOF or long-term drought mitigation. A major challenge is **financial constraint**, with 80% of adaptation projects

depending on foreign funding. **Low public awareness** about climate threats, with 60% of rural residents lacking perception of these risks, hinders community engagement. Moreover, **women are largely excluded** from climate change adaptation decision-making processes.



GHG Emission Sources

Regarding **greenhouse gas emissions**, the paper indicates that **agriculture is the largest contributor (45%)** due to livestock methane and synthetic fertilizers. The **transport sector accounts for 25%** due to aging diesel vehicles, followed by **energy production (diesel generators and brick kilns) at 20%** and **waste management (open burning) at 10%**. This sectoral breakdown provides crucial information for targeted mitigation strategies.

The white paper offers several **recommendations** to enhance climate resilience in Swat. It emphasizes the urgency of enacting the **Swat Climate Resilience Act by 2026**, which should mandate a **30% reduction in CO_2 emissions by 2030**. Allocating **5% of the provincial budget towards climate adaptation** could finance vital infrastructure like small dams for flood control. The government should prioritize delivering **heat-resistant seeds to 50,000 farmers by 2025** and enforce **flood-resistant building codes**. Empowering communities is also crucial, with a recommendation to train **500 women as "Climate Champions"** for outreach and participation in climate planning. The media should play a role by developing a **monthly Swat Climate Bulletin** to track progress. Supporting **solar-power-using businesses through tax relief** and providing **biogas plant subsidies** to households are also suggested.

Peshawar's Climate Urgency: Challenges and Solutions

Sami Ud Din Khisrow (Marks obtained: 99/Out of: 150)

Peshawar, a historically significant and densely populated urban center, is facing escalating climate change impacts that threaten its environmental sustainability and the well-being of its 4,267,198 residents. Once known as the city of flowers, Peshawar now ranks as the fifth most polluted city globally. This vulnerability is highlighted in this white paper, which analyzes the city's demographic, economic, and environmental landscape, identifies climate-related challenges, and proposes actionable adaptation and mitigation strategies.

Climate Change Impacts

Climate change is already manifesting in Peshawar through rising temperatures, with a 1.5°C increase over the past 50 years and projections of a further 2-3°C rise by 2050. More frequent heatwaves, with temperatures exceeding 45°C, pose significant health risks. **Changes in precipitation patterns** are also evident, characterized by both prolonged droughts and intense rainfall events, such as the record 300 mm of rainfall in a single day that caused severe flooding. These shifts threaten agriculture and water resources. Consequently, heat-related illnesses surged by 40%, and waterborne diseases increased by 25% after recent floods. The economic toll of climate disasters in Peshawar is estimated at **$500 million annually**, with over 50% of the population potentially facing climate-induced displacement by 2040.

Exacerbating Factors

Several challenges exacerbate Peshawar's climate vulnerability. **Deforestation**, driven by urbanization and resource extraction, reduces green cover. **Air and water pollution** are growing concerns due to industrial activities, vehicle emissions, and inadequate waste management. Aging and **inadequate urban infrastructure**, such as non-functional drainage systems, worsen flooding. **Limited public awareness** of climate risks and

Climate change is already manifesting in Peshawar through rising temperatures, with a 1.5°C increase over the past 50 years and projections of a further 2-3°C rise by 2050. More frequent heatwaves, with temperatures exceeding 45°C, pose significant health risks.

adaptation practices hinders effective community action. Significant **financial shortfalls** in the climate adaptation budget and reliance on international donors create instability. **Barriers to effective adaptation** include frequent shifts in leadership and poor inter-departmental coordination. Furthermore, **equity gaps** exist, with marginalized groups often excluded from adaptation programs.

Adaptation Measures

Despite these challenges, the paper highlights ongoing and proposed **adaptation measures**. Urban planning initiatives focus on upgrading drainage, constructing embankments, and retrofitting infrastructure. The **Billion Tree Tsunami project** has increased forest cover, improving soil stability and reducing flood risks. Early warning systems are being established to enhance disaster preparedness. To address inadequate infrastructure, flood-resistant roads are proposed. Enhancing public awareness through climate literacy campaigns and advocating for equity in adaptation efforts are also crucial.

Mitigation Strategies

Regarding **mitigation**, the paper identifies major **greenhouse gas (GHG) emission sources** in Peshawar, including **coal-fired power plants** (40% of emissions), **transportation** (the largest source, projected to be 59.3% in 2030), and **agriculture and livestock** (36.1%). To mitigate these emissions, the paper suggests developing a comprehensive **Climate Action Plan** with binding emission reduction targets. **Strict enforcement of industrial emission standards** and promoting sustainable urban planning, such as expanding the BRT system, are recommended. Encouraging **methane-reducing agricultural practices** and launching public education campaigns are also vital. For businesses, adopting **renewable energy** and sustainable practices is encouraged. Citizens are urged to adopt **eco-friendly lifestyles** and participate in community action. Partnering with China for **waste-to-energy plants** is also proposed.

The Way Forward

In conclusion, this white paper provides a comprehensive overview of climate change issues in Peshawar, outlining significant challenges and proposing a range of adaptation and mitigation strategies across political, governmental, civil society, media, business, and citizen levels. Collaborative and sustained efforts rooted in these actionable strategies are essential to build a climate-resilient and environmentally sustainable future for Peshawar.

KRK: Facing Climate Change Impacts

Muhammad Waleed Meeran (Marks obtained: 90/Our of: 150)

This review focuses on the climate change aspects detailed in the White Paper on Kot Radha Kishen (KRK), a tehsil in Punjab, Pakistan. The document highlights the significant climate change issues facing KRK, the associated challenges, and proposes adaptation and mitigation strategies, alongside emphasizing the urgent need for collaborative action.

The agricultural sector of KRK, a cornerstone of the local economy, faces threats from declining yields and water scarcity. Human health is increasingly at risk due to heatwaves and the proliferation of vector-borne diseases like malaria and dengue, exacerbated by altered temperatures and rainfall.

KRK Under Climate Siege

The White Paper identifies several critical **climate change issues** impacting KRK. The region has experienced **rising temperatures**, with heat surges reaching as high as 44°C in nearby Lahore affecting KRK. This has led to decreased productivity in key agricultural sectors like wheat and cotton (up to 20%), causing economic hardships for farmers. Human health has also been severely impacted, with an increase in sunstroke, cardiac arrest, dehydration, fever, and breathing problems, particularly among vulnerable populations and laborers. Livestock suffer from heat stress, lower milk yields, and increased mortality. Additionally, altered precipitation patterns are evident, with a **42% reduction in precipitation** observed between September 2024 and mid-January 2025, leading to winter drought, reduced soil moisture, and crop yield losses. Conversely, more frequent and intense rainfall events in other seasons cause flooding, soil erosion, and waterlogging, further disrupting agriculture. The unpredictability of rainfall makes traditional farming increasingly challenging, leading to economic instability and food insecurity.

Combating Climate Change in KRK

These climatic changes present significant **challenges** for KRK. The agricultural sector, a cornerstone of the local economy, faces threats from declining yields and water

scarcity. Human health is increasingly at risk due to heatwaves and the proliferation of vector-borne diseases like malaria and dengue, exacerbated by altered temperatures and rainfall. The ecological state of KRK is also under pressure, with decreased native species populations due to habitat modification and the spread of invasive species. Prolonged heatwaves have eroded forest cover, deteriorating soil conditions and impacting essential pollinators. Changes in water availability and quality in freshwater bodies like canals and ponds have disrupted local fisheries. Quantifiable impacts over the past four decades include temperature rises of **12.2% to 15.9%** and precipitation increases of **10.9% to 14.9%**. These changes have harmed natural habitats, reduced agricultural production, degraded soil, and potentially caused population shifts. Healthcare facilities face increasing strain due to climate-related incidents and the rise in waterborne and vector-borne diseases.

A Call for Unified Action

The Paper proposes several **adaptation** strategies to address these challenges. These include developing **heat-resistant crops**, implementing **improved irrigation techniques** and better water management. For human health, the recommendations include **enhanced urban heat reduction techniques**, expanding medical services, implementing cooling programs, improving water accessibility, and strengthening disease monitoring systems.

In terms of **mitigation**, the document emphasizes the need for an integrated approach involving various stakeholders. Political leadership should establish a climate action plan integrating adjustment and mitigation into all policies and developmental plans, along with a targeted green funding initiative to boost renewable energy capacity. Government departments are tasked with monitoring and executing climate policies, creating a carbon discharge trading system, establishing energy efficiency programs for at least a 10% reduction by 2030, and integrating

solar power in 30% of public schools and hospitals by 2030. Civil society organizations will promote climate action through grassroots programs, focusing on capacity building for vulnerable groups and incorporating local knowledge into policies. The media should disseminate accurate climate change information, hold responsible parties accountable, and facilitate public discussions. Businesses are encouraged to support sustainable methods and green technologies, aiming for 15% electric vehicle adoption in new car purchases by 2030 and collaborating on green projects.

Conclusion

In conclusion, the Paper effectively highlights the significant climate change issues and challenges confronting Kot Radha Kishen. It underscores the urgent need for comprehensive and collaborative adaptation and mitigation strategies involving all levels of society. The suggested solutions provide a framework for building climate resilience in the region.

Mohmand's Climate Crisis: Challenges and Solutions

Sami Ullah (Marks obtained: 90/Out of: 150)

Mohmand, a fully rural district in Khyber Pakhtunkhwa, Pakistan, with a population of 553,933 (2023), faces a **severe underground water crisis** exacerbated by climate change. The primary economic activities of agriculture and mining are significantly threatened by **declining groundwater levels**. This white paper highlights the climate change issues, challenges, existing and potential adaptation strategies, limited information on mitigation, and offers several key suggestions for addressing this critical situation.

Climate change impacts

Climate change is significantly impacting Mohmand through rising temperatures, changes in precipitation patterns, and increased frequency of extreme weather events. **Increasing temperatures** have led to higher evaporation rates, further reducing water availability. **Erratic rainfall** results in prolonged droughts and flash floods, negatively affecting agriculture and drinking water supply. These extreme weather events also impact human health through water shortages and increased waterborne diseases. The persistent drought conditions are causing **vegetation loss and desertification**, leading to reduced groundwater recharge rates and loss of biodiversity.

Challenges Exacerbating the Water Crisis

Mining activities not only contribute to environmental degradation but also to water depletion. Traditional housing structures often have limited access to clean drinking water and sanitation facilities, making the population more vulnerable to waterborne diseases during shortages.

Several challenges compound these climate change impacts. **Water scarcity** due to over-extraction of groundwater is a pressing issue. The reliance on **water-intensive agricultural practices** further strains the already limited water resources. **Mining activities** not only contribute to environmental degradation but also to water depletion. Traditional housing structures often have **limited access to clean drinking water and sanitation facilities**, making the population more vulnerable to waterborne diseases during shortages.

Furthermore, there is a **lack of large-scale water management projects** and **insufficient investment in sustainable water conservation technologies**. Poor enforcement of water usage regulations and financial constraints also hinder effective action. A lack of awareness about water conservation strategies and an inadequate policy framework and government support further contribute to inaction.

Limited Existing Adaptation Measures

Despite these challenges, some adaptation measures are being implemented. **Traditional rainwater harvesting methods** are used on a small scale. Farmers are adapting by **growing drought-resistant crops**. Some **irrigation projects** have been initiated to manage water usage. However, these measures are insufficient to address the scale of the crisis, indicating significant **adaptation gaps**.

The paper provides a brief overview of greenhouse gas (GHG) emission sources in Mohmand. While power plants have a minimal contribution due to limited electricity production, **mining activities and livestock farming** in the agriculture sector exacerbate climate issues. **Excessive groundwater extraction** for agriculture is also linked to climate challenges. Limited waste management infrastructure leading to **uncontrolled waste disposal** is another contributing factor. The paper primarily focuses on the impacts of climate change and adaptation strategies rather than detailed mitigation plans.

Key Solutions and Recommendations

The white paper offers several key solutions and recommendations. It emphasizes the need for **implementing policies for sustainable water management** and allocating funds for water conservation projects by political leadership. Government departments should **regulate groundwater extraction and enforce water conservation measures**. **Civil society** needs to raise

awareness about water conservation techniques, and the **media** should disseminate information about climate change impacts and solutions. **Businesses** are encouraged to invest in sustainable mining and water-efficient agricultural practices, while **citizens** should adopt responsible water usage habits.

Proposed solutions include promoting **rainwater harvesting and groundwater recharge projects**. A shift towards **drip irrigation and drought-resistant crop varieties** in agriculture is recommended. **Policy interventions** are needed to prevent excessive groundwater extraction. **Infrastructure development**, such as building small dams and reservoirs, is suggested to store water. Crucially, the paper highlights the importance of **community engagement** in water conservation efforts.

Proposed Solutions and Implementation Framework

The proposed implementation framework includes setting a measurable goal to **reduce groundwater depletion by 20% in the next decade**. Solutions must align with local economic and environmental conditions to ensure feasibility and relevance. The timeline for implementation includes short-term (1-2 years) awareness campaigns and policy formulation, medium-term (3-5 years) infrastructure development and regulatory enforcement, and long-term (5+ years) aiming for significant improvements in water conservation.

Conclusion

In conclusion, Mohmand is grappling with a severe water crisis driven by climate change and unsustainable practices. Addressing this requires urgent and collaborative efforts involving sustainable water management, policy interventions, and active community engagement to ensure a water-secure future for the district.

Lasbela's Climate Change: Urgent Action Needed

Anas Habib (Marks obtained: 82/Out of: 150)

District Lasbela, situated in southern Balochistan, Pakistan, is grappling with significant climate change impacts primarily stemming from unchecked deforestation. This illegal logging has diminished the land's capacity to absorb carbon dioxide, resulting in **rising temperatures and more frequent heatwaves**. The **loss of forest cover has also disrupted local weather patterns**, leading to unpredictable rainfall and extended dry spells, which in turn cause major issues for local farmers and diminish agricultural productivity. The devastating floods of 2022 further highlighted the district's vulnerability, causing widespread damage to crops, housing, and public health.

Insufficient Current Adaptation Strategies

Several **challenges** hinder effective climate action in Lasbela. **Deforestation and illegal logging** continue unabated due to weak enforcement. **Forest conservation efforts are limited**, exacerbating the environmental degradation.

Challenges Hindering Climate Action in Lasbela

Several **challenges** hinder effective climate action in Lasbela. **Deforestation and illegal logging** continue unabated due to weak enforcement. **Forest conservation efforts are limited**, exacerbating the environmental degradation. The **economy, heavily reliant on fishing, agriculture, livestock breeding, and mining, is increasingly threatened** by altered weather patterns and reduced productivity of natural resources. Existing **flood protection measures are inadequate**, as evidenced by the 2022 disaster. Furthermore, **investment in climate-smart agricultural practices and modern irrigation systems remains insufficient**, limiting the ability of farmers to adapt. Weak governance and corruption pose significant obstacles to implementing and enforcing environmental regulations.

Current **adaptation strategies** are largely insufficient. While some small-scale **reforestation projects** exist, a more comprehensive approach is urgently needed. Similarly, while there are efforts towards **water conservation**, they require significant

scaling and investment in climate-smart agricultural techniques. The white paper emphasizes the necessity for **robust flood management and water conservation infrastructure** to mitigate future disasters.

Emerging Mitigation Needs

While not explicitly detailed as mitigation, the recommended actions include elements of it. **Enforcing strict laws against illegal logging and protecting existing forests** would help preserve carbon sinks. Promoting **renewable energy and environmentally friendly practices** among businesses and citizens can also contribute to reducing emissions. **Extensive reforestation programs** are crucial for restoring lost forest cover and enhancing carbon sequestration.

Recommended Solutions and Coordinated Action

The white paper offers several **solutions and recommendations** to address the climate crisis in Lasbela. **Political leadership** is urged to enforce strict laws against illegal logging and invest in climate-smart agriculture and irrigation. **Government departments** are tasked with launching extensive reforestation programs and developing robust flood management and water conservation infrastructure. **Civil society and media** should run public awareness campaigns on forest conservation and promote community-led environmental projects. Finally, **businesses and citizens** are encouraged to support renewable energy and participate in local environmental improvement initiatives. Coordinated and immediate action from all stakeholders is deemed essential to restore ecological balance and secure a resilient future for Lasbela.

Zhob Climate Change: Impacts and Pathways

Mujeeb Ullah (Marks obtained: 51/Out of: 150)

This review focuses on the climate change issues affecting Zhob, a district in Balochistan, Pakistan.

Cracked, dry earth with minimal, withered vegetation

Zhob is experiencing significant climate change impacts due to its semi-arid climate and geographical location near the Afghanistan border. These impacts manifest as **rising temperatures**, leading to increased frequency of heatwaves and higher evaporation rates, and **changes in precipitation**, resulting in unpredictable rainfall, droughts, and flash floods. The region also faces more frequent extreme weather events like dust storms and cold waves, contributing to environmental degradation. These changes have dire consequences for human health, with an increase in heat-related illnesses and poor air quality, and for ecosystems, leading to a reduction in vegetation cover and declining livestock health.

No Climate-Resilience

Several challenges hinder effective responses to these climate change impacts in Zhob. There is a **lack of climate-resilient infrastructure** and **weak policy implementation** for environmental protection. Financial constraints, limited awareness of climate risks, and political instability and governance issues further exacerbate the situation. The district also grapples with fundamental issues such as water scarcity, poor road connectivity, and a dependence on a limited and often unreliable electricity supply.

There is a lack of climate-resilient infrastructure and weak policy implementation for environmental protection. Financial constraints, limited awareness of climate risks, and political instability and governance issues further exacerbate the situation.

Adaptation Measures at Limited Scale

Despite these challenges, some adaptation measures are being implemented, including small-scale water conservation projects, reforestation initiatives, and traditional rainwater harvesting techniques. However,

significant adaptation gaps remain. In terms of mitigation, the major greenhouse gas (GHG) emission sources in Zhob include power plants relying on fossil fuels, increasing vehicle emissions due to road transport, methane emissions from livestock (a dominant aspect of the local agriculture), and emissions from open waste burning and poor waste management. Industrial emissions are minimal due to the lack of large-scale industries.

Solutions and Recommendations

The document proposes several solutions and recommendations to address these issues. For **water management**, the construction of small dams and promotion of efficient irrigation are suggested. **Reforestation** through increased afforestation programs is another key recommendation. The development of **renewable energy** projects, particularly solar and wind energy, is highlighted as a crucial step. In the agricultural sector, promoting **climate-resistant crops** and improving livestock management are recommended for **sustainable agriculture**. Addressing **waste management** through proper collection and recycling systems is also essential.

Collection Action Required

It also emphasizes the roles and responsibilities of various stakeholders in tackling climate change in Zhob. **Political leadership** needs to implement strict environmental policies and allocate necessary resources. **Government departments** should develop sustainable urban planning strategies and strengthen disaster management capabilities. **Civil society** organizations can play a vital role in promoting awareness campaigns and encouraging community participation. The **media** should highlight environmental issues and educate the public. **Businesses** are encouraged to adopt sustainable production methods and support local green initiatives. Finally, individual **citizens** are urged to conserve water and energy, reduce waste, and adopt eco-friendly habits.

About the author: *Mujeeb Ullah, a BBA student at the University of Sargodha, hails from Zhob. Deeply passionate about climate action, he contributes to the Ashar Movement, promoting greenery in Balochistan's deserts. He also supports Mission Awareness in wildlife protection.*

About Climate Action Skills

Climate Action Skills is a not-for-profit startup dedicated to making Pakistan a more sustainable place. We're a team of experienced climate change experts and activists who have been working for years to raise awareness and educate people about environmental issues.

We've realized that while awareness campaigns are important, they often don't lead to lasting change. True impact comes from education and training. By teaching people practical skills and knowledge, we empower them to take action in their daily lives, jobs, and businesses.

While climate education is often seen as a specialized field for experts, the reality is that everyone needs to have a basic understanding of climate change and climate action skills. Whether you're a student, a professional, or a business owner, you can contribute to a more sustainable future by incorporating climate-friendly practices into your daily life.

Our mission is to train 10,000 Pakistanis, especially young people, to incorporate sustainable practices into their routines. We'll be offering regular training programs and educational resources through our website and social media channels.

About the Founder

The Founder of Climate Action Skills is Mujtaba Baig, a well-known figure in Sindh, who has now broadened his focus nationwide, driven by his unwavering commitment to empowering young people to tackle climate change. His dedication is profound, backed by 27 years of experience. He's authored two Urdu books on the subject, translated two English books into Urdu, and led hundreds of training sessions and workshops. Additionally, he's a regular contributor to the Express Tribune and The Friday Times.

Upcoming Program

A 12-week online and field training diploma in Climate Journalism for recent media graduates begins on May 3rd, 2025. Please continue to visit our website and social for more information.

- Website
- LinkedIn Page
- Facebook Page
- Instagram

The End