

NATIONAL ADAPTATION PLAN

PAKISTAN
2023



MINISTRY OF CLIMATE CHANGE
&
ENVIRONMENTAL COORDINATION

**NATIONAL
ADAPTATION
PLAN** PAKISTAN
2023

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List of Abbreviations

AJK	Azad Jammu Kashmir
AWG	Adaptation Working Group
BISP	Benazir Income Support Programme
CCF&EDs	Climate Change, Forestry and Environment Departments
COP	UN Climate Change Conference
CSOs	Civil Society Organizations
DAs	Development Authorities for City Planning
DDMA	District Disaster Management Authority
DoCCF&E	Department of Climate Change, Forestry and Environment
DRM	Disaster Risk Management
EAD	Economic Affairs Division
FBR	Federal Board of Revenue
FFC	Federal Flood Commission
GB	Gilgit Baltistan
GCF	Global Climate Fund
GDP	Gross Domestic Product
GLOF	Glacial Lake Outburst Flood
GoP	Government of Pakistan
HKH	Hindu Kush-Karakoram-Himalayan
IBIS	Indus Basin Irrigation System
IDP	Internally Displaced Person
ID	Information Department
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRD	Indus River Delta
IRSA	Indus River System Authority
LDC	Least Developed Country
LGD	Local Government Department
MoC	Ministry of Commerce
MoCC&EC	Ministry of Climate Change and Environmental Coordination
MoE	Ministry of Education
MoF	Ministry of Finance
MoNHSR&C	Ministry of National Health Services Regulations and Coordination
Mol	Ministry of Interior
MoIB	Ministry of Information and Broadcasting
MoIT	Ministry of Information Technology and Telecommunication
MoMA	Ministry of Maritime Affairs
MoNFS&R	Ministry of National Food Security and Research
MoPD&SI	Ministry of Planning, Development and Special Initiatives
MoWR	Ministry of Water Resources
NAP	National Adaptation Plan
NBSs	Nature-Based Solutions
NCAP	National Clean Air Policy
NCCP	National Climate Change Policy
NDC	Nationally Determined Contributions

NDMA	National Disaster Management Authority
NDRMF	National Disaster Risk Management Fund
NDRRP	National Disaster Risk Reduction Policy
NGO	Non-governmental Organization
P&DD	Planning & Development Department
PASS	Poverty Alleviation and Social Safety Net Division
PBS	Pakistan Bureau of Statistics
PCRWR	Pakistan Council of Research in Water Resources
PDMA	Provincial Disaster Management Authority
PMD	Pakistan Meteorological Department
PoU	Prevalence of Undernourishment
PPP	Public-Private Partnerships
PSLM	Pakistan Social & Living Standard Measurement
PWD	Public Works Department
RCP	Representative Concentration Pathway
RD	Revenue Department
SDG	Sustainable Development Goal
SMEs	Small and Medium Enterprises
SUPARCO	Space & Upper Atmosphere Research Commission
SWM	Solid Waste Management
UHI	Urban Heat Island
UN-ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	The United Nations Framework Convention on Climate Change
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

Foreword



Climate change is redefining every human experience on the planet. Despite being a fractional emitter of greenhouse gases, Pakistan is in the frontline of global impacts, with skyrocketing temperatures pushing the country and its people into a dangerous zone of climate fragility. Heatwaves, delta draughts, forest fires, glacial lake outburst floods (GLOFs) from glacial melt, have combined with an unprecedented cascade of heavy monsoons and riverine flooding to bring on climate emergencies in the country's mountain-to-delta terrain. High on the global index of vulnerable countries, Pakistan is now on the world's radar as a flashing hotspot for climate disasters.

After the 2022 mega-flood impacted 33 million people of Pakistan and broke all records of monsoon flooding anywhere in the world, a National Adaptation Plan became an urgent imperative for the country. In the long journey towards rehabilitation and rebuilding resilience for one-third of the country, the Ministry of Climate Change & Environmental Coordination (MoCC&EC) took up the challenge of completing it in an accelerated timeframe of nine months.

The vision guiding this Plan pivots on enabling a climate-resilient Pakistan where communities can collaborate to build their socioeconomic and environmental adaptive capacities, with governments, civil society and agencies supporting the promotion of personal and national wellbeing. The goals are to foster social, economic, and environmental resilience, focused first on enhancing the resilience of vulnerable cohorts through equitable resource utilization, while embedding gender-responsive participatory, transparent, and socially inclusive approaches.

The priorities that this Plan addresses flow out of an assessment of potential impacts on multiple sectors, many of which have already withstood an existential erosion in their lifeline functions and capacities. The water-agricultural nexus gets particular attention because it is critical to Pakistan's entire social, economic, and adaptive trajectory, with recurring hydromet crises and looming scarcity a real possibility. Other sections focus on renewable natural capital that contributes significantly to Pakistan's per capita wealth, while the country's fast urbanizing needs and climate-induced pressures on under-serviced cities also merit attention. Because climate stress intensifies risks to Pakistan's human capital, enhancing poverty and limiting access to health and education, investments in these sectors are also recommended for immediate action, with an added emphasis on the needs of our youth cohort, women, and marginalised communities. At the same time lessons learnt from recent crises make modernizing Disaster Risk Management (DRM) and Early Warning Systems (EWS) crucial for the adaptation imperatives of Pakistan. For this reason, reducing communities' exposure to growing climate hazards are seen as invaluable pillars of risk-reduction strategies for enhancing resilience capabilities.

The assessments are built on local knowledge and lessons learned of adaptation needs at the cross-sectoral and human levels. None of these are by any means exhaustive, but instead focus on a first roadmap of actions and changes needed in our development knowledge, planning and resourcing. These will all add complementarity to our international agreements, NDCs and SDGs commitments, while prioritising the most vulnerable cohorts in the cascade of priorities.

The process has been country-driven, entirely home-grown, and embedded in rigorous consultations at several levels, especially the related federal ministries, and the provinces, who will undertake the coordination of mainstreaming adaptation measures at the local levels. It will continue to be an inclusive work-in-progress, with civil society and development partners integrated into periodic updates and budgeting impacts by the lead ministry. Climate financing remains a pivotal challenge, which is why some of the NAP's focus remains on resourcing streams, while monitoring and evaluation frameworks are advised for maximum cross-sectoral transparency across horizontal and vertical national tiers. To successfully implement the NAP with a 'whole of society' approach, it is essential to have a comprehensive and inclusive communication strategy that creates buy-in at the public and local level, because real and substantive behaviour change cannot be implemented from above. The NAP document will be followed by a NAP Communication Strategy document over the next few months.

In shepherding the inputs, knowledge-building, strategizing, collating, rethinking, fact-checking, designing, and writing, thanks are due to a small dedicated core team at the MoCC&EC. At the same time, I must acknowledge that none of this would have been possible without speedy support from our go-to World Bank team. All team members worked night and day in its last stages particularly, to fulfil our government's commitment to giving Pakistan a NAP to meet the ongoing life-altering challenge of climate stress to our people. Thanks are also due to the Prime Minister, Mian Muhammad Shehbaz Sharif and the Foreign Minister, Bilawal Bhutto Zardari for their constant and wholehearted support of all climate adaptive endeavours both at home and abroad.

Finally, this Plan is embedded in the philosophy that all human accomplishment begins with a hope and a prayer but needs a strategy to translate vision into reality. Our hope is that Pakistan seizes an opportunity to rebuild with real resilience and become a leader in creating climate adaptive futures from the burning soil of extreme climate adversity. The climate clock is ticking for all, so this is a Plan to scaffold that hope.

Senator Sherry Rehman
Minister for Climate Change & Environmental Coordination

Executive Summary

Executive Summary

Introduction: The Adaptation Imperative

Pakistan has in some ways become an epicentre for climate change, ranking among the top-ten countries most vulnerable to its devastating effects. As temperatures, already high, surge at a rate surpassing global averages, heat stress and extreme weather impacts threaten the very fabric of livelihoods and human potential. The nation teeters on the brink of a water scarcity threshold, while rising sea levels in the Indus Delta relentlessly accelerate the salinization of precious inland waters. The 2022 floods submerged one-third of the country, uprooting 8 million lives. Adding to the peril, the projected recession of the Hindu Kush-Karakoram-Himalayan glaciers heightens the haunting threat of glacial lake outburst floods. If current trends continue, large swathes of the country could become uninhabitable, and the most vulnerable segments, such as the marginalized and the landless population, would be on the frontlines of the devastation. With the clock ticking, and global inaction on Paris commitments to reduce emissions stalemated, and no pledged transformational funding available, Pakistan stands at a defining moment, where it must stocktake and build on stressed resources to catalyse a resilient and equitable future.

Despite being an almost negligible contributor to global warming, the costs of climate change to Pakistan are substantial and continuously increasing as the country faces severe economic challenges. The accelerated impacts of climate change have added a new layer of pressures on the economy, including the exogenous shock of severe climate disasters, which in 2022 exerted a drag of 8 percent loss on the Gross Domestic Product (GDP). Rising inflation, high indebtedness, low growth, currency depreciation, and depleted foreign currency reserves have further added to the scale and multitude of challenges.

Given the growing and cross-cutting challenges posed by climate change, Pakistan needs to urgently prioritize adaptation and building resilience. By proactively addressing climate risks and embedding adaptation strategies in its development and planning frameworks, Pakistan could reduce its economic losses, reduce some level of climate-induced risks, enhance business continuity, and pursue sustainable economic development.

Pakistan has taken significant steps toward combating climate change effects. It is a signatory to major international conventions and has translated these commitments into national policies and programs. A robust institutional framework, led by the Ministry of Climate Change & Environmental Coordination (MoCC&EC), has been established to guide and implement these initiatives and to coordinate with the many stakeholders involved at the national, provincial, and local levels.

The Pakistan National Adaptation Plan (NAP) provides a framework for implementing adaptation, promoting inclusivity, and facilitating collaboration among different stakeholders, and serves as an effective tool for climate finance mobilization. It provides an overview of the country's climate risks and vulnerabilities, and of the NAP process, vision, and principles. The plan lays out an adaptation strategy and priorities in seven key areas: the agriculture-water nexus; natural capital; urban resilience; human capital; disaster risk management; and gender, youth, and social inclusion.

NAP Process, Vision, and Principles

The NAP was developed through an extensive consultation process—including through national workshops, online surveys, and expert consultations with federal and provincial stakeholders. The plan has benefitted from the collective knowledge, experience, and ownership of diverse actors. The consultative process has helped ensure ownership of key stakeholders in promoting effective implementation of adaptation measures. The vision, goals, and ten guiding principles of the Pakistan NAP are presented below.

Vision: A climate-resilient Pakistan made up of communities with socioeconomic and environmental adaptive capacities—collaborating to pursue prosperity, promote personal and national wellbeing, and protect their ecosystems through inclusive sustainable approaches.

Goals: Enhance the sustainable development of vulnerable communities by fostering social, economic, and environmental resilience. This can be achieved through a progressive empowerment process that ensures equitable resource utilization, building on gender-responsive, participatory, transparent, and socially inclusive approaches.

Guiding Principles:

- 1) Integrate Climate Adaptation** – Make it a core part of all decisions
- 2) Think Strategically** – Plan for the changing climate across generations
- 3) Make Evidence-Based Decisions** – Rely on scientific data and local knowledge
- 4) Promote Nature-Based Solutions** – Prioritize nature protection for climate change
- 5) Act Locally** – Understand and address local risks and opportunities
- 6) Leave No One Behind** – Prioritize inclusivity and support vulnerable groups
- 7) Think Ahead and Stay Flexible** – Proactively adapt to changing conditions
- 8) Address Inequity** – Choose actions that promote social justice
- 9) Coordinate and Collaborate** – Partner for effective adaptation efforts
- 10) Build Capacity & Knowledge** – Enhance adaptation planning and understanding

Adaptation Strategies and Priorities

The Agriculture-Water Nexus

The agriculture sector is critical to Pakistan's growth, employment, poverty reduction and food security ambitions. It accounts for over 20 percent of GDP, and 40 percent of the labour force, and is the major source of subsistence and livelihood for the rural population. However, the sector's potential is undermined by significant challenges, including inefficiency in use of land, wasteful and unsustainable use of water, wastage of outputs, and a weak irrigation system. The challenges to this sector are manifested in low productivity, suboptimal crop yields, and an inability to meet the rising demand for food in the country.

Climate change risks in the sector include reduced crop yields, increased water stress, and reduced livestock productivity. Rising temperatures will add to the already growing demand for water, pushing it to a projected 60 percent increase by 2047, with the largest volumetric rise coming from agricultural water demand. The adoption of reforms for irrigation water-usage innovations, the enhancement of storage and conservation systems, and better distribution mechanisms is essential for the sector's climate-resilient development.

Priority initiatives focus on achieving **four key objectives:**

- 1)** Incentivizing farmers to transition to climate-smart water and land management practices
- 2)** Modernizing surface and groundwater irrigation services to support transitions to climate-smart agriculture
- 3)** Developing a long-term agriculture growth strategy, with a focus on productivity improvement, climate resilience, and physical expansion
- 4)** Developing a plan for managing projected river flow and rainfall variability under different climate scenarios

Natural Capital

Pakistan's economy is underpinned by significant renewable natural capital that contributes an estimated 13-15 percent to per capita wealth.¹ However, climate change has far-reaching impacts on eroding land, forests, and biodiversity. Rising temperatures and prolonged droughts contribute to deforestation, forest degradation, and an increase in wildfires, altering ecosystems which result in biodiversity loss. Currently, Pakistan ranks among the top ten countries in the world most impacted by the loss of biodiversity and ecosystem services.²

Furthermore, rivers, wetlands, and aquifers are heavily polluted as they receive untreated sewage and industrial effluent, poorly managed solid waste, and agricultural runoff and drainage with high concentrations of agro-chemicals and salinity. As a river that flows from mountain to delta across the length of the country, with most major cities clustered around it, the Indus River stands as the second most polluted river in the world, suffocating under the weight of plastic and other waste.³ The poor environmental outcomes from mismanaged water resources create multiple public health hazards, most prominently through their impact on groundwater. Per capita consumption of water also remains too high for Pakistan's existing resources to support its growing population. As climate change increases water demand across sectors, access to water of acceptable quality will be subjected to more competition between upper and lower riparian populations. As a result, the impacts on livelihoods will likely continue to bring higher levels of social fragility to this context.

Pakistan is also the world's third-most polluted country in terms of air quality.⁴ Air pollution exacts a high health and economic toll. In 2019, 235,000 premature deaths were attributed to air pollution exposure in Pakistan, and its prevalence has reduced average life expectancy by almost 2.7 years. According to a 2016 World Bank report, the economic loss from air pollution in Pakistan in 2013 was US\$47.8 billion, which was 5.8 percent of GDP. For this as well as other reasons, addressing air pollution would yield substantial climate co-benefits, as the associated pollutants, such as methane and black carbon, are potent contributors to global warming.

Climate change clearly poses huge challenges to natural resources in Pakistan and the socio-economic sectors that depend on them. Adaptation measures geared towards preserving and improving Pakistan's natural capital are therefore essential.

Priority initiatives focus on achieving **five key objectives:**

- 1) Mainstreaming sustainable land management into ecosystem resilience
- 2) Promoting integrated watershed management
- 3) Improving water quality through better wastewater management
- 4) Investing in coastal and marine resources
- 5) Investing in the air pollution-climate change nexus

Urban Resilience

Pakistan is among the most urbanized countries in South Asia, with 38 percent of its population living in urban areas. It continues to see rapid urbanization in line with its population growth. Urbanization is expected to further increase due to climate-induced migration. Contributing approximately 55 percent of Pakistan's total GDP, the cities play a vital role in the country's economy. However, urban areas face several challenges, such as inadequate service delivery, insufficient regulation, unplanned expansion, social inequality, and funding constraints.

Urban areas are becoming increasingly vulnerable to climate change risks. Flood hazards are projected to increase, with primary cities (notably Lahore and Karachi) having the highest exposure to urban flooding. The Urban Heat Island effect exacerbates the risks of extreme heat in nearly all Pakistani cities. Additionally, severe air pollution, indicated by high concentrations of fine particulate matter (PM_{2.5}), poses a significant health risk.

The inequality that characterizes Pakistan's rapid urbanization, and its lagging urban services, exacerbate vulnerability to disaster and climate change impacts. Infrastructure and services play a crucial role in empowering vulnerable urban communities to cope with geo-hazards and climate-related challenges. Conversely, the presence of unsafe and inadequate service delivery infrastructure, urban sprawl, and the lack of green spaces amplify public exposure and vulnerability to shocks.

The proposed NAP adaptation strategy and initiatives address the major problems facing Pakistani cities. They seek to improve service delivery, regulate planning and urban expansion, address flood and heat risks, and build municipal financial capacity to meet the needs of urban residents.

Priority initiatives focus on **five key objectives:**

- 1) Mainstreaming climate adaptation across federal, provincial, and local governments
- 2) Improving land regulation and land-use planning to bolster resilient service provision
- 3) Bolstering climate-smart municipal services
- 4) Leveraging nature-based solutions to manage climate risks
- 5) Developing financing instruments to ensure sustainable revenue streams for green and resilient urbanization

Human Capital

Pakistan's human capital indicators are a cause of concern requiring urgent attention. The situation points to vulnerabilities stemming from factors such as poverty, limited education, and lack of health coverage. Poor nutrition is a growing threat. Inadequate water, sanitation, and hygiene services, particularly in rural areas, compound health risks. Education levels have been improving over time, but the pace is very slow. Gender and regional gaps in enrolment rates remain significant. Pakistan's high fertility rate reinforces a vicious cycle of greater unmet basic needs - higher population growth, and lower resources per capita. Nevertheless, amidst these challenges, Pakistan boasts an invaluable asset - its sizeable labour force, counted among the top 10 largest in the world.

Climate change intensifies existing challenges and introduces new risks for Pakistan's human capital. Vulnerable segments of society, including the poor as well as rural dwellers, residents of informal or congested urban settlements, and children, will be particularly impacted due to the accelerated impacts of climate stress, further increasing inequalities in education, health, and labour and economic productivity. Extreme climate events impede access to basic health and education services, give rise to malnutrition and life-threatening diseases, and diminishes economic productivity of labour force, leading to reduced incomes, financial instability, and further exposure to poverty and hardship.

Inadequate investment in health and education services, coupled with limited access to essential resources, exacerbates vulnerabilities stemming from climate change. Climate change significantly impacts the social and environmental determinants of health, affecting access to clean air, safe drinking water, sufficient food, and secure shelter. Moreover, vector-borne diseases like malaria, diarrhea, and heat stress, exacerbated by climate change, contribute to morbidity and mortality, particularly among vulnerable populations facing malnutrition. Additionally, climate change profoundly affects education, leading to damaged infrastructure from extreme weather events and disruptions in learning due to environmental challenges. Students' health and well-being are at risk from heatwaves and poor air quality, while climate-induced displacement and migration strain educational resources. Addressing these issues from a human capital perspective is crucial to promote resilience and equitable development in the face of climate change's far-reaching impacts.

Strengthening Pakistan's human capital is crucial for climate-resilient and equitable development. The NAP takes a comprehensive approach to address this challenge by enhancing the adaptive capacity of infrastructure and services delivery within the health and education sectors. Moreover, it places significant emphasis on developing a skilled and green-oriented workforce that can actively contribute to the nation's climate-resilient

development pathway.

Priority initiatives focus on **three key objectives**:

- 1) Mainstreaming climate adaptation in health and education policies
- 2) Enhancing climate resilience through disaster emergency preparedness and response
- 3) Building workforce capacities to address and adapt to climate risks

Cross-Cutting Areas

Disaster Risk Management

The primary objectives of disaster risk management (DRM) efforts are to prevent new disaster risks, mitigate existing ones, and strengthen resilience in the context of extreme weather events. The 2010 floods led to the establishment of a comprehensive institutional framework of DRM bodies at the national, provincial, and district levels, as well as the development of long-term DRM policies.

The floods of 2022 brought to the forefront the limitations within Pakistan's DRM system, notably at the subnational and local levels, spotlighting areas that require further attention and improvement. The main challenges are (i) poor coordination, particularly between federal and provincial governments, and the GoP and international community; (ii) suboptimal understanding of the roles and responsibilities of stakeholders, especially the multiple agencies at all levels of government mandated to manage disasters; and (iii) weak capacity of all stakeholders, in both the public and private sectors, highlighted by their increased workload and overstretch.

The NAP strategy revolves around four pivotal entry points of strengthening the DRM institutional framework; mainstreaming DRM into critical sectors; improving hydromet, climate and early warning systems; and investing in ex-ante recovery preparation.

Priority initiatives are organized under the following **four key objectives**:

- 1) Understanding climate and disaster risk by investing in state-of-the-art early warning systems, gathering and utilizing data-driven insights to analyse climate patterns and potential disasters
- 2) Strengthening disaster risk governance by establishing clear policies, institutional frameworks, and coordination mechanisms
- 3) Investing in disaster risk reduction to bolster the resilience of communities and critical infrastructure
- 4) Enhancing disaster preparedness for effective response and to "Build Back Better" by incorporating risk-informed approaches into recovery and reconstruction efforts

Gender, Youth, and Social Inclusion

Women, youth, persons with disabilities, transgender, and religious minorities are among the most marginalized groups in Pakistan. Pakistan has made notable strides in promoting basic human rights, protecting vulnerable social groups against discrimination and violence, and addressing the factors that contribute to social exclusion and discrimination. However, despite these positive efforts, many of them lack access to opportunities for education, skills development, livelihoods, and decision-making.

Climate change poses disproportionate challenges for marginalized groups with limited capacity to respond and recover. They commonly face higher risks and greater burdens from its impacts. Impoverished households find themselves trapped in a vicious cycle of low human capital and poor labour market outcomes, which are exacerbated by climate change. These can lead to women having additional workloads, for example, spending more

time collecting water and firewood. Girls' education can be disrupted as family's resort to negative coping strategies such as child marriage. The physical and mental health of children and youth can be impacted, leading to long-term negative repercussions. Lack of data on persons with disabilities and other vulnerable populations lead to their exclusion in the design and implementation of programs and policies that address climate change risks and impacts.

The proposed NAP strategy recognizes and addresses the unique impacts of climate change on vulnerable groups and works to address underlying drivers of inequalities.

Priority initiatives focus on **three key objectives:**

- 1) Supporting vulnerable groups in strengthening their capacity for DRM
- 2) Empowering vulnerable groups through fostering climate-resilient livelihoods
- 3) Promoting inclusive participation of vulnerable groups in climate-related policy and development planning

Implementation

Overall Approach

The NAP sets forth an ambitious agenda for a climate-resilient Pakistan, encompassing a truly “whole-of-society” approach involving different tiers of government, multiple agencies, and diverse sectors. NAP implementation will therefore be a highly complex process. To effectively implement the NAP, it is crucial to ensure the coherence and integration of adaptation considerations across diverse sectors and multiple government agencies and tiers. It is essential to establish coordination and governance mechanisms at all levels of government (federal, provincial, and local), including ministries, departments, agencies, and sectors. To maximize impact, it is crucial to prioritize activities based on specific vulnerabilities, risks, and adaptation needs while considering their proper sequencing. Clear definition of objectives, identification of activities, resource allocation, and realistic timelines for implementation are vital aspects. Additionally, establishing national and sub-national monitoring and evaluation (M&E) mechanisms will support progress tracking, assess the effectiveness of adaptation actions, and ensure accountability. A comprehensive and inclusive communications strategy will be developed, delivering tailored messages through suitable channels to reach audiences locally, nationally, and globally.

Institutional Arrangements

Governance and implementation of the Pakistan NAP will involve the following institutional arrangements at the federal level: i) with a clear lead role of the MoCC&EC; ii) and coordination between the Ministry of Planning, Development & Special Initiatives (MoPD&SI) as the focal point with the federal line ministries and provincial line departments.

Provincial and local governments are responsible for developing and implementing climate adaptation policies and implementation plans tailored to the needs and vulnerabilities of their regions with support from the NAP. Multi-sectoral bodies including the Pakistan Climate Change Council (PCCC), and the Expert Group (EG) can provide guidance and technical inputs to support the implementation and monitoring of the NAP.

Monitoring, Evaluation (M&E) and Reporting

The M&E framework and process is vital for tracking progress, assessing effectiveness of actions, ensuring transparency, and promoting accountability. It can also have wider applications, as there are synergies between the NAP, the Nationally Determined Contributions (NDCs) and Sustainable Development Goals (SDGs).

It will operate as a continuous, iterative, and progressive cycle, with each phase informing the next. Stakeholder engagement is a vital feature; participatory mechanisms capture local insights from vulnerable groups and non-government actors, leading to more ownership and sustainable outcomes. The NAP M&E system will work at three levels under a comprehensive plan: **(i)** strategy and policy level; **(ii)** planning and program level; and **(iii)** project level. Indicators will be carefully chosen to be practical and relevant. Capacity building will be carried out to help stakeholders effectively contribute to the M&E process, supported by the use of technology and digital tools.

Financing Climate Adaptation and Resilience

The funding required for NAP implementation is significant. Public finance for climate adaptation and resilience has been increasing at the federal and provincial levels. It is therefore vital to have a comprehensive financing strategy for climate adaptation and resilience through the following key pathways.

First, Pakistan has globally advocated the capitalisation of multilateral funds and finances that address the climate crisis faced by many developing countries that are fractional emitters. The current international financial architecture is complex and fragmented, and it is a major challenge for countries like Pakistan to access timely climate finance due to a lack of capacity in formulating bankable projects. Capacity must be strengthened to access and make effective use of grant-based financing and concessional loans instruments.

Second, domestic financing can be mobilized through innovative financing mechanisms such as the monetization of natural capital, green and blue bonds, debt for climate swaps, equity financing, and results-based climate finance.

Third, an enabling policy and regulatory environment for private sector investment in adaptation is needed to promote and accelerate private sector-led adaptation, such as innovations in products or services. There is also the potential to channel adaptation finance through public-private partnerships. Small and medium enterprises also need support in transitioning to sustainable practices.

Fourth, line ministries will need to prioritize and plan for climate sensitive development projects. For Climate Change to gain traction and be mainstreamed through the government budget process, selection towards climate positive projects will be required and supported by the MoF and MoPD&SI. Line ministries will need to clearly appreciate the climate related risks within their sectors, determine a level of priority of climate change among competing interests and plan investment submissions appropriately. This can be done within a suitably strengthened Midterm Budgetary Framework (MTBF) process as the MTBF process sets budget limits from the top-down but supports bottom-up planning to deliver specified outputs/outcomes.

While it is essential for Pakistan to proactively create the necessary fiscal space to invest in climate resilience by addressing structural gaps, Pakistan cannot be expected to raise the required financing through only domestic resources. The World Bank's Country Climate and Development Report identified that Pakistan needs to invest US\$348 billion by 2030, or 10.7 percent of GDP annually over the next 7 years, in adaptation and deep decarbonization. Mobilizing climate financing as part of the redistribution of resources pledged by developed countries to countries such as Pakistan that are suffering the high impacts of GHG emissions from post-industrial nations needs to be done in line with the Common but Differentiated Responsibilities (CBDR) principle of the United Nations Framework Convention on Climate Change. It is imperative that the scale of adaptation financing is further capitalized and is at par with mitigation financing.

At home, capacity needs to be built to improve the efficacy of public spending and increase domestic revenue mobilization. Climate budget tagging can support the line ministries in understanding the depth and reach of pro-climate programs and policies and can further guide climate resilient planning in Pakistan's long-term development and strategic planning.

Summary

In conclusion, the Pakistan NAP stands as a visionary blueprint for a climate-resilient and prosperous future. It symbolizes a call to action, urging all stakeholders to unite and forge a path of transformation in the face of climate adversity. By prioritizing adaptation and implementing the NAP's strategies, Pakistan can not only mitigate the growing risks but also seize the limited but real opportunities for sustainable economic growth and social inclusivity. It presents a unique and pivotal opportunity for the nation to take the lead, becoming a beacon of inspiration for the rest of the world in the critical battle against climate change.

1. Introduction

1. Introduction

1.1 Context

The accelerated impacts of climate change have redefined Pakistan's experience with vulnerability, disaster management, resilience, and development. Pakistan is among the top-ten countries in the world most vulnerable to the negative effects of climate change.⁵ These effects are clearly visible in the country: for example, rising temperatures over the past century—increasing at a higher rate than average global temperatures—are leading to heat stress and increased water scarcity. Pakistan is close to reaching the water scarcity threshold of 1,000 cubic meters per capita of annual water availability. Sea levels in the Indus Delta are rising, accelerating the salinization of inland waters. Perhaps most dramatically, Pakistan is seeing both more frequent and more intense extreme weather events and natural disasters. The most recent floods, in 2022, inundated one-third of districts in the country and affected 33 million people, 8 million of whom were displaced.

All these effects—increased temperature, greater heat and water stress, more frequent and more intense floods and drought, uneven erratic precipitation, and rising sea levels—have massive spill-over and knock-on effects on development and economic growth. Agriculture is among the sectors worst hit by climate change effects: reduced productivity is leading to the loss of agricultural livelihoods and growing food insecurity. The human, physical, and economic toll of repeated natural disasters is huge: each new disaster further erodes Gross Domestic Product (GDP), personal resilience, and development gains.

Every part of Pakistan is experiencing the adverse effects of climate change, but the extent and nature of those effects vary from one region to another—from glacial lake outburst floods (GLOFs) in the north, to drought in parts of Sindh and Balochistan, to cyclones in coastal areas. Nonetheless, the scale of damage and loss from climate change is so vast that few Pakistanis have not felt these directly.

Among them, it is the marginalized groups who are affected the most. This is one of the most significant impacts of climate change: groups that lack the resources and capacity to withstand the effects of climate change, or to recover and rebuild, and the ones that bear its brunt. Thus, climate change in Pakistan is, deliberately or not, fuelling greater inequities.

Projections about future climate change effects in Pakistan offer little comfort. They indicate further increases in temperature, declining water availability, higher sea levels, and even more frequent and intense extreme weather events.

1.2 Combating Climate Change

It is clear from current data and future projections that climate change poses fundamental risks for Pakistan: if current trends persist, more and more of the country will be rendered uninhabitable. This would lead to mass population displacement, increased competition for depleting resources, and the very real prospect of conflict. All this means that combating climate change in Pakistan is imperative.

Because Pakistan has some of the world's lowest levels of greenhouse gas emissions, mitigation—taking measures to reduce such emissions—is therefore less pertinent than adaptation in the country's battle with climate change. Emphasizing adaptation measures will enable Pakistan to proactively address the potential impacts of climate change and build resilience to withstand its effects. By prioritizing adaptation, Pakistan can effectively tackle the

challenges posed by climate change while utilizing its relatively low greenhouse gas emissions as a starting point for a sustainable and climate-resilient future.

The economic cost of climate change in Pakistan is substantial and continuously increasing. It affects all sectors, including agriculture, infrastructure, trade, and tourism. By proactively addressing climate risks and developing adaptation strategies, Pakistan could reduce its economic losses, enhance business continuity, and pursue sustainable economic development.

Pakistan has already taken significant steps toward combating climate change effects. It is a signatory to major international conventions and has translated these commitments into national policies and programs. A robust institutional framework, led by the Ministry of Climate Change & Environmental Coordination (MoCC&EC), has been established to guide and implement these initiatives and to coordinate the many stakeholders involved at the national, provincial, and local levels.

Given the challenges posed by climate change, Pakistan needs to prioritize adaptation. This is where the National Adaptation Plan (NAP) is critical. NAPs are one of the most important mechanisms for adapting to climate change. They create comprehensive medium- and long-term plans, and—crucially—integrate adaptation into national policies and development.

The Pakistan NAP provides a framework for implementing adaptation, promoting inclusivity, and fostering collaboration among different stakeholders. It can also be an effective tool for resource mobilization. By encouraging the country to invest in adaptive strategies, innovation, and the empowerment of vulnerable communities, the NAP endeavours to safeguard the wellbeing of present and future generations and to preserve the rich biodiversity, ecosystems, and cultural heritage that make Pakistan such a distinctive and vibrant nation. This report represents one outcome of the NAP process. It both explains the background to the Pakistan NAP and details its scope as well as implementation and monitoring arrangements.

Chapter 2 describes the effects of climate change already observed in Pakistan and the impact these have had on development and economic growth. It also presents future projections in relation to climate change, and the consequences for development and growth.

Chapter 3 explains the background and importance of the NAP and how it fits into the country's existing climate change policy and institutional framework. It also describes the process by which the NAP was developed and the principles that guided its development. Chapter 3 ends with the vision and goals of the Pakistan NAP and outlines the main sectors and cross-cutting areas covered in it.

Chapter 4 focuses on climate-related sectors and cross-cutting areas. For each, the chapter explores the importance of the sector or cross-cutting area and the challenges climate change poses to it. The chapter then presents the various adaptation initiatives to be carried out, and the objectives they are intended to achieve.

Chapter 5 sets out implementation arrangements for the NAP, along with monitoring and evaluation arrangements.

The NAP will shed light on the adaptation measures Pakistan needs in order to reduce its vulnerability to the accelerated impacts of climate change, prevent further adverse effects, build climate resilience among communities, and promote sustainable development.

2. Climate Risks and Vulnerabilities

2. Climate Risks and Vulnerabilities

2.1 Historic Climate Profile

Observed Climate Trends

According to the 2021 Global Climate Risk Index, Pakistan ranks eighth among countries in the world most vulnerable to long-term climate risk. These most vulnerable countries can be divided into two groups: those most affected because of exceptional natural catastrophes, and those affected on an ongoing basis by extreme climate events. Pakistan falls into both groups.

The impacts of climate change already being observed in Pakistan include (i) rising temperatures that are leading to enhanced heat and water-stressed conditions, particularly in arid and semi-arid regions, reducing agricultural productivity; (ii) an increase in the frequency and intensity of extreme precipitation events, causing frequent and intense floods and droughts; (iii) the projected recession of the Hindu Kush- Karakoram-Himalayan (HKH) glaciers due to global warming and black carbon deposits from indigenous and trans-boundary pollution sources, threatening water inflows into the Indus River System; and (iv) rising sea levels that threaten coastal areas. These effects are elaborated below.

- **Rising temperatures:** Pakistan has seen an increase in mean temperature of 0.63°C over the past century. However, during the 1981–2005 period, the decadal mean temperature rise in Pakistan was 0.39°C as compared to 0.18°C for the globe, which implies that the warming over Pakistan was twice as fast as the global mean temperature rise.⁶
- **Precipitation:** Overall, mean precipitation in Pakistan increased by 25 percent during the past century (1901–2000).⁷ However, there were regional variations. Average precipitation in arid plains and the coastal belt has fallen by 10–15 percent since 1960, but most other regions have seen a slight increase, both in the monsoon and the dry seasons.⁸
- **Water scarcity:** Because of climate change and over-exploitation, water flow in the Indus River System, Pakistan's main source of freshwater, is considerably reduced. Between 1990 and 2015, per capita water availability in Pakistan declined from 2,172 to 1,306 cubic meters.⁹ According to the International Monetary Fund (IMF), Pakistan's per capita annual water availability as of 2017 is 1,017 cubic meters—perilously close to the scarcity threshold of 1,000 cubic meters.¹⁰ It is likely to be even less now. Pakistan Council of Research in Water Resources (PCRWR) has warned that the country will approach absolute water scarcity by 2025,¹¹ which will be further exacerbated by water distribution issues between upper and lower riparian communities at the national and transboundary levels with India.
- **Rising sea levels:** Climate change has impacted the Indus River Delta, where the Indus flows into the Arabian Sea. With the rising of the sea level, the delta is now almost at sea-level. Increasing salinity in creeks and streams inland is negatively impacting local ecosystems and fresh water supplies and reducing the available agricultural land. Rising water temperature—average surface temperature in the Arabian Sea rose from 29°C to 31°C in just two years—has increased the formation of storms that are pushing the sea into coastal communities.¹² An estimated 100 acres of arable land are destroyed every day by sea intrusion.¹³ Some parts of Karachi, which sits close to the delta, are already submerged in the Arabian Sea, and there are warnings that many other areas could follow in the next 35 to 45 years.¹⁴

Pakistan is one of the most flood-prone countries in South Asia. Flooding is the most frequently recurring natural disaster in Pakistan, with major events occurring almost annually since 2000.¹⁵ The devastating mega-floods of 2022 broke all previous records. However, the forms of flooding vary in different parts of the country, the most common being GLOFs in the north, riverine flooding and flash floods in the plains, and coastal flooding associated with cyclone events. The low-land plains of Sindh and Balochistan, which include the urban regions of Karachi and Hyderabad, are vulnerable to the impact of cyclones. In June 2023, storm surges and heavy rain caused by Cyclone Biparjoy, which became the longest surviving cyclone in the Arabian Sea, besieged parts of Sindh that were still reeling from the 2022 floods.

Climate change is leading to increasing periods of drought in parts of Pakistan. Low rainfall levels and water shortages lasting many months in 2018 produced drought conditions in Balochistan and Sindh: in September 2018, the Sindh government declared substantial parts of southern Sindh as “calamity areas” due to low rainfall during the monsoon season.¹⁶ Drought differs from other natural disasters in that it can build up gradually over a period of time, and its effects can linger for years afterward.¹⁷

Observed Climate Change Impacts

Human Toll

Climate change effects and related extreme weather events can cause large-scale loss of life and suffering. The super-flood of 2010 alone inundated an area of 38,600 square km and killed 1,600 people,¹⁸ while the mega flood of 2022 took the lives of more than 1,700 people, one-third of them children, and affected 33 million people, 8 million of whom were reportedly displaced. Drought periods (1969, 1974, 1987, 2002, and 2013–2015) have been associated with acute and chronic malnutrition.¹⁹ In Tharparkar (Sindh), for example, many children died of malnutrition in 2014 after severely reduced rainfall from March 2013 to February 2014.²⁰ In 2015, an unprecedented heat wave with temperatures as high as 49°C killed more than 1,200 people in Karachi.²¹ Air pollution poses a significant challenge in Pakistan. In 2019 alone, it is estimated that 114,000 deaths were attributable to PM2.5 pollution. Furthermore, the impact on public health is evident as Pakistan's average life expectancy has been reduced by 4.3 years.²²

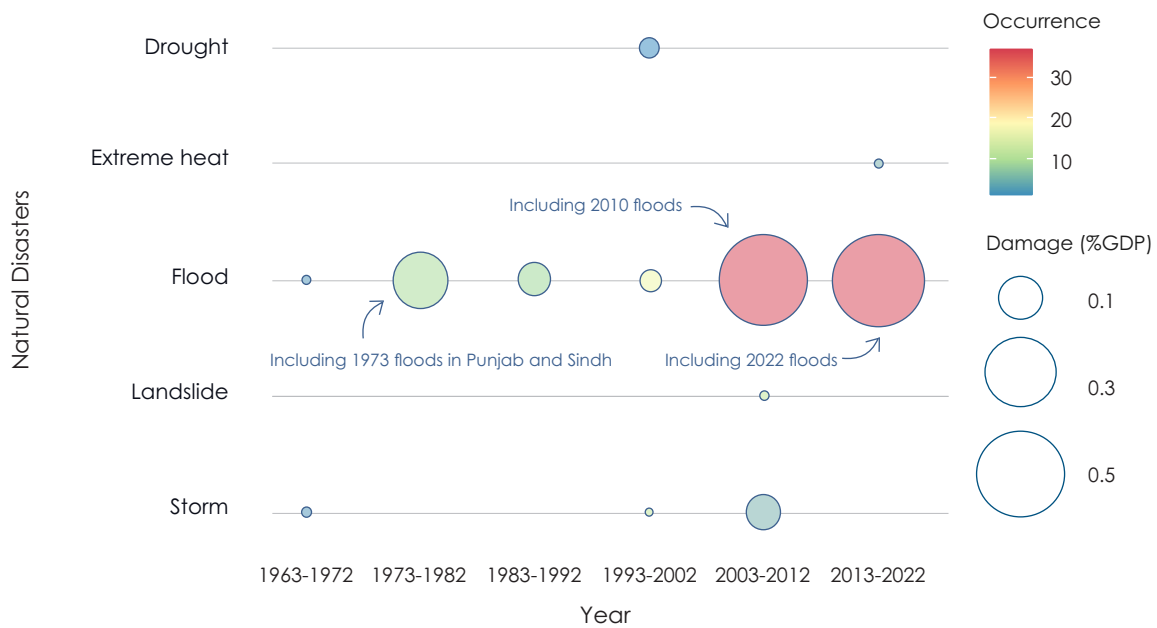
Economic Losses

According to the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP), Pakistan faces the highest projected loss of GDP from climate change, reaching 9.1 percent of GDP annually in the worst-case climate change scenario.²³ The negative economic impact of climate change manifests in two broad ways: one, damage to infrastructure, property, and other physical assets that have to be replaced; and two, loss of lives, livelihoods, and economic activity, leading to reduced growth. Both lead to a reversal of development gains. Between 1992 and 2021, climate- and weather-related disasters in Pakistan resulted in US\$29.3 billion of economic losses (inflation-adjusted to 2021 US dollars) from damage to property, crops, and livestock, equivalent to 11.1 percent of 2020 GDP.

Floods cause particularly massive damage: between 2010 and 2014, five major flood events affected 38.12 million people and resulted in monetary losses of over US\$18 billion,²⁴ with the super-flood of 2010 alone accounting for damage of around US\$10 billion.²⁵ Damage from the 2022 floods was even higher, estimated at US\$14.9 billion, with an estimated total loss of US\$15.2 billion and total needs of US\$16.3 billion. It is projected that recovery and reconstruction needs will be sizable—1.6 times the budgeted national development expenditure for FY23. The 2022 floods caused loss and damage equivalent to 8 percent of Pakistan's GDP, and overall decline in 2023 GDP as a direct impact of the 2022 floods is projected to be around 2.2 percent of FY22 GDP.

Similarly, between 2000 and 2002, drought in Balochistan and Sindh caused economic growth to fall from an average of 6 percent to 2.6 percent.²⁶ The northern regions of Pakistan, particularly those connected to Azad Jammu Kashmir (AJK) and Gilgit Baltistan (GB), are severely affected by frequent GLOFs and landslides, which often limit transportation and evacuation routes, further hampering economic activity.

Figure 2.1.1: Total Occurrence and Average Economic Damage from Natural Disasters in Pakistan between 1963 and 2022 (as a percentage of GDP)²⁷



Note: The occurrence is measured by combining the total counts of events, while the average economic damage is quantified by calculating the yearly average value over the ten-year period. To calculate %GDP, adjusted total damage is divided by the 2022 GDP.

Source: The international disasters database

Agricultural Productivity and Food Security

Natural disasters, in particular floods, cause massive loss of crops and livestock, and stagnant water in farmland further delays efforts to grow other crops. In addition, nearly all arable land in Pakistan is already cultivated and production is dependent on a glacier- and snow-fed irrigation network, making it extremely vulnerable to climate change. The negative effects of climate change on agriculture include **(i)** reduced availability of irrigation water, which limits crop productivity; **(ii)** altered growing periods, which adversely affects staple crops such as wheat, maize and rice predominantly grown in the south of the country, leading to higher food prices; **(iii)** crops and rangelands damaged by floods and droughts; **(iv)** deteriorated agricultural land due to saline intrusion, soil erosion, and waterlogging—almost 2 million acres of arable land in the fertile Indus Delta have been lost as a result of saline intrusion from reduced river flows and rising sea levels; **(v)** reduced foreign exchange earnings and agricultural livelihood security; and **(vi)** decreased livestock productivity (due to higher temperatures and drought leading to heat stress), reduced animal fodder production, and increased stress on feed and water sources.²⁸

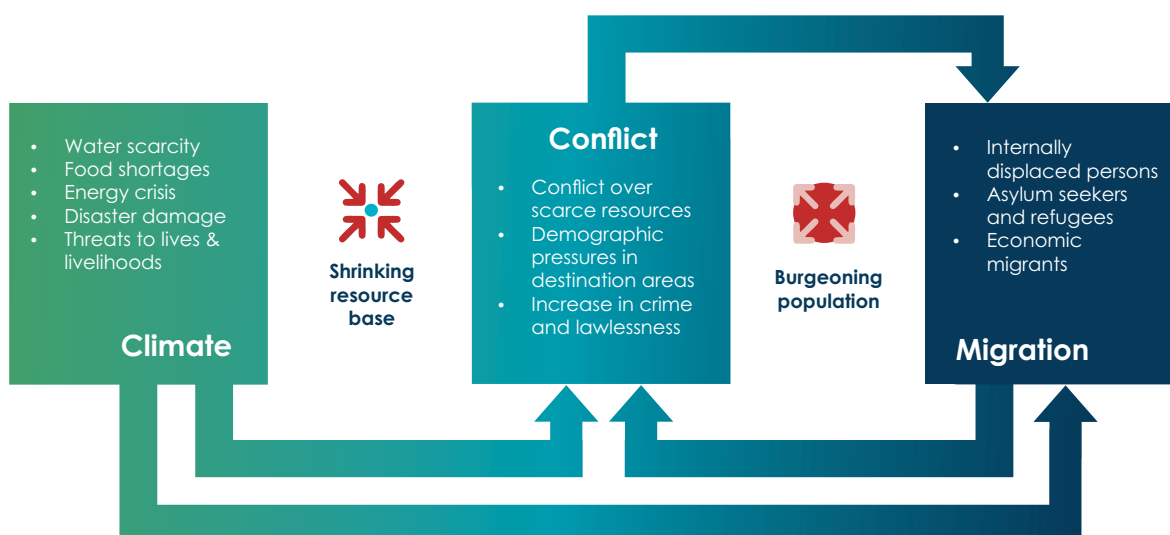
Agricultural productivity is directly linked to food security. Pakistan is already a food-insecure country: approximately 40 percent of households already grapple with this pressing issue, and climate change threatens to exacerbate the situation to a distressing 60 percent by the year 2050. Two key indicators of food insecurity are Prevalence of Undernourishment (PoU)—meaning how many people lack dietary energy—and Prevalence of Moderate and Severe Food Insecurity (that is, access to nutritious and sufficient food). PoU in Pakistan has remained at around 20 percent since 2007–2009 but has increased in absolute terms (to 40 million in 2016–2018) because of population growth as well as increased droughts.²⁹ In 2018, 23.5 percent of Pakistani households were estimated to be either moderately or severely food-insecure, with 10.1 percent severely food-insecure.³⁰

Competition for Resources

As noted, climate change is leading to the loss of agricultural and grazing land, increased water scarcity, and the loss of livelihoods. This creates greater pressure and competition for the remaining scarce resources, for example, between pastoralists and livestock farmers for land as Pakistan's vegetation cover and pastures shrink. Where the

effects of climate change are chronically severe, this leads to forced population displacement and thereby increased strain on resources and services. This in turn often sparks tensions—even conflict—between host and internally displaced person (IDP) communities. These effects are exacerbated by Pakistan's growing population. With a current population of over 240 million³¹ and a growth rate in 2022 of 1.9 percent,³² the country is already the world's fifth-most populous. Figure 2.1.2 traces the knock-on effects of climate change, showing how it generates competition for, and potentially conflict over, resources.

Figure 2.1.2: Links between Climate Change and Conflict and Migration



Source: Adapted from Abel et al., "Climate, conflict and forced migration"³⁵

Karachi, Pakistan's largest city, aptly illustrates the challenge of increased competition over depleting resources. Climate change from both natural causes—for example, the increased salinity in the Indus Delta—and from human causes—such as the cutting of mangrove forests in the past that displaced an estimated 80 percent of the 5 million Pakistanis who once lived along the banks of the Delta—exacerbates this issue.³³ Many of them have moved to Karachi, placing additional pressure on resources there. Karachi is expanding rapidly—the urban footprint increased by a quarter between 2001 and 2013. But this is largely in the form of space-inefficient sprawl, without adequate investment in services and infrastructure, and not planned in a way to minimize exposure to natural disasters.³⁴ Water is already a scarce resource in the city. Karachi merits particular attention as it is Pakistan's most vital economic hub, and the effects of climate change and water scarcity are particularly acute—and threatening—in the city.

Vulnerable Population Groups Most at Risk

It is important to stress that the adverse effects of climate change are not experienced equally by the population, women, the poor and landless are particularly impacted. Women are disproportionately vulnerable because their socioeconomic status is not equal to those of men, reflecting patriarchal norms and attitudes. Globally, women are 14 times more likely to die when a disaster hits.³⁶ The poor and landless have the least capacity to respond (that is, to adapt and to recover). Differences in land distribution and ownership structures in rural areas are significant factors in the incidence of poverty and thus in vulnerability. The poorest and landless tend to have homes in flood-prone, low-lying areas of the main village. Furthermore, *katcha* or *semi-pukka* (semi-solid) houses in rural areas are tend to be constructed out of low-cost, easily available materials.³⁷ Such houses are highly vulnerable to meteorological or geological hazards.

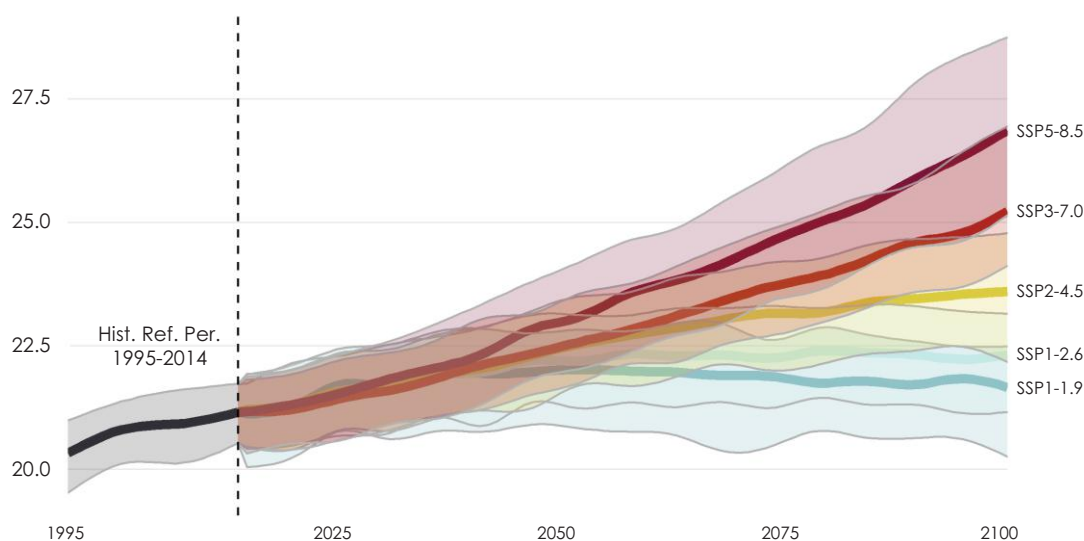
2.2 Future Climate Profile

Projected Climate Trends

As seen, the effects of climate change to date in Pakistan have been significant. Regrettably, future projections are equally sombre. Based on a number of sources,³⁸ climate change effects are projected to be as follows:

- **Temperature:** Pakistan's projected temperature increase is expected to be higher than the global average. Temperature increases of 1.4°–3.7°C are projected by the 2060s and increases of 6.0°C by the 2090s (figure 2.2.1), with projected increases higher during winter and in the north. The frequency of hot days and hot nights is expected to rise significantly, and the Intergovernmental Panel on Climate Change (IPCC) has issued a warning that the frequency and severity of extreme heatwaves are expected to rise in the region due to climate change.
- **Precipitation:** Mean annual precipitation changes are uncertain, with projected monthly rainfall changes ranging from a decrease of 20 percent to an increase of 41 percent by the 2090s. While large uncertainties remain, climate models point to increased rainfall from January to June and a decrease from July to September, along with an increasing trend in rainfall over the Upper Indus Basin and a decreasing trend in the Lower Indus Basin.
- **Water scarcity:** It is projected that water availability per capita will decrease to an alarmingly low level by 2025. Yields of major crops such as wheat and rice are expected to decrease significantly.
- **Sea level rise and sea water intrusion:** Increases in sea levels of 30–80 cm are forecast by 2100. The low-lying coastal regions of Pakistan, including the city of Karachi, are at significant risk from projected sea-level rise. As it rises, it is causing sea water intrusion further into the Indus Delta, affecting the freshwater sources and overall ecological balance of the Indus Delta.
- **Extreme weather events:** Higher frequency and intensity of extreme weather and climate events, such as cyclones, floods, and droughts, are expected. Projected decreases in glacier volume and snow cover will lead to alterations in the seasonal flow pattern of the Indus River System and an increase in the formation and outburst of glacial lakes.

Figure 2.2.1: Projected Annual Mean Temperatures between 2015 and 2100 in Pakistan
(Baseline: 1995–2014, Multi-Model Ensemble)



Source: World Bank Climate Change Knowledge Portal³⁹

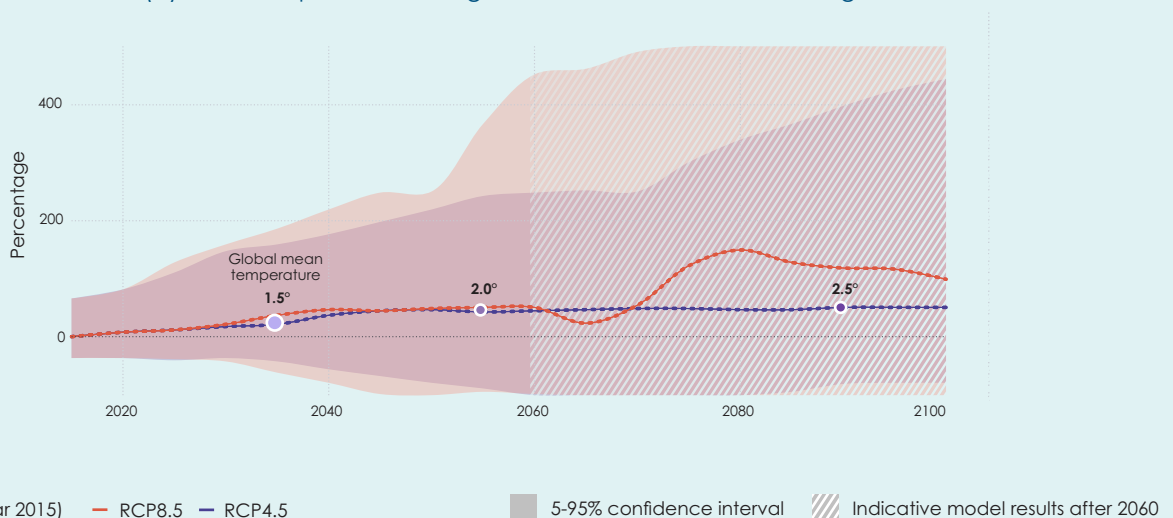
Projected Climate Change Impacts

Just as climate change effects to date have had highly negative impacts on development and growth in Pakistan, so will future climate change projections have severe adverse consequences. Seven of the most likely impacts of climate change on development in Pakistan are as follows:⁴⁰

- The annual expected damage from riverine floods by 2050 is projected to surge by 47 percent (RCP 4.5) and 49 percent (RCP 8.5), respectively.
- The fraction of the population exposed to heatwaves each year is expected to increase by 32 percent (RCP 4.5) and 36 percent (RCP 8.5) by 2050, respectively.
- Labour productivity is projected to decline across the board because of escalating heat stress—by 7 percent (RCP 4.5) and 10 percent (RCP 8.5), respectively.
- The agriculture sector is likely to be severely impacted by climate change, leading to increased pressure on food production and access. For example, by 2050 the annual mean wheat yield is expected to decline by 1 percent (RCP 4.5) and 2.5 percent (RCP 8.5), respectively.
- Precipitation changes and declining water availability could damage riverine ecology, impair water security, and affect hydropower production.
- Sea-level rise will contribute to the further salinization of soils and coastal erosion, and inundation will harm fisheries and aquaculture; over time, there is likely to be a partial collapse of the natural systems that underpin Pakistan's economy.
- Air and water pollution will have aggravated effects on human health, especially those living in the vulnerable areas.

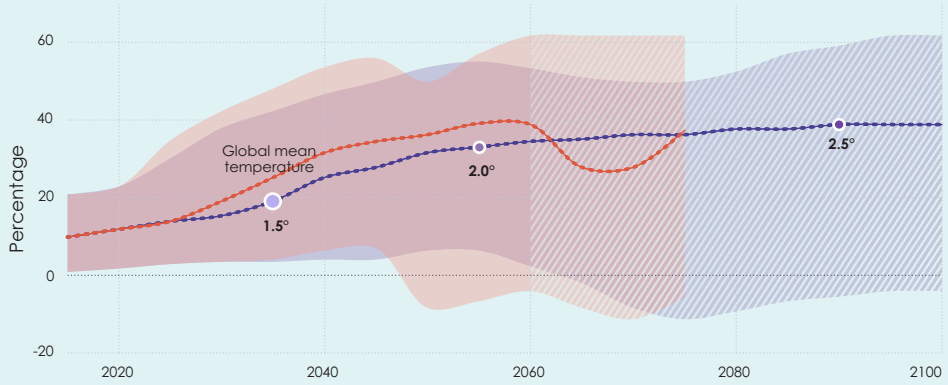
Figure 2.2.2: Projected Impacts of Climate Change

(a) Annual Expected Damage from River Floods in Percentage



Source: CLIMADA

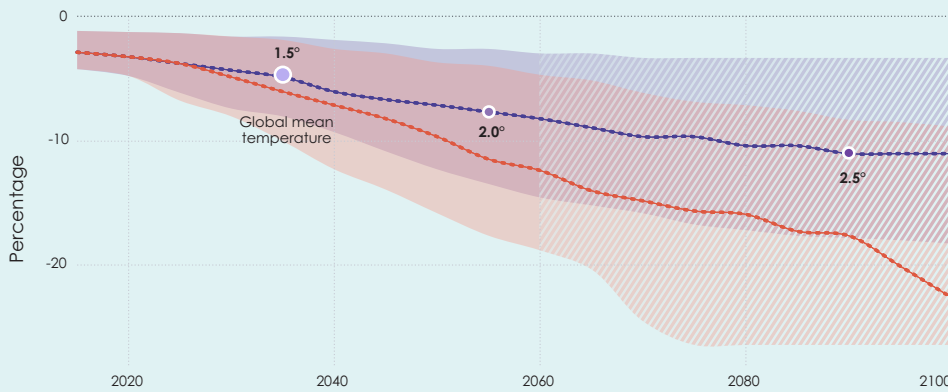
(b) Fraction of Population annually exposed to Heatwaves in Percentage⁴¹



Baseline (reference period 1986-2006) — RCP8.5 — RCP4.5 5-95% confidence interval Indicative model results after 2060

Source: ISIMIP - Secondary Output Based on population from 2005

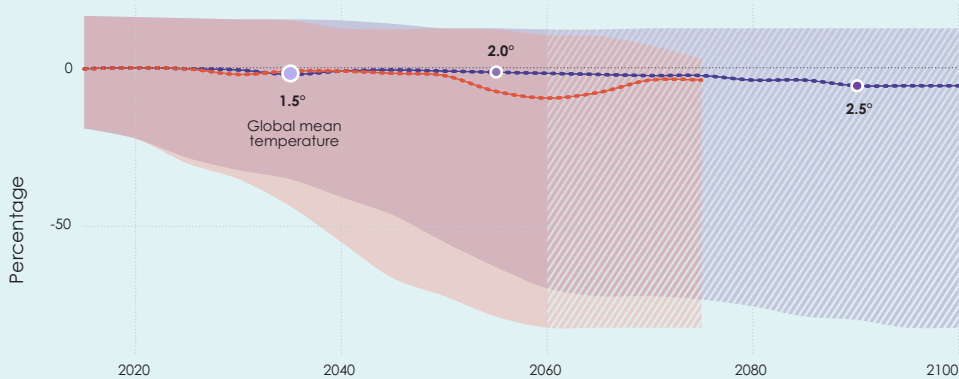
(c) Decline in Labour Productivity from Heat Stress in Percentage⁴²



Baseline (reference period 1986-2006) — RCP8.5 — RCP4.5 5-95% confidence interval Indicative model results after 2060

Source: ISIMIP - Secondary Output Based on population from 2005

(d) Annual Mean Wheat Yield in Percentage⁴³



Baseline (reference period 1986-2006) — RCP8.5 — RCP4.5 5-95% confidence interval Indicative model results after 2060

Source: ISIMIP - Secondary Output Based on population from 2005

Note: An important caveat is that the numbers presented in the above figures represent the median of ensemble projections. Some models, in other words, predict even more severe impacts, as indicated by the spread of the time series. These model-to-model variations highlight the uncertainties inherent in projecting the extent of climate change impacts. When formulating adaptation plans and policies, it is therefore necessary to consider the full range of potential outcomes and account for the entire spectrum of possibilities, some of which could be graver than what these figures present.

Overall, these shocks will adversely affect all aspects of the economy in an already fiscally constrained country that has seen relatively low growth, especially in the past few years. The GDP losses that Pakistan is already facing from the degradation of its environment and its low human capital will only be magnified if extreme climate-related events reverse development gains made over the last several decades and divert limited public financing toward relief and recovery efforts instead of economic growth and the building of climate resilience.

Weak growth will increase the risk of extreme poverty, food insecurity, and malnutrition. This will make sustained progress in poverty reduction and human development far more challenging than it is today. These interrelated risks could also set the stage for major societal disruptions, including the displacement of people and greater pressure on cities unprepared for the influx of displaced migrants, on top of those they currently host. These projections highlight the urgency and importance of devising comprehensive adaptation strategies to reduce the impact of climate change on various sectors of Pakistan's economy and society.

3. The NAP Process, Vision and Principles

3. The NAP Process, Vision and Principles

3.1 NAP Process Overview

National Adaptation Plans (NAPs) are widely seen within the international development community as one of the most important mechanisms for adapting to climate change. They aim to reduce vulnerabilities to climate impacts by creating comprehensive medium- and long-term plans, including the integration of adaptation measures into national policy. Adaptation can take the form of activities designed to enhance the adaptive capacity of a system, or actions that modify socioeconomic and environmental systems to prevent or minimize the damage caused by climate change. The NAP process was formally established in 2010 under the Cancun Adaptation Framework—an outcome of the 2010 UN Climate Change Conference (COP16)—and reiterated in the 2015 Paris Agreement at the 2016 UN Climate Change Conference (COP21).

The United Nations Framework Convention on Climate Change (UNFCCC) defines adaptation as adjustments in ecological, social, or economic systems or policy processes in response to actual or expected climate stimuli and their effects or impacts. Adaptation can take the form of activities designed to enhance the adaptive capacity of a system, or actions that modify socioeconomic and environmental systems to prevent or minimize the damage caused by climate change. It is a critical component of the long-term global response to climate change to protect people, livelihoods, and ecosystems.

Moving from adaptation to resilience involves a shift in focus from reactive responses to climate impacts towards proactive measures that enhance the capacity to withstand and thrive in the face of climate change. While adaptation strategies aim to adjust to current climate challenges, building resilience encompasses a broader and more forward-looking approach. Rather than addressing climate challenges in isolation, the key is to emphasize system-wide solutions that offer co-benefits across various sectors, such as nature-based solutions that protect ecosystems, and to mitigate climate risks while supporting biodiversity and livelihoods.

Building resilience in Pakistan requires the formulation and implementation of transformative policies and investments that unlock the nation's suppressed economic and social potential. By adopting an integrated approach and addressing various sectors, Pakistan can effectively overcome its challenges and pave the way for sustainable development, that leads to a prosperous and resilient future for its people. Climate-resilient planning and design are closely linked to development planning. In most cases, adaptation in practice is naturally embedded in the fabric of development. Moreover, investments in technology and innovation can catalyse economic growth and improve the efficiency and effectiveness of various sectors.

Identifying and addressing major vulnerabilities to climate change are central to the NAP process. It represents a shift from ad hoc, project-based adaptation interventions focused on short-term needs to more strategic and programmatic approaches, ensuring that interventions are aligned with long-term climate resilience goals.

The NAP process has three broad phases: planning, implementation, and monitoring and evaluation (M&E). In 2012, at the COP level,⁴⁴ a comprehensive set of technical guidelines were organized in four clusters: (i) laying the groundwork and addressing gaps; (ii) preparatory elements; (iii) implementing strategies; and (iv) report monitoring and review. These form a roadmap for countries in the NAP process. But it is important to stress that they are generic guidelines. Countries can choose which steps to apply to their specific situation, and which activities are to be carried out under each phase. Crucially, the NAP process is continuous, iterative, country-driven, participatory, and transparent.

Nationally Determined Contributions (NDCs) are pledges countries make to achieve the Paris Climate Agreement objectives, that is, to take steps aimed at limiting global temperature increase and adapting to climate change. The

process to formulate and implement NAPs was set in 2010 during COP16, while NDCs were introduced in COP21 under the Paris Agreement. Even though the NAPs pre-date the NDCs and focus on adaptation, the goals and priorities identified through the NAP process can be included in a country's NDC. The NAP process is a means of operationalizing adaptation commitments listed in the NDC. NAPs and NDCs can thus be mutually reinforcing.

The NAP document is a key outcome and central component of the NAP process that (a) describes the principles and overall approach of the NAP process, and aligns it with the broader policy landscape; (b) identifies specific sectors and themes that are especially relevant to the country's context, its medium- and long-term adaptation priorities, and the strategies for addressing and tracking them; and (c) can also describe how a country will go about embedding adaptation into its development planning, decision-making, and budgeting processes. Other documents might also be prepared as part of the process, including implementation plans, resource mobilization strategies, financing strategies, concept notes, and funding proposals.

The NAP process continues to regularly assess climate risks, engage stakeholders, build capacities, identify potential sources of finance for implementation, track, monitor and report on the progress, and review stated adaptation priorities. Pakistan's NAP should be reviewed by 2030.

3.2 Rationale for Pakistan's NAP

The rationale for the NAP stems from Pakistan's vulnerability to climate change and the pressing need to tackle its effects, and the fact that its development and implementation would bring numerous benefits.

First, an adaptation framework will provide the framework for identifying and prioritizing adaptation needs, developing strategies, and implementing actions to reduce vulnerability and build resilience.

Second, mainstreaming adaptation will help integrating it into national planning processes, making it an integral part of development decision making. Such mainstreaming will ensure a more coordinated and effective response across different sectors and levels of governance.

Third, safeguarding development emerges as another significant benefit. Integrating adaptation measures into policies, plans, and programs will allow Pakistan to effectively manage climate risks, minimize their negative impacts on development, and safeguard the progress achieved in sectors such as agriculture, health, education, and disaster risk reduction.

Fourth, resource mobilization could help Pakistan mobilize domestic and international resources for adaptation efforts. The NAP will provide a comprehensive framework for identifying funding needs, aligning resources, and attracting investments in climate-resilience-promoting projects and programs. Collaboration is another benefit. Since NAP development involves extensive collaboration and engagement with diverse stakeholders, this will foster partnerships and knowledge-sharing, enabling collective and collaborative responses.

Fifth, the NAP would enhance inclusivity by serving as a platform for stakeholders to contribute their expertise, resources, and perspectives. This will lead to more informed and inclusive decision-making processes.

Sixth, the NAP would strengthen Pakistan's international commitments because of its strong links with the international convention frameworks. By implementing the NAP, Pakistan will make progress toward relevant Sustainable Development Goals (SDGs) and fulfill its obligations under the Paris Agreement and Sendai Framework for Disaster Risk Reduction.

In summary, by developing the NAP and implementing effective adaptation measures, Pakistan can enhance climate resilience, reduce risks to accelerated impacts of climate change, climate-proof critical infrastructure, and ensure sustainable development amid a changing climate.

3.3 Foundation

Policy Framework

Pakistan's commitment to tackling climate change is manifested internationally and domestically. The country is a party to the UN Framework Convention on Climate Change (UNFCCC), and successfully submitted its updated NDCs to UNFCCC in 2021. It has also ratified the 2015 Paris Climate Agreement. Other international conventions to which Pakistan is a signatory include the Sendai Framework for Disaster Risk Reduction and the Global Methane Pledge. As a member and former chair of the G77+China group, the country has also played an active role in climate policy negotiations, notably at COP27 in Sharm El-Sheikh, where Pakistan's leadership played a vital role in establishing the Loss & Damage Fund.

Domestically, Pakistan's National Climate Change Policy (NCCP), first published in 2012 and updated in 2021, is the key document. It provides a framework for addressing climate-related issues in Pakistan through action plans, programs, and projects. The NCCP takes an integrated approach to building resilience in various climate-sensitive sectors at the national and subnational levels, and to covering both mitigation and adaptation.

The Framework for Implementation of NCCP 2014-2030, a follow-up document, offers more detail on how to adapt to climate change and carry out mitigation. Given Pakistan's profound vulnerability to climate change, the nation's paramount focus lies in adaptation. The document presents adaptation actions for various climate-sensitive sectors, including water, agriculture, forestry, coastal areas, biodiversity, and health. It also identifies appropriate actions for disaster preparedness, capacity building, institutional strengthening, and awareness raising.

Other relevant policies and laws incorporating commitments to addressing climate change include National Clean Air Policy 2023, National Hazardous Waste Management Policy 2022, Updated National Climate Change Policy 2021, Updated Nationally Determined Contributions 2021, Pakistan Vision 2025, Alternative Renewable Energy Policy 2019, National Electric Vehicle Policy 2019, Agriculture Policy 2018, Climate Change Act 2017, National Water Policy 2017, Biodiversity Strategy and Action Plan 2017, National Forest Policy 2015, and the Sustainable Development Goals 2015 and Intended Nationally Determined Contributions 2015. A high-priority initiative under the updated NDC is the preparation of the NAP. Additionally, initiatives and programs such as the Living Indus Initiative, Recharge Pakistan, and GLOF-II project are currently underway, aligning with Pakistan's NAP and reinforcing the country's resilience to climate change.

Institutional Framework

Responsibility for actions to address climate change effects in Pakistan is shared among multiple government bodies at the federal and provincial levels. Key among these is the Ministry of Climate Change and Environmental Coordination (MoCC&EC), the national focal point and designated authority for all multilateral environmental agreements, including the UNFCCC, the IPCC, Paris Agreement, Adaptation Fund, and Green Climate Fund. Coordination of climate change activities is thus a significant part of MoCC&EC's mandate. The MoCC&EC and its committees work with line ministries/divisions and departments at the national and provincial levels to ensure that climate change is mainstreamed across different sectors.

Specifically in relation to adaptation, the 2017 Pakistan Climate Change Act empowers the MoCC&EC to establish the Pakistan Climate Change Council, which met in 2022. It can approve and monitor the implementation of comprehensive adaptation policies, strategies, plans, programs, projects, and other measures.

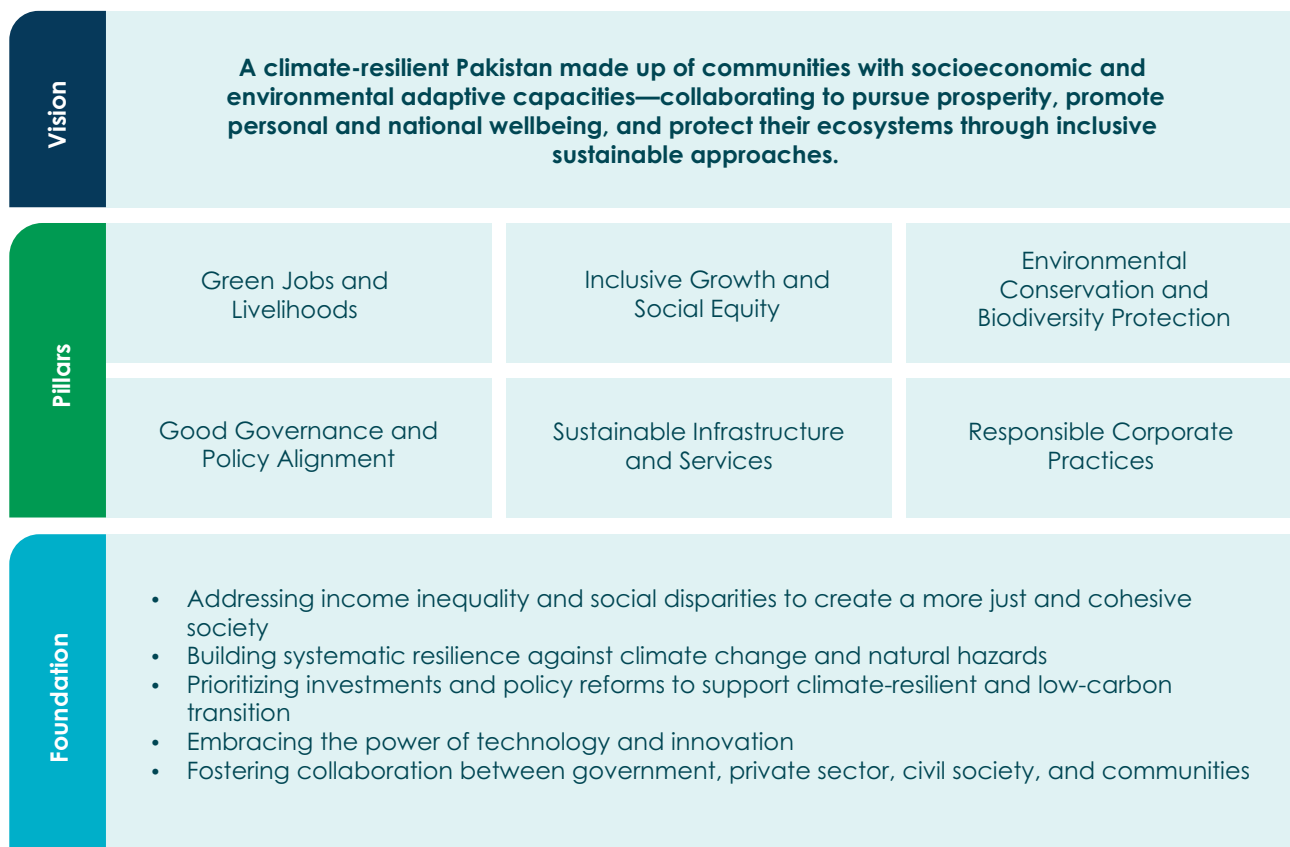
The Expert Group (EG) will be constituted, consisting of experts 25 technical institutions who will meet periodically to oversee the implementation of NAP. MoCC&EC will serve as the Secretariat for the EG, and it will be co-chaired by the Planning Commission.

3.4 Vision and Goals

The Pakistan National Adaptation Plan has the following vision and goals:

- Vision:** A climate-resilient Pakistan made up of communities with socioeconomic and environmental adaptive capacities—collaborating to pursue prosperity, promote personal and national wellbeing, and protect their ecosystems through inclusive sustainable approaches.
- Goals:** Enhance the sustainable development of vulnerable communities by fostering social, economic, and environmental resilience. This can be achieved through a progressive empowerment process that ensures equitable resource utilization, building on gender-responsive, participatory, transparent, and socially inclusive approaches.

Figure 3.4.1: Vision for Building Systemic Climate Resilience



The full achievement of the NAP vision rests on six pillars and four foundations.

Six Pillars:

- 1. Green Jobs and Livelihoods:** Fostering green jobs and livelihoods is essential for climate resilience. This involves creating employment opportunities in sectors that contribute to environmental sustainability, such as renewable energy, sustainable agriculture, green manufacturing, and eco-tourism. Investing in workforce training and capacity-building for green industries will not only reduce carbon emissions but also enhance the resilience of communities by providing stable and sustainable income sources.

2. **Inclusive Growth and Social Equity:** Ensuring that economic development benefits all segments of society is vital. Prioritize inclusive growth that gives marginalized groups equal access to opportunities, education, healthcare, and decent work. Address income inequality and social disparities to create a more just and cohesive society.
3. **Sustainable Infrastructure and Services:** Climate-resilient infrastructure and services are essential for withstanding the impacts of extreme weather events and ensuring continued access to essential resources. This involves incorporating climate considerations into the design and maintenance of infrastructure, such as resilient buildings, flood defences, and reliable water and energy systems. Ensuring the accessibility of these services to all communities, including those in remote and underserved areas, is critical for building climate resilience.
4. **Environmental Conservation and Biodiversity Protection:** Protecting and restoring natural ecosystems is crucial for climate resilience. Healthy ecosystems provide numerous benefits, such as carbon sequestration, water regulation, and protection against natural disasters. Investing in biodiversity conservation helps maintain the balance of ecosystems and enhances their resilience to climate change. Preserving biodiversity also supports food security, as diverse ecosystems provide essential resources for agriculture and fisheries.
5. **Good Governance and Policy Alignment:** Effective governance and policy frameworks are fundamental for building climate resilience. Governments need to develop and implement robust climate change adaptation and mitigation strategies, aligning them with national and international commitments like the Paris Agreement. Transparent and accountable governance ensures the efficient allocation of resources, effective climate risk management, and the integration of climate considerations into development planning.
6. **Responsible Corporate Practices:** The private sector has a crucial role to play in the climate resilience agenda. Responsible corporate practices involve adopting sustainable business models, reducing greenhouse gas emissions, minimizing environmental impacts, and respecting human rights. Emphasizing corporate social responsibility ensures that businesses actively contribute to climate resilience by addressing environmental challenges and supporting communities' well-being.

Four Foundations:

- 1) **Capacity Building and Knowledge Management:** Strengthening research and development efforts to generate climate data, improve modelling capabilities, and develop innovative solutions for climate resilience; and forging national and international partnerships to share knowledge, best practices, and technological advancements in climate resilience.
- 2) **Collaboration and Partnerships:** Actively engaging in international climate negotiations and cooperation to advocate for global climate justice and against loss and damage, and to secure financial resources, capacity building, and technology transfer; collaborating with neighbouring countries and with international organizations to address transboundary climate challenges such as water scarcity, cross-border pollution, and shared ecosystem management.
- 3) **Technology and Innovation:** Embracing digitalization to enhance Pakistan's governance systems, improve service delivery, facilitate access to information and resources, and empower citizens; supporting the growth of small and medium enterprises (SMEs) and entrepreneurship to unleash the entrepreneurial spirit and creativity of the Pakistani people, driving economic diversification, job creation, and inclusive development.
- 4) **Strategic Investments and Policy Reforms:** Prioritizing investments and policy reforms that support climate-resilient and low-carbon transitions is crucial. This involves directing resources towards sustainable infrastructure, green technologies, and adaptation measures. Policy reforms should align with climate goals, incentivize sustainable practices, and provide a conducive environment for climate-resilient development.

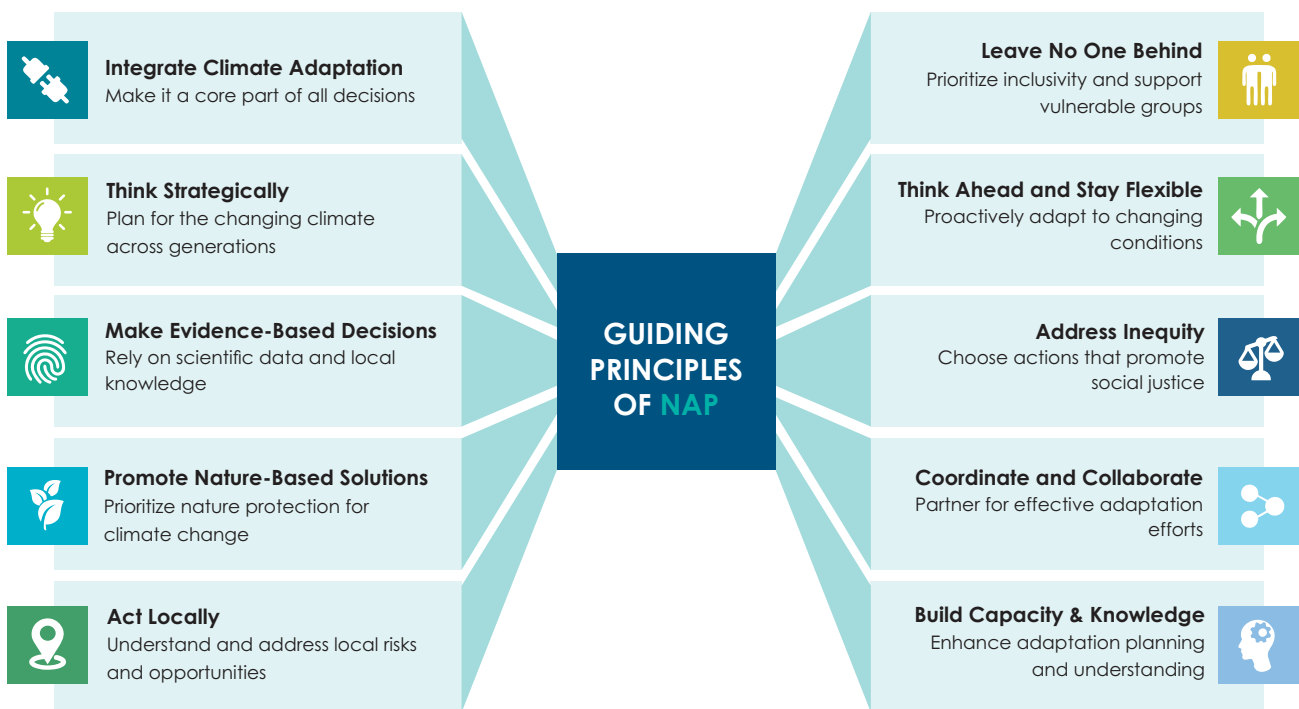
3.5 Principles and Approach

3.5.1 Guideline Principles

The Pakistan NAP was developed by drawing on ten guiding principles:

- 1) **Mainstream Climate Adaptation:** This principle emphasizes the need to consider climate adaptation in every aspect of decision making, across sectors and levels of governance. Whether it is infrastructure development, urban planning, agricultural practices, or disaster preparedness, integrating climate adaptation measures will ensure that Pakistan builds resilience to climate change impacts.
- 2) **Think Strategically:** Climate change is a long-term challenge, and effective adaptation requires strategic planning that considers the needs of both current and future generations. It involves developing adaptive strategies that anticipate potential future climate scenarios and evolving risks, adopting an intergenerational perspective that spans political, planning, and financial cycles.
- 3) **Make Evidence-Based Decisions:** Science-based evidence is crucial for understanding the impacts of climate change and identifying appropriate adaptation measures. Local knowledge, particularly from indigenous and traditional communities, can offer valuable insights into climate-related vulnerabilities and effective adaptation practices.
- 4) **Promote Nature-Based Solutions (NBSs):** NBSs involve utilizing and preserving natural ecosystems and their functions to address climate challenges. These solutions can include reforestation, wetland restoration, sustainable agriculture, and green infrastructure. By prioritizing nature protection, Pakistan can not only enhance climate resilience but also protect biodiversity and promote sustainable development.
- 5) **Act Locally:** Climate change impacts vary significantly from region to region. Acting locally involves contextualizing and understanding the specific risks and opportunities each community faces from climate change, and tailoring adaptation strategies to their unique needs.
- 6) **Leave No One Behind:** Foster inclusivity by prioritizing the participation of marginalized groups, in particular women, children, indigenous groups, and persons with disabilities, in decision making to ensure that their needs, knowledge, and perspectives are taken into account. Prioritize support for the most vulnerable people, places, and infrastructure impacted by climate change, while building adaptive capacity for all.
- 7) **Think Ahead and Stay Flexible:** Take proactive measures to adapt to changing conditions. Design actions and decisions to be flexible and open to revision as circumstances evolve. At the same time, set clear policies that provide predictability for communities and businesses, and try to avoid abrupt disruptions in taking early adaptation action.
- 8) **Address Inequity:** Incorporating climate justice into adaptation actions means addressing the historical and systemic inequalities that have led to certain groups being more vulnerable to climate change impacts. It involves making intentional efforts to reduce these disparities and ensuring fair access to resources and opportunities for all. Choose adaptation actions that achieve complementary goals and avoid maladaptation.
- 9) **Coordinate and Collaborate:** Climate change is a complex challenge that requires collaboration among various stakeholders, including governments, communities, NGOs, businesses, and international organizations. By coordinating efforts and sharing resources and knowledge, adaptation measures can be more efficient and impactful.
- 10) **Build Capacity and Knowledge:** To achieve successful climate adaptation, it is crucial to build capacity and knowledge at all levels. This includes investing in research, education, and training to equip decision-makers, professionals, and communities with the tools and understanding needed to implement effective adaptation strategies.

Figure 3.5.1: Guiding Principles for Pakistan's NAP



Three aspects of the NAP development process need to be stressed:

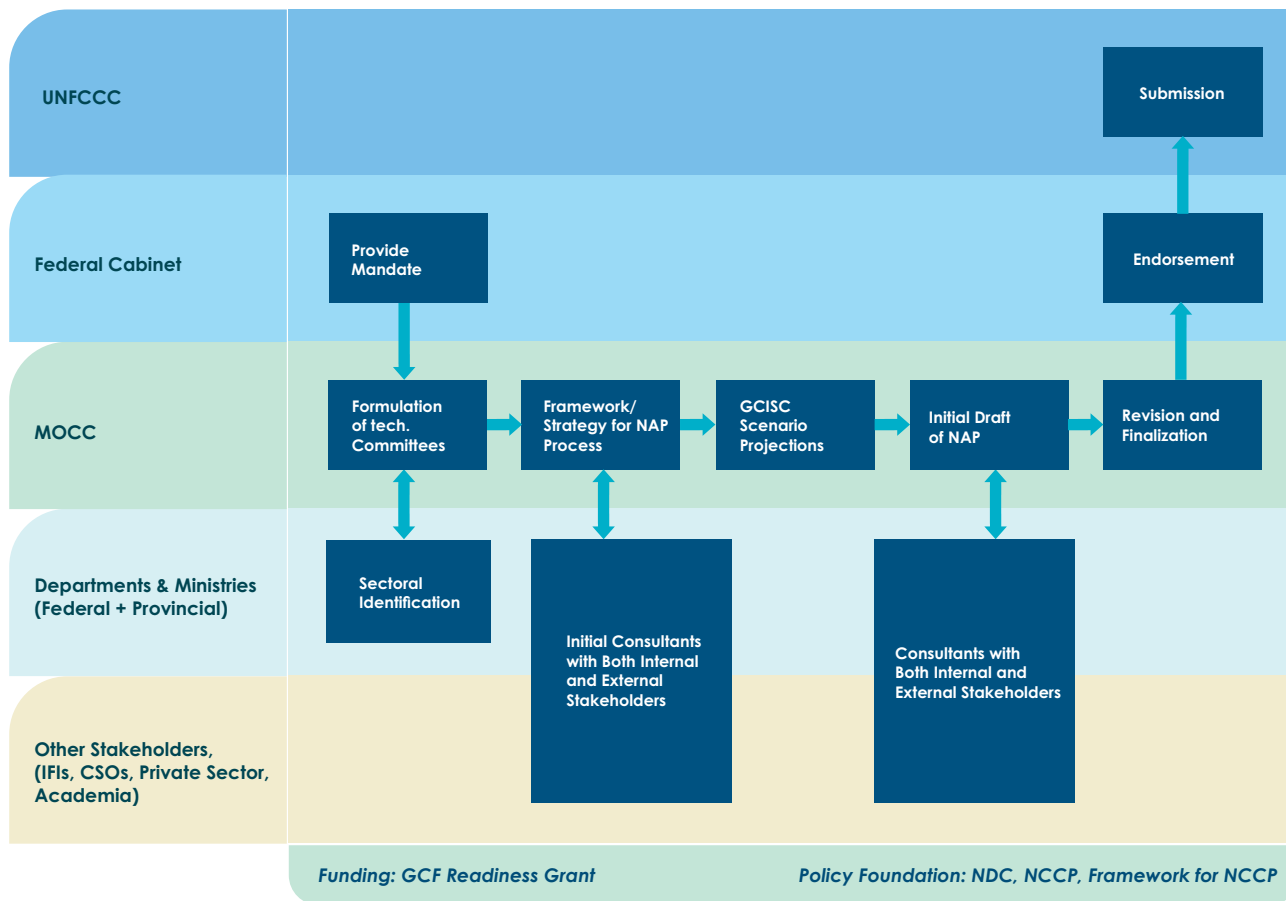
- 1) Aligning Adaptation with Equity.** Climate change can exacerbate existing inequities. It is therefore crucial to ensure that adaptation measures address the needs and vulnerabilities of marginalized and disadvantaged groups to promote fairness and inclusivity and to reduce inequity.
- 2) Tailoring Adaptation to Local Conditions.** Climate change impacts vary across regions, from coastal to mountain communities. This necessitates diverse adaptation approaches. By engaging with local communities, solutions can be developed that meet the specific needs of different communities. This in turn promotes local ownership and thus enhances sustainability.
- 3) Viewing Adaptation as a Continuous Evolving Process.** Adaptation is an ongoing, dynamic process that involves continuously assessing risks, formulating, and implementing plans, and monitoring and evaluating their effectiveness. Consequently, the NAP should incorporate flexibility to accommodate changing circumstances and evolving knowledge, enabling timely adjustments and improvements

3.5.2 Pakistan's NAP Preparation Process

The process to develop the NAP for Pakistan started after the mega flood of 2022. It involved five steps: (i) An initial internal assessment by the MoCC&EC, in concert with the Working Group constituted to update the NDCs; (ii) stakeholder engagement in the form of assessment contributions sought through consultations with a wide range of actors, including relevant government ministries, technical experts, research institutions, and sector specialists; (iii) alignment with the NCCP and its Implementation Framework, as well as relevant sectoral policies, including through coordination with different government bodies; (iv) identification of adaptation priorities by analysing the potential impacts of climate change, evaluating the feasibility and effectiveness of different adaptation options, and taking stock of the social, economic, and environmental aspects; and finally (v) action planning in order to develop detailed strategies, policies, and programs for implementing the adaptation measures,

including defining roles and responsibilities, identifying resource requirements, establishing monitoring and evaluation mechanisms, and setting timelines for implementation. The final draft was again shared with stakeholders for review and feedback.

Figure 3.5.2: Flow Chart of NAP Preparation Process



Source: MoCC&EC, 2023

The development process of the NAP was distinguished by an extensive consultation process at both the federal and provincial levels, engaging various stakeholders through national workshops, online surveys, and expert consultations. This inclusive approach allowed the NAP to benefit from the collective knowledge, experience, and ownership of diverse actors, ensuring that it effectively addresses stakeholders' priorities while promoting ownership of the implementation of adaptation measures. Notably, a high level of coordination between the MoCC&EC and the provincial governments was essential, because it serves as the cornerstone of effective climate governance and implementation of the NAP countrywide.

4. Adaptation Priorities

4. Adaptation Priorities

Sectors

4.1 The Agriculture - Water Nexus

4.1.1 Sectoral Context

Agriculture-Food System

- **The agriculture–food system is critical to Pakistan's growth, employment, poverty reduction and food security ambitions.** Agriculture remains the backbone of the economy and a critical feature of the fabric of rural society but faces significant challenges in all three of the basic resources that underlie the agricultural system: land, water, and labour.
- **The agriculture sector contributes over 20 percent to the country's GDP and is the largest source of export earnings.** It absorbs over 40 percent of Pakistan's labour force and is the primary source of livelihood for the 63 percent of the rural population.⁴⁵
- **Wheat is the staple crop of Pakistan and cotton production is critical to Pakistan's export regime.** However, the yields of major crops are 1.5 to 4.2 times below field potential, and 2.1 to 5.6 times below international best practice.⁴⁶
- **The agriculture–food system struggles to meet changing consumption patterns due to rapid urbanization, income growth, changing dietary habits, and higher demand for nutritious food.** Instead, the demand gap is being met by imports. Not only is Pakistan paying the opportunity cost of forgone economic productivity and water conservation, but it is also—literally—paying in foreign exchange.

Agricultural Land

- **35 percent of irrigated land is waterlogged and 30 percent highly saline,** reducing agricultural production by about 25 percent and, in extreme cases, making land completely unfit for agricultural production.⁴⁷
- **Agricultural land is also facing increasing stress from land conversion,** most significantly rural-to-urban land use change. It is projected that all the agricultural land on the fringes of Lahore Metropolitan area will be converted by 2030.⁴⁸ In Multan and Hyderabad, urban housing has already replaced over 7600 ha of cultivated land in the last two decades.^{49,50}

Water Management for Irrigation

- **Irrigated agriculture accounts for 75 percent of Pakistan's cultivated area** and 95 percent of water withdrawals, supporting 90 percent of wheat production and almost all rice, sugarcane, and cotton production. These four crops account for fully 80 percent of water use in agriculture.

- **Groundwater usage in agriculture is an unregulated informal system.** The current monitoring of groundwater levels is suboptimal, and existing practices are not consistent with climate-smart agriculture practices.
- **The Indus Basin Irrigation System (IBIS), the world's largest contiguous, gravity-based irrigation system,** supplies water to a truly vast command area of more than 18 million ha. Indirectly, the IBIS accounts for about 70 percent of annual recharge to groundwater, which in turn contributes to 50 percent of total irrigation in Punjab and 20 percent in Sindh.

Livestock

- **Livestock accounts for about 60 percent of agricultural GDP.** More than 8 million rural families are engaged in livestock activities and derive more than 35–40 percent of their income from this sector.⁵¹
- **The livestock sector is hampered by low productivity** which, when combined with limited access to markets for a majority of the farmers, negatively impacts efficiency.

Famer-Level Challenges

- **Mechanization, already extensive, leaves little room for further improving productivity.** In many locations, groundwater abstraction is exceeding recharge, while in other locations poor on-farm water management (OFWM) has left farms waterlogged.
- **Over-application of agro-chemicals (fertilizers and pesticides) is impacting soil and human health.** Excessive pesticide application harms biodiversity in addition to poisoning about 500,000 Pakistanis every year.
- **Post-harvest losses are contributing to food insecurity and growth shortfalls,** which prevent even bumper crops from translating into high availability in markets and a boost in value-added revenue.

4.1.2 Climate Change Impacts

Climate change will likely contribute to decline in crop productivity and livestock productivity. Specially, climate change is expected to alter crop growth cycles, including sowing and harvest timing, and to increase the threat of hydro-climatic disasters, such as floods and drought, to agricultural production systems. Production of key crops is projected to be 14 percent to 50 percent lower with climate change than the no-climate change scenario.⁵² In addition, climate change is expected to impair livestock productivity through changes in fodder and feed quality and quantity, increased risk of disease epidemics, and the increased cost of feed, water, energy, and cooling systems. Climate impacts affecting cropped agriculture also indirectly impact livestock, as approximately 40 percent of fodder production relies on agricultural fields. The remaining 60 percent comes from rangelands, which are affected by ecological decline and are vulnerable to climate change, population increase, economic growth, and urbanization. (This is discussed further in Chapter 4.2 on Natural Capital).

Increasing temperatures will add to the already growing demand for water, pushing it to a projected 60 percent increase by 2047, with the largest volumetric increase in agricultural water demand. Annual water supply will likely remain fixed for the next few decades, but the timing will become more variable due to climate change, while water availability for agriculture will decline owing to rising domestic, industrial, and environmental demand. Estimates suggest that under a high warming scenario (3°C by 2047), agriculture could maintain its current levels of surface water consumption only up to 2037. Beyond that, agriculture will have to give up water in order not to compromise industrial use and domestic water needs. The outlook for groundwater is bleaker. Current levels of use can only be sustained up until 2030 without taking away from other sectors. Maintaining current levels of groundwater overuse

in agriculture will limit its role as a buffer in water-scarce and drought years. Over the next three decades, about one-tenth of current irrigation withdrawals (12 billion cubic meters) will need to be reallocated, and the performance of the IBIS will be a critical lever for this.⁵³

Water scarcity will become a challenge particularly in the face of rising temperatures, which are accelerating glacial melt, resulting in extreme flooding originating from the northern Gilgit-Baltistan and Khyber Pakhtunkhwa regions. Pakistan has more than 7000 glaciers,⁵⁴ and rapid glacial melt has led to a 300 percent increase in GLOF events.⁵⁵ Furthermore, the Hindu Kush Himalayan glaciers face a future of growing peril, with the potential loss of up to 80 percent of their volume by the end of this century,⁵⁶ which will present a major threat to Pakistan's agriculture sector. Such rapid glacial melt would present a major challenge for water distribution in the country, particularly between upper and lower riparian communities, leading to heightened competition for already scarce resources.

4.1.3 Priority Adaptation Areas and Initiatives

There are three main priority areas for transforming the agriculture–food system:

(a) Promote Climate Smart Agriculture Practices

To address the impacts of climate change, Pakistan should embrace the scale-up of climate smart agriculture (CSA) practices, which emphasizes on the responsible use of natural resources such as water, soil, and biodiversity. The historical farming methods of physical expansion and input intensification are rapidly approaching their natural limits and have already exceeded their environmental sustainability limits. It is important to proactively intervene and incentivize shifts to high productivity and environmentally sustainable systems. This requires substantial investment and reform in the water, agriculture, and environment sectors.

There is a need to align the agriculture sector with priority interventions, encompassing relevant policies and plans—most notably Pakistan's revised NDCs. There are pilot-scale experiments and small-scale successes with alternative crops, precision irrigation, tunnel farming, and integrated pest management. The problem is low adoption of these potentially transformational strategies, especially among smallholder farmers.⁵⁷ Policy coherence is needed to ensure that research, extension services, and access to finance and to appropriate technology and machinery all converge toward the objective of creating a high-productivity, climate-resilient agriculture and water sector that can also help reduce GHG emissions and ensure natural capital conservation.

Despite the incentives to increase livestock production such as income growth and urbanization, domestic production is ill-equipped to adopt climate-smart production practices that would increase productivity in a sustainable way. To increase productivity in smallholder and semi-commercial livestock systems, a multifaceted approach is essential. Strengthening disease control through vaccination and hygiene practices, supporting breeding programs for more productive and disease-resistant animals, ensuring access to nutritious feed to reduce emissions, and creating an enabling environment for the adoption of CSA practices are key strategies.

(b) Modernize the Irrigation Systems

Irrigation modernization holds the key to support CSA in Pakistan. In its current capacity, the IBIS is not flexible enough to support the needed agriculture–food system transformation. Its rigid, supply-driven infrastructure design and operations impede an agile transition to demand-responsive service delivery and use-based charges. Without this flexibility, CSA will be difficult to scale, especially in areas that primarily depend on surface water deliveries. In areas where groundwater is a secondary or the primary source, poor monitoring and mismanagement make existing irrigation arrangements unsustainable, and jeopardize groundwater use for domestic water and as a buffer for drought management. IBIS infrastructure and operations need to be modernized to make groundwater use sustainable, reduce distributional losses and inequity, facilitate rapid surface water reallocations, respond to largescale shifts in cropping patterns without increasing water withdrawal, and enhance drainage capacity to prevent waterlogging and flood water retention in cultivated areas.

(c) Formulate Long-Term Agriculture Growth Strategy




Pakistan requires the institutional and policy enabling environment to support the development and uptake of CSA and to incentivize a shift to modern agronomic practices and crop diversification. The agriculture–food system suffers from poor internal coordination, especially among institutions mandated to work on CSA. Agriculture research funding is a low priority (roughly 0.2 percent of the agricultural GDP); the same applies to CSA.⁵⁸ At the level of provincial departments, there is awareness of, and access to, international CSA best practices. But public agriculture extension services and their curricula remain focused on traditional crops and agronomic practices. Private service providers are starting to fill this gap, albeit on a small scale. Hence, an urgent imperative lie in devising a comprehensive, long-term agricultural growth strategy centred around promoting CSA practices, enhancing agricultural productivity, and supporting sustainable physical expansion. Additionally, this strategy should encompass a well-defined coordination mechanism aimed at minimizing redundancy and harnessing synergies among diverse public and private institutions engaged in CSA initiatives.

Based on the priority areas identified above, table 4.2.1 elaborates on the key objectives and initiatives.





Table 4.1.1: Key Objectives and Initiatives for the Agriculture–Water Nexus








No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Incentivizing farmers to transition to climate smart water and land management practices			
1.1	<p>Improve agricultural research and extension services. This will include:</p> <ul style="list-style-type: none"> Focusing on climate resilient crop varieties, regenerative agriculture practices for land preparation, sowing, and harvesting, efficient and sustainable fertilizer application, improved on-farm water management (OFWM), inter-cropping and crop diversification Tailoring extension services to agro-ecological zones, fostering inclusivity in the development process, and learning from past successful pilots (e.g., expansion of olive cultivation) and accomplishments at scale (e.g., steady increase in maize production) Ensuring extension services related to irrigation application are informed by groundwater assessments and best estimates of projected changes in rainfall timing Research and extension priorities specific to livestock in strengthening disease control, breeding of more productive and disease-resistant animals and increasing access to nutrition and feed to increase productivity and reduce enteric emissions 		Ministry of National Food Security and Research (MoNFS&R); Provincial, GB and AJK Departments of Agriculture, Livestock and Fisheries; Livestock and Dairy Development Boards; Agriculture Universities
1.2	Support creation of forums, such as producer groups, that facilitate collaboration between small farmers and other actors in crop-specific value chains, including private sector that can help farmers access national and international markets		Provincial, GB and AJK Agriculture Departments; Zarai Taraqati Bank; Microfinance Banks; SMEs; Local Government Departments (LGDs); Private Banks

1.3	Increase access to credit for on-farm technology adoption and purchase of inputs that support CSA, which includes establishing institutions that provide information to the farmers regarding finances available for technologies, equipment, and climate resilient crops.		MoNFS&R; MoF; Provincial, GB and AJK Agriculture Departments; SMEs; Microfinance Banks; Private Banks
1.4	Restructure existing financial tools to target smallholder farmers and repurpose them as instruments to incentivize crop diversification, improved water productivity, and improved land management.		Ministry of Finance (MoF); MoPD&SI; MoNFS&R; Zarai Taraqati Bank
1.5	Identify and develop a risk management system including crop insurance		MoNFS&R; MoF; NDRMF; Private Banks; National Insurance Companies



Objective 2: Modernizing surface and groundwater irrigation services to support the transition to CSA

2.1	<p>Upgrade IBIS rehabilitation programs to modernize surface water distribution systems. Key modernization steps will include:</p> <ul style="list-style-type: none"> Increasing hydraulic control in the secondary distribution system to ensure sufficient delivery to water courses under different flow regimes Improving real-time groundwater monitoring in canal command areas to facilitate conjunctive management of ground and surface water Developing integrated hydro-agro informatics systems to make irrigation supply responsive to crop water requirements Develop flexible and participatory institutional arrangements and regulations to maximize equity and reliability in the operations of modernized infrastructure 		Ministry of Water Resources (MoWR); IRSA; Provincial, GB and AJK Departments of Irrigation and Agriculture; LGDs
2.2	<p>Develop a long-term plan for asset management, and operations and maintenance with a focus on:</p> <ul style="list-style-type: none"> Maintaining conveyance efficiency Reducing non-beneficial losses, especially leakages in saline groundwater zones and waterlogged areas Ensuring access for tail-end users Ensuring all measurement systems are regularly calibrated 		MoWR; Planning & Development Departments (P&DDs); Provincial, GB and AJK Departments of Irrigation and Agriculture; LGDs
2.3	Develop regulatory frameworks to manage groundwater use in agriculture and a program for managed aquifer recharge		MoWR; Water and Power Development Authority (WAPDA); Provincial, GB and AJK Departments of Irrigation and Agriculture; LGDs
2.4	Modernize the abiana framework by digitizing the abiana assessment and collection system and creating a financial diversification program for irrigation departments to increase revenue		Provincial, GB and AJK Departments of Irrigation, Revenue and Agriculture

Objective 3: Developing long-term agriculture growth strategy with a focus on productivity improvement, climate resilience, and physical expansion.

3.1	Establish a coordination mechanism to reduce overlap and maximize synergies between various public sector and private institutions working on CSA		MoCC&EC; MoNFS&R; Provincial, GB and AJK P&DDs; and Agriculture Departments
3.2	Develop a dynamic dashboard for monitoring crop water requirements using a combination of remote sensing and periodic ground-truthing, linking to the action above on developing hydro-agro informatics systems		MoNFS&R; Global Change Impact Studies Centre (GCISC), Pakistan Meteorological Department (PMD); Provincial, GB and AJK Irrigation Departments
3.3	Develop an environmental management plan for agriculture which focuses on conservation of soil and water quality		MoCC&EC; MoWR, Provincial, GB and AJK Agriculture Departments;
3.4	Assess culturable wastelands of Pakistan and develop a long-term investment program to identify feasible interventions that can bring land into environmentally sustainable productive use		MPD&SI; Economic Affairs Division (EAD); MoCC&EC; Provincial, ICT, GB and AJK P&DDs; and Agriculture Departments
3.5	Reduce post-harvest losses by investing in agricultural storage, transport, and investments in physical and communication infrastructure that integrate farmers with value-chains		Provincial, GB and AJK Departments of Agriculture, Food; P&DDs

Objective 4: Developing a plan for managing projected river flow and rainfall variability under different climate scenarios

4.1	<p>Develop plans for managing drought-flood cycles in areas where both hazards affect agricultural communities. Key actions in the development and implementation of these plans will include:</p> <ul style="list-style-type: none"> • The most feasible and locally appropriate infrastructure options from the above list • Institutional and community-based measures for rationalizing water use during periods of drought • Improving risk monitoring and early warning systems 		MoWR; MoCC&EC; Federal Flood Commission; WAPDA; Provincial, GB and AJK Agriculture Departments; PMD; LGDs
4.2	<p>Develop a plan for strategic water storages across the country that minimize environmental and social harms and decentralize and devolve management of stored water. Priority will be given to:</p> <ul style="list-style-type: none"> • Small rainfall and runoff capture dams for groundwater recharge or direct use • Dispersion structures with downstream storages for productive use of hill torrents • Small storages within the canal distribution system to regulate irrigation supply • Watershed restoration work that increases infiltration of rainfall and runoff into groundwater 		WAPDA; MoWR; Provincial, GB and AJK Irrigation Departments; MoCC&EC

4.2 Natural Capital (Land, Water, and Air)

4.2.1 Sectoral Context

Land and Ecosystem

- **Pakistan's economy is underpinned by significant renewable natural capital** (rangelands, forests, fertile soils, fisheries, and so on) that contributes an estimated 13–15 percent to per capita wealth.⁵⁹ These assets, currently and in future, are expected to continue to drive the nation's development.
- **The expansion of agriculture and urban development, overharvesting and overuse of resources, pollution, and climate change** all pose significant threats to natural capital's potential contribution to development. Globally, Pakistan ranks among the top-10 countries most impacted by the loss of biodiversity and ecosystem services.
 - Rangelands and forests, which cover 65 percent of Pakistan and account for over 50 percent of agricultural GDP, are heavily overgrazed and overharvested and achieve only about 40 percent⁶⁰ of their potential.
 - Soils in the Indus Irrigation Scheme are not well suited to current agricultural practices and are therefore increasingly unproductive, with 4.5 million ha—about 30 percent of the total irrigated area—affected by high salinity and waterlogging.
 - Pakistan's fisheries, an important source of livelihood for coastal communities, directly employ approximately 400,000 people,⁶¹ with exports of US\$414 million in 2021, yet because of heavy overexploitation without proper fisheries management, catches are projected to decline.
 - Pakistan's coast is home to the 7th-largest mangrove forest in the world, situated in the Indus Delta. This mangrove forest has the potential to sequester carbon at a rate 3 to 5 times higher than terrestrial forests. The country's Blue Carbon Project, launched in 2020, if nurtured successfully, would be worth US\$500 million by 2050.⁶²

Water

- **Water security plays a pivotal role in bolstering the economy**, necessitating the efficient and holistic management of diverse landscapes within watersheds.
- **The poor environmental outcomes of inadequate water resource management create public health hazards, most prominently through their impact on groundwater.** Groundwater supplies 90 percent of domestic water in rural Pakistan and 70 percent of domestic water nationally,⁶³ and serves as a buffer during drought. The declining availability of fresh groundwater due to depletion and the deterioration of its quality throughout the Indus Basin has profound socioeconomic implications.
- **Although depletion is strongly correlated with agricultural use of groundwater, quality concerns are linked to a variety of anthropogenic and geogenic drivers.** The human-made include bacterial contamination from untreated sewage, which is a major public health concern as an underlying driver of high rates of stunting and the high incidence of diarrhea. Geogenic drivers include trace metal contamination, most notably arsenic, lead, and fluoride.

Air Pollution

- **Pakistan is the world's third-most, air-polluted country.**⁶⁴ Air pollution shortens the average Pakistani's life expectancy by 4.3 years, relative to what it would have been if the WHO guideline on air pollution were

met. Children are highly sensitive to air and water pollutants, which can have lifetime consequences in terms of diseases, disability, cognitive impairment, and death.⁶⁵

- **The most harmful emissions to air are fine particulate matter, or PM_{2.5} and NO_x.** Pakistan's PM_{2.5} concentrations levels, which on average are estimated at 49.5 micrograms per cubic meter (µg/m), five times higher than the WHO's recommended limits, pose a serious health hazard, and are even higher in urbanized areas. In the highly urbanized cities, especially Lahore, Karachi, and Peshawar, more than a million citizens are at increased mortality risk from air pollution.
- **Air pollution has contributed to substantial economic losses.** According to the World Bank report of 2016, the economic loss of air pollution in Pakistan was US\$47.8 billion, which was 5.8 percent of GDP in 2013.
- **Air pollution stems from a variety of sources, each playing a significant role in the degradation of air quality.** The main sources include the domestic use of fossil fuels (necessitated by inadequate access to clean modern energy for cooking), motor vehicle emissions, industrial emissions, and emissions from agriculture including fertilizers, livestock, and the burning of crop residues.

4.2.2 Climate Change Impacts

Climate change has far-reaching impacts on land, forests, and biodiversity. Rising temperatures and prolonged droughts contribute to deforestation, forest degradation, and an increase in wildfires, altering ecosystems and leading to biodiversity loss. Sea level rise and increased storm intensity can lead to coastal inundation and erosion and the loss of critical coastal habitats such as mangroves, which serve as important nurseries for many fish species. Additionally, changing climate conditions can enable invasive species to thrive, disrupting local ecosystems. Pakistan is ranked among the top-five countries in the world most impacted by the loss of biodiversity and ecosystem services.⁶⁶ To address these challenges, urgent action is needed to promote sustainable land management.

Pakistan's coastal ecosystems face an array of climate-related hazards, including tropical cyclones, severe storms, floods, and shoreline erosion. These threats not only jeopardize lives but also cause extensive damage to property and infrastructure. Projected sea level rise and increased storm intensity in Pakistan could lead to the erosion of beaches, devastating flooding, and the inundation of vital wetlands and low-lying areas. Moreover, there is a growing risk of seawater infiltrating both groundwater and surface waters, leading to salinization and compromising freshwater resources.

Climate change is increasing water demand across sectors, making access to water of acceptable quality subject to more competition. As floods and droughts become more frequent and intense, the role of forests, rangelands, and wetlands to regulate water flow, increase groundwater recharge, and reduce erosion will become more important. Water quality, flood control, and drought management are water security issues that require attention from an environmental management perspective.

Climate change has a profound impact on air pollution, aggravating existing problems and introducing new challenges. Rising temperatures are leading to heatwaves and temperature inversions that trap pollutants close to the ground during stagnant conditions. Increased wildfires release particulate matter and other pollutants into the atmosphere, while changing precipitation patterns result in both momentary improvements in air quality through rain washout and dust storms during droughts. Higher temperatures promote ground-level ozone formation, exacerbating air-quality issues. Poor air quality from climate change worsens respiratory and cardiovascular diseases, especially for vulnerable populations, straining public health systems.

4.2.3 Priority Adaptation Areas and Initiatives

There are four main priority areas for protecting natural capital and ecosystem services:

(a) Sustainable Land Management

Promoting sustainable landscape management is imperative to restoring and enhancing Pakistan's forests and ecosystems.⁶⁷ A crucial step towards climate change adaptation involves the restoration of rangelands, forests, and mangroves. By increasing forest cover, Pakistan can effectively mitigate the flood impacts and prevent soil erosion, thereby reducing silting in rivers and dams. In the coastal areas, the preservation of mangroves serves as a natural defence against cyclones, providing valuable protection to vulnerable communities, especially in Sindh. Measures are needed to restore coastal and marine resources and protect ecosystems and biodiversity. Examples include the creation of marine protected areas; the demarcation of extensive no-take zones in coastal areas; and the establishment of wildlife protection corridors. Community-based wildlife management and carbon-based payments for mangrove restoration hold significant potential for scaling up landscape restoration action.

(b) Integrated Watershed Management

The development of a more formal approach to managing large watersheds that house forests and rangelands is critical to mitigating water-related risks, especially for managing soil erosion, floods, and droughts. This would also help reduce sediment build-up in dams, extend their storage life, and simultaneously increase groundwater recharge, which in turn would enable better management of aquifers for water storage. Addressing the decline in water quality through better monitoring (especially of groundwater) and enforcing environmental legislation is critical. Water quality can be improved by reducing inflows of solid waste (through better water sanitation facilities), industrial effluents, pesticides, and other pollutants. Moreover, close coordination with developments in the irrigation and on-farm water management sectors is necessary.

(c) Coastal and Marine Protection

To build resilience through coastal and marine protection, comprehensive efforts are needed. This will involve developing and implementing coastal management and resilience plans to restore mangroves, coastal barriers, and coastal aquifer recharge. Additionally, there should be a focus on reducing coastal plastic, solid, and liquid pollution through effective waste management systems and enforcing regulations to prevent contamination. Exploring the potential of the "Blue Economy" while conserving marine and coastal ecosystems is vital for promoting responsible fishing and ecotourism. Restoration and conservation of marine habitats, climate-resilient infrastructure, community engagement, and capacity building are also key elements in safeguarding coastal areas and promoting sustainable development.

(d) Investing in Air Quality Management

The National Clean Air Policy (NCAP), enacted in 2023, aims to improve air quality nationwide, with a prioritized focus on areas such as vehicle inspection and maintenance, fuel quality standards, electric vehicles, mass-transit systems, traffic management, and emission control in industries. The NCAP also identifies interventions in agriculture, waste management, and household pollution. Full implementation of these interventions would reduce PM_{2.5} emissions by 38 percent by 2030, and 81 percent by 2040, compared to baseline scenarios.










Based on the priority areas identified above, Table 4.2.1 elaborates on the key objectives and initiatives.











Table 4.2.1: Key Objectives and Initiatives for Natural Capital

Short-term
2023-2025

Medium-term
2025-2030

Long-term
2030 Onwards

No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Mainstreaming sustainable land management into ecosystem services			
1.1	Prepare and implement a landscape restoration program across Pakistan, including innovative financing approaches and mainstreaming into provincial programs		MoPD&SI; MoCC&EC; Provincial, ICT, GB and AJK Departments of Forestry and Wildlife, Irrigation; Water Supply and Sewerage Authority (WASA); ICT Administration
1.3	Support a transition to regenerative agriculture for the reduction of agro-chemical usage, which plays a crucial role in curbing water body pollution		Provincial, GB and AJK Environment Protection Agencies (EPA); Departments of Agriculture; Industries; LGDs
1.4	Expand agro-forestry into smallholder farming and rangelands management across Pakistan		Provincial, GB and AJK Departments of Forestry and Wildlife, Agriculture
1.5	Introduce a system to reduce and replace pesticide and chemical fertilizer use to minimum needs		Provincial, GB and AJK Agriculture Departments
1.6	Introduce schemes to reduce agricultural burning of crop residues and to improve soil fertility		Provincial, GB and AJK Environment Protection Agencies (EPA); including Departments of Agriculture; LGDs; ICT Administration
1.7	Increase investment in the restoration of ecosystem services and income-generating infrastructure in priority-protected areas		Provincial, ICT, GB and AJK Forestry and Wildlife Departments; P&DDs; Development Authorities; Private Sector and Banks
1.8	Introduce right pricing of user charges and fees for natural resources (water, fisheries, timber) and the polluter pays principle		Provincial, ICT, GB and AJK Forestry and Wildlife; including P&DDs; Development Authorities; LGDs
Objective 2: Promoting integrated watershed management			
2.2	Restore top 20 percent of heavily degraded upper watersheds through re-seeding, forest planting, land reclamation structures, and livestock management and productivity improvements		Provincial, ICT, GB and AJK Departments of Forests and Wildlife, Agriculture, Irrigation, and Livestock and Fisheries
2.3	Introduce ecosystem service payments to communities for providing clean, sediment-free water downstream and for watershed maintenance		Provincial, ICT, GB and AJK Departments of Forests and Wildlife, Agriculture, Irrigation, and Public Health Departments; LGDs; SMEs; Non-Governmental Organisations (NGOs)

2.4	<p>Operationalize the Living Indus Initiative:</p> <ul style="list-style-type: none"> Establish the Indus Protection Act and associated trust fund Prepare study and implement scheme to return e-flows to the Indus Promote coordination and knowledge exchange 		MoCC&EC; Provincial, GB and AJK Irrigation Departments; Indus River System Authority (IRSA); National Disaster Risk Management Fund (NDRMF)
Objective 3: Improving water quality through better wastewater management			
3.1	Install wastewater treatment plants in all urban sewerage systems; and develop a financing model to maintain the existing combined effluent treatment plants to keep them functional and operational at their full capacity		Provincial, ICT, GB and AJK LGDs; Development Authorities; Urban Units of P&DDs;
3.2	Replicate existing best practices in anaerobic digestion technology for recycling and waste-to-energy use		Provincial, ICT, GB and AJK LGDs; Development Authorities
Objective 4: Investing in coastal and marine resources protection			
4.1	Design and implement coastal management and resilience plans to restore mangroves, coastal barriers and coastal aquifer recharge		Ministry of Maritime Affairs (MoMA); Sindh and Balochistan Coastal Development Authority, and Forest & Wildlife Departments; Port Authorities
4.2	Implement plans to reduce coastal plastic, solid and liquid pollution		MoMA; LGDs; Municipalities and Development Authorities; Sindh and Balochistan EPA; Coastal Authorities; Port Authorities;
4.3	Develop the potential of the “Blue Economy,” including the health of marine and coastal ecosystems		MoMA; MoCC&EC; Provincial Fisheries Departments; Coastal Authorities; Port Authorities
Objective 5: Investing in air pollution-climate change nexus			
5.1	Prepare and implement clean-air investment plans for priority sectors to achieve Pakistani air-quality standards (domestic cooking, transport, industries, agriculture, municipal solid waste burning)		Provincial, ICT, GB and AJK EPAs; including Departments of Industries, Transport; LGDs; Development Authorities
5.2	Prepare air governance assessments and implement strengthening plans		Provincial, ICT, GB and AJK EPAs; LGDs/Municipalities; Transport and Industries Departments; P&DDs
5.3	Establish and enforce air quality standards in priority sectors		Provincial, ICT, GB and AJK EPAs; including Departments of Industries, Transport; LGDs/Municipalities; P&DDs
5.4	Implement the identified programs; and periodically review and update the investment plans based on new data and changing circumstances		Provincial, ICT, GB and AJK Departments Transport, Agriculture, Industries; LGDs; EPAs; P&DDs; Private Sector

4.3 Urban Resilience

4.3.1 Sectoral Context

Urban Development

- **Pakistan is one of the most urbanized countries in South Asia.** Around 38 percent of the population lives in urban areas, which are growing at an annual rate of 2.7 percent.⁶⁸ By 2030, more than half of Pakistanis are expected to live in cities.⁶⁹
- **Pakistan's cities contribute only around 55 percent of total GDP,** compared to the global average of approximately 80 percent.⁷⁰
- **Rapid, unplanned urbanization is fuelling poverty and inequality.** Urban population growth has not been matched by growth in housing units nor by equitable access to land, resulting in housing shortages and slums.
- **Despite a high urban population growth rate, most cities are not becoming denser.** Urban sprawl is more the norm. The average city built-up growth is 3.5 times higher than the urban population growth rate. This involves the conversion of agricultural land into peri-urban land, which requires additional supportive infrastructure and makes it more expensive and inefficient to provide services.
- **This is a significant opportunity to address the growing urban sprawl positively by implementing robust urban planning and regulation measures.** Currently, the absence of a unified land record system and patchy data on land use result in poor urban land management.

Municipal Services

- **While access to critical services is relatively high in Pakistan's cities, the quality of the services is low.** For example, a large share of the water supply in many cities is unsafe for drinking, and inadequate sanitation facilities lead to health issues and labour productivity loss.⁷¹
- **A lack of comprehensive solid waste management (SWM) infrastructure and services is creating serious environmental problems.** Pakistan generated an estimated 36 million tons of solid waste in 2020, projected to increase to 85 million tons by 2050.⁷² Each year, an estimated 3.3 million tonnes of plastics are wasted in Pakistan, equivalent to two K-2 mountains made of plastic waste in height. Most municipal waste is either burned, dumped, or buried on vacant lots, threatening the health and welfare of the population.
- **Pakistan's urban centres face resource constraints that contribute to the poor delivery of municipal services.** Only a fraction of costs is recovered from water, sanitation, SWM, and mass transit services. The provincial governments subsidize these services instead of aiming for higher cost recovery.

Air Pollution

- **Nearly all cities in Pakistan face severe air pollution.** In 10 of 11 cities studied, pollution levels in the entire city were at least 10 $\mu\text{g}/\text{m}^3$ of $\text{PM}_{2.5}$ concentration, a threshold which, according to the World Health Organization (WHO), is associated with an increase in long-term mortality.⁷³ Urban air pollution has harmful effects on both human health and the environment.

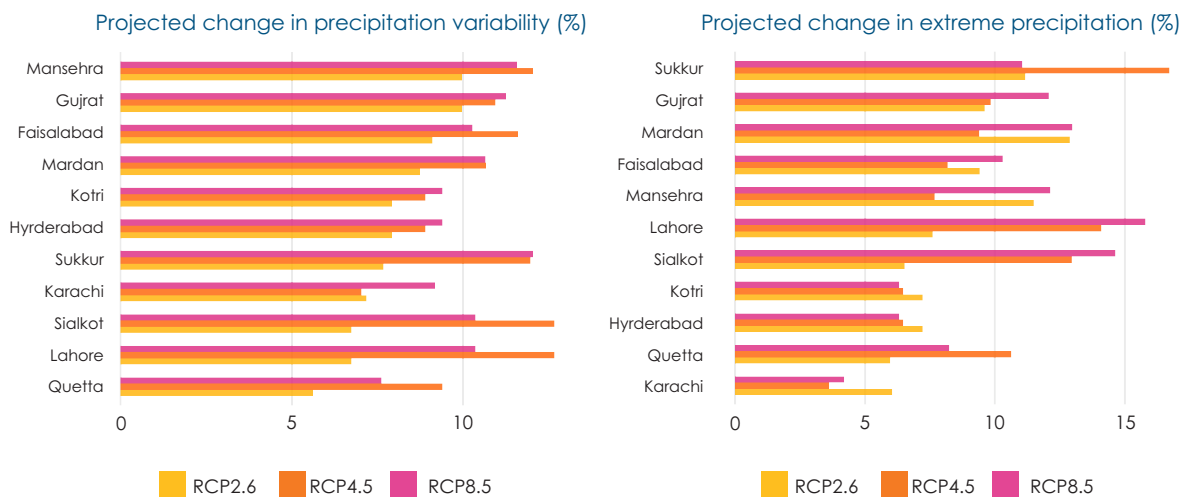
4.3.2 Climate Change Impacts

Urban areas are becoming increasingly vulnerable to a wide range of climate change and disaster risks.⁷⁴ These include pluvial and fluvial floods, earthquakes, heat waves, and droughts, which can further trigger hazards such as landslides. A growing body of research from multiple agencies has identified key climate-related risks for several large and medium-sized cities in Pakistan. These risks vary depending on the city's size, regional importance, and contribution to emissions, as confirmed a study of 11 cities by the World Bank's City Resilience Program in 2022.⁷⁵

The imbalance that characterizes Pakistan's rapid urbanization, and the lagging urban services, exacerbate residents' vulnerability to disaster and climate change impacts. Infrastructure and services are crucial to the ability of vulnerable urban communities to cope with geo-hazards and climate-related challenges. By contrast, unsafe and inadequate service delivery infrastructure, urban sprawl, and the absence of green spaces increase exposure and vulnerability to shocks.

Flood hazards across cities are projected to increase by 2050 as precipitation intensifies and weather patterns become more unpredictable. Climate projections show that precipitation variability and extreme precipitation in cities are both expected to rise (see Figure 4.3.1). This suggests the incidence of more serious fluvial and pluvial flooding and drought in the medium term. The primary cities have the highest risk exposure. Lahore has the most settlement area exposed to fluvial and pluvial flooding, with 163 square km and 129 sq km, respectively, exposed. Karachi has the second most settlement area exposed to pluvial flooding.⁷⁶

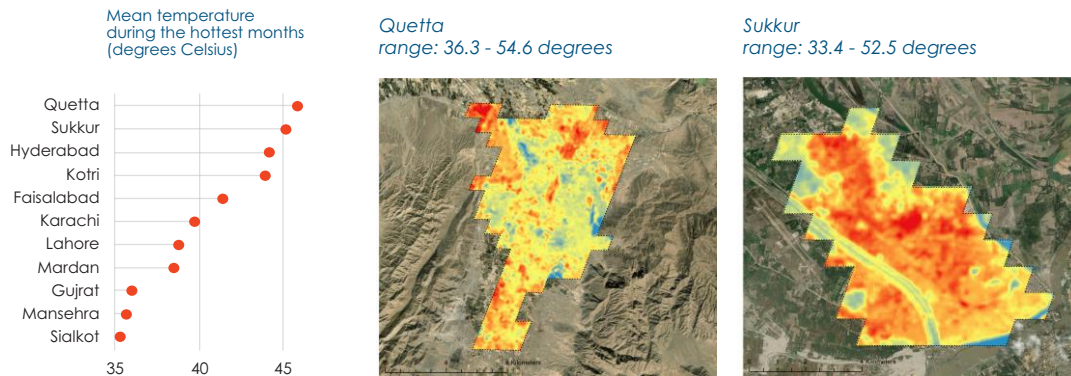
Figure 4.3.1: Projected Changes in Precipitation Variability and Extreme Events in Major Cities



Low-density expansion of cities at their fringes (urban sprawl) has amplified these risks. Overall, settlements grew in size by an average of 144 percent between 1985 and 2015.⁷⁷ But new settlements are at greater risk of fluvial and pluvial flooding. Exposed settlements hazard grew by 327 percent and 227 percent, respectively.⁷⁸ Such risks are expected to continue to rise until at least the middle of the century.⁷⁹

Extreme heat is increasing in frequency, severity, and complexity due to climate change, with heat risks in cities amplified by the Urban Heat Island (UHI) effect. Under business-as-usual GHG emission scenarios, cities in Pakistan could be among the first places in the world to experience heat waves that exceed the survivability threshold of 35°C.⁸⁰ Jacobabad surpassed 50°C during the 2022 heat wave. Figure 4.3.2 shows heat maps of Quetta and Sukkur, the cities with the highest mean temperature during the summer months. In the future, under both SSP1 and SSP5 scenarios, cities could see further temperature increases because of urban land expansion.

Figure 4.3.2: Mean Temperature during Summer Season in Major Cities (left) and Heat Maps of Quetta and Sukkur (right)



4.3.3 Priority Adaptation Areas and Actions

The key priority areas for building climate-resilient and liveable cities include:

(a) Promoting Climate-Informed Urban Planning

To adapt and mitigate the impacts of climate change, there is a vital need to introduce climate and disaster risk considerations (including cooling) into urban planning and systems building. By conscientiously designing the layout and infrastructure of these cities with such in mind, Pakistan can unlock a number of advantages. This climate-informed approach allows for optimized resource utilization, improved service delivery, and the creation of resilient systems capable of withstanding the impact of weather and climate hazards. Cities should embrace efficient urban anatomies, which entails smart zoning and land use planning, and promoting compact and connected neighbourhoods that minimize travel distances and reduce energy consumption. In addition, incorporating green spaces, urban parks, and permeable surfaces within cities can act as natural buffers against extreme weather events, reducing flood risks and mitigating the UHI effect. Moreover, by incorporating peri-urban properties into the formal land management system through registration, these areas would become subject to land conversion controls, zonation, and building codes. Such inclusion would strengthen their capacity to withstand disasters and provides enhanced oversight over urban expansion.

(b) Improving Municipal Service Delivery

Robust and equitable municipal services increase the overall resilience of urban systems to respond to and cope with climate shocks by maintaining reliable service delivery. There is a wide range of municipal services that could be prioritized. For example, well-designed and maintained stormwater management and drainage systems are essential for preventing waterlogging, reducing the impact of heavy rainfall on urban areas. Proper waste management, including recycling and waste reduction programs, is essential to maintain a clean and healthy urban environment, which also helps prevent the spread of diseases. Ensuring a reliable and sustainable water supply, including investing in water infrastructure, a distribution network, and water conservation measures, is vital for coping with water scarcity during droughts or other water-related challenges.

(c) Leveraging Nature-Based Solutions (NBSs)

Nature-Based Solutions (NBSs) are of paramount importance in effectively addressing heat and flood risks and have the potential to generate carbon credits. NBSs conserve or restore natural systems to support built infrastructure.⁸¹ NBSs facilitate better thermal regulation, rainwater harvesting, and water retention and treatment, and reduce stormwater runoff. Bioretention areas, constructed wetlands, and open spaces can help control stormwater by capturing and retaining runoff. NBSs can be integrated into river flood control systems.⁸² Pakistan's NDCs foresee the implementation of 126 urban forest projects throughout the country.⁸³ It is critical to identify opportunities to scale up these projects and provide guidance on recommended species and locations to maximize the mitigation of

urban heat and flooding risks. Some NBSs have carbon sequestration effects, which have the potential to generate carbon credits.

(d) Strengthening Municipal Financial Capacity













Enhancing urban services necessitates substantial investments. It is therefore crucial to explore avenues that promote municipal financial capacity. Public-private partnerships (PPPs) present a highly viable option for fostering private sector investment in the infrastructure of climate-smart service delivery. Intergovernmental fiscal transfer, in the form of a performance-based, climate-resilience, grant-financing mechanism, is another option that could provide incentives for climate change adaptation interventions. Further, local governments could also explore the option of improving the cost recovery of municipal services, which will enable a reduction in subsidies, freeing up resources for productive investments. User charges for services can serve a dual purpose by not only putting a price on the utilization of resources but also acting as a disincentive to excessive consumption and pollution.



Based on the priority areas identified above, Table 4.3.1 elaborates on the key objectives and initiatives.

Table 4.3.1: Key Objectives and Initiatives for Urban Resilience



No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Mainstream climate adaptation in urban planning across federal, provincial, and local governments			
1.1	Generate granular, precise, and reliable data on climate risks, infrastructure, and poverty to improve the targeting of adaptation measures		MoCC&EC; Pakistan Bureau of Statistics (PBS)
1.3	Incorporate climate vulnerability and risk considerations into the city's master plan and other urban development policies		MoCC&EC; Provincial, ICT, GB and AJK P&DDs; LGDs
Objective 2: Improving land regulation and land-use planning to bolster resilient service provision			
2.1	Introduce better land use planning and control measures to ensure that settlements do not occur in flood, landslide, and liquefaction-prone areas		MoCC&EC; Provincial, ICT, GB and AJK Pⅅ LGDs; Development Authorities for City Planning (DAs); Revenue Department (RD); Provincial Disaster Management Authorities (PDMAs)
2.2	Apply land use planning and tools such as site and service instruments to enable more efficient urban anatomies		MoPD&SI; Provincial, ICT, GB and AJK P&DDs; DAs; LGDs
2.3	Register peri-urban properties to make them part of the formal land management system, with land conversion controls, zoning and building codes to increase resilience in the face of disasters		Provincial, ICT, GB and AJK LGDs; DAs; RDs
2.4	Ensure that land records and maps are unified, accurate, and digitized as the basis for improved land allocation, risk-informed spatial planning, and asset management strategies to support resilience		Federal Board of Revenue (FBR); Provincial, ICT, GB and AJK RDs; Survey of Pakistan; LGDs

2.5	Develop and adopt national and subnational urban resilience strategy and action plans		FBR; Provincial, ICT, GB and AJK RDs; Survey of Pakistan; LGDs
2.6	Upgrade informal settlements based on the action plan adopted in the national urban resilience strategy and subnational adaptation plans		Ministry of Interior (MoI); LGDs; DAs
2.7	Address poorly functioning land markets and onerous land use regulations to limit current low-density growth patterns		Ministry of Law (MoL); Provincial, ICT, GB and AJK P&DDs; LGDs; DAs
Objective 3: Bolstering climate-smart municipal services			
3.1	Mobilize local authorities and community volunteers to proactively remove debris and garbage from drainage systems to reduce flooding		Provincial, ICT, GB and AJK LGDs; DAs
3.2	Enhance drainage networks and promote sustainable urban drainage solutions		Provincial, ICT, GB and AJK LGDs; DAs; PWD
3.3	Strengthen regulations and institutions that regulate, manage, and enforce the provision of infrastructure and services		MoL, Provincial, ICT, GB and AJK Pⅅ LGDs; DAs;
3.4	Upgrade infrastructure and systems to provide adequate and equitable municipal services		MoPD&SI; LGDs; DAs; Public Works Department (PWD)
Objective 4: Leveraging NBSs to manage climate risks			
4.1	Identify and introduce NBS initiatives to enable adaptation and to tackle urban heat, urban water scarcity, and flood risks		MoCC&EC; Provincial, GB and AJK Department of Climate Change, Forestry and Environment (CCF&EDs); MoWR; LGDs
4.2	Identify opportunities to scale up urban forest projects		MoCC&EC; Provincial, GB and AJK CCF&EDs; DAs; LGDs
4.3	Construct open spaces and wetlands to help control stormwater by capturing runoff		MoWR; Provincial, GB and AJK CCF&EDs; LGDs; DAs; PWD; Federal Flood Commission
4.4	Construct green roofs and permeable pavements to promote rainfall infiltration		MoWR; Provincial, GB and AJK CCF&EDs; LGDs; P&DDs
Objective 5: Developing financing instruments to ensure sustainable revenue streams for green and resilient urbanization			
5.1	Carry out concentrated policy action to facilitate PPPs, including addressing gaps at the framework level and in existing standardized contracts to address climate change issues		MoCC&EC; MoF; MoPD&SI; Provincial, GB and AJK P&DDs; DAs; LGDs

5.2	Introduce intergovernmental fiscal transfers focused on a multi-sectoral investment menu which targets adaptation interventions		MoCC&EC; MoF; MoPD&SI; Provincial, GB and AJK P&DDs; LGDs
5.3	Improve cost recovery for urban services through the adjustment of user-charges to free up financing for green public investments and address relevant policy actions		MoPD&SI; Provincial, GB and AJK LGDs; DAs; RDs

4.4 Human Capital

4.4.1 Sectoral Context

Health

- Pakistan's human capital indicators are a cause of concern requiring urgent attention.** The situation points to vulnerabilities stemming from factors such as poverty, limited education, and lack of universal health coverage.
- Inadequate water, sanitation, and hygiene (WASH) services, particularly in rural areas, compound health risks.** Low investment in wastewater treatment infrastructure, especially in rural areas, has increased many communities' exposure to disease-causing pathogens. The gaps in WASH services contribute to a high incidence of diseases for all income quintiles.
- The prevalence of both vector-borne diseases (especially dengue and malaria) and water-borne diseases is critical.** Currently, more than 62 million Pakistanis are vulnerable to dengue,⁸⁴ while over 60 million live in areas at high risk for malaria, and another nearly 50 million live in areas of low to medium risk.⁸⁵ Water-borne diseases are also highly prevalent in Pakistan—in 2019, diarrheal diseases were the fourth-leading cause of mortality nationwide.⁸⁶
- Poor nutrition is a growing threat.** Nearly 40 percent of Pakistan's population is food insecure. The prevalence of child malnutrition is amongst one of the highest in the world and continues to increase.⁸⁷
- Pakistan's high fertility rate reinforces a vicious cycle of greater unmet basic needs - higher population growth, and lower resources per capita.** In 2021, the fertility rate stood at 3.5 births per woman—the fifth-highest fertility rate in the world among non-African countries.⁸⁸ The above attributable to a complex web of factors such as deeply ingrained sociocultural norms, limited access of females to education and family planning services, economic challenges and gender disparities.

Education

- Education indicators are poor.** An estimated 22.8 million school-age children in Pakistan are out of school. Learning poverty—the percentage of children by age of 10 unable to read and comprehend age-appropriate text—stood at 75 percent, a situation further worsened by calamities such as 2022 floods and COVID-19.⁸⁹
- Education levels have been improving over time, but the pace is very slow.** Gender and regional gaps in enrolment rates remain significant.

Labour and Economic Productivity

- **Pakistan has a large labour force that stands among the top 10 largest labour forces in the world, which plays a pivotal role in propelling economic development.** The labour force increased from 65.5 million in 2017-18 to 71.76 million in 2020-21 and the number of employed persons increased from 61.71 million to 67.25 million during the same period.
- **The distribution of employment across key sectors exhibits variation.** Notably, the agriculture sector's share of employment witnessed a decline from 39.2 percent in 2018-19 to 37.4 percent in 2020-21. In contrast, the construction sector experienced growth, with its share of employment increasing from 8.0 percent in 2018-19 to 9.5 percent in 2020-21.⁹⁰

4.4.2 Climate Change Impacts

Health

Pakistan faces significant vulnerability to the health impacts of climate change. While Climate Change affects everyone, not everybody is equally vulnerable. A number of factors like geography, health-system preparedness, health status, age, gender, and support systems determine to what extent the population's health is under peril due to the impacts of Climate Change. Adverse effects on health can arise through multiple pathways.

- 1) Direct health impacts from extreme weather events and natural disasters.** These include respiratory health risks, mental health impacts, and direct injuries and mortality associated with natural hazard events.⁹¹ Extreme weather-related events and natural disasters have significant repercussions on healthcare systems, notably by compromising their effectiveness and capabilities. These events can inflict damage or destruction on crucial health facilities, disrupting essential services and delaying prompt medical response. The aftermath of such disasters often overwhelms the healthcare infrastructure, impeding its ability to provide adequate care to affected communities.
- 2) Heat stress.** Pakistan experiences frequent heatwaves. In that regard, 2015 was the deadliest year on record, with 1,200 deaths in Karachi alone, while the heatwave of 2022 resulted in the hottest March recorded on the Indian subcontinent since 1901.⁹² Even in years with average weather, temperatures widely exceed 30°C for months, and maximum temperatures routinely cross 40°C. Besides heat stress, indirect threats such as outbreaks of malaria, dengue, and severe gastroenteritis can occur in Pakistan following heatwaves.⁹³ Heat-related deaths will likely increase under both high- and low-emission scenarios, and it is projected that rising future temperatures will reduce labour productivity.⁹⁴
- 3) Vector-borne and water-borne diseases.** Although the factors that affect the transmission and prevalence of vector-borne diseases are complex, the risk of disease rises in the aftermath of heavy precipitation events, which can lead to an exponential increase in mosquito population.⁹⁵ Similarly, climate warming increases water-borne bacteria and toxins. Intense precipitation and melting glaciers cause floods, damaging WASH infrastructure and introducing pathogens, pollutants, and agricultural runoff.⁹⁶ Drought limits water supply, leading to the use of contaminated sources for drinking, bathing, and irrigation. An increase in extreme climate events, compounded by socioeconomic inequality, is likely to raise the risks of water-borne disease in Pakistan even further.
- 4) Nutrition.** Pakistan is highly agrarian. Agricultural productivity, crucial for food availability, is influenced by weather and climate in various ways, including short-term shocks (natural disasters) and long-term changes in agro-ecological conditions, which can impact yields or alter crop suitability patterns. Without adaptation measures, climate change will likely substantially aggravate food insecurity and worsen nutrition outcomes.

- 5) **Water, Sanitation and Hygiene (WASH).** Extreme weather events can cause significant damage to WASH infrastructure, disrupting the supply of clean water and sanitation services to communities in affected areas. The destruction of water supply networks, pipelines, and sewage systems can lead to contamination of water sources, rendering them unsafe for consumption. As a result, people may be compelled to resort to using contaminated water, which significantly increases the risk of waterborne diseases and infections.
- 6) **Reproductive health.** Climate change directly and indirectly impacts maternal health, making pregnancy less safe and worsening neonatal health outcomes. A mere one-degree Celsius rise in the week before delivery leads to a six percent higher likelihood of stillbirth.⁹⁷ Vector-borne diseases, affected by climate change, can increase the risk of spontaneous abortion, premature delivery, stillbirth, low-weight births, eclampsia, and caesarean delivery for pregnant women.⁹⁸ Climate-related emergencies cause major disruptions in access to health services and lifesaving commodities. Increased poverty and food insecurity driven by climate-related loss of livelihoods negatively affects maternal health.⁹⁹

Education

Climate change also poses significant threats to education services and equalities, especially among vulnerable groups. There are multiple ways in which this can happen.

- 1) **Physical impacts on education facilities.** Extreme weather events, such as monsoon floods or GLOFs, can significantly impact education facilities, disrupting learning continuity. Such events inflict substantial damage to school infrastructure, leaving classrooms and other educational facilities submerged in water, and ruining equipment. This raises the likelihood of temporary or prolonged school closures, disrupting students' education. The floods of 2022 damaged or destroyed over 24,000 schools and disrupted the education of more than 3.5 million children. Strategic interventions are imperative to fortify education infrastructure against such climate-related perils.¹⁰⁰
- 2) **Human responses to climate-induced challenges.** Heatwaves, for instance, prompt local governments to take precautionary measures, leading to school closures and the postponement of examinations to protect student and staff health. Droughts also disrupt education delivery as communities grapple with water scarcity and agricultural impacts. Such human responses to climate change have an adverse effect on education and underscore the need for adaptive strategies and policies that can mitigate disruptions and ensure continuity of learning.
- 3) **Access to education facilities.** An examination of 2019 Pakistan Social & Living Standard Measurement (PSLM) survey data reveals a striking correlation between longer distances to school and decreased attendance, particularly for girls, with an even more pronounced impact on lower-income households. This alarming pattern highlights the vulnerable position of low-income families and girls when flooding disrupts access to schools by damaging educational facilities or rendering roads and bridges impassable. As a result, during climate-induced disruptions they bear a disproportionate burden, facing higher barriers that further deepen gender and economic inequalities in access to good-quality education.¹⁰¹ Urgent attention is required to bridge this gap and ensure equitable opportunities for all, regardless of socioeconomic status or gender, to access uninterrupted education despite the challenges of climate change.
- 4) **Negative coping strategies.** Climate change can produce severe economic shocks to families, causing them to lose valuable assets and livelihood sources. In the face of such challenges, families often resort to negative coping strategies to survive. This often involves pulling children, especially girls, out of school to reduce their financial burden and assigning them household chores or earning responsibilities. Such coping mechanisms perpetuate a cycle of poverty, deprivation, and gender inequality, hindering children's access to education and perpetuating negative gender norms.

Labour and Economic Productivity

Climate change presents formidable threats to labour and economic productivity, particularly for those engaged in the lowest income-bracket work, including heavy labour and low-skill agricultural and manufacturing jobs. The adverse impacts are multifaceted, ranging from occupational health hazards to skill deficiency and economic vulnerability.

- 1) Direct Impacts:** Excessive workplace heat, exacerbated by climate change, is a well-known occupational health and productivity danger. High body temperature or dehydration causes heat exhaustion, heat stroke and in extreme cases, death. A worker's natural protection is to slow down work or limit working hours, which reduces productivity, economic output, pay and family income.¹⁰² Study has shown that temperature has a negative and significant relationship with GDP and productivity in agriculture, manufacturing, and services sectors. However, severity of these negative impacts is higher in agriculture in comparison with manufacturing and services.¹⁰³
- 2) Skill Deficiency and Economic Vulnerability:** Climate-induced extreme weather events can disrupt access to quality education and specialized training, making skill deficiency a pressing concern. It limits the individual's ability to adapt to changing labour demands and maintain productivity, and the lack of essential skills leaves many behind as ill-equipped to secure stable and sustainable livelihoods. The most susceptible are those engaged in low-income, labour-intensive jobs, particularly in sectors like agriculture and manufacturing. As climate impacts exacerbate existing vulnerabilities, the economic productivity of these workers diminishes, leading to reduced incomes, financial instability, and further exposure to poverty and hardship. With limited capacity to cope with adverse climate impacts, individuals find themselves increasingly at risk of falling deeper into vulnerability.

4.4.3 Priority Adaptation Areas and Initiatives

The key priority areas for strengthening human capital include these:

(a) Mainstreaming Climate Adaptation in Health and Education Policies

Sectoral plans in health and education and associated sectors need to be aligned with national climate change policies and international commitments. The NDCs, for example, articulate the need to revise curricula to strengthen climate resilience. Provincial and subnational adaptation and emergency response plans should be promoted for local educational institutions and healthcare providers to ensure timely, effective action.

Sectoral climate vulnerability assessments should be regularly updated to inform these policy and planning processes. Particularly relevant vulnerability and resilience indicators are the mapping of schools, clinics, and other buildings in areas prone to floods, heatwaves, droughts, landslides, and air pollution. Following extreme weather events, tracking data on education-day losses, student absenteeism, and other impacts is essential. Corresponding health indicators, such as the prevalence and spread of diseases due to climate extremes, also need to be identified and monitored. Additionally, it is crucial to analyse climate-induced migration patterns and their potential influence on education and health outcomes.

(b) Enhancing Community Resilience through Emergency Preparedness and Response

Investing in climate-resilient infrastructure is crucial for both the health and education sectors. It is imperative to redesign programs in these sectors to ensure enhanced day-to-day service delivery while also preparing for and responding to extreme weather events effectively. Climate disaster related procedures and training (e.g., evacuation plans and drills) within both sectors must be revised to integrate climate vulnerabilities and risks.

Further, it is essential to equip health providers, community workers, and teachers with the necessary skills through trainings to deliver community awareness programs, respond effectively to extreme weather events, and provide psychosocial support. Such a comprehensive approach will ensure that these frontline professionals play a vital role in promoting climate resilience and supporting communities during climate-related challenges and emergencies.

(c) Building Workforce Capacities to Address Climate Risks

To foster climate resilience, it is crucial to integrate climate education (both adaptation and mitigation) across all levels of educational curricula. This allows the country to effectively equip its youth with the knowledge and skills necessary to navigate the challenges posed by climate change and prepare them for the emerging green job opportunities. Education departments, universities, and research institutions must collaboratively develop comprehensive curricula that integrate climate education into various subjects (e.g., economics, social sciences, and technology), which would cultivate interdisciplinary approach of innovative problem solving to address climate change.











To facilitate a successful transition towards a green and resilient economy, it is crucial to invest in occupational and vocational training programs. One key aspect of this training is equipping labour force with specialized knowledge in green industries, climate smart agriculture, circular development, etc. These efforts should be extended to vulnerable communities that might be disproportionately affected by climate and environmental challenges, such as the 2022 flood, by equipping them with skills and opportunities to rehabilitate their livelihoods. In addition, these programs will have the potential to foster innovation by encouraging entrepreneurs and small businesses to develop environmentally friendly products and services.





Based on the priority areas identified above, Table 4.4.1 elaborates on the key objectives and initiatives.

Table 4.4.1: Key Objectives and Initiatives for Human Capital



No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Mainstream Climate Adaptation in Health and Education Policies			
<i>Health</i>			
1.1	Conduct assessment to strengthen the understanding of climate change impact on public health, and formulate a roadmap to address such challenges		Ministry of National Health Services Regulations and Coordination (MoNHSR&C); MoCC&EC; Provincial, Islamabad Capital Territory (ICT), GB and AJK Health Departments
1.2	Improve data collection, reporting, analysis, and record keeping of climate-sensitive diseases		MoNHSR&C; MoCC&EC; Provincial, ICT, GB and AJK and District Health Departments
1.3	Upgrade and extend disease outbreak monitoring and forecasting to counteract possible climate change health impacts, and support planning for effective interventions		MoNHSR&C; Provincial, ICT, GB and AJK Health Departments; P&DDs
1.4	Integrate climate change adaptation measures into the national and subnational policies in health sector		MoNHSR&C; MoCC&EC; Provincial, ICT, GB and AJK and District Health Departments

Education			
1.5	Conduct assessment to strengthen the understanding of climate change impact on education, and formulate a roadmap to address such challenges		Ministry of Education (MoE); MoCC&EC; Provincial, ICT, GB and AJK Education Departments
1.6	Improve data collection, reporting, analysis, and record keeping of loss to education-days, student-absenteeism		MoE; MoCC&EC; Provincial, ICT, GB and AJK Education Departments
1.7	Mainstream climate change adaptation into the roadmap for skills development in Pakistan		MoE; MoCC&EC; Provincial, ICT, GB and AJK Education Departments
1.8	Integrate climate change adaptation measures into the national and subnational policies in education sector		MoE; MoCC&EC; Provincial, ICT, GB and AJK Education Departments
Objective 2: Enhance Climate Resilience through Disaster Emergency Preparedness and Response			
Health			
2.1	Develop a communication and dissemination strategy for climate-health nexus and implement associated the awareness and prevention campaigns		MoNHSR&C; MoCC&EC; Provincial, ICT, GB and AJK Health Departments; NDMA; PDMA; District Administrations
2.2	Issue timely alerts and advisories on climate and disaster information to health personnel and communities		MoNHSR&C; MoCC&EC; Provincial, ICT, GB and AJK Health Departments; NDMA; PDMA; District Administrations
2.3	Strengthen the capacity of federal, provincial, and district level healthcare bodies to prepare for and respond to health risks during climate-exacerbated disasters		MoNHSR&C; MoCC&EC; Provincial, ICT, GB and AJK Health Departments; NDMA; PDMA; District Administrations
2.4	Ensure family planning services are available at all levels.		MoNHSR&C; Provincial, ICT, GB and AJK Health Departments
2.5	Expand climate-resilient WASH facilities to unserved and underserved areas and populations		MoNHSR&C; Provincial, ICT, GB and AJK Health Departments; Development Authorities
Education			
2.6	Develop emergency and evacuation Standard of Procedures for educational institutions and associated facilities		MoE; MoCC&EC; NDMA; PDMA; Rescue 1122; Provincial, ICT, GB and AJK Education Departments
2.7	Provide trainings and simulations (or drills) for teachers, students, workers, and other education personnel on emergency response and evacuation procedures		MoE; MoCC&EC; NDMA; PDMA; Rescue 1122; Provincial, ICT, GB and AJK Education Departments

2.8	Construct educational facilities that could serve as multi-purpose shelters in the event of weather or climate disasters, especially in most vulnerable areas		MoE; MoCC&EC; Provincial, ICT, GB and AJK Education Departments
Objective 3: Build Workforce Capacities to Address Climate Risks			
1.1	Include climate change in the curricula of all secondary schools and offer specialized courses in colleges and universities		MoE; Higher Education Commission; MoCC&EC; Provincial, ICT, GB and AJK Education Departments
1.2	Develop and implement occupational and vocational training programs to a wide range of occupational fields, production, services, and livelihoods that are directly or indirectly linked with climate change		MoE; Higher Education Commission; MoCC&EC; Provincial, ICT, GB and AJK Education Departments (including both formal and informal educational institutes)
1.3	Provide enabling environment for entrepreneurs and small businesses to develop environmentally friendly products and services		MoCC&EC; MoF; Ministry of Commerce (MoC)

Cross-Cutting Areas

4.5 Disaster Risk Management

4.5.1 Context

Institutional and Policy Framework

- **After the 2005 earthquake Pakistan underwent a profound transformation in Disaster Risk Management (DRM) that culminated in the establishment of a comprehensive institutional framework.** The National Disaster Management Act was passed, and under the 18th Constitutional Amendment, the disaster management function was devolved to provincial and local governments. Pakistan's DRM infrastructure now comprises different tiers of DRM bodies at the national, provincial, and district levels.
- **Pakistan has made commendable efforts in developing comprehensive DRM policies.** These include the National Disaster Management Plan and National Flood Protection Plan IV.

Lessons from 2022 Flood

- **The 2022 floods brought to the fore the limitations of the DRM system, particularly at the subnational and local levels.** While technical agencies possess the capability to forecast impending disasters and provide crucial information, provincial authorities exhibited shortcomings in timely preventive measures and coordinating response and recovery efforts for all stakeholders. These limitations stem primarily from the lack of operationalization of plans due to shortages of trained personnel, equipment, technical expertise, and, most critically, financial resources.

- **One important system-level issue is in the limited absorptive capacity to integrate risk assessments into infrastructure investments and land use planning**, which intensifies vulnerabilities to disaster risks. Addressing these challenges will reinforce the resilience of Pakistan's DRM system and ensure effective disaster response and recovery measures at all levels.

4.5.2 Climate Change Impacts

As articulated in Chapter 2, recent disasters serve as a poignant reminder that climate-related hazards are growing in complexity and pose formidable challenges in their management.¹⁰⁴ The recurrence of risks, such as repeated flooding and heatwaves, compounds the difficulty of dealing with such events effectively. Moreover, the simultaneous occurrence of multiple hazards can create a cascading effect, amplifying the overall risk and immersing sectors and regions in interconnected vulnerabilities. Adding to the intricacy of the situation, certain responses to climate change may themselves inadvertently introduce new impacts and risks, necessitating the adoption of a comprehensive and adaptive approach to safeguarding communities and ecosystems. Addressing these multifaceted challenges requires a unified effort, combining innovative strategies, modernized early warning systems, enhanced coordination, and a strong commitment to building resilience in the face of a dynamically evolving climate.

The already challenging landscape of natural disasters is further exacerbated by a series of additional external shocks in Pakistan. The COVID-19 pandemic, the energy crisis, spiralling price inflation, and fiscal challenges further compound the country's difficulties and highlight the fact that its vulnerability to climate risks stems as much from political and economic instability as from natural factors. Pakistan's governance challenges both exacerbate the impacts of disasters and hamper recovery efforts. Recognizing the interconnected nature of these crises, concerted efforts must be undertaken to develop holistic and adaptable strategies that can effectively address the compounding impacts and build systemic resilience.

4.5.3 Priority Adaptation Areas and Initiatives

The key priority areas for strengthening Pakistan's DRM include:

(a) Strengthening Hydromet, Climate and Early-Warning Systems and Services

Hydromet (hydro-meteorological), climate and early-warning systems are indispensable for DRM as they provide crucial data and information about weather patterns, precipitation, river levels, and other hydrological conditions. These services enable risk assessment, preparedness, and timely alerts in the event of hazards such as floods, storms, and droughts, allowing for proactive measures and early evacuation to save lives and reduce property damage. Additionally, access to accurate hydromet data aids in adaptive planning, raising public awareness, and facilitating coordination and response efforts between different levels of government and humanitarian agencies. With the intensification of extreme weather events, these services play a vital role in supporting communities in monitoring, preparing, and responding to such climate-related hazards.

(b) Strengthening Disaster Risk Governance

There is an urgent need to review and operationalize the 2007 National DRM Framework of Pakistan. The 2013 National Disaster Risk Reduction Policy outlined the need to develop DRM institutions, mechanisms and capacities that can address multiple hazards and raises the resilience, efficiency, and effectiveness of the whole system.

(c) Bolstering the Resilience of Communities and Critical Infrastructure

DRM is relevant for various sectors of the economy, encompassing organizations, communities, and ecosystems.

Effective DRM requires enhancing the stability, adaptability, recovery capacity, and sustainability of all relevant sectors. This entails a meticulous process of identifying vulnerabilities and conducting in-depth risk analyses that consider different climate scenarios. Subsequently, implementing sectoral adaptation strategies to mitigate these risks while fortifying the overall resilience of system and service provision is paramount.

(d) Enhancing Disaster Response and Recovery


Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction requires incorporating risk-informed approaches into recovery and reconstruction efforts. Mitigating the risk of post-disaster delays in relief, recovery, and planning requires focusing on institutionalizing recovery before the disaster. Ex-ante recovery preparation is a vital aspect of disaster risk management, aimed at mitigating the risk of post-disaster delays in relief, recovery, and planning. It includes activities such as conducting risk assessments, developing recovery plans, securing financing mechanisms, building institutional capacities, and establishing coordination mechanisms among various stakeholders. By preparing in advance, communities and authorities can better anticipate and respond to disasters, reducing the time and resources needed to recover and rebuild. This approach is critical for enhancing disaster resilience and ensuring a more efficient recovery process in the face of climate and disaster challenges.

Based on the priority areas identified above, Table 4.5.1 elaborates on the key objectives and initiatives.



Table 4.3.1: Table 4.5.1: Key Objectives and Initiatives for DRM



No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Understanding climate and disaster risk by investing in state-of-the-art hydromet, climate and early-warning systems			
1.1	Establish an open-access, credible, national climate data and information database for sharing climate-related data and information to stakeholders across various sectors		MoCC&EC; Federal Flood Commission (FFC); National Disaster Management Authority (NDMA); PMD
1.2	Develop a nationwide and district-level <i>Multi-Hazard Vulnerability and Risk Assessment</i> in a spatial-temporal format, including detailed and location-specific assessments		MoCC&EC; NDMA; PDMA
1.3	Undertake GIS mapping of all existing irrigation infrastructure, especially flood embankments, for effective flood monitoring and management		MoCC&EC; PMD; FFC; NDMA; SUPARCO; Provincial, GB and AJK Irrigation Departments
1.4	Undertake hydrological modeling and flood-plain mapping and zoning of the Indus River system using climate change scenarios to estimate various projected flood levels		MoCC&EC; FFC; NDMA; SUPARCO; Pakistan Commission for Indus Water
1.5	Strengthen hydro-meteorological monitoring, forecasting, and early-warning systems		PMD; FFC; MoCC&EC; NDMA; SUPARCO
1.6	Develop capacity based on Remote Sensing and GIS techniques for monitoring temporal changes in glaciers and snow cover, and in land cover in different agro-ecological zones		PMD; FFC; NDMA; MoCC&EC; SUPARCO

1.8	Strengthen GCISC's capacity to enhance knowledge management on climate change adaptation, fostering interdisciplinary research, innovation, and capacity building within the country		MOCC&EC, MoPD&SI
Objective 2: Strengthening disaster risk governance			
2.1	Prepare and upgrade National Disaster Management Plan II (NDMP) and National Flood Protection Plan IV (NFPP-IV)		NDMA; PDMA
2.2	Formulate and approve provincial-level disaster management and climate change legislation, policies, plans and strategies		NDMA; PDMA; MoCC&EC; Provincial, GB and AJK CCF&EDs; LGDs
2.3	Put systemic functions in place to ensure that policy and regulatory frameworks are implemented and enforced		MoCC&EC; NDMA; PDMA
2.4	Enhance coordination and cooperation among entities responsible for climate change and development to identify means for risk-informed development		MoCC&EC; MoPD&SI; NDMA
Objective 3: Investing in disaster risk reduction to bolster the resilience of communities and critical infrastructure			
3.1	Develop robust disaster and climate risk-screening tools to be integrated into the public financial management processes at both the federal and provincial levels		MoPD&SI; MoCC&EC; NDMA; PDMA
3.2	Mainstream disaster and climate risk screening into public investment appraisals, planning, implementation, and monitoring at both the federal and provincial levels		MoPD&SI; MoCC; NDMA; PDMA
3.3	Implement cost-effective, innovative, and agile DRM solutions to reduce the loss of life, infrastructure, and livelihoods at all scales		PDMA; NDRMF; LGDs
3.4	Establish Climate and DRM Funds at the subnational or provincial levels		MoCC&EC; MoF; EAD; PDMA; Provincial, GB and AJK Finance Departments
3.5	Develop and implement climate and disaster risk finance and insurance products, with a focus on the most vulnerable and marginalized communities		MoCC&EC; Poverty Alleviation and Social Safety Net Division (PASS); Social Welfare Departments; Benazir Income Support Programme (BISP)
3.6	Building on existing programs, establish a climate and disaster shock-responsive social protection system, with a focus on the most vulnerable and marginalized communities		MoCC&EC; PASS; Social Welfare Departments; BISP
3.7	Ensure that infrastructure, including telecommunication, power, utilities, and transport, are resilient in the face of climate change impacts, particularly extreme weather events		MoPD&SI; MoCC&EC; Provincial, GB and AJK Public Works and Communication Departments; LGDs; DAs

Objective 4: Enhancing disaster preparedness for effective response and to “Build Back Better” by incorporating risk-informed approaches into recovery and reconstruction efforts

4.1	Develop a Disaster Recovery Framework (DRF) to institutionalize recovery, enabling the development of strategies, guidelines, capacities, and institutions for proactive recovery management		NDMA; PDMA; MoCC&EC; P&DDs
4.2	Develop a last-mile, early-warning dissemination system for natural disasters using innovation and technology (for example, radio and SMS messaging)		NDMA; Provincial, GB and AJK Information Departments (IDs); PDMA; LGDs
4.3	Ensure community participation in early-warning dissemination and disaster risk reduction activities, particularly in developing evacuation plans		MoCC&EC; NDMA; PDMA; Provincial, GB and AJK P&Ds; LGDs, Education Departments; Relief and Rehabilitation Departments
4.4	Develop standard operating procedures (SOPs) that clearly define the roles and responsibilities of each relevant department during natural disasters		MoPD&SI; NDMA; PDMA; P&DDs; LGDs
4.5	Strengthen the capacities of the DRM agencies and the district-level actors to address multiple hazards and to raise the resilience, efficiency, and effectiveness of the whole DRM system		MoCC&EC; NDMA; PDMA; District Disaster Management Authorities (DDMA); LGDs; Relief & Rehabilitation Departments
4.6	Scale up community-based disaster risk management (CBDRM) to strengthen the adaptive capacity of communities through local-level organizations		NDMA; PDMA; DDMA LGDs; Social Welfare Departments; District Administrations
4.7	Upgrade public evacuation shelters and provide comprehensive awareness training to ensure their effective use		MoCC&EC; NDMA; PDMA; DDMA; LGDs, Social Welfare Departments; District Administrations; Civil Society Organizations (CSOs)

4.6 Gender, Youth, and Social Inclusion

4.6.1 Context

Gender

- **Gender is the main factor driving Pakistan's low labour force participation**, with fewer than one in four (23 percent) women in the labour force, compared with four in five men (81 percent). About 60 percent of working-age women are not in employment, education, or training.¹⁰⁵
- **Gender disparities in education persist**, with girls in poor families being 22 percentage points less likely to attend school compared to boys.¹⁰⁶ As a result, the literacy rate of adult women is only 46 percent compared to 69 percent of men, which has significant implications for their ability to access services and participate in the economy.¹⁰⁷
- **The drivers of the gender gap in Pakistan are multi-faceted**, including the low availability and accessibility of schools, security and safety issues, competing household burdens, and societal beliefs

about the value of educating girls and training female teachers.¹⁰⁸ In addition, lack of good-quality family planning services prevent women from making informed choices about their health, future, and wellbeing.

Youth

- **Pakistan is among the world's youngest nations, which offers demographic opportunities for transformative climate actions.** Two-thirds of the population are younger than 30. The country is experiencing a youth bulge, with approximately 30 percent of the population under age 10.¹⁰⁹
- **Although 2.1 million young people (ages 15–24) enter the labour pool every year, many are poorly skilled and will increasingly face greater health risks.**¹¹⁰ About 35 percent of youth is neither enrolled in an educational or training facility nor employed. The ratio is particularly high for women at 56 percent uneducated or unemployed.¹¹¹
- **Access to quality formal and informal education is essential for Pakistani youth to acquire core and transferable life and technical skills to support climate transitions.** Education impacts labour productivity and jobs; social, environmental, and political consciousness. A weak education system makes youth less capable of critical evaluation¹¹² and hinders people's capacity to contribute to sustainable policy solutions, including for climate change.

Social Inclusion

- **Vulnerable groups in Pakistan often lack access to opportunities** for education, skills development, livelihoods, and decision-making, with consequences for the country's sustainable and inclusive development.
- **The country has made some notable strides in promoting basic human rights, protecting vulnerable social groups against discrimination and violence.** Pakistan has enacted extensive legislation, including the National Commission on the Status of Women Act, 2012; the ICT Rights of Persons with Disability Act 2020; and the Enforcement of Women's Property Rights Act, 2020; introduced quotas for women and minorities in jobs and Parliament; and implemented special interventions for the empowerment of vulnerable groups including women, transgender, youth, and other historically marginalized groups.¹¹³

4.6.2 Climate Change Impacts

Climate change poses disproportionate challenges for vulnerable groups with limited capacity to respond and recover. Such groups commonly face higher risks and greater burdens from the impacts of climate change, especially when coupled with poverty, limited technical capacity, and insufficient financial resources.^{114,115} Poorer households are hardest hit by climate change and disasters because they have the least capacity to respond, recover, and adapt. They tend to reside in more disadvantaged areas and have reduced access to critical services such as health and education. The assets they do possess—for example, *katcha* houses and livestock—tend to be less resilient, making them more vulnerable to extreme weather- and climate-related events.¹¹⁶

Unequal participation in decision-making processes across all sectors and domains perpetuates and exacerbates inequalities for vulnerable groups. This disparity hinders their ability to fully contribute to climate-related planning, policymaking, and implementation, despite possessing valuable knowledge and capabilities.¹¹⁷ The lack of representation and involvement of these groups in crucial climate-related discussions not only limits the diversity of perspectives but also overlooks the unique insights and experiences of the indigenous community.

4.6.3 Priority Adaptation Areas and Initiatives

The key priority areas for building climate-resilient and livable cities include:

(a) Supporting Capacity Development of Vulnerable Groups






It is crucial to tackle both the immediate risks and impacts of climate change, while also addressing the underlying causes of inequality. To address immediate risks, the focus lies on empowering communities to adapt to uncertainties and surmount challenges. This includes preparing vulnerable groups for disaster risk management through targeted education and training programs, supporting climate-resilient livelihoods by diversifying income sources, and promoting sustainable practices, such as climate-smart agriculture, and nature-based enterprises. Simultaneously, to address the underlying causes of inequality, efforts should be made to ensure equitable access to education, healthcare, social protection, and economic opportunities for all individuals, irrespective of their gender, sexual orientation, disability, or social background.

(b) Ensuring Inclusion Policy Making and Development Planning

By promoting inclusive and equitable participation, Pakistan can unlock the full potential of its communities, including indigenous populations, harnessing their expertise to develop more effective and sustainable climate solutions that address the specific needs and challenges they face. Empowering vulnerable groups through meaningful engagement and decision-making during policy making and development planning processes fosters resilience and a more just and inclusive approach to tackling climate change and its impacts.

Based on the priority areas identified above, Table 4.6.1 elaborates on the key objectives and initiatives.

Table 4.6.1: Key Objectives and Initiatives for the Gender, Youth, and Social Inclusion

No.	Objective & Initiative	Timeframe	Key Responsible Entity
Objective 1: Support Vulnerable Groups in Strengthening Their Capacity for DRM			
1.1	Map key stakeholders and identify their capacity needs for gender and socially inclusive DRM; conduct training and capacity development corresponding to their needs		NDMA; PDMAAs
1.2	Set quotas for the inclusion of women in all district and municipal DRM authorities		DDMAAs
1.3	Set up a helpline for reporting gender-based violence (GBV) and child marriage to protect women and girls during and post disasters		MoI; Provincial, ICT, GB and AJK Departments of Interior, Social Protection; National Commission for Human Rights; National Commission on Rights of Child;
1.4	Develop learning materials to integrate gender and social inclusion, and how they link with climate change and disasters, into school, college, and university curricula		MoE; Provincial, ICT, GB and AJK Education Departments
1.5	Develop community disaster management systems linked to existing community service delivery platforms, strengthening early-warning systems		NDMA; PDMAAs; DDMAAs, PMD

Objective 2: Empower Vulnerable Groups through Fostering Climate-Resilient Livelihoods

2.1	Introduce energy-efficient, low-cost cooking technologies tailored to women's needs to promote sustainable cooking practices		Provincial, ICT, GB and AJK Energy Departments; Tech Incubators; Research Institutions
2.2	Provide comprehensive training programs on climate smart agriculture practices and regenerative agriculture		MoNFS&R; Provincial, ICT, GB and AJK Agriculture Departments
2.3	Foster entrepreneurship in agriculture and food production by removing bottlenecks and providing financial and other incentives, such as business incubation and mentoring programs		MoNFS&R; Chambers of Commerce; Commercial Banks; Microfinance Institutions; Tech Incubators; CSOs
2.4	Increase the representation of female extension officers and invest in safer transport to reach female farmers, particularly in rural areas		MoNFS&R; Provincial, ICT, GB and AJK Agriculture Departments
2.5	Identify, document, and scale up indigenous water management technologies to promote sustainable water resource use		MOCC&EC; Provincial, ICT, GB and AJK Water Resources Departments; CSOs
2.6	Provide comprehensive training programs focusing on water, sanitation, and health issues at the local level		MOCC&EC; Provincial, ICT, GB and AJK Health Departments; CSOs
2.7	Provide comprehensive training programs focusing on sustainable land and watershed management, and biodiversity conservation at the local level		MOCC&EC; Provincial, ICT, GB and AJK CCF&EDs, Water Resource Departments; CSOs
2.8	Provide comprehensive training programs focusing on fisheries and coastal management at local level		Provincial, ICT, GB and AJK CCF&EDs; District Authorities; CSOs
2.10	Promote entrepreneurship in forestry and non-timber forest products by removing bottlenecks and providing financial and other incentives, such as business incubation and mentoring programs		Provincial, ICT, GB and AJK Forest Departments; Chambers of Commerce; Commercial Banks; Microfinance Institutions; Tech Incubators

Objective 3: Promote Inclusive Participation of Vulnerable Groups in Climate-Related Policy and Development Planning

3.1	Conduct research and data collection to better understand the specific impacts of climate change on vulnerable groups		MOCC&EC
3.2	Launch awareness campaigns and outreach programs to raise awareness about the importance of including vulnerable groups in climate change decision-making		MOCC&EC; Ministry of Information Technology & Telecommunication (MoIT)
3.3	Encourage the representation of vulnerable groups in key decision-making bodies related to climate change, such as climate councils, environmental agencies, and advisory committees		MOCC&EC
3.4	Integrate gender and social inclusion considerations in all climate-related policies and programs to ensure that they are inclusive and responsive to the needs of diverse vulnerable groups		MOCC&EC

5. Implementation Strategies

5. Implementation Strategies

5.1 Institutional Arrangements

5.1.1 Advancing Climate Action Implementation

Key Challenges and Opportunities

Climate adaptation in Pakistan presents formidable challenges because of significant impacts of climate change and the complexities involved in effective implementation of adaptation strategies and measures. In formulating NAP implementation arrangements, it is imperative that barriers hindering effective adaptation in the country are identified and addressed to ensure that the country successfully builds up its resilience in the face of the adverse impacts of climate change.

Notably, these key barriers are:¹¹⁸

- **Policy and Regulatory Barriers:** Existing policies and regulations that do not support or align with adaptation goals can create barriers to NAP implementation. Inconsistent or conflicting policies across sectors can hinder progress.
- **Limited Institutional Capacity:** Uneven institutional capacity and expertise within government agencies responsible for adaptation planning and implementation can hinder effective NAP implementation. This requires upgrading certain laws and regulations and revisiting mandates of various departments to remove duplications and gaps, in addition to limited capacity for monitoring, evaluation, and reporting on adaptation actions and outcomes.
- **Lack of Financial Resources:** Lack of dedicated funding streams and limited access to financial resources can pose a significant barrier to implementing adaptation actions outlined in the NAP.
- **Data and Information Gaps:** Lack of identification of data streams, data collection and data repository. Incomplete or insufficient data and information on climate change impacts, vulnerabilities, and adaptation options can hinder effective decision-making and planning for adaptation actions.
- **Stakeholder Engagement and Coordination Challenges:** Lack of coordination between national and provincial levels, inadequate stakeholder engagement and coordination among relevant government agencies, the private sector, academia, and civil society organizations, and other stakeholders can impede the implementation of NAPs.
- **Lack of awareness:** Lack of awareness and understanding of climate change impacts and adaptation measures among key stakeholders, including policymakers, political leadership, communities, and businesses, can impede NAP implementation.

Nevertheless, amidst these challenges, Pakistan has witnessed encouraging successes in translating national-level climate change policies into concrete and actionable plans at the provincial levels.

5.1.2 NAP Implementation Strategy

The NAP represents an ambitious agenda for change in Pakistan, encompassing a truly “whole-of-country” approach – involving different tiers of government both at the national, provincial, and local levels, as well as development agencies, and diverse sectors. NAP implementation will therefore be a highly complex process.

To effectively implement the NAP, the following key strategies are crucial:

- **Policy Cohesion:** Ensuring coherence and integration of adaptation considerations across diverse sectors and multiple government agencies is crucial for the success of Pakistan's NAP, both at the federal and provincial levels. To achieve this, it is essential to promote the seamless integration of NAP priorities into policies, action plans, and investment plans at the sectoral and subnational levels.
- **Integration of Adaptation Strategies:** It is important to ensure coherence and integration of adaptation strategies across diverse sectors and multiple government agencies involved in Pakistan's NAP at both the federal and the provincial levels. This can be promoted by integrating NAP priorities in sectoral as well as subnational policies and plans.
- **Coordinated Governance:** Establishing coordination and governance mechanisms at all levels of government (federal, provincial, and local), ministries, departments, agencies, and sectors is vital for fostering synergy, engagement, and clarity on respective roles and responsibilities to enable cohesive action in climate adaptation efforts.
- **Targeted Prioritization:** Prioritizing activities based on specific vulnerabilities, risks, and adaptation needs at the provincial and district levels is essential. Identifying key sectors, geographic areas, and vulnerable populations ensures focused attention and effective adaptation actions where they are most urgently required. Additionally, careful sequencing of actions to create an enabling environment for transformative activities is vital. This entails adequate preparation and capacity building to pave the way for successful implementation and to maximize the impact of these transformative initiatives.
- **Operational Planning:** Developing operational and costed plans to translate adaptation priorities into actionable measures is crucial. This involves setting clear objectives, defining activities, allocating resources, and establishing realistic timelines for implementation. Moreover, deep engagement with relevant stakeholders is essential to ensure a collaborative and inclusive approach.
- **Resource Mobilization:** Identifying funding gaps and mobilizing financial resources for NAP implementation is a critical aspect. Diverse financing mechanisms, such as domestic budgets, international climate finance, public-private partnerships, and innovative financing instruments, can be employed to ensure adequate resources for adaptation initiatives. More information is provided in Chapter 5.3.
- **Effective Implementation:** Successful execution of planned activities is of utmost importance. To ensure the efficient and effective implementation of adaptation actions, proactive measures should be taken to overcome potential challenges. This includes identifying and establishing dedicated implementation units, equipped with the necessary resources and expertise, to spearhead the execution process. Capacity-building initiatives should be prioritized to empower stakeholders with the skills and knowledge required to drive the adaptation efforts. Additionally, social mobilization plays a crucial role in fostering community engagement and ownership, encouraging active participation and collaboration in climate resilience initiatives.
- **Monitoring and Evaluation (M&E):** Establishing national and subnational M&E mechanisms is crucial for tracking progress, assessing the effectiveness of adaptation actions, and ensuring accountability. Defining relevant indicators, collecting data, conducting periodic reviews, and reporting on adaptation outcomes provide essential insights for continuous improvement and evidence-based decision-making. More information is provided in Chapter 5.2.

- **Communication Strategy:** Clear and effective communication with government and non-government stakeholders during NAP implementation ensures their specific adaptation needs are considered. Wide dissemination of the NAP will increase awareness, participation, and cooperation among stakeholders, promoting climate resilience and sustainable socioeconomic development. A comprehensive and inclusive communications strategy will be developed, delivering tailored messages through suitable channels to reach audiences locally, nationally, and globally. The NAP identifies various communication tools, such as websites, apps, workshops, webinars, and infographics, while emphasizing gender and disability sensitivity to ensure equal outreach to all marginalized groups.

5.1.3 Legal Landscape and Foundation

Pakistan already has a well-developed legal landscape to support adaptation in the country. Several existing policies, plans, laws, environmental protection regulations and climate change measures could be leveraged to strengthen adaptation planning and implementation. Notable among these are the NCCP (2021) and NDC (2021), as both documents have outlined Pakistan's mitigation and adaptation goals to address climate change.

The NDC's high-priority initiatives will significantly contribute to the country's adaptive capacity as they aim to: promote climate-smart inputs and management practices in agriculture; improve irrigation and water management; build resilience; provide nature-based solutions and protection of ecosystems and biodiversity; mitigate the impacts of extreme events through preparedness and capacity building; incorporate health and environment in climate and disaster risk-reduction related policies and vice versa; enhance the climate resilience of communities through improved outcomes in the WASH sector; promote gender equality and the mainstreaming of youth and volunteering engagements; and link all interventions with the SDGs. The need for additional or new policies and regulations for NAP implementation will depend on the specific context and national and provincial-level priorities.

5.1.4 Implementation Arrangement

The governance and implementation arrangement of the NAP in Pakistan will hinge on the following central pillars:

Federal Level

- **Ministry of Climate Change & Environmental Coordination (MoCC&EC):** The MoCC&EC is responsible for the following six key elements: (1) Steering the NAP process at the national level; (2) Undertaking climate change research, vulnerability reduction assessment, and prioritization of climate actions; (3) Developing climate information systems; (4) Streamlining the planning process for the NAP, and climate-proofing the development sector; (5) Mobilizing finance for climate change adaptation; and (6) Developing and implementing monitoring, evaluation and verification systems.
- **Ministry of Planning, Development & Special Initiatives (MoPD&SI):** The MoPD&SI serves as the focal point for planning and coordination with the provincial planning and development departments. The latter spearheads planning and investment portfolios and projects and programs with sectoral ministries, departments, and line agencies. It is also the custodian of the budget-making process, in collaboration with Economic Affairs Division (EAD) and Ministry of Finance (MoF) and the MoPD&SI provincial counterparts. It plays an important role in mainstreaming climate change considerations into the overall development planning and public financial management processes.
- **Line Ministries and Departments:** Line ministries and departments need to integrate climate imperatives into their policies, plans, and programs. This involves analysing how climate change impacts and risks could affect their respective sectors and incorporating adaptation measures accordingly. They need to collaborate with

other line ministries, government agencies, local authorities, and relevant stakeholders to ensure a coordinated and integrated approach to climate action.

Provincial and District Level

- **Provincial and Local Governments:** Provincial and local governments are responsible for developing and implementing climate adaptation policies and implementation plans tailored to the specific needs and vulnerabilities of their regions. This includes identifying local climate risks and vulnerabilities and adaptation priorities and designing strategies to build resilience at the community level. They oversee critical infrastructure and public services (including municipal services and disaster risk management) as well as land-use, management, planning and development which are critical areas for building resilience as articulated in Chapter 4.

Key Advisory and Implementing Bodies

- **Pakistan Climate Change Council (PCCC):** The PCCC is the apex advisory body that will provide strategic advice on the implementation framework of the NAP.
- **Expert Group (EG):** The EG should be constituted, consisting of experts from 25 technical institutions. They will meet periodically but not less than once a quarter in a hybrid manner to report on progress in their respective sectors. The MOCC&EC will serve as the Secretariat for the EG, and it will be co-chaired by the Planning Commission. The sectoral focal points will have overall responsibility for the relevant NAP sections. The EG will include working groups on various sectoral areas, including Agriculture, Forestry & Land Use, Water Resources Management, Urban Resilience & Infrastructure, Health & Public Health Systems, Disaster Risk Management and Research and Statistics. The EG will monitor and evaluate progress under NAP and report back to the NCCC.

5.2 Monitoring, Evaluation (M&E) and Reporting

5.2.1 Importance of NAP M&E

Adaptation to the ever-evolving challenges of climate change demands relentless commitment to progress and innovation. The National Adaptation Plan recognizes that addressing climate change requires not only initial action but also ongoing adaptation actions that are regularly reviewed and evaluated for transparency. This approach drives the imperative for regular reporting, monitoring, and review of NAP implementation.

The essence of NAP M&E lies in its power to establish accountability and transparency. By systematically tracking and reporting progress towards established targets, it ensures that stakeholders remain committed and motivated. The process ascertains the roles and responsibility of stakeholders with clarity towards the implementation of the NAP process.

The NAP M&E and reporting will provide insights into the effectiveness, efficiency, and equity of adaptation actions. Through meticulous evaluation, it will enable policymakers to identify the interventions that work and yield positive outcomes. This knowledge becomes the bedrock of informed decision-making and policy adjustments, enhancing adaptive capacity across all levels of governance.

NAP M&E recognizes the vital role of stakeholders in shaping its success. Government agencies, communities, technical experts, and private sector shall be actively involved in the monitoring and evaluation process. This inclusive approach will foster collaboration, transparency and generating a wealth of invaluable insights and experiences. It becomes a catalyst for evidence-based decision-making, propelling policy adjustments that truly reflect the needs and aspirations of those most affected by climate change.

Furthermore, NAP M&E broadens our understanding of the medium- and long-term impacts of climate change.

With regular monitoring and review, high-quality climate data and projections can be seamlessly incorporated into ongoing adaptation efforts. This ensures that interventions are based on the most accurate and up-to-date information available, making it possible to test, identify, and adopt robust and climate-proof approaches capable of withstanding the accelerated impacts of climate change.

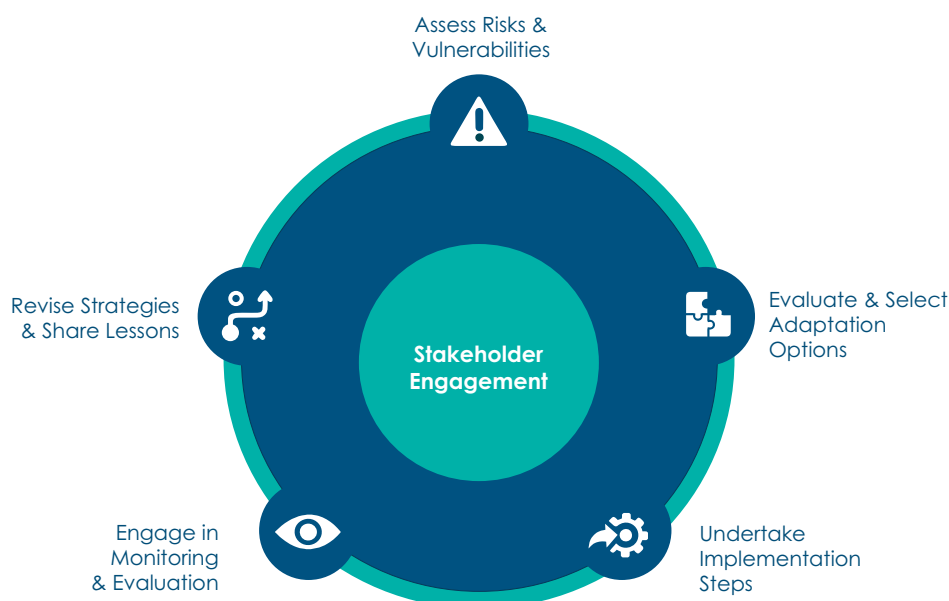
The NAP and NDCs are intertwined in their shared goal of combating climate change. The NAP M&E system assumes a pivotal role within the broader monitoring, reporting, and verification (MRV) framework that tracks the implementation of adaptation measures outlined in the NDCs. By integrating the NAP M&E system into the MRV mechanism, it ensures that adaptation efforts are seamlessly monitored and evaluated within the comprehensive landscape of climate action. This harmonization enables a holistic perspective, fostering alignment and coherence between adaptation initiatives and the broader climate agenda. It ensures that adaptation efforts are accounted for and contribute meaningfully to the national climate agenda. Simultaneously, its integration with other established M&E exercises optimizes resources, reduces duplication, and fosters a culture of collective action.

Moreover, the interconnections between the NAP M&E framework and other national M&E exercises further amplify its impact. By forging connections with established monitoring systems such as Sustainable Development Goals (SDGs) reporting system, and the Compendium on Environment Statistics of Pakistan (CESP), the NAP M&E system capitalizes on existing structures and processes. This integration streamlines M&E processes, eliminating redundancies and unlocking greater efficiency.

To ensure the successful implementation of the NAP throughout its cycle, a robust, transparent, and dynamic M&E process becomes an indispensable pillar. The M&E process operates as a continuous, iterative, and progressive cycle, each phase informing the next in a seamless flow of knowledge and action. Figure 5.2.1 provides a concise overview of this interconnected NAP process, illustrating its cyclical nature and the pivotal role of M&E in driving progress.

The significance of the NAP M&E process extends beyond its cyclical nature. It embraces important principles of inclusivity and sensitivity, recognizing the diverse needs and perspectives of vulnerable communities, regions, and ecosystems. Moreover, the NAP M&E process actively seeks to engage and involve stakeholders at every stage. Through participatory mechanisms, it ensures that the M&E process is enriched with on-the-ground knowledge, lived experiences, and local wisdom. This participatory ethos empowers vulnerable communities to play an active role in shaping their own adaptation pathways, leading to more contextually appropriate and sustainable outcomes.

Figure 5.2.1: M&E Process for the NAP



5.2.2 M&E Framework

The M&E framework for Pakistan's NAP unfolds as a dynamic and comprehensive system, harnessing three tiers of interventions that fortify the country's response to climate change. It's a carefully crafted blueprint designed to ensure both the effectiveness and efficiency of the plan's implementation, leaving no room for ambiguity or oversight.

- **Strategy and Policy Level:** This first tier sets the stage for success, acting as the strategic compass that guides Pakistan's NAP. Here, the M&E framework diligently scrutinizes the alignment of the plan with both national and subnational policies and international climate change treaties, laying the foundation for a cohesive approach. It meticulously evaluates the Plan's effectiveness in addressing the country's unique adaptation challenges while monitoring progress towards strategic objectives and targets. By doing so, it ensures that the Plan remains finely tuned, consistently evolving to meet the demands of a rapidly changing world.
- **Planning and Program Level:** The second tier brings the NAP to life, breathing vitality into the planning and programmatic aspects. With unwavering focus, the M&E framework dissects the intricacies of the Plan's execution. It rigorously examines the quality and effectiveness of the planning processes, identifying gaps and areas ripe for improvement. This tier is central to resource allocation, meticulously evaluating the allocation's efficiency. By monitoring program implementation, it provides real-time insights into the NAP's progress, ensuring its trajectory remains on course to confront the challenges that lie ahead.
- **Project Level:** At the heart of the framework lies the third tier, a meticulous examination of individual projects and activities that embody the NAP's purpose. This level of scrutiny allows for a granular understanding of project progress, objectives, and targets. The M&E framework will track outputs, outcomes, and impacts to institutionalise valuable lessons and best practices that can inform future project interventions.

The above-mentioned M&E framework can empower Pakistan to confront the urgent challenges posed by climate change head-on. If embraced whole-heartedly, it will forge a path of unwavering commitment, enabling the nation to adapt and thrive in the face of climate adversity. The different aspects of the NAP M&E are elaborated on in the sections below.

5.2.3 M&E Implementation Responsibilities

Just as NAP implementation will involve multiple stakeholders at all levels, it will also involve multiple bodies. Key among these are:

- **Ministry of Climate Change and Environmental Coordination (MoCC&EC):** Consistent with its position as the central authority for climate change at federal level, the MoCC&EC will be the focal point for monitoring, reviewing, and reporting on the NAP. It will provide overall coordination and ensure collaboration across government and non-government bodies involved in the M&E process and will be responsible for final reporting and data dissemination.
- **Pakistan Bureau of Statistics (PBS):** PBS will be responsible for data collection. Provincial statistical bureaus and government line departments responsible for NAP implementation will serve as the primary sources of administrative and programmatic data for adaptation initiatives. The PBS will collate provincial outputs and conduct independent data collection measures to provide national-level statistics. In addition, household surveys conducted by the PBS can be utilized to assess the impact of NAP activities.
- **Global Change Impact Studies Centre (GCISC):** As a dedicated research centre for climate change studies, the GCISC will play a pivotal role in synthesizing information and conducting research on climate issues. It will collaborate closely with the MoCC, provincial counterparts, committees, cells, and working groups to ensure the

integration of new scientific findings into national planning and decision-making processes during the implementation of the NAP. The GCISC's responsibilities will include regularly synthesizing scientific literature, assessing impacts and vulnerability, and providing recommendations for policymaking based on the latest research findings. Additionally, the GCISC will support learning and capacity-building efforts among the stakeholders involved in the NAP implementation.

At the end of each NAP's cycle year, an Annual Progress Review of NAP implementation will be undertaken with PCCC for advisory purposes. Additionally, reviews of monitoring reports and activities will be provided by respective provincial P&DDs including GB and AJK, as well as a review by the EG under the chair of MoCC&EC as shown in the Table 5.2.1.

Table 5.2.1: Reporting Responsibilities for NAP

Activity	Responsible Entity	Frequency
Review and monitoring of NAP provincial activities	Respective provincial P&DDs including GB and AJK	Bi-annual
Review of NAP activities at the national level	EG under the chair of MoCC&EC	Bi-annual
Annual Progress Review for advisory purposes	PCCC	Annual

Recognizing the power of collaboration, the NAP M&E process actively seeks the involvement of non-governmental actors. The private sector brings expertise and resources, offering innovative solutions and contributing to the scalability and effectiveness of adaptation efforts. Non-governmental organizations, with their specialized knowledge and grassroots connections, offer valuable insights into the needs and aspirations of local communities. Scientists and researchers provide evidence-based analysis, enabling rigorous assessment and identification of emerging trends. Civil society acts as a crucial voice, representing the interests of marginalized groups, advocating for equity, and ensuring that adaptation measures are inclusive and address social justice concerns.

The engagement of these non-governmental actors will contribute to the holistic functioning of the M&E operations and adds depth and breadth to the NAP M&E process. It encourages a multiplicity of perspectives, fostering robust discussions and opening avenues for creative solutions. By tapping into the collective intelligence and resources of these stakeholders, the evaluation of the NAP becomes more comprehensive, capturing a wide array of experiences, and knowledge.

5.2.4 M&E Indicators

Indicators lie at the very core of an effective M&E framework that drives targeted action, highlights areas requiring additional efforts, supports informed decision-making, and promotes climate-smart approaches. Well-defined indicators are essential, as they ensure relevance and practicality in terms of data availability, time, and resource requirements.

To establish a robust set of indicators for the NAP, a collaborative and iterative process will be undertaken, involving stakeholder and expert consultations. This inclusive approach will enable the selection of indicators that align with sectoral priorities and capture the desired outcomes. Once identified, these indicators will undergo a piloting phase, allowing redundant ones to be filtered out and any missing indicators to be addressed.

The NAP M&E indicators will encompass both critical and supporting actions. Regular assessments conducted by the MoCC&EC will evaluate the preparedness of relevant organizations, including policymakers and service providers. Through these assessments, areas for improvement will be identified, ensuring efficient and effective implementation of the NAP. The selected indicators will cover both process and outcome aspects. Process metrics will gauge the progress and achievement of defined milestones in NAP implementation. This entails reporting on the adoption of laws, development of policies, implementation of strategies, and allocation of financing. Outcome indicators, on the other hand, will focus on evaluating the extent to which adaptation objectives are being achieved and climate vulnerability is being reduced in Pakistan. These indicators will assess the impact of implemented laws, policies, plans, and interventions.

To provide a comprehensive assessment of progress, a combination of quantitative and qualitative measures will be utilized. Quantitative data will be employed to evaluate the results of key sectoral adaptation strategies and priorities, offering tangible insights into progress. Complementing this approach, qualitative measures will help to contextualize the data, providing a narrative that adds depth and understanding to the quantitative findings.

Drawing from these considerations, pertinent entities led by MoCC&EC will collaboratively establish suitable log frame structures. These structures will be rooted in the theory of change for each sector and cross-cutting area, incorporating defined indicators, baselines, targets, time periods, and data sources. This concerted effort will ensure a cohesive and strategic approach to monitoring and evaluation throughout the NAP implementation.

To streamline data collection, existing sources of information will be leveraged whenever possible. Household surveys, administrative data, sectoral MRV systems, and data collected under the Sustainable Development Goals (SDGs) initiative will be utilized, optimizing efficiency, and reducing duplication of efforts. By tapping into these established sources, the NAP M&E process will benefit from a wealth of pre-existing data, enhancing its effectiveness and timeliness.

The development of a comprehensive M&E plan within six months at the beginning of NAP implementation is crucial for ensuring consistency and effectiveness in evaluating the progress of the NAP. This plan will serve as a roadmap, providing clear guidance on data collection, compilation, and synthesis. It outlines protocols for standardized data collection methods and establishes guidelines for organizing and managing data. The plan also addresses the frequency of data collection and reporting, defining timelines for periodic evaluations and progress reports. Additionally, it clarifies the roles and responsibilities of different stakeholders involved in the M&E process, promoting accountability and coordination.

5.2.4 Supporting M&E Implementation

Comprehensive training programs will be provided to all key stakeholders, enabling them to effectively contribute to the NAP M&E process. Programs will be developed to focus on promoting a shared understanding of M&E concepts, tools, and methodologies, equipping stakeholders with the necessary knowledge and skills to actively engage in monitoring and evaluation activities. Special training programs will be tailored to meet the needs of government officials involved in adaptation efforts. These programs will ensure that officials receive continuous learning opportunities, enabling them to keep abreast of emerging practices, methodologies, and approaches in the field of adaptation. By integrating continuous learning into their work, government officials will be better equipped to incorporate new knowledge and best practices into future planning and implementation activities, fostering adaptive and forward-thinking approaches to addressing climate change challenges. Through collaboration and knowledge sharing, the GCISC will facilitate the dissemination of relevant information, tools, and resources to enhance the capabilities of stakeholders. This support will further strengthen the understanding and application of M&E principles, ensuring that stakeholders are equipped with the necessary skills and knowledge to effectively monitor, evaluate, and adapt the NAP over time.

Technology and digital tools will play a crucial role in supporting various aspects of the NAP. These tools will facilitate data collection, management, analysis, reporting, dissemination, remote monitoring, collaboration, and

knowledge sharing, enhancing the overall effectiveness of implementation. The MoCC&EC will establish a web-based dashboard to streamline data collection and monitor the progress of adaptation measures. Protocols for data collection and metadata details will be defined, and efforts will be made to make the dashboard publicly accessible, promoting transparency. Furthermore, the GCISC, with support from CITEPA France, is developing the “Pakistan Transparency Platform” for adaptation tracking. This platform aims to improve monitoring, reporting and evaluation (MRE) capabilities in the country and is being designed based on national needs. Currently, the pilot sector platform for agriculture is ready, while work on the platforms for water and health sectors is still in progress. These platforms will enhance M&E efforts in the respective sectors, providing valuable insights for adaptation planning and decision-making.

Despite significant progress, Pakistan continues to face notable knowledge gaps in research concerning climate change adaptation specific to its context. These gaps encompass critical areas such as the collation and prioritization of data on climate risks, including vulnerability, hazards, and exposure within the country. Additionally, ensuring open access to relevant data remains a challenge. There is a need to establish mechanisms and platforms that enable the sharing and dissemination of climate-related data, fostering transparency and facilitating informed decision-making by researchers, policymakers, and development practitioners.

Furthermore, the establishment of research platforms dedicated to climate change adaptation in Pakistan is imperative. This would facilitate the transformation of collected data into actionable knowledge on adaptation and vulnerability, enabling evidence-based decision-making and the development of context-specific strategies. Comprehensive monitoring and evaluation of policies and interventions related to climate change adaptation is another crucial area that requires attention. Establishing robust systems for monitoring and evaluating the effectiveness of implemented measures is essential for assessing progress, identifying gaps, and refining strategies.

5.2.6 M&E Outcomes: NAP Revision and Update

The findings and increased knowledge generated through the NAP M&E process will serve as a transparent foundation for making necessary changes to the NAP and to capitalize on the improved understanding of climate change issues to expedite, reform, and reprioritize the actions outlined in the NAP. This will involve updating actions with new or enhanced data, acquiring further knowledge for effective implementation, and considering the outcomes of the upcoming national climate change risk and vulnerability assessment scheduled for publication in 2028. By actively integrating new scientific insights, the NAP can adapt and respond adeptly to the evolving climate challenges faced by Pakistan.

During the Annual Progress Review Meetings chaired by MoCC&EC, modifications can be made; however, significant shifts in priorities, implementation strategies, and institutional mechanisms necessitate a thorough review process. To accommodate evolving climate change scenarios, emerging risks, and updated knowledge on adaptation actions, the NAP will undergo a review process in the year 2028. These revisions will employ an inclusive approach, engaging a diverse set of stakeholders to ensure a comprehensive and integrated response.

After the completion of the NAP cycle in 2030, the National Steering Committee (NSC) will have the opportunity to initiate a post-Plan review aimed at assessing the overall achievements and identifying best practices for future action. This thorough review will comprehensively evaluate the accomplishments of the NAP, allowing for the identification of successful approaches and valuable lessons learned. The insights gained from this review will play a crucial role in informing and guiding subsequent climate change adaptation efforts in Pakistan, ensuring continuous improvement and effectiveness. The NAP will be reviewed and updated after every five years to align the new needs and dimensions of climate change impacts on Pakistan.

5.3 Financing Climate Adaptation and Resilience

5.3.1 The importance of a comprehensive financing strategy

Adaptation and resilience needs in Pakistan are huge and increasing over time. The total estimated investment needs for a comprehensive response to Pakistan's climate and development challenges between 2023 and 2030 amount to approximately US\$348 billion, or 10.7 percent of cumulative GDP for the same period. Of this total, adaptation and resilience needs amount to US\$152 billion.^{119,120} These figures are likely to be an underestimate due to limited data availability on the investment needs of key transformative sectors, such as fostering sustainable agri-food systems, integrated water resource management, climate-resilient and sustainable cities, and a shock-responsive social safety net. Nevertheless, they indicate the magnitude of investment and commitments required for building long-term climate resilience.

The financing gap is enormous relative to current and historic financing flows. Based on a retrospective review of funding levels in recent years, an illustrative assessment suggests that approximately US\$39 billion of public finance, and US\$9 billion from public-private partnerships for infrastructure will be available for both mitigation and adaptation over the next decade, including from multilateral development banks.¹²¹

At the same time, Pakistan's ability to plan for and raise additional financing for climate change adaptation and mitigation projects is severely limited. Rigid expenditure obligations erode the country's ability to sustainably raise revenues for pro-climate projects in the future. Pakistan's fiscal deficits have been growing larger: in FY22, the general government deficit stood at 7.9 percent of GDP - the highest in more than 22 years. The deficit has been growing over time, with the post-2010 annual average 50 percent larger than its pre-2010 average. These recurrent shortfalls have led to a rapid accumulation of public debt, the stock of which has measured approximately 80 percent of annual GDP from FY20 to FY23. Government borrowing from the domestic financial sector has led to a deep sovereign-financial sector nexus, which crowds out private investment. Growth in real GDP per capita has been low and particularly volatile, averaging only 1.8 percent over the past 2 decades. Public development spending averaged only 2.1 percent of GDP over the past decade and dropped to 1.2 percent of GDP in FY22 when debt-servicing obligations rose rapidly above budgeted amounts.

Given the scale of the financing gap, a comprehensive financing strategy will be needed to finance priority areas for climate adaptation and resilience. Three areas are key:

- 1)** Pakistan has globally advocated the capitalisation of multilateral funds and finances that address the climate crisis faced by many developing countries that are fractional emitters. The current international financial architecture is complex and fragmented, and it is a major challenge for countries like Pakistan to access timely climate finance due to lack of capacity in formulating bankable projects. Capacity must be strengthened to access and make effective use of grant-based financing and concessional loans instruments.
- 2)** Domestic financing can be mobilized through innovative financing mechanisms such as monetisation of natural capital, green and blue bonds, debt for climate and nature swaps, equity financing, and results-based climate finance.
- 3)** An enabling policy and regulatory environment for private sector investment in adaptation is needed to promote and accelerate private sector-led adaptation, such as innovations in products or services. There is also the potential to channel adaptation finance through public-private partnerships. Small and medium enterprises also need support in transitioning to sustainable practices.
- 4)** Line ministries will need to prioritize and plan for climate sensitive development projects. For Climate Change to gain traction and be mainstreamed through the government budget process, selection towards climate positive projects will be required and supported by the MoF and MoPD&SI. Line ministries will need to clearly appreciate the climate related risks within their sectors, determine a level of priority of climate

change among competing interests and plan investment submissions appropriately. This can be done within a suitably strengthened Midterm Budgetary Framework (MTBF) process as the MTBF process sets budget limits from the top-down but supports bottom-up planning to deliver specified outputs/outcomes.

Furthermore, although this section largely focuses on mobilizing adaptation financing, adaptation and mitigation will be taken jointly into account in planning, financing, and implementation, recognising the potential for co-benefits. Adaptation actions will be prioritized according to their potential not only to avoid future losses, but also to produce development and environmental co-benefits in support of Pakistan's growth trajectory.¹²²

5.3.2 Mobilizing public finance for adaptation and resilience

Public finance for climate adaptation and resilience has been increasing over time. Between 2011/2012 and 2014/2015, public spending on climate actions, both mitigation and adaptation, increased from 6.6 to 8.3 percent of total federal and provincial expenditures.¹²³ Several provinces have paved the way by increasing financial commitments to climate action within a green growth approach. For example, Punjab increased its budget allocation to climate-related activities from 6.2 percent in 2011-12 to 13.7 percent in 2015-16. Table 5.3.1 below provides further details on the proportion of public expenditure spent on climate-related activities at federal and provincial levels. A fresh stocktake on such spending across ministries and provinces is being done for the next decade starting from 2016.

Table 5.3.1: Proportion of Public Expenditure Spent on Climate-Related Activities at Federal and Provincial Levels (in Percentage)*

Activity	2011-12	2012-13	2013-14	2014-15	2015-16
Federal	6.5	5.8	6.2	8.1	6.5
Khyber Pakhtunkhwa**	7.8	5.9	7.6	9.9	9.0
Balochistan	7.3	10.4	11.1	11.3	12.0
Punjab	6.2	7.1	8.2	9.3	13.7
Sindh	6.9	4.3	4.2	5.7	7.3
National	6.6	6.0	6.6	8.3	8.2

*The results of the federal government for FY 15-16 have been generated from Expenditure Coding and Tracking System. The results of provincial governments have been generated partially by the Climate Public Expenditure and Institutional Review (CPEIR) methodology.

** Province defined as in 2023.

Climate Budget Tagging can support line ministries in understanding the depth and reach of pro-climate programs and policies. In view of the same, this exercise needs to be done on a regular basis to ascertain the budgetary and expenditure requirements of both adaptation and mitigation initiatives. Achieving Pakistan's climate policy objectives calls for the integration of climate change imperatives with fiscal policy actions. To achieve this, the government could consider mainstreaming budget tagging across line ministries to better understand the level and composition of expenditures that are needed and associated with climate change mitigation and adaptation. Based on other country experiences, climate budget tagging can enable the planning and budgeting of climate-related expenditures and will enable the government to strategize its climate policy actions to achieve both greenhouse gas emission reduction and climate-resilient development goals, as outlined in the NDC document.

Mainstreaming climate risk management and resilience needs into planning processes and public financial management systems, such as through screening for climate risks and budget tagging, would further improve the transparency and efficiency of public spending on climate actions. Developing metrics, targets and tracking methodologies will be important not only to mobilize adaptation funding, but also to ensure that all future investments and development activities are climate resilient. New capital-intensive projects should disclose and be screened for potential climate risks to project implementation and sustainability. Although some headway has already been made in tracking and tagging climate-related expenditure through the Pakistan Climate Public Expenditure and Institutional Review (CPEIR),¹²⁴ stronger links across departments and ministries – both at the federal and provincial levels – will be needed to make a case for sustained climate financing.

To coordinate adaptation investments, a National Climate Change Fund (NCCF) needs to be created and managed by the MoCC&EC. The NCCF would draw seed funding from the government budget as an annual allocation for a pre-specified period. Using this seed funding, the government would seek to catalyse co-financing from the donor community to develop an endowment to support various adaptation and resilience actions in Pakistan. The NCCF would thereby use concessional finance for high-impact adaptation opportunities based on the recommendations of the Sectoral Climate Adaptation Cells (SCACS).

Introducing innovative financing mechanisms will also be crucial for closing the financing gap for adaptation and resilience, such as in the form of concessional loans and grants through instruments like monetisation of natural capital, green and blue bonds, debt for climate and nature swaps, equity financing, and results-based climate finance. There is potential in leveraging green, blue bonds and Islamic finance, especially given the growing market for green and sustainable sukuk.¹²⁵ The Securities and Exchange Commission of Pakistan (SECP) has approved national guidelines for the issuance of green bonds or sukuk financing by the corporate sector, which will encourage more innovative and inclusive financing mechanisms for adaptation and resilience. Beyond debt instruments, the government will explore grant-based financing, such as RBCF and other climate focused market financing instruments that do not need to be repaid. RBCF is an opportunity to scale up finance for climate action, and carbon markets are growing in price and volume, creating a growing potential to monetize the emission reductions in the form of carbon credits. The government of Pakistan will also press for access to the IMF's Resilience and Sustainability Trust, which has been capitalised for addressing the climate needs of vulnerable countries.

Mainstreaming federal with provincial green growth programs and fiscal frameworks will be crucial for success of adaptation initiatives. The continued devolution of spending to provinces can increase the quality of development planning and implementation and enhance climate mitigation and adaptation measures.¹²⁶ Increasing the quality and efficacy of project selection and spending requires, for example, the development of sectoral growth strategies or provincial green-growth programs and applying strict (and common) quantitative scoring criteria for project selection. If Pakistan were to achieve a nationwide implementation of a "Clean Air Scenario" meeting national and recommended WHO air quality standard cooperatively and strategically, this could reduce premature deaths by up to 122,500 (or 53 percent) by 2030 and eliminate associated mortality and morbidity by 2040 and reduce CO₂ emissions by 24 million ton by 2030 and 85 million ton by 2040. However, administrative capacity at subnational levels is low overall and is lowest among the most deprived districts. This means that support for provinces and subnational units with lower capacity for coordination, management, and quality control is urgently needed if project outcomes are to be met.

The MoCC&EC also needs financial and technical support to strengthen its capacity for developing a long-term plan to implement its mandate and further guide other ministries and departments at the federal, provincial, and local levels.

5.3.3 Creating an enabling environment to attract private sector investment

The role of the private sector is indispensable in meeting adaptation and resilience needs, but overall investment levels remain low to date. Private sector investments from households, corporations and commercial financial institutions have largely been channelled towards climate mitigation, rather than adaptation and resilience, amounting only to US\$1.4 billion or 0.5 percent of GDP in 2019. More generally, Pakistan's total investment-to-GDP

ratio remains around 15 percent, low compared to South Asia's regional average of over 30 percent.¹²⁷

Government policy will be directed towards creating an enabling policy and regulatory environment for private sector investment, which alleviate market barriers, build capacity, and produce incentives for private actors to act. An enabling environment would engage private sector participation in two ways: first, in promoting and accelerating private sector-led adaptation, such as innovations in products or services; and second, in channelling adaptation finance. Financial institutions and large industries will be called on to take a leading role in advancing technology and bankable products, such as drought-tolerant seeds, climate-resilient construction materials, climate-smart agriculture, improved cold storage facilities, and e-commerce.

There is plenty of opportunity for the private sector to implement adaptation actions in collaboration with the government and development partners and explore blended financing options. Public-private partnerships play an important role in promoting investments in climate-resilient infrastructure and climate-smart agriculture, among others. Both the federal and provincial governments have created comprehensive frameworks and regulations for PPP projects.

These frameworks should be further strengthened by: **(i)** integrating climate costs in project designs; **(ii)** incorporating resilience as part of the evaluation criteria for tenders; **(iii)** including climate experts on project approval committees; and **(iv)** fostering partnerships with the insurance industry and engineering firms on the use of climate screening and risk forecasting tools. In addition, sharing information and building capacity to tap into these frameworks will be a necessary component for building an enabling environment.

An enabling policy and regulatory environment would also support small and medium enterprises (SMEs), which make up 90 percent of all businesses and employ roughly 80 percent of the non-agricultural labour force. SMEs will be supported in transitioning to sustainable practices through green financing, human capital investments and compliance requirements. Risk-mapping of SMEs and the informal sector will be undertaken at the local level. To incentivize climate-resilient SMEs, green credit guarantees will be explored. Further dialogue with the informal sector will inform the design of financial inclusion strategies, skills and capacity development, and identification of climate-resilient opportunities.

Lastly, several policy measures will be explored to scale up green investments in the financial sector, such as: **(i)** enhancing the existing Green Banking Guidelines and mandating their adoption to allow the banking sector to develop much needed environmental and social risk management frameworks; **(ii)** issuing green financing targets from the State Bank of Pakistan to financial institutions; **(iii)** introducing commercially viable incentives for green financing for financial institutions; and **(iv)** requiring financial institutions to report on the greenhouse gas emissions and adaptation impacts of their financing. Moreover, the regulatory framework for foreign direct investment needs to be strengthened, especially at the subnational level.

5.4.4 Increasing access to international climate finance

International climate finance will be required to fill the gap because the investments needed to build climate resilience and implement climate adaptation will substantially exceed the scale of domestic capital. Similarly, the Nationally Determined Contribution submitted in 2016 and updated in 2021 is conditional and heavily reliant on external finance for meeting its goals.

While Pakistan has received climate-related financing from multilateral development banks (MDBs). However, beyond the MDBs, Pakistan needs to build technical capacity to garner and make effective use of concessional loans and grant-based international climate finance. Between 2015 and 2021, Pakistan received a total of US\$9.1 billion of climate finance from MDBs, averaging US\$1.3 billion annually.¹²⁸ In 2021, World Bank alone committed US\$1.6 billion of climate finance (around 60 percent of the total climate finance that year).¹²⁹ On the other hand, the country only received an annual average of US\$0.25 billion from the Global Environment Facility (GEF) and Green Climate Fund (GCF) between 2016 and 2022. So far Pakistan has only been able to access US\$11 million through the Global Adaptation Fund over the last two decades.

In addition to understanding the barriers to Pakistan accessing international public climate finance, it is important to recognize that the international climate finance infrastructure is complex and fragmented. It takes 18 to 24 months on average to run through and get a project proposal approved from the GCF Board, by which time the ground realities from climate stress have shifted. In view of the same, MoCC&EC has been consistent in advocating for simplifying the criteria to bring agility and speed to the onerous funding process.

Thus, a comprehensive climate finance strategy would aim to unlock complementary sources of finance from all players in the climate finance landscape, including but not limited to: UNFCCC financial mechanisms, such as GCF, GEF, and Adaptation Fund (AF); Climate Investment Funds (CIFs); bilateral partnerships; and the private sector. Similarly, the private sector will also be empowered to access the GCF and other global climate funds. Notwithstanding the same, Pakistan requires extensive amounts of climate finance especially from external sources due to its extreme vulnerability and recurring incidents of climate extreme events. This has been aptly reflected in the World Bank's CCDD and Pakistan's updated NDCs document.

Efforts are needed to strengthen government capacity to access international climate finance for climate adaptation and resilience. First, it is important to identify which needs are most aligned with relevant climate finance sources so that technical capacities about preparing bankable project proposals can be improved. For instance, preparing guidelines that explain the stepwise process of submitting proposals to existing climate funds would further strengthen government capacity to tap into these funding sources. Second, developing and implementing an adaptation monitoring and evaluation system would enable real-time tracking of implementation progress towards targets and will be essential for unlocking access to international climate finance. Third, the State Bank of Pakistan is expected to develop a green taxonomy to ensure that investments meet key climate and other sustainable objectives. Lastly, a robust governance and digital infrastructure will be critical for the credibility and transparency required to participate in international carbon markets.

5.4.5 Transforming Strategies into Action through Sector-Specific Investments

During the NAP implementation period, one crucial step to ensure the effective realization of adaptation priorities is the development of a sector-specific investment framework. This framework will serve as a blueprint to translate identified adaptation needs and strategies into tangible and bankable projects, tailored to the unique requirements of each sector. By doing so, it enables a focused and targeted approach to climate resilience, fostering a more coordinated and efficient response to climate change challenges.

The first step is to identify suitable projects that address those specific needs. These projects should be based on the principles of sustainability, feasibility, and cost-effectiveness. They should align with national development goals, and where possible, integrate with existing initiatives and programs to maximize resources and streamline implementation.

To ensure successful implementation, the sector-specific investment framework will emphasize close coordination and collaboration among various stakeholders. Regular consultations, workshops, and feedback mechanisms will be established to facilitate effective communication and participation throughout the process. This collaborative approach fosters a sense of ownership among stakeholders, enhancing the likelihood of successful project execution and long-term sustainability.

Furthermore, the investment framework will be designed to prioritize projects that have co-benefits beyond climate adaptation, such as enhancing livelihoods, reducing poverty, conserving natural resources, and promoting sustainable economic growth. Integrating adaptation efforts with broader development objectives not only optimizes resource allocation but also enhances the potential for securing external funding and partnerships.

The finalized sector-specific investment framework will be presented as part of the next NAP update. This ensures that the adaptation projects are explicitly linked to the overarching national climate change strategy, aligning with the country's commitments under international agreements.

References

- Abel, Guy J., Michael Brottrager, Jesus Crespo Cuaresma, and Raya Muttarak. "Climate, conflict and forced migration." *Global Environmental Change* 54 (January 2019): 239–249. <https://doi.org/10.1016/j.gloenvcha.2018.12.003>.
- ADB. *Climate Change Profile of Pakistan*. Asian Development Bank, 2017. <https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>.
- African Development Bank, Asian Development Bank, Asian Infrastructure Investment Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, Islamic Development Bank, New Development Bank, and World Bank. *Joint Report on Multilateral Development Banks' Climate Finance*, 2021. <http://dx.doi.org/10.18235/0004505>.
- Akram, Naeem, and Asma Gulzar. "Climate Change and Economic Growth: An Empirical Analysis of Pakistan." *Pakistan Journal of Applied Economics* 23, No. 1 (Summer 2013): 31–54. http://aerc.edu.pk/wp-content/uploads/2016/08/Article_32Paper-540-III-1.pdf.
- Ali, Ahmed, and Fizza Batool. *Making Sense of Pakistani Youth: How Youth in Pakistan View State, Society, Religion, and Politics*. Islamabad, Pakistan: Pak Institute for Peace Studies, 2022. <https://www.pakpips.com/web/wp-content/uploads/2022/04/National-Report.pdf>.
- Ali, M. "Diagnosis of the climate-smart agriculture and water management innovation systems in Pakistan." Unpublished paper, 2022.
- AQLI (Air Quality Life Index). "Pakistan Fact Sheet." University of Chicago: AQLI. Last accessed July 24, 2023. https://aqli.epic.uchicago.edu/wp-content/uploads/2021/08/PakistanFactSheet_update.pdf.
- Baloch, S. "Water crisis: why is Pakistan running dry?" *DW*, June 7, 2018. <https://www.dw.com/en/water-crisis-why-is-pakistan-running-dry/a-44110280>.
- Babar, Maryam Salma, Saema Tazyeen, Hiba Khan, Christos Tsagkaris, Mohammad Yasir Essar, and Shoaib Ahmad. "Impact of climate change on health in Karachi, Pakistan." *The Journal of Climate Change and Health* 2 (May 2021): 100013. <https://doi.org/10.1016/j.joclim.2021.100013>.
- Bari, Mavra. "Is rapid urbanization ruining Pakistan's cities?" *DW*, May 10, 2020. <https://www.dw.com/en/is-rapid-urbanization-making-pakistans-cities-less-livable/a-55162735>.
- Blakstad, Mia M., and Emily R. Smith. "Climate change worsens global inequity in maternal nutrition." *The Lancet* 4, no. 12 (December 2020): E547–E548. [https://doi.org/10.1016/S2542-5196\(20\)30246-1](https://doi.org/10.1016/S2542-5196(20)30246-1).
- BTI. *Pakistan Country Report 2018*. Bertelsmann Stiftung, 2018. https://www.bti-project.org/fileadmin/files/BTI/Downloads/Reports/2018/pdf/BTI_2018_Pakistan.pdf.
- BTI. *Pakistan Country Report 2020*. Bertelsmann Stiftung, 2020. https://www.bti-project.org/content/en/downloads/reports/country_report_2020_PAK.pdf.
- Chen, G., Xia Li, Xiaoping Liu, Yimin Chen, Xun Liang, Jiye Leng, Xiaocong Xu, et al. "Global projections of future urban land expansion under shared socioeconomic pathways." *Nature Communications* 11, no. 1 (2020): 537. <https://doi.org/10.1038/s41467-020-14386-x>.
- Climate Analytics. *Climate Impact Explorer*. Last accessed July 23, 2023. <https://climate-impact-explorer.climateanalytics.org>.
- Daud, M. K. M. Nafees, S. Ali, M. Rizwan, R. A. Bajwa, M. B. Shakoore, M. U. Arshad, et al. "Drinking Water Quality Status and Contamination in Pakistan." *Biomed Res Int* (2017): 7908183. doi: 10.1155/2017/7908183.
- Davies, Stephen, and William Young. "Unlocking Economic Growth Under a Changing Climate: Agricultural Water Reforms in Pakistan." In *Water Resources of Pakistan: Issues and Impacts*, edited by Muhammad Arif Watto, Michael Mitchell, and Safdar Bashir. DOI: https://doi.org/10.1007/978-3-030-65679-9_7.

- DAWN. "300pc increase in glacial lake outburst flooding recorded, Senate body told." October 29, 2022. <https://www.dawn.com/news/1717412>.
- EM-DAT. "Inventorying hazards & disasters worldwide since 1988." Database. Last accessed July 18, 2023. <https://www.emdat.be>.
- Ersado, Lire, Amer Hasan, Koen Martijn Geven, Ashi Kohli Kathuria, Juan Baron, May Bend, and S. Amer Ahmed. *Pakistan – Human Capital Review: Building Capabilities throughout Life*. Washington, DC: World Bank, 2023. <https://openknowledge.worldbank.org/entities/publication/8748b7a7-7345-4298-9631-3f5f146c7007>.
- ESCAP. *Asia-Pacific Riskscape @ 1.5°C: Subregional Pathways for Adaptation and Resilience—Asia-Pacific Disaster Report 2022 for ESCAP Subregions: Summary for Policymakers*. Bangkok, Thailand: Economic and Social Commission for Asia and the Pacific, 2022. <https://www.unescap.org/kp/2022/asia-pacific-disaster-report-2022-escap-subregions-summary-policymakers>.
- Fathom-Global. 2.0 Flood Data 2020 (90m). <https://www.fathom.global/fathom-global>.
- Food and Agriculture Organization, Government of Pakistan, United Nations Children's Fund, World Food Programme, and World Health Organization. *Pakistan Overview of Food Security and Nutrition: Improving Access to Food – 2019*. FAO et al., 2020. <https://reliefweb.int/report/pakistan/pakistan-overview-food-security-and-nutrition-improving-access-food-2019>.
- Food and Agriculture Organization. *Rangelands of Pakistan: Current status, threats and potential*. Rome: FAO, 2016. <https://www.fao.org/publications/card/ru/c/af354e5b-3aab-4be5-8742-f95430e90f79>.
- Food and Agriculture Organization. "Sustainable Land Management." *Land & Water*, FAO website. Last accessed July 24, 2023. <https://www.fao.org/land-water/land/sustainable-land-management/en/#:~:text=The%20United%20Nations%20defines%20sustainable,the%20maintenance%20of%20their%20environmental>.
- GermanWatch. "Who suffers Most from Extreme Weather Events? Weather-related Loss Events in 2019 and 2000 to 2019." *Global Climate Risk Index 2021*, January 25, 2021. Last accessed July 23, 2023. <https://www.germanwatch.org/en/19777>.
- Government of Pakistan. *Management of Vector-Borne Diseases (VBDs) in Pakistan*. Islamabad, Pakistan: Ministry of National Health Services, Regulations & Coordination, n.d. https://www.apmen.org/sites/default/files/all_resources/Management%20of%20VBDs_Pakistan%202020-2024.pdf.
- Government of Pakistan. *National Climate Change Policy (NCCP)*. Islamabad, Pakistan: Ministry of Climate Change, 2021. <https://mocc.gov.pk/SitelImage/Policy/NCCP%20Report.pdf>.
- Government of Pakistan. *National Disaster Response Plan*. Islamabad, Pakistan, 2019. https://app.adpc.net/sites/default/files/public/publications/attachments/SECTION%20I%20-%20Profile%20of%20Pakistan_0.pdf.
- Government of Pakistan. *National Gender Policy Framework*. Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022. <https://www.pc.gov.pk/uploads/report/NGPF.pdf>.
- Government of Pakistan. *National Nutrition Survey 2018 Key Findings Report*. Islamabad, Pakistan: Ministry of National Health Services, Regulations & Coordination, 2018. <https://www.unicef.org/pakistan/media/1951/file/Final%20percent20Key%20percent20Findings%20percent20Report%202019.pdf>.
- Government of Pakistan. *Pakistan Economic Survey 2019–20*. Islamabad, Pakistan: Finance Division, 2021. https://www.finance.gov.pk/survey_1920.html.
- Government of Pakistan. *Pakistan's First Biennial Update Report to UNFCCC*. Islamabad, Pakistan, 2022. <https://unfccc.int/documents/470405>.
- Government of Pakistan. *Pakistan's Resilient Recovery, Rehabilitation, and Reconstruction Framework (4RF)*. Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022. https://www.pc.gov.pk/uploads/downloads/Final_4RF.pdf.

- Government of Pakistan. *Percentage Distribution of Population by Age, Sex and Area 2020-21*. Islamabad, Pakistan, n.d. https://www.pbs.gov.pk/sites/default/files/labour_force/publications/lfs2020_21/tables/Table_1.pdf.
- Government of Pakistan, Bureau of Statistics. *Brief on PSLM Survey*. Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2023. <https://www.pbs.gov.pk/content/pakistan-social-and-living-standards-measurement>.
- Government of Pakistan, Bureau of Statistics. *Labour Force Survey 2020-21 Annual Report*. Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022. <https://www.pbs.gov.pk/publication/labour-force-survey-2020-21-annual-report>.
- Hallegatte, Stephane, Marianne Fay, and Edward B. Barbier. "Poverty and climate change: Introduction." *Environment and Development Economics* 23, no. 3 (2018): 217-233. doi:10.1017/S1355770X18000141.
- Hanif, Mohammed and Muhammad Aleem UI Hassan Ramey. *Climate Change Scenarios in Pakistan: A Case Study of Thar, Sindh*. Hyderabad, Pakistan: Research & Development Foundation (RDF), 2014. https://www.preventionweb.net/files/41642_41642climatechangescenariosacastestu.pdf.
- Hasan, Arif, and Hamza Arif. *Pakistan: the causes and repercussions of the housing crisis*. International Institute for Environment and Development. Working paper. London: IIED, 2018. <http://pubs.iied.org/10864IIED>.
- Heubaum, Harald, Carter Brandon, Thomas Tanner, Swenja Surminski, and Viktor Rözer. *The Triple Dividend of Building Climate Resilience: Taking Stock, Moving Forward*. World Resources Institute, 2022. DOI: <https://doi.org/10.46830/wriwp.21.00154>.
- ICOMOD. *Water, ice, society, and ecosystems in the Hindu Kush Himalaya: An outlook*. Nepal, International Centre for Integrated Mountain Development, 2023. <https://doi.org/10.53055/ICIMOD.1028>.
- Institute for Health Metrics and Evaluation (IHME). *Health Research by Location*, n.d. Last accessed July 23, 2023. <https://www.healthdata.org/pakistan>.
- Interactive Country Fiches. "What are the key values and trends?" Climate Change (website). Last accessed July 23, 2023. <https://dicf.unepgrid.ch/pakistan/climate-change>.
- International Labour Organization. *Working on a warmer planet: The impact of heat stress on labour productivity and decent work*. Geneva: ILO, 2019. www.ilo.org/publns.
- IPCC. "Summary for Policymakers Headline Statements." *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*, 2022. <https://www.ipcc.ch/report/ar6/wg2/resources/spm-headline-statements>.
- IQAir. "World's most polluted countries & regions (historical data 2018-2022)." Last accessed July 21, 2023. <https://www.iqair.com/world-most-polluted-countries>.
- Javed, U., and I. Nabi. *Heterogeneous fragility: The case of Pakistan*. LSE-Oxford Commission on State Fragility, Growth and Development, 2018. <https://www.theigc.org/publication/heterogeneous-fragility-case-pakistan>.
- Jones, Benji. "How melting glaciers fueled Pakistan's fatal floods." VOX, August 30, 2022. <https://www.vox.com/science-and-health/2022/8/30/23327341/pakistan-flooding-monsoon-melting-glaciers-climate-change>.
- Kaza, Silpa, Lisa C. Yao, Perinaz Bhada-Tata, and Frank Van Woerden. *What a Waste 2.0 - A Global Snapshot of Solid Waste Management to 2050*. Washington, DC: World Bank, 2018. <http://hdl.handle.net/10986/30317>.
- Khan, S. "Pakistan: Climate change, environmental problems put government in a bind." DW, September 8, 2020. <https://www.dw.com/en/climate-change-puts-pakistan-in-a-bind/a-54849791>.
- Kjellstrom, Tord, Matthias Otto, Bruno Lemke, Olivia Hyatt, Dave Briggs, Chris Freyberg, and Lauren Lines. *Climate Change and Labour: Impacts of Heat in the Workplace*. Geneva: International Labour Organization (ILO), 2016. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---gjp/documents/publication/wcms_476194.pdf.
- Kuehn, Leann, and Sabrina McCormick. "Heat Exposure and Maternal Health in the Face of Climate Change." *Int J Environ Res Public Health* 14, no. 8(2017): 853. doi:10.3390/ijerph14080853.

- Kulkarni, M. A., C. Duguay, and K. Ost. "Charting the evidence for climate change impacts on the global spread of malaria and dengue and adaptive responses: a scoping review of reviews." *Globalization and Health* 18, no. 1 (2022). <https://doi.org/10.1186/s12992-021-00793-2>.
- Landrigan, Philip J. Richard Fuller, Nereus J. R. Acosta, Olusoji Adeyi, Robert Arnold, Niladri Basu, Abdoulaye Bibi Baldé, et al. "The Lancet Commission on pollution and health." *The Lancet* 391, no. 10119 (February 2018): 462–512. <http://www.thelancet.com/commissions/pollution-and-health>. DOI: [https://doi.org/10.1016/S0140-6736\(17\)32345-0](https://doi.org/10.1016/S0140-6736(17)32345-0).
- Larsen, O., J. Oliver, and E. Casiles Lanuza. *Developing a disaster risk insurance framework for vulnerable communities in Pakistan: Pakistan disaster risk profile*. United Nations University, Institute for Environment and Human Security, 2014. <https://collections.unu.edu/eserv/UNU:1854/pdf11810.pdf>.
- Lytton, Lucy, Akthar Ali, Bill Garthwaite, Jehangir F. Punthakey, and Basharat Saeed. *Groundwater in Pakistan's Indus Basin: Present and Future Prospects*. Washington, DC: World Bank, 2021. <https://documents1.worldbank.org/curated/en/501941611237298661/pdf/Groundwater-in-Pakistan-s-Indus-Basin-Present-and-Future-Prospects.pdf>.
- Masud, Shafaq and Ahmad Khan. "Policy implementation barriers in climate change adaptation: The case of Pakistan." *Environmental Policy and Governance* (March 2023): 1–11. <https://doi.org/10.1002/eet.2054>.
- McKinsey Global Institute. *Climate risk and response in Asia*. McKinsey & Company, 2020. <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Asia%20Pacific/Climate%20risk%20and%20response%20in%20Asia%20Research%20preview/Climate-risk-and-response-in-Asia-Future-of-Asia-research-preview-vF.pdf>.
- Nazar, Sualiha. "Pakistan's Biggest Threat isn't Terrorism – It's Climate Change." *Foreign Policy*, March 4, 2016. <https://foreignpolicy.com/2016/03/04/pakistans-big-threat-isnt-terrorism-its-climate-change/#>.
- Okai, Asako. "Women are hit hardest in disasters, so why are responses too often gender-blind?" UNDP (blog). <https://www.undp.org/blog/women-are-hit-hardest-disasters-so-why-are-responses-too-often-gender-blind#:~:text=Asako%20Okai&text=The%20statistics%20are%20staggering%3B%20when,Tsunami%2C%2070%20percent%20were%20women>.
- Office of the United Nations High Commissioner for Human Rights. *Understanding Human Rights and Climate Change*. Geneva: OHCHR, 2015. <https://www.ohchr.org/sites/default/files/Documents/Issues/ClimateChange/COP21.pdf>.
- Ozment, Suzanne, Gretchen Ellison, and Brenden Jongman. *Nature-based Solutions for Disaster Risk Management (DRM)*. Washington, DC: World Bank, 2022. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/253401551126252092/booklet>.
- Patil, Pawan, D. Kaczan, J. Roberts, R. Jabeen, B. Roberts, J. Barbosa, S. Zuberi, et al. *Revitalizing Pakistan's Fisheries: Options for Sustainable Development*. Washington, DC: World Bank, 2018. https://www.academia.edu/45570521/Revitalizing_Pakistans_Fisheries_Options_for_Sustainable_Development.
- Peerzado, Moula Bux, Habibullah H. Magsi, and Muhammad Javed Sheikh. "Land use conflicts and urban sprawl: Conversion of agriculture lands into urbanization in Hyderabad, Pakistan." *Journal of the Saudi Society of Agricultural Sciences* 18, no. 4 (October 2019): 423–428. <https://doi.org/10.1016/j.jssas.2018.02.002>.
- Qureshi, A. S. "Perspectives for Bio-Management of Salt-Affected and Waterlogged Soils in Pakistan." in *Agroforestry for the Management of Waterlogged Saline Soils and Poor-quality Waters, Advances in Agroforestry* 13, edited by J. C. Dagar and P. S. Minhas. Springer: India, 2016. doi: 10.1007/978-81-322-2659-8_6.
- Saavedra, Jaime, and Lynne Sherburne-Benz. *Pakistan's Floods are Deepening its Learning Crisis*. World Bank End Poverty in South Asia (blog), September 28, 2022. <https://blogs.worldbank.org/endpovertyinsouthasia/pakistans-floods-are-deepening-its-learning-crisis>.
- Shaikh, Hina, and Ijaz Nabi. "The six biggest challenges facing Pakistan's urban future." IGC (blog), January 16, 2017. <https://www.theigc.org/blogs/six-biggest-challenges-facing-pakistans-urban-future>.
- Sorensen, Cecelia, Virginia Murray, Jay Lemery, and John Balbus. "Climate change and women's health: Impacts and policy directions." *PLoS Med* 15, no. 7 (July): e1002603. <https://doi.org/10.1371/journal.pmed.1002603>.

- United Nations Climate Change. *Introduction to Gender and Climate Change*. Bonn, Germany: UNFCCC Secretariat, 2022. <https://unfccc.int/gender>.
- United Nations Development Programme (UNDP). *Pakistan – Climate Public Expenditure and Institutional Review (CPEIR)*. UNDP Pakistan, 2015. <https://www.undp.org/pakistan/publications/climate-public-expenditure-institutional-review>
- United Nations Development Programme (UNDP). *Pakistan – Climate Public Expenditure and Institutional Review (CPEIR): Working towards a more efficient and effective allocation and use of climate change-related finance October 2017*. UNDP Pakistan, 2017. https://www.researchgate.net/publication/343961887_Pakistan_-_Climate_Public_Expenditure_and_Institutional_Review_CPEIR_Working_towards_a_more_efficient_and_effective_allocation_and_use_of_climate_change-related_finance_October_2017.
- United Nations Development Programme Pakistan. *Water Security in Pakistan: Issues and Challenges*. Islamabad: UNDP Pakistan, 2017. <https://www.undp.org/pakistan/publications/development-advocate-pakistan-volume-3-issue-4>.
- UN-Habitat. *State of Pakistani Cities 2018*. <https://unhabitat.org/state-of-pakistan-cities-report-2018>.
- USAID. *Pakistan Climate Change Risk Profile*. United States Agency for International Development, 2017. <https://www.climatelinks.org/resources/climate-risk-profile-pakistan>.
- Waseem, Liaqat Ali, Komal Farhat, and Syed Ali Asad Naqvi. "Urbanization Impacts on Urban Agriculture Land Conversions and Crop Production in Metropolitan Lahore Pakistan." *Pakistan Geographical Review* 74, no. 1(2019): 48-60. http://pu.edu.pk/images/journal/geography/pdf/5_V74_No1_2019.pdf.
- Wasif, Sehrish. "Pakistan may run dry by 2025: study." *The Express Tribune* (Pakistan), May 30, 2016. <https://tribune.com.pk/story/1112704/pakistan-may-run-dry-2025-study>.
- World Health Organization. "WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide." *Air Quality Guidelines*. Geneva: WHO, 2021. <https://www.who.int/publications/i/item/9789240034228>.
- World Health Organization. *World Malaria Report 2019*. Geneva: WHO, 2019. <https://www.who.int/publications-detail/world-malaria-report-2019>.
- World Bank. *The Changing Wealth of Nations 2021: Managing Assets for the Future*. Washington, DC: World Bank, 2021. <https://doi.org/10.1596/978-1-4648-1590-4>.
- World Bank. "Climate Change and Education Vulnerability Assessment" (unpublished), CCDR Background Notes.
- World Bank. *Climate Change Knowledge Portal*. Last accessed July 23, 2023. <https://climateknowledgeportal.worldbank.org>.
- World Bank. *Climate Health Vulnerability Assessment*. Unpublished, 2022.
- World Bank. *The Economic Case for Nature*. Washington, DC: World Bank, 2021. <https://thedocs.worldbank.org/en/doc/81385f4e89ae1c1e2278e404728bc1d4-0320072021/original/GEEM-2pg-Jun28.pdf>.
- World Bank. "Fertility rate, total (births per woman) – Pakistan," 2021. Last accessed July 18, 2023. https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?most_recent_value_desc=true.
- World Bank. "Literacy rate, adult female (% of females ages 15 and above) – Pakistan." Databank. Last accessed July 23, 2023. <https://data.worldbank.org/indicator/SE.ADT.LITR.FE.ZS?locations=PK>.
- World Bank. *Pakistan Country Climate and Development Report (CCDR)*. Washington, DC: World Bank, 2022. <https://openknowledge.worldbank.org/entities/publication/614ddc2b-ca31-53c9-b59c-6bf12a56d336>.
- World Bank. *Pakistan Federal Public Expenditure Review 2023*. Washington, DC: World Bank, 2023. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099041223153536828/p17507702d44490bd0bb660b4b60037e93>.

- World Bank. *Pakistan Urban Population and Urban Population Growth, 1960–2020*. Databank. Last accessed July 23, 2023. <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=PK>.
- World Bank. "Rural Population (% of total population) – Pakistan." World Bank website, 2021. Last accessed July 23, 2023. <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=PK>.
- World Bank. "Share of youth not in education, employment or training (% of youth population)." *Gender Data Portal*. Last accessed July 23, 2023. <https://genderdata.worldbank.org/indicators/sl-uem-neet-zs>.
- World Bank. "Share of youth not in education, employment or training, total (% of youth population) – Pakistan." Last accessed July 23, 2023. <https://data.worldbank.org/indicator/SL.UEM.NEET.ZS?locations=PK>.
- World Population Review. *Pakistan Population 2023*. Last accessed July 23, 2023. <https://worldpopulationreview.com/countries/pakistan-population>.
- Young, William J., Arif Anwar, Tousif Bhatti, Edoardo Borgomeo, Stephen Davies, William R. Garthwaite III, E. Michael Gilmont, et al. *Pakistan: Getting More from Water*. Washington, DC: World Bank, 2019. <https://documents1.worldbank.org/curated/en/251191548275645649/pdf/133964-WP-PUBLIC-ADD-SERIES-22-1-2019-18-56-25-W.pdf>.

Notes

¹ World Bank, *The Changing Wealth of Nations 2021: Managing Assets for the Future* (Washington, DC: World Bank, 2021), <https://doi.org/10.1596/978-1-4648-1590-4>.

² World Bank, *The Economic Case for Nature* (Washington, DC: World Bank, 2021), <https://thedocs.worldbank.org/en/doc/81385f4e89ae1c1e2278e404728bc1d4-0320072021/original/GEEM-2pg-Jun28.pdf>.

³ "Indus is second most polluted river with plastic, speaker tells KU event," *The News (International)*, October 24, 2019, <https://www.thenews.com.pk/print/545282-indus-is-second-most-polluted-river-with-plastic-speaker-tells-ku-event>.

⁴ IQAir, "World's most polluted countries & regions (historical data 2018 -2022)," last accessed July 21, 2023, <https://www.iqair.com/world-most-polluted-countries>.

⁵ GermanWatch, "Who suffers Most from Extreme Weather Events? Weather -related Loss Events in 2019 and 2000 to 2019," *Global Climate Risk Index 2021*, January 25, 2021, last accessed July 23, 2023, <https://www.germanwatch.org/en/19777>.

⁶ Government of Pakistan, *Pakistan's First Biennial Update Report to UNFCCC* (Islamabad, Pakistan, 2022), 2, <https://unfccc.int/documents/470405>.

⁷ Mohammed Hanif and Muhammad Aleem UI Hassan Ramey, *Climate Change Scenarios in Pakistan: A Case Study of Thar, Sindh* (Hyderabad, Pakistan: Research & Development Foundation (RDF), 2014), https://www.preventionweb.net/files/41642_41642climatechangescenariosacasestu.pdf.

⁸ Interactive Country Fiches, "What are the key values and trends?" Climate Change (website), last accessed July 23, 2023, <https://dicf.unepgrid.ch/pakistan/climate-change>.

⁹ United Nations Development Programme Pakistan, *Water Security in Pakistan: Issues and Challenges* (Islamabad: UNDP Pakistan, 2017), <https://www.undp.org/pakistan/publications/development-advocate-pakistan-volume-3-issue-4>.

¹⁰ S. Baloch, "Water crisis: why is Pakistan running dry?" *DW*, June 7, 2018, <https://www.dw.com/en/water-crisis-why-is-pakistan-running-dry/a-44110280>.

¹¹ Sehrish Wasif, "Pakistan may run dry by 2025: study," *The Express Tribune* (Pakistan), May 30, 2016, <https://tribune.com.pk/story/1112704/pakistan-may-run-dry-2025-study>.

¹² S. Khan, "Pakistan: Climate change, environmental problems put government in a bind." *DW*, September 8, 2020, <https://www.dw.com/en/climate-change-puts-pakistan-in-a-bind/a-54849791>.

¹³ Khan, "Pakistan: Climate change, environmental problems put government in a bind."

¹⁴ Sualiha Nazar, "Pakistan's Biggest Threat isn't Terrorism - It's Climate Change." *Foreign Policy*, March 4, 2016, <https://foreignpolicy.com/2016/03/04/pakistans-big-threat-isnt-terrorism-its-climate-change/#>.

¹⁵ Government of Pakistan, *National Disaster Response Plan* (Islamabad, Pakistan, 2019), https://app.adpc.net/sites/default/files/public/publications/attachments/SECTION%20I%20-%20Profile%20of%20Pakistan_0.pdf.

¹⁶ BTI, *Pakistan Country Report 2020* (Bertelsmann Stiftung, 2020), 24, https://www.bti-project.org/content/en/downloads/reports/country_report_2020_PAK.pdf.

¹⁷ Government of Pakistan, *National Disaster Response Plan* (Islamabad, Pakistan), 32.

¹⁸ ADB, *Climate Change Profile of Pakistan* (Asian Development Bank, 2017), 1, <https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf>.

¹⁹ BTI, *Pakistan Country Report 2020*, 24.

²⁰ O. Larsen, J. Oliver, and E. Casiles Lanuza, *Developing a disaster risk insurance framework for vulnerable communities in Pakistan: Pakistan disaster risk profile* (United Nations University, Institute for Environment and Human Security, 2014), 20, <https://collections.unu.edu/eserv/UNU:1854/pdf11810.pdf>.

²¹ USAID, *Pakistan Climate Change Risk Profile* (United States Agency for International Development, 2017), <https://www.climatelinks.org/resources/climate-risk-profile-pakistan>.

²² AQLI (Air Quality Life Index), "Pakistan Fact Sheet" (University of Chicago: AQLI), last accessed July 24, 2023, https://aqli.epic.uchicago.edu/wp-content/uploads/2021/08/PakistanFactSheet_update.pdf.

²³ ESCAP, *Asia-Pacific Riskscape @ 1.5°C: Subregional Pathways for Adaptation and Resilience –Asia-Pacific Disaster Report 2022 for ESCAP Subregions: Summary for Policymakers* (Bangkok, Thailand: Economic and Social Commission for Asia and the Pacific, 2022), <https://www.unescap.org/kp/2022/asia-pacific-disaster-report-2022-escap-subregions-summary-policymakers>.

²⁴ BTI, *Pakistan Country Report 2018* (Bertelsmann Stiftung, 2018), 27, https://www.bti-project.org/fileadmin/files/BTI/Downloads/Reports/2018/pdf/BTI_2018_Pakistan.pdf.

²⁵ ADB, *Climate Change Profile of Pakistan*, 1.

²⁶ Larsen, Oliver, and Casiles Lanuza, *Developing a disaster risk insurance framework*, 20.

²⁷ The occurrence is measured by combining the total count of events, while the average economic damage is quantified by calculating the yearly average value over the ten-year period. To calculate percentage of GDP, adjusted total damage is divided by the 2022 GDP.

²⁸ USAID, *Pakistan Climate Change Risk Profile*, 2.

²⁹ Food and Agriculture Organization, Government of Pakistan, United Nations Children’s Fund, World Food Programme, and World Health Organization, *Pakistan Overview of Food Security and Nutrition: Improving Access to Food – 2019*. (Food and Agriculture Organization et al., 2020), 8, <https://reliefweb.int/report/pakistan/pakistan-overview-food-security-and-nutrition-improving-access-food-2019>.

³⁰ Food and Agriculture Organization et al., *Pakistan Overview of Food Security and Nutrition*, 17–18.

³¹ World Population Review, *Pakistan Population 2023*, last accessed July 23, 2023, <https://worldpopulationreview.com/countries/pakistan-population>.

³² World Bank, *Pakistan Urban Population and Urban Population Growth, 1960–2020*, databank, last accessed July 23, 2023, <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=PK>.

³³ Nazar, “Pakistan’s Biggest Threat isn’t Terrorism.”

³⁴ U. Javed and I. Nabi, *Heterogeneous fragility: The case of Pakistan* (LSE–Oxford Commission on State Fragility, Growth and Development, 2018), 40, 44, <https://www.theigc.org/publication/heterogeneous-fragility-case-pakistan>.

³⁵ Guy J. Abel et al., “Climate, conflict and forced migration,” *Global Environmental Change* 54 (January 2019): 239–249, <https://doi.org/10.1016/j.gloenvcha.2018.12.003>.

³⁶ Asako Okai, “Women are hit hardest in disasters, so why are responses too often gender-blind?” UNDP (blog), <https://www.undp.org/blog/women-are-hit-hardest-disasters-so-why-are-responses-too-often-gender-blind#:~:text=Asako%20Okai&text=The%20statistics%20are%20staggering%3B%20when,Tsunami%2C%2070%20percent%20were%20women>

³⁷ *Kutcha* (or *katcha*) houses—the word in Hindi implies ramshackle—are small, makeshift, shelter-like, semi-permanent structures made with whatever materials are at hand, such as bamboo, wooden planks, mud, reeds, plastic, tarpaulin, thatch, and asphalt. *Pukka* houses—the word in Urdu mean solid—are permanent homes typically constructed by more affluent families using durable materials such as concrete blocks, cement, iron, and steel. *Semi-pukka* (semi-solid) houses are in between the two, a mix of durable (brick) and non-durable (mud) materials.

³⁸ ADB, *Climate Change Profile of Pakistan*, 1; USAID, *Pakistan Climate Change Risk Profile*, 2; Government of Pakistan, *Pakistan’s First Biennial Update Report to UNFCCC*, 6.

³⁹ World Bank, *Climate Change Knowledge Portal*, last accessed July 23, 2023, <https://climateknowledgeportal.worldbank.org>.

⁴⁰ Climate Analytics, *Climate Impact Explorer*, last accessed July 23, 2023, <https://climate-impact-explorer.climateanalytics.org>.

⁴¹ The indicator utilized in this context incorporates an assessment of moist heat stress (characterized by hot and humid conditions). It takes into account the exceedance of an absolute moist heat stress level, which holds particular relevance for the case of Pakistan.

⁴² These projections rely on a globally extrapolated exposure–response relationship rather than a locally inferred one, representing the current state of the art in this field. While it is essential to acknowledge the limitations of this approach, it remains particularly relevant for outdoor work, such as in the agriculture sector.

⁴³ Crop models often do not adequately consider the impacts of extreme events on yields, leading to potential underestimations. For instance, the adverse effects of the 2022 floods might not be accounted for in these models, resulting in a failure to capture the true extent of the damage.

⁴⁴ In 2012, the COP requested the LDC to form an Experts Group to develop technical guidelines for the NAP process. As a result, the LEG (Expert Group) submitted the above guidelines.

- ⁴⁵ World Bank, "Rural Population (% of total population) – Pakistan" (World Bank website, 2021), last accessed July 23, 2023, <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=PK>.
- ⁴⁶ William J. Young et al., *Pakistan: Getting More from Water* (Washington, DC: World Bank, 2019), <https://documents1.worldbank.org/curated/en/251191548275645649/pdf/133964-WP-PUBLIC-ADD-SERIES-22-1-2019-18-56-25-W.pdf>.
- ⁴⁷ A. S. Qureshi, "Perspectives for Bio-Management of Salt-Affected and Waterlogged Soils in Pakistan," in *Agroforestry for the Management of Waterlogged Saline Soils and Poor-quality Waters, Advances in Agroforestry* 13, edited by J. C. Dagar and P. S. Minhas (Springer: India, 2016), doi: 10.1007/978-81-322-2659-8_6.
- ⁴⁸ Liaqat Ali Waseem, Komal Farhat, and Syed Ali Asad Naqvi, "Urbanization Impacts on Urban Agriculture Land Conversions and Crop Production in Metropolitan Lahore Pakistan," *Pakistan Geographical Review* 74, no. 1 (2019): 48-60, http://pu.edu.pk/images/journal/geography/pdf/5_V74_No1_2019.pdf.
- ⁴⁹ Moula Bux Peerzado, Habibullah H. Magsi, and Muhammad Javed Sheikh, "Land use conflicts and urban sprawl: Conversion of agriculture lands into urbanization in Hyderabad, Pakistan," *Journal of the Saudi Society of Agricultural Sciences* 18, no. 4 (October 2019): 423-428, <https://doi.org/10.1016/j.jssas.2018.02.002>.
- ⁵⁰ Arif Hasan and Hamza Arif, *Pakistan: the causes and repercussions of the housing crisis*. International Institute for Environment and Development, working paper (London: IIED, 2018), <http://pubs.iied.org/10864IIED>
- ⁵¹ Government of Pakistan, *Pakistan Economic Survey 2019-20* (Islamabad, Pakistan: Finance Division, 2021), https://www.finance.gov.pk/survey_1920.html.
- ⁵² World Bank, *Pakistan Country Climate and Development Report* (CCDR) (Washington, DC: World Bank, 2022), <https://openknowledge.worldbank.org/entities/publication/614ddc2b-ca31-53c9-b59c-6bf12a56d336>.
- ⁵³ Stephen Davies and William Young, "Unlocking Economic Growth Under a Changing Climate: Agricultural Water Reforms in Pakistan," in *Water Resources of Pakistan: Issues and Impacts*, edited by Muhammad Arif Watto, Michael Mitchell, and Safdar Bashir. DOI: https://doi.org/10.1007/978-3-030-65679-9_7.
- ⁵⁴ Benji Jones, "How melting glaciers fueled Pakistan's fatal floods," VOX, August 30, 2022, <https://www.vox.com/science-and-health/2022/8/30/23327341/pakistan-flooding-monsoon-melting-glaciers-climate-change>.
- ⁵⁵ "300pc increase in glacial lake outburst flooding recorded, Senate body told," DAWN, October 29, 2022, <https://www.dawn.com/news/1717412>.
- ⁵⁶ ICOMOD, *Water, ice, society, and ecosystems in the Hindu Kush Himalaya: An outlook* (Nepal, International Centre for Integrated Mountain Development, 2023), <https://doi.org/10.53055/ICIMOD.1028>.
- ⁵⁷ Among the main limitations for CSA adoption is farmers' low investment capacity, lack of financing, and lack of knowledge and information. Farmers in Pakistan lack knowledge of, for instance, appropriate practices for local climate conditions, nutritional crop requirements, and soil fertility status to effectively balance their use of inputs. The upfront cost of adopting CSA technology is high so large and progressive farmers are more likely to adopt them than smallholders. Access to finance in rural areas has fallen behind the country's growth and development needs. Commercial banks are oriented toward urban areas and tend to avoid agriculture lending because of high perceived risk and seasonality.
- ⁵⁸ M. Ali, "Diagnosis of the climate-smart agriculture and water management innovation systems in Pakistan." Unpublished background paper (2022).
- ⁵⁹ World Bank (2021). *Changing Wealth of Nations*.
- ⁶⁰ FAO, *Rangelands of Pakistan: Current status, threats and potential* (Rome: Food and Agriculture Organization, 2016), <https://www.fao.org/publications/card/ru/c/af354e5b-3aab-4be5-8742-f95430e90f79>.
- ⁶¹ This represents direct employment. When secondary activities are included, the fisheries subsector comprises 1.8 million jobs. See Pawan Patil et al., *Revitalizing Pakistan's Fisheries: Options for Sustainable Development* (Washington, DC: World Bank, 2018), https://www.academia.edu/45570521/Revitalizing_Pakistans_Fisheries_Options_for_Sustainable_Development.
- ⁶² Government of Pakistan, *National Climate Change Policy (NCCP)* (Islamabad, Pakistan: Ministry of Climate Change, 2021), <https://mocc.gov.pk/SiteImage/Policy/NCCP%20Report.pdf>.
- ⁶³ Lucy Lytton et al., *Groundwater in Pakistan's Indus Basin: Present and Future Prospects* (Washington, DC: World Bank, 2021), <https://documents1.worldbank.org/curated/en/501941611237298661/pdf/Groundwater-in-Pakistan-s-Indus-Basin-Present-and-Future-Prospects.pdf>.
- ⁶⁴ IQAir, "World's most polluted countries & regions (historical data 2018 -2022)," last accessed July 21, 2023, <https://www.iqair.com/world-most-polluted-countries>.

- ⁶⁵ Philip J. Landrigan et al., "The Lancet Commission on pollution and health," *The Lancet* 391, no. 10119 (February 2018): 462–512, <http://www.thelancet.com/commissions/pollution-and-health>. DOI: [https://doi.org/10.1016/S0140-6736\(17\)32345-0](https://doi.org/10.1016/S0140-6736(17)32345-0).
- ⁶⁶ World Bank, *The Economic Case for Nature* <https://openknowledge.worldbank.org/handle/10986/35882>.
- ⁶⁷ The United Nations defines sustainable land management (SLM) as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions". See Food and Agriculture Organization, "Sustainable Land Management," *Land & Water*, FAO website, last accessed July 24, 2023, <https://www.fao.org/land-water/land/sustainable-land-management/en/#:~:text=The%20United%20Nations%20defines%20sustainable,the%20maintenance%20of%20their%20environmental>.
- ⁶⁸ World Bank, *Pakistan Urban Population and Urban Population Growth, 1960–2020*.
- ⁶⁹ Hina Shaikh and Ijaz Nabi, "The six biggest challenges facing Pakistan's urban future," IGC (blog), January 16, 2017, <https://www.theigc.org/blogs/six-biggest-challenges-facing-pakistans-urban-future>.
- ⁷⁰ Mavra Bari, "Is rapid urbanization ruining Pakistan's cities?" *DW*, May 10, 2020, <https://www.dw.com/en/is-rapid-urbanization-making-pakistans-cities-less-livable/a-55162735>.
- ⁷¹ Shaikh and Nabi, "The six biggest challenges facing Pakistan's urban future." <https://www.theigc.org/blogs/six-biggest-challenges-facing-pakistans-urban-future>.
- ⁷² Silpa Kaza et al., *What a Waste 2.0 – A Global Snapshot of Solid Waste Management to 2050* (Washington, DC: World Bank, 2018), <http://hdl.handle.net/10986/30317>.
- ⁷³ World Health Organization, "WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide," *Air Quality Guidelines* (Geneva: WHO, 2021), <https://www.who.int/publications/i/item/9789240034228>.
- ⁷⁴ UN-Habitat, *State of Pakistani Cities 2018* <https://unhabitat.org/state-of-pakistan-cities-report-2018>.
- ⁷⁵ The cities covered were Karachi, Lahore, Faisalabad, Hyderabad, Quetta, Mardan, Mansehra, Gujrat, Sialkot, Kotri, and Sukkur.
- ⁷⁶ World Bank, *Pakistan Country Climate and Development Report (CCDR)* (Washington, DC: World Bank, 2022).
- ⁷⁷ Built-up area: German Aerospace Center, World Settlement Footprint (WSF) Evolution 1985–2015 (30m). https://download.geoservice.dlr.de/WSF_EVO/files/.
- ⁷⁸ Fathom-Global 2.0 Flood Data 2020 (90m). <https://www.fathom-global/fathom-global>.
- ⁷⁹ G. Chen et al., "Global projections of future urban land expansion under shared socioeconomic pathways," *Nature Communications* 11, no. 1 (2020): 537, <https://doi.org/10.1038/s41467-020-14386-x>.
- ⁸⁰ McKinsey Global Institute, *Climate risk and response in Asia* (McKinsey & Company, 2020), <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Asia%20Pacific/Climate%20risk%20and%20response%20in%20Asia%20Research%20preview/Climate-risk-and-response-in-Asia-Future-of-Asia-research-preview-vF.pdf>.
- ⁸¹ World Bank, *Nature-based Solutions for Disaster Risk Management (DRM)* (Washington, DC: World Bank, 2022), <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/253401551126252092/booklet>.
- ⁸² World Bank, *Nature-based Solutions for Disaster Risk Management (DRM)* (Washington, DC: World Bank, 2022).
- ⁸³ Pakistan has implemented ambitious natural capital reforestation efforts to expand NbS implementation. These include the Ten Billion Tree Tsunami Program (TBTP), Billion T trees Afforestation Project (BTAP), Protected Areas Initiative (PAI) and Recharge Pakistan, where BTAP and TBTP is estimated to sequester 500 MtCO_{2e} emissions by 2040 according to the updated NDCs.
- ⁸⁴ Government of Pakistan, *Management of Vector-Borne Diseases (VBDs) in Pakistan* (Islamabad, Pakistan: Ministry of National Health Services: Regulations & Coordination, n.d.), https://www.apmen.org/sites/default/files/all_resources/Management%20of%20VBDs_Pakistan%202020-2024.pdf.
- ⁸⁵ World Health Organization, *World Malaria Report 2019* (Geneva: WHO, 2019), <https://www.who.int/publications-detail/world-malaria-report-2019>.
- ⁸⁶ Institute for Health Metrics and Evaluation (IHME), *Health Research by Location* (n.d.), last accessed July 23, 2023, <https://www.healthdata.org/pakistan>.
- ⁸⁷ Government of Pakistan, *National Nutrition Survey 2018 Key Findings Report* (Islamabad, Pakistan: Ministry of National Health Services, Regulations & Coordination, 2018), https://www.unicef.org/pakistan/media/1951/file/Final_percent20Key_percent20Findings_percent20Report_percent202019.pdf.

- ⁸⁸ World Bank, "Fertility rate, total (births per woman) – Pakistan," 2021, last accessed July 18, 2023, https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?most_recent_value_desc=true.
- ⁸⁹ World Bank, *Pakistan Human Capital Review: Building Capabilities throughout Life*, May 1, 2023, last accessed July 18, 2023, <https://www.worldbank.org/en/region/sar/publication/pakistan-human-capital-review-building-capabilities-throughout-life>.
- ⁹⁰ Government of Pakistan, Bureau of Statistics, *Labour Force Survey 2020-21 Annual Report* (Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022), <https://www.pbs.gov.pk/publication/labour-force-survey-2020-21-annual-report>.
- ⁹¹ World Bank, *Climate Health Vulnerability Assessment* (unpublished, 2022).
- ⁹² EM-DAT, "Inventorying hazards & disasters worldwide since 1988," database, last accessed July 18, 2023, <https://www.emdat.be>.
- ⁹³ Maryam Salma Babar et al., "Impact of climate change on health in Karachi, Pakistan," *The Journal of Climate Change and Health* 2 (May 2021): 100013, <https://doi.org/10.1016/j.joclim.2021.100013>.
- ⁹⁴ International Labour Organization, *Working on a warmer planet: The impact of heat stress on labour productivity and decent work* (Geneva: ILO, 2019), www.ilo.org/publns.
- ⁹⁵ M.A. Kulkarni, C. Duguay, and K. Ost, "Charting the evidence for climate change impacts on the global spread of malaria and dengue and adaptive responses: a scoping review of reviews," *Globalization and Health* 18, no. 1 (2022). <https://doi.org/10.1186/s12992-021-00793-2>.
- ⁹⁶ M.K. Daud, et al. "Drinking Water Quality Status and Contamination in Pakistan." *Biomed Res Int* (2017): 7908183, doi: 10.1155/2017/7908183.
- ⁹⁷ Leann Kuehn and Sabrina McCormick, "Heat Exposure and Maternal Health in the Face of Climate Change," *Int J Environ Res Public Health* 14, no. 8(2017): 853, doi:10.3390/ijerph14080853.
- ⁹⁸ Cecelia Sorensen et al., "Climate change and women's health: Impacts and policy directions," *PLoS Med* 15, no. 7 (July): e1002603. <https://doi.org/10.1371/journal.pmed.1002603>.
- ⁹⁹ Mia M. Blakstad and Emily R. Smith, "Climate change worsens global inequity in maternal nutrition," *The Lancet* 4, no. 12 (December 2020): E547–E548, [https://doi.org/10.1016/S2542-5196\(20\)30246-1](https://doi.org/10.1016/S2542-5196(20)30246-1).
- ¹⁰⁰ Jaime Saavedra and Lynne Sherburne-Benz, *Pakistan's Floods are Deepening its Learning Crisis*, World Bank *End Poverty in South Asia* (blog), September 28, 2022, <https://blogs.worldbank.org/endpovertyinsouthasia/pakistans-floods-are-deepening-its-learning-crisis>.
- ¹⁰¹ World Bank, "Climate Change and Education Vulnerability Assessment" (unpublished), CCDR Background Notes.
- ¹⁰² Tord Kjellstrom et al., *Climate Change and Labour: Impacts of Heat in the Workplace* (Geneva: International Labour Organization (ILO), 2016), https://www.ilo.org/wcmsp5/groups/public/--ed_emp/--gjp/documents/publication/wcms_476194.pdf.
- ¹⁰³ Naeem Akram and Asma Gulzar, "Climate Change and Economic Growth: An Empirical Analysis of Pakistan," *Pakistan Journal of Applied Economics* 23, No. 1(Summer 2013): 31–54, http://aerc.edu.pk/wp-content/uploads/2016/08/Article_32Paper-540-III-1.pdf.
- ¹⁰⁴ IPCC, "Summary for Policymakers Headline Statements," *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)* (2022), <https://www.ipcc.ch/report/ar6/wg2/resources/spm-headline-statements>.
- ¹⁰⁵ World Bank, *Pakistan Human Capital Review: Building Capabilities throughout Life*, 2023.
- ¹⁰⁶ Government of Pakistan, Bureau of Statistics, *Brief on PSLM Survey* (Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2023), <https://www.pbs.gov.pk/content/pakistan-social-and-living-standards-measurement>.
- ¹⁰⁷ World Bank, "Literacy rate, adult female (% of females ages 15 and above) – Pakistan," databank, last accessed July 23, 2023, <https://data.worldbank.org/indicator/SE.ADT.LITR.FE.ZS?locations=PK>.
- ¹⁰⁸ Government of Pakistan, *National Gender Policy Framework* (Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022), <https://www.pc.gov.pk/uploads/report/NGPF.pdf>.
- ¹⁰⁹ Government of Pakistan, *Percentage Distribution of Population by Age, Sex and Area 2020-21* (Islamabad, Pakistan: n.d.), https://www.pbs.gov.pk/sites/default/files/labour_force/publications/lfs2020_21/tables/Table_1.pdf.
- ¹¹⁰ World Bank, *Pakistan Country Climate and Development Report*, 2022.

- ¹¹¹ World Bank, "Share of youth not in education, employment or training, total (% of youth population) – Pakistan, <https://data.worldbank.org/indicator/SL.UEM.NEET.ZS?locations=PK>; "Share of youth not in education, employment or training (% of youth population)," *Gender Data Portal*, last accessed July 23, 2023, <https://genderdata.worldbank.org/indicators/sl-uem-neet-zs>.
- ¹¹² Ahmed Ali and Fizza Batool, *Making Sense of Pakistani Youth: How Youth in Pakistan View State, Society, Religion, and Politics* (Islamabad, Pakistan: Pak Institute for Peace Studies, 2022), <https://www.pakpips.com/web/wp-content/uploads/2022/04/National-Report.pdf>.
- ¹¹³ Government of Pakistan, *Pakistan's Resilient Recovery, Rehabilitation, and Reconstruction Framework (4RF)* (Islamabad, Pakistan: Ministry of Planning, Development & Special Initiatives, 2022), https://www.pc.gov.pk/uploads/downloads/Final_4RF.pdf.
- ¹¹⁴ United Nations Climate Change, *Introduction to Gender and Climate Change* (Bonn, Germany: UNFCCC Secretariat, 2022), <https://unfccc.int/gender>.
- ¹¹⁵ Government of Pakistan, *National Climate Change Policy*, 2021.
- ¹¹⁶ Stephane Hallegatte, Marianne Fay, and Edward B. Barbier, "Poverty and climate change: Introduction," *Environment and Development Economics* 23, no. 3 (2018): 217–233, doi:10.1017/S1355770X18000141.
- ¹¹⁷ Office of the United Nations High Commissioner for Human Rights, *Understanding Human Rights and Climate Change* (Geneva: OHCHR, 2015), <https://www.ohchr.org/sites/default/files/Documents/Issues/ClimateChange/COP21.pdf>.
- ¹¹⁸ Shafaq Masud and Ahmad Khan, "Policy implementation barriers in climate change adaptation: The case of Pakistan," *Environmental Policy and Governance* (March 2023): 1–11, <https://doi.org/10.1002/eet.2054>.
- ¹¹⁹ World Bank, *Pakistan Country Climate and Development Report*, 2022.
- ¹²⁰ The Ministry of Climate Change has also estimated the cost of response and recovery from climate-related disasters to be over US\$85 billion between 2022 to 2030.
- ¹²¹ World Bank, *Pakistan Country Climate and Development Report*, 2022.
- ¹²² Harald Heubaum, et al., *The Triple Dividend of Building Climate Resilience: Taking Stock, Moving Forward* (World Resources Institute, 2022), <https://www.wri.org/research/triple-dividend-building-climate-resilience-taking-stock-moving-forward>.
- ¹²³ United Nations Development Programme (UNDP), *Pakistan – Climate Public Expenditure and Institutional Review (CPEIR)*(UNDP Pakistan, 2017). <https://www.undp.org/pakistan/publications/climate-public-expenditure-institutional-review>
- ¹²⁴ United Nations Development Programme (UNDP), *Pakistan – Climate Public Expenditure and Institutional Review (CPEIR): Working towards a more efficient and effective allocation and use of climate change -related finance October 2017*(UNDP Pakistan, 2017). https://www.researchgate.net/publication/343961887_Pakistan_-_Climate_Public_Expenditure_and_Institutional_Review_CPEIR_Working_towards_a_more_efficient_and_effective_allocation_and_use_of_climate_change-related_finance_October_2017.
- ¹²⁵ A *sukuk* is a sharia-compliant, bond-like instrument used in Islamic finance.
- ¹²⁶ World Bank, *Pakistan Federal Public Expenditure Review 2023* (Washington, DC: World Bank, 2023), <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099041223153536828/p17507702d44490bd0bb660b4b60037e93>.
- ¹²⁷ World Bank, *Pakistan Country Climate and Development Report*, 2022.
- ¹²⁸ African Development Bank et al., *Joint Report on Multilateral Development Banks' Climate Finance* (2021), <http://dx.doi.org/10.18235/0004505> ; https://www.eib.org/attachments/lucalli/mdbs_joint_report_2021_en.pdf.
- ¹²⁹ World Bank data

