KHYBER PAKHTUNKHWA

CLIMATE CHANGE ACTION PLAN

August 2022

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF KHYBER PAKHTUNKHWA
FORESTRY, ENVIRONMENT & WILDLIFE DEPARTMENT

PREFACE

Anthropogenic emissions of Green House Gases (GHG) have increased since the industrial era, resulting in global warming and large-scale changes in weather patterns, collectively known as "Climate Change." Globally, scientific evidence suggests that Climate Change is responsible for changes in precipitation, increased occurrence of droughts and heat waves, increased intensity and frequency of hurricanes, sea level rise, melting glaciers and arctic ice. These effects can also be seen in Pakistan, where historical data shows that the country experienced 152 climate-related disasters between 1999 and 2018, ranking it as the fifth most vulnerable country to the effects of Climate Change in 2020. Pakistan is facing threats because of recession of Hindu Kush-Karakoram-Himalayan (HKH) glaciers threatening water inflows into Indus River System, increased temperature and sea-level rise causing increase in frequency and intensity of extreme weather events, coupled with erratic monsoon rains resulting in frequent and intense floods, droughts resulting in enhanced heat and water-stressed conditions, particularly in arid and semi-arid regions, impacting agriculture productivity negatively, decrease in the already scanty forest cover from rapid change in climatic conditions, increased intrusion of saline water in the Indus delta, adversely affecting coastal agriculture, mangroves and breeding grounds of fish and increased health risks due to climate-induced factors. Pakistan was one of the first South Asian countries to establish a Ministry of Climate Change and to adopt a National Climate Change Policy in 2012 to address climate-related issues.

Recognizing the risks and vulnerabilities, the UN General Assembly established the 17 Sustainable Development Goals (SDGs) in 2015 to achieve a brighter and more sustainable future for all. Pakistan was the first country to accept the SDGs-2030 agenda, through a unanimous resolution of the Pakistani Parliament and it produced Vision 2025, aligned with the SDGs. In addition, to address Climate Change concerns, a legally binding international treaty was signed at the Conference of Parties (COP21) in Paris, known as the Paris Agreement 2015. The treaty's goal is to keep global warming well below 2°C, preferably 1.5°C, compared to pre-industrial levels. Pakistan became a signatory to the Paris Agreement in 2016 and submitted its first Nationally Determined Contributions (NDCs) with the goal of reducing emissions by 20% and taking actions to adapt to changing climate by 2030. These pledges were made in accordance with the country's National Climate Change Policy 2021 and Vision 2025.

The on-ground action dictated by these policy frameworks and commitments resulted in Pakistan emerging as one of the countries to achieve SDG-13 “Climate Action” by 2020. This is the first time, Pakistan has achieved any SDG goal. Pakistan's SDG index score increased from 54.9 in 2018 to 56.2 in 2020, according to the SDG report 2020. Furthermore, Pakistan's ranking dropped from fifth most vulnerable to eighth in the 2021 as per report of German-watch Climate risk index. To maintain this momentum, the Ministry of Climate Change is committed to assisting provinces in incorporating these policies and commitments into their mandates. As a result, the action plan provides a comprehensive framework to assist the province in maximizing its efforts on adaptation and mitigation actions in agriculture, water resources, forestry, wildlife and fisheries, health, energy, transportation, industry, waste and urban planning.

MESSAGE

Climate Change poses a greater security threat to Pakistan because it has the potential to affect temperatures, environment, economy, and the country's future policies. There is mounting evidence that the effects of climate change on the systems that sustain people and other species are occurring sooner than expected.

The Govt. of Khyber Pakhtunkhwa has formulated the first Provincial Climate Change Policy in 2017, realizing that the economy of the province is in grave danger as a result of climate change impacts and is vulnerable due to its geographical spread. The government is very committed to implement the policy in letter and spirit.

Due to merger of newly merged districts into the province, revision of National Climate Change Policy 2021 and to fulfill the commitments of updated Nationally Determined Contributions 2021, the Govt. of Khyber Pakhtunkhwa felt it imperative to update the previous Climate Change Policy into KP Climate Change Policy 2022. The revised policy aims to outline the provincial government commitments to combat climate change scenarios through mitigation and adaptation measures.

The Khyber Pakhtunkhwa Climate Change Policy provides a roadmap through a comprehensive Climate Change Action Plan which aims to reduce the devastating effects of the nature induced calamities in the province through consolidated efforts of all provincial departments. It is further aimed to link with a sustainable infrastructure like strengthening and reorientation of investment strategies and to avail the significant opportunities of low-carbon, climate-resilient infrastructure; transforming finance to enable and drive change; and phasing out fossil fuel consumption contributing to global agenda on UNFCCC.

MAHMOOD KHAN
Chief Minister
Government of Khyber Pakhtunkhwa

FOREWORD

Khyber Pakhtunkhwa Province is one of Pakistan's most sensitive provinces when it comes to the adverse effects of Climate Change. The Government of Khyber Pakhtunkhwa began responding proactively to the Climate Change implications by updating the Provincial Climate Change Policy 2022 and formulation of Provincial Climate Change Action Plan 2022 simultaneously for the very first time.

This preemptive strategy shows the seriousness of the Govt of KP towards mitigating the effects of climate change.

In order to provide recommendations and a way forward on Climate Change in the Province, the Forestry, Environment & Wildlife Department (FE&WD) established a Climate Change Cell in Environmental Protection Agency (EPA) which further keeps liaison with the Federal Govt on Climate Change Agenda.

The Provincial Climate Change Policy and Action Plan 2022 are consistent with the updated National Climate Change Policy 2021. The policy also gives a roadmap to cope with the health hazards caused by nature and human induced calamities.

For effective implementation of policy and action plan, the roles and responsibilities of provincial climate change implementation committee have been emphasized in the policy to make the strategy a success.

SYED MUHAMMAD ISHTIAQ URMAR
PROVINCIAL MINISTER FOR
Environment Government of Khyber Pakhtunkhwa

MESSAGE

Following the 18th Constitutional Amendment and the mounting signs of Climate Change in the province, the Environmental Protection Agency (EPA) took the initiative and established a "Climate Change Cell" mandated to interact with all other government agencies and departments to incorporate climate change scenarios into their respective policies, strategies, and actions, as well as to mitigate the adverse effects of Climate Change.

The first step in this regard was to formulate a provincial Climate Change policy in 2017 and now it has been updated in 2022. For its effective implementation, Khyber Pakhtunkhwa government formulated the Provincial Climate Change Action Plan 2022 which is consistent with the National Climate Change Policy 2021 and Nationally Determined Contributions 2021.

The Provincial Climate Change Action Plan 2022 is well aligned with the vulnerabilities of Khyber Pakhtunkhwa to Climate Change and the implementation of various adaptation and mitigation measures highlighted in the policy will cause a positive impact in boosting all sectors besides imparting awareness to the masses of the province on Climate Change.

The Forestry, Environment &Wildlife Department appreciates the contribution of the parliamentarians, line department, civil societies, academia and intelligencia for their efforts in realization of KP Climate Change Policy and Action Plan 2022. The document will contribute to revive the fragile ecosystem and sustainable development of natural resources.

MUHAMMAD ABID MAJEED
SECRETARY TO GOVERNMENT
OF KHYBER PAKHTUNKHWA
Forestry, Environment & Wildlife Department

ACKNOWLEDGEMENT

The formulation of Provincial Climate Change Policy (PCCP) 2017 was a milestone in the history of KP Environment sector. The updated National Climate Change Policy 2021, NDCs 2021 together with national and international commitments to reduce GHG emissions necessitated updation of Provincial Climate Change Policy and to formulate the Provincial Climate Change Action Plan for the province.

In this regard, the efforts of Provincial line Departments, Deputy Commissioners of the Province, Private & Public Sector Organizations and Experts are worth appreciation in formulation of the Khyber Pakhtunkhwa Provincial Climate Change Policy & Action Plan-2022. The contribution of Climate Change Cell of Environmental Protection Agency (EPA), Government of Khyber Pakhtunkhwa, deserves much accolade as they worked wholeheartedly. Besides academia and civil society also participated and demonstrated their keen interest in suggesting measures by providing valuable comments and feedback in refining this document.

In formulation of this Action Plan, special focus was given for Youth & Women Development. The role of Mrs. Aisha Bano Member of Provincial Assembly & Mrs. Amna Durani Director on the Status of Commission of Women Khyber Pakhtunkhwa and other women working in International and National Public / Private Sector Organizations also added valuable contributions during various consultation workshops etc. We highly appreciate the critical analysis of Chairman Environmental Sciences Department, University of Peshawar, Abdulwali Khan University Mardan and Haripur University, which were valid and contemporary. We also acknowledge the support of various Universities, Chairman Textbook Board Peshawar, KP Chamber of Commerce and Industry, SRSP, IUCN, WWF, Ministry of Climate Change and especially the UNDP (under GLOF-II Project, Scaling up of Glacial Lakes Outburst Flood in Northern Pakistan) for financially supporting the formulation of Khyber Pakhtunkhwa Climate Change Policy & Action Plan 2022.

We also appreciate Honorable Minister and Secretary Forestry, Environment & Wildlife for supporting and providing guidance and platform to accomplish the activity in a professional manner.

We highly appreciate the dedication and commitment of Dr. Qamar uz Zaman Chaudhry (Ex. Director General, Pakistan Meteorological Department) in the formulation of Climate Change Policy and Action Plan for the province. For the successful implementation of the Policy and Action Plan in the province, the EPA is looking forward for support of all stakeholders in order to reduce the risks posed by climate change and to build a resilient province.

MUHAMMAD ANWAR KHAN
Director General
Environmental Protection Agency
Government of Khyber Pakhtunkhwa

List of Abbreviations

C&W	Communication & Works
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DDMA	District Disaster Management Authority
DRM	Disaster Risk Management
EPA	Environmental Protection Agency
FE&WD	Forestry, Environment & Wildlife Department
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS/RS	Geographic Information System/Remote Sensing
GLOF	Glacier Lake Outburst Flood
IPC	Inter Provincial Coordination
IMF	International Monetary Fund
IPCC AR-6	Intergovernmental Panel on Climate Change Assessment Report 6
KP	Khyber Pakhtunkhwa
LGE&RDD	Local Government, Election & Rural Development Department
MoCC	Ministry of Climate Change
NARC	National Agriculture Research Centre
NCCP	National Climate Change Policy
NHA	National Highway Authority
NTFP	Non-Timber Forest Produce
OFWM	On Farm Water Management
PEC	Pakistan Engineering Council
P&DDD	Planning & Development Department
PDMA	Provincial Disaster Management Authority
PEDO	Pakhtunkhwa Energy Development Organization
PFI	Pakistan Forest Institute
PHED	Public Health Engineering Department
PKHA	Pakhtunkhwa Highway Authority
PMD	Pakistan Meteorological Department
RR&SD	Relief, Rehabilitation & Settlement Department
SDG	Sustainable Development Goal
SFM	Sustainable Forest Management
UNOCHA	United Nation's Office for the Coordination of Humanitarian Affairs
VETS	Vehicle Emission Testing Stations
WAPDA	Water & Power Development Authority
WASH	Water, Sanitation & Hygiene
WSS	Water & Sanitation Services
WWF	World Wide Fund for Nature (Formerly, World Wildlife Fund)

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1. INTRODUCTION

Khyber Pakhtunkhwa (KP) is the third-largest province in terms of population though, it is the smallest in terms of land area. It is located in Pakistan's northwest region and has a variety of topographical features. The Karakoram, Himalayan and Hindukush Mountain ranges are found primarily in the province's northern, northwestern and eastern regions. The province's southern region, on the other hand, is mostly comprised of central valley plains, which consist of agricultural land and rangelands. Throughout KP, severe climate conditions exist. The province's northern region experiences extremely snowy and cold winters, with high intensity rainfall and pleasant summers, whereas the province's southern region experiences relatively less severe winters, with reasonable rainfall and warmer summers. Chitral is the province's highest district, with the coldest winter temperatures. As a result, the Chitral has a large number of glaciers. The province is divided into seven divisions, which are further subdivided into 35 districts, as shown in the Figure 1.

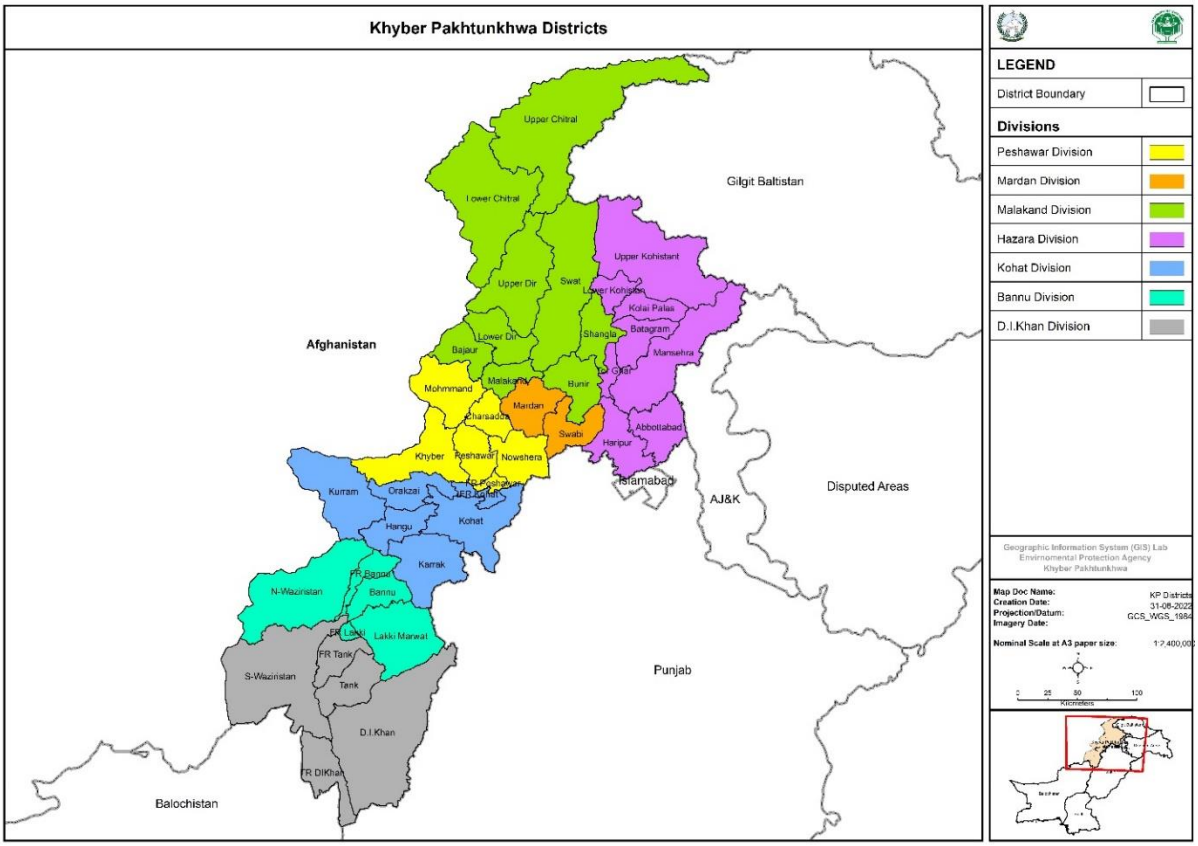

Figure 1: Districts Map of KP(Data Source: Bureau of Statistics and UNOCHA)

1.1 Ecological Classification of Khyber Pakhtunkhwa

According to the study conducted by Nizami et al., (2020)under Swiss Development and Cooperation (SDC), KP is divided into nine **agro-ecological zones** based on climate, rainfall, temperature, altitude, soil and topography. Figure 2 shows the map of the agro-ecological zones of KP. The district-wise zonal details are provided in Table 1.

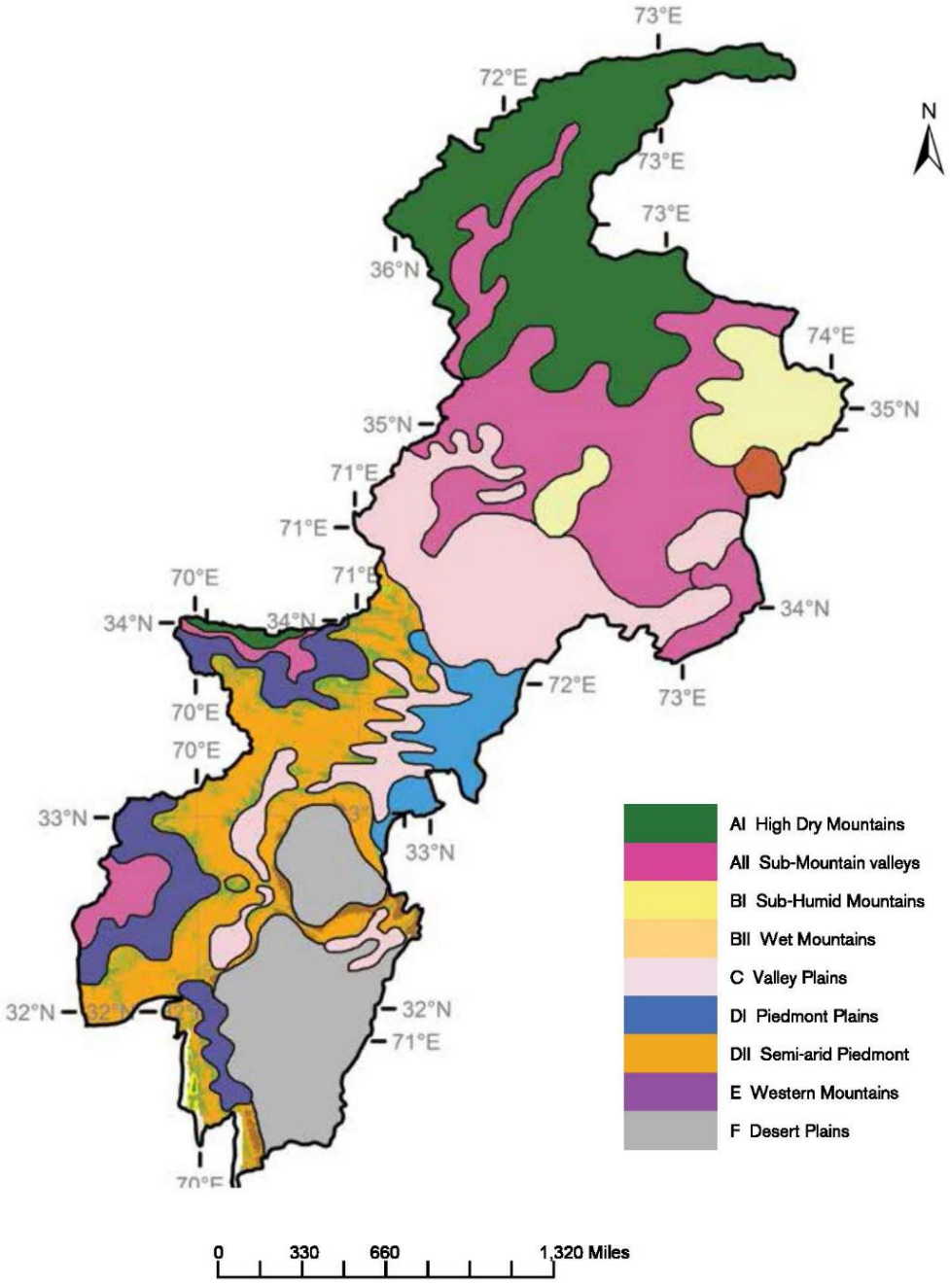

Figure 2: Agro-ecological zones of KP (Source: Nizami et al., 2020)

Table 1: District-wise distribution of agro-ecological zones of KP (Source: Nizami et al., 2020)

S. No.	District	AEZs with Percentage area	% geographical area under the zone
1	Abbottabad	All: Sub-Mountain Valleys	91%
		C: Valley Plains	9%
2	Bajaur	C: Valley Plains	62%
		All: Sub-Mountain Valleys	38%
3	Battagram	C: Valley Plains	77%
		BI: Sub-Humid Mountains	23%
4	Bannu	F: Desert Plains	54%
		DII: Semi-Arid Piedmont	33%
		C: Valley Plains	13%
5	Buner	All: Sub-Mountains Valley	93%
		BI: Sub-Humid Mountains	7%
6	Charsadda	C: Valley Plains	100%
7	Chitral	AI: High Dry Mountains	91%
		All: Sub-Mountain Valleys	9%
8	DI Khan	F: Desert Plains	90%
		C: Valley Plains	6%
		DII: Semi-Arid Piedmont	4%
9	Hangu	DII: Semi-Arid Piedmont	96%
		C: Valley Plains	3%
		E: Western Mountains	2%
10	Haripur	All: Sub Mountain Valleys	73%
		C: Valley Plains	27%
11	Karak	DI: Piedmont Plains	77%
		C: Valley Plains	23%
12	Khyber	DII: Semi-Arid Piedmont	61%
		E: Western Mountains	17%
		C: Valley Plains	13%
		DI: Piedmont Plains	9%
13	Kohat	DI: Piedmont Plains	85%
		C: Valley Plains	10%
		DII: Semi-Arid Piedmont	5%
14	Kurram	DII: Semi-Arid Piedmont	67%
		E: Western Mountains	15%
		All: Sub-Mountain Valleys	11%
		AI: High Dry Mountains	7%
15	Lakki Marwat	F: Desert Plains	87%
		DII: Semi-Arid Piedmont	10%
		C: Valley Plains	3%
16	Lower Dir	All: Sub-Mountain Valleys	74%
		C: Valley Plains	26%
17	Lower Kohistan	All: Sub-Mountain Valleys	93%
		BI: Sub-Humid Mountains	7%
18	Malakand	All: Sub-Mountain Valleys	65%
		C: Valley Plains	35%
19	Mansehra	BI: Sub-Humid Mountains	42%
		All: Sub-Mountain Valleys	37%
		C: Valley Plains	11%
		BII: Wet Mountains	10%
20	Mardan	C: Valley Plains	90%
		All: Sub-Mountain Valleys	6%
		BI: Sub-Humid Mountains	4%
21	Mohmand	All: Sub-Mountain Valleys	79%
22	Nowshera	C: Valley Plains	21%
23	Orakzai	C: Valley Plains	100%
		DII: Semi-Arid Piedmont	68%
		E: Western Mountains	21%
		C: Valley Plains	6%
24	Peshawar	All: Sub-Mountain Valleys	5%
		C: Valley Plains	83%
		DI: Piedmont Plains	17%
25	Shangla	All: Sub-Mountain Valleys	93%
		AI: High Dry Mountains	4%
		BI: Sub-Humid Mountains	3%
26	Swabi	C: Valley Plains	83%
		All: Sub Mountain Valleys	17%
27	Swat	AI: High Dry Mountains	50%
		All: Sub-Mountain Valleys	40%
		BI: Sub-Humid Mountains	10%
28	Tank	F: Desert Plains	56%
		DII: Semi-Arid Piedmont	26%
		C: Valley Plains	18%
29	Torghar	All: Sub-Mountain Valleys	97%
		BI: Sub-Humid Mountains	3%
30	Upper Dir	All: Sub-Mountain Valleys	58%
		AI: High Dry Mountains	42%
31	Upper Kohistan	AI: High Dry Mountains	47%
		BI: Sub-Humid Mountains	36%
		All: Sub-Mountain Valleys	17%
32	Waziristan North	DII: Semi-Arid Piedmont	51%
		E: Western Mountains	23%
		C: Valley Plains	14%
		All: Sub-Mountain valleys	12%
33	Waziristan South	DII: Semi-Arid Piedmont	53%
		E: Western Mountains	26%
		All: Sub-Mountain Valleys	21%

1.2 Impacts of Climate Change in KP

In Pakistan, the annual temperature has increased by around 0.5 °Cduring the last few decades[1], resulting in regular heat waves. Analysts predict a large increase in demand for irrigation water and domestic energy as a result of increased evaporation rates and regular usage of air conditioners, respectively. In terms of death toll, Pakistan recorded 174,000 deaths as a result of severe climatic events during 1995 - 2014. Pakistan, on the other hand, suffered a monetary loss of 26 billion US dollars during the same time period[2].

Climate Change has influenced KP like other regions of Pakistan. Climate Change has caused progressive changes in weather and food production patterns, as well as abrupt and disastrous weather catastrophes such as severe floods caused by high rainfall (2010, 2022), droughts caused by water scarcity and stress and extended heat waves. In KP, all of these disastrous events have resulted in the following changes:

1.2.1 Temperature Changes

According to IPCC AR-6, the entire planet has experienced an increase in surface temperature. This temperature change in KP has resulted in longer summers and shorter, milder winters, which has had a significant impact on the province's agricultural output. Furthermore, surface warming will increase the intensity of rainfall, posing a flood risk in the province combined with the increased rates of glacier melting in northern parts of the province, which are dominated by glaciers and sub-humid forest.

1.2.2 Precipitation Changes

There is a likelihood that precipitation events will become more erratic, intense and frequent. The mountainous parts of the province may become vulnerable to flash flooding. The floodplains (central valley plains and southern parts of the province), which have a considerable population and are the major hub of agricultural activity due to the alluvial soil, are likely to be affected by riverine floods. Intense rains may also cause soil erosion and nutrient depletion. Furthermore, drought events may also become frequent, and will affect the crop yield in the areas of average annual low rainfall.

1.2.3 Changes in Food Production

Changes in food production have the greatest impact on central valley plains and southern parts of the province because the majority of agricultural operations take place in these zones. Temperature fluctuations and rainfall events become more unpredictable as weather patterns change. As a result, changes in crop type and agricultural yield are seen. Temperature rise in the province's northern region may result in improved agricultural yields of rice, wheat, maize, vegetables and other crops. In the central and southern parts of the province, rising temperatures combined with a lack of water diminish crop productivity. Farmers are also subjected to frequent insect infestations because the warmer, humid climate encourages insect reproduction. These changes in food production, combined with natural disasters such as droughts and floods, have the potential to generate food security challenges in the province.

[1]Chaudhry, Q.U.Z., 2017. Climate Change profile of Pakistan. Asian Development Bank.
[2]TIU, 2014 Accessed at: https://www.academia.edu/35243533/CLIMATE_RISK_MANAGEMENT_FRAMEWORK_FOR_BUSINESS_ORGANIZATIONS_IN_PAKISTAN

1.2.4 Shifting Weather Patterns

The people, flora and fauna of KP may be severely impacted by the changing weather patterns, which include heavy rainfall and temperature rise. Warmer weather stimulates the growth of forest insects, which damages the trees. Droughts, on the other hand, have a comparable weakening impact. Temperature rise also encourages the spread of viruses and bacteria, posing health concerns to individuals, particularly those who consume polluted water. Moreover, droughts and floods play a significant part in the scarcity of potable drinking water.

1.2.5 Glacial Melting

The Hindu Kush Himalayan Range is dominated by glaciers throughout the year. Glacial Lake Outburst Floods (GLOFs) are one of the most serious hazards that affectthe mountain areas of the province. Higher temperatures and longer summers have led to rapid glacier melting. Normally, the spring season aids in the freezing process of glaciers because the temperature is lower. However, due to global warming and extremely short spring season, glaciers do not have enough time to freeze. As a result, glaciers melt at a faster rate throughout the summer. These glaciers are natural, huge reservoirs of fresh water that take many years to fill up.As a result, if glacier melting is not addressed appropriately, the province may face more GLOFs eventstogether with freshwater crisis.

1.2.6 Loss of Biodiversity

Climate Change is also a threat to diversity of species. There are approximately 100 endemic species in Pakistan, with 90 percent of theseare found in the province of KP. Several mammal species, seven bird species and twelve internationally endangered endemic and migratory birds live in the Himalayan range and sub humid forests of KP. As a result, mountain regions are more vulnerable to biodiversity loss as a result of Climate Change[3]. Furthermore, changes in precipitation and temperature patterns affect ecosystems, which provide habitat for numerous forest bird, mammals and insect species. Many plant species are unable to adapt to rapid Climate Changes. The same is true for mammals. Furthermore, changes in ecosystems can trigger changes in animal feeding patterns, weakening them and eventually leading to their extinction[4].

1.2.7 People and Society

Climate Change has an impact on how people live. People must devise policies and strategies that will not only minimize the effects of Climate Change but will also slow down the rate of Climate Change. Extreme weather events caused by Climate Change have a significant impact on human health, livelihood, infrastructure and culture. People are also displaced as a result of Climate Change due to the loss of infrastructure and livelihood.

[3]Ullha, H., Ahmad, Z.M., Manzoor, S.R., Hussain, M. and Farooq, M.A., 2012. Problems faced by women entrepreneurs in Kohat city of Khyber Pakhtunkhwa-Pakistan. International Journal of Human Resource Studies, 2(1), p.1.

[4]IPCC. (2014a). Climate Change 2014, Synthesis Report, Summary for policymakers. IPCC

2. SITUATION ANALYSIS

The following thread provides a brief summary of the situation analysis of the effects of Climate Change on various thematic groups, as well as strategies for translating National Climate Change Policy (NCCP) into Provincial Climate Change Policy (PCCP). The proposed actions are based on Climate Change policy, the competency of relevant government institutes and the resources available for their implementation.

2.1 Water Resources

In KP, water resources are used by domestic households, power generation facilities, industries and agriculture sector. Tarbela, Warsak and Dargai-Jaban dams are mainly responsible for the generation of hydro-electric power in the province. In KP, the surface water exists in the form of rivers, lakes, glaciers, streams, springs and precipitation whereas groundwater is found in aquifers and alluvial deposits. The uncontrolled dumping of chemicals in surface-water bodies, over extraction of groundwater, exploitation by water intensive manufacturing processes and increased pressure due to deforestation, agriculture, population growth.The impacts of Climate Change have further aggravated the water stress issues in the province. The availability of water in KP is anticipated to decline due to rise in water stress per capita and losses from reservoirs. Changes in precipitation and snowfall patterns as a result of Climate Change, have also contributed to increased demand on water resources.

Water stress will have a disproportionate impact on food security and agriculture in KP. The province of KP contains around 7.67 percent of Pakistan's total cultivable area and over half of this territory is dependent on rain-fed agriculture. As a result, a decline in water supplies might have a severe spillover effect not just in KP but also in adjacent provinces. These consequences will include forced relocation, economic losses and diminished activity in agriculture, livestock, industry and other domestic areas. Water resource management, on the other hand, can improve agricultural land revenue and alleviate water scarcity difficulties in the province.

2.2 Agriculture

The agriculture sector in KP is plagued by a variety of issues. Small farmers own about one-fifth of the cultivable land in the province. The strain on natural resources is increasing as a result of urbanization, the scarcity of uncultivated land and the ineffectiveness of the existing irrigation system. The province is highly dependent on the import of various products from other provinces, including wheat. The crop production is low because the fertilizer and seed quality is substandard. Approximately 20% of cultivable land is uncultivated and a large portion of this uncultivated land is prone to land degradation (water logging and salinity), urbanization and inefficient water usage.The use of fertilizers and pesticides should not be excessive in order to increase agricultural productivity. Farmers frequently use pesticides in excess of their permitted limits due to lack of regulation and awareness and they often utilize chemicals that are forbidden in the international market. The institutional capacity of the KP government's departments and research is inadequate. Other issues confronting the agriculture sector include a lack of economic incentives and financial structures for farmers and weak market mechanisms, which needs improvement.

2.3 Livestock

Rangelands and livestock in KP complement each other and consequently play an important role in the rural economy. The majority of the livestock are cows, goats and sheep, however there are donkeys, buffaloes, horses, mules and yaks. Domestic poultry is also employed for egg and protein production. Transhumance livestock farming is also practiced at higher altitudes, in which households keep a primary home at lower elevations where they live along with their animals for a specific period (mostly seven months). During the winter and early spring months, when livestock feeds on hay, straw and dry alfalfa, problems develop owing to a severe lack of fodder availability.Due to the low nutritional value of dry grass, livestock become weaker and malnourished during this time. During the summer, the animals gain optimal weight because they are fed on fresh grass and shrubs by taking them to grazing lands and alpine pastures. This annual cycle of under-nourishment and over-nourishment in animals is a primary cause of low milk, meat and wool production, as well as low animal immunity to viral and bacterial infections. The provision of veterinary services is a challenge, hampered by a lack of staff, equipment, drugs and farmer awareness, as well as seasonal relocation of animals to inaccessible locations.

2.4 Fisheries

The majority of the fish are found in rivers, natural ponds and lakes. The fishery department also operates hatcheries, where trout fish are primarily cultured in ponds. The fishery department is also in-charge of providing extension services to both public and private fish farming operations. Fishing (especially trout fishing) is largely a recreational and sporting activity. The region is home to both exotic and indigenous fish species. Trout fish, as a bio-indicator of aquatic ecosystem, is sensitive to changes in water temperature, turbidity, water quantity, dissolved oxygen and geological aspects of the water body. It is harmed by rising temperatures, varying turbidity levels and contaminants in the water body.Climate Change causes variations in the flow of water in rivers and other bodies of water, which has a direct impact on the fisheries sector.

2.5 Forestry

According to the Planning and Development Department Govt. of KP, the forest cover provides a source of income for many people in Pakistan. This sector requires a lot of labor and it has a lot of potential for generating income and alleviating poverty. Aside from being a source of income, forests also serve as a home for a variety of species. Climate Change has an impact on forests both directly and indirectly. Climate Change affects not just forest production and growth, but it is also associated with an increase in the number of forest disturbances. Carbon dioxide levels in the atmosphere, precipitation and temperature are all important factors influencing forest productivity.Storms, droughts and decreased tree health are some of the forest disturbances that influence forest productivity and tree species distribution. Due to lack of preventive techniques for improving forest health, valuable goods and services derived from forest ecosystems may be lost. Non-Timber Forest Produce (NTFP) is a vital source of revenue for forest inhabitants, providing a variety of fodders, resins, medicinal plants, honey, Mazri leaves and gums. Over exploitation of forests and Climate Change have significantly influenced KP's forest sector. As a result, restoration of damaged natural forests, watershed

sources and pasturelands in the province must be prioritized. Furthermore, supporting the NTFP ensures an improvement in livelihood and a reduction in poverty[5].

2.6 Wildlife and Biodiversity

KP is home to a rich diversity of animal and plant species, including snow leopards, brown bears and eagles, all of which are possibly threatened by extreme climate events. Aside from that, the region is rich in agro-diversity, having varieties of fruit and a diverse range of indigenous livestock. More than half of the region is protected to safeguard endangered species, but they continue to be threatened for a variety of causes, including over-exploitation of medicinal plants and habitat loss.

To address these issues, in-situ biodiversity conservationmust be strengthened by improving the management of existing protected areas and developing collaborative management regimes incorporating coordination mechanisms between government and communities. Outside of protected areas, establishing village-based and sustainable-use programs will be extremely beneficial.

The destruction of habitats as a result of the effects of Climate Change is one of the risks to biodiversity in the region. Because of rising temperatures, the snowline is migrating up the mountains and glaciers are disappearing; this phenomenon has major implications for biodiversity found at high altitudes. The impacts of Climate Change on environmental processes and compartments are complicated and the subsequent implications must be investigated in order to comprehend the effects on wildlife and biodiversity.

2.7 Vulnerable Ecosystem

Ecosystems play a critical role in supplying valued goods and environmental services that are required for economic and social well-being. Natural habitats in KP are degrading as a result of anthropogenic activities and the effects of Climate Change are becoming more severe. Because of the rise in glacier melt and extreme weather events, the province is prone to flash floods. Agro-biodiversity has suffered badly as a result of widespread usage of agrochemicals and the introduction of high-yielding variants of food and cash crops. Terrestrial ecosystems, on the other hand, face risks from deforestation and overgrazing as a result of poverty and rising population.

2.8 Disaster Preparedness

Due to the topographical and geographical condition of the province, KP is subject to multiple and frequent disasters of various types, primarily floods, droughts, heat waves, wildfire and locust attacks etc. As a result of Climate Change, the likelihood of extreme weather events has increased. According to data compiled by the Federal Flood Commission (2016)[6], the combined flow of the Swat and Kabul rivers reached a new record level of 400,000 cusecs, compared to the previous count of 250,000 cusecs recorded in 1929. The increased frequency of flash floods and floods is anticipated to result in surface runoff, avalanches, riverbank cuttings, soil erosion and landslides, causing damage to properties, roads, houses and

[5]KHYBER PAKHTUNKHWA CLIMATE CHANGE POLICY (Final Draft). Accessed at: http://kp.gov.pk/uploads/2016/11/Final_Climate_Change_Policy_for_KP_Province_2017_WebSec_Comments.pdf

[6]Annual Flood report-2016. Accessed at: https://mowr.gov.pk/wp-content/uploads/2018/06/Annual-Flood-Report-2016.pdf

agricultural fields. The recent floods witnessed in the month of August 2022, inundated crops, demolished infrastructure and resulted in mass migration/displacement across the province.

2.9 Public Health

Public health is defined as the protection and improvement of community health facilities via education, policy development and research for illness and injury prevention. Quality healthcare delivery is the base upon which any region's development can be exponentially accelerated. The primary healthcare system is facing challenges in terms of preventive and curative health care particularly in the rural areas. There are someissues with regards to availability of health care facilities, trained human resources and medical equipment coupled with flawed referral system.

The influence of Climate Change on human health is determined by sensitivity, coping capacity and exposure. Disease prevalence is projected to climb as temperatures rise and natural catastrophes become more common, primarily due to water-borne diseases (diarrhea) and vector-borne diseases (dengue/malaria). Climate Change consequences are expected to increase the intensity, frequency and severity of respiratory ailments, eye infections, gastrointestinal disorders, malaria, skin infections, heat strokes and mortality. Furthermore, droughts, floods and storms compel people to migrate to metropolitan areas, which can lead to an increase in disease transmission in densely populated areas, water and sanitation problems and a shortage of housing facilities.The province already has high maternal, child and infant mortality rates, as well as inadequate health services and infrastructure and if these issues are not handled appropriately, the effects of Climate Change will exacerbate these challenges.

2.10 Socio-Economic Measures

Climate conditions are thought to have a significant impact on economic growth and, as a result, contribute to poverty. Climate Change impacts not only challenge the population's current socioeconomic capacity, but also the drivers of Climate Change are attributable to the socioeconomic vulnerabilities of poor people.

The percentage of people living in poverty in KP is predicted to be 39 percent, which is substantially higher than the national average. Poverty is concentrated in rural areas, where more than 80% of the population of KP lives. A considerable fraction of the population lives at or near the poverty level and their vulnerability increases in the case of a natural disaster. An internal or external crisis, particularly the effects of Climate Change, could push these people even further into poverty[7].

Due to the significant social and economic implications of Climate Change, achieving sustainable development in the country will be challenging in the absence of a comprehensive and efficient Climate Change response plan. In recent years, Pakistan has endured devastating drought and flood catastrophes, resulting in a high death toll, forced relocation and damage to infrastructure and public livelihoods. The agricultural sector was not immune to the consequences of these catastrophic events, which resulted in low crop production, disease, food insecurity, poverty and socioeconomic disadvantage.Damage to the agricultural sector has a serious impact on women's livelihoods, as women make up more than half of

[7] KHYBER PAKHTUNKHWA CLIMATE CHANGE POLICY (Final Draft). Accessed at: http://kp.gov.pk/uploads/2016/11/Final_Climate_Change_Policy_for_KP_Province_2017_WebSec_Comments.pdf

farm work. Women work in livestock raising, fishing, horticulture etc. In addition, women participate in other domestic duties such as collecting firewood, water and fodder. Global warming has increased the water, fodder and firewood issue, resulting in an increase in the workload, time and engagement of women in doing these duties, increasing their vulnerability to severe weather conditions.

2.11 Youth and Gender Development

Pakistan is one of the world's youngest countries. It currently possesses the highest generation of young people in national history; 68 percent of Pakistanis are under the age of 30 and 27 percent are between the ages of 15 and 29[8]. As young people constitute the largest segment of society, they may play an important role as agents of change in the country's growth and the fight against Climate Change.

When compared to their male counterparts, Pakistani women are often at a disadvantage. Women have limited access to opportunities and resources, particularly in rural areas. For example, the child enrolment rate of female students in elementary schools in urban regions is higher than in rural areas and it nearly matches the rate of male child enrolment. Similarly, 21 percent of the female population, compared to 18 percent of the male population, has less than a primary level of education. Women's labor-force involvement has increased significantly in recent years. The agricultural sector employs 72 percent of women. Aside from agriculture, women's engagement in electronics, knitting, textiles and other informal sectors has expanded.

In terms of its implications and mitigation techniques, Climate Change is inextricably linked to several other challenges. Because of the cross-cutting impacts ofClimate Change, the Climate Change response strategy cannot be addressed in isolation. Climate Change adaptation and mitigation measures should be included in all developmental programs and provincial policies. Furthermore, gender inclusive programs should be incorporated into Climate ChangePolicy while taking into account women's susceptibility, gender inequality and the various effects of Climate Change on the marginalized segments of the society.

2.12 Energy

The energy sector in KP province is critical because it is responsible for supplying electricity to the entire country through its hydro-power units. The other provinces of Pakistan have low primary energy resources, which is exacerbated by a lack of prospective sites for hydropower generation. Due to rising population, industry andurbanization in recent years, the gap between electricity demand and generation has grown, resulting in energy crisis. Due to the increased demand for air conditioning as a result of global warming, Pakistan's electricity demand has been increased to 40,000 Megawatts by 2020[9].

2.13 Industry

The industries of KP play an essential role in improving the province's and country's financial condition. The industrial sector accounts for 13.5 percent of total provincial GDP and is a

[8] Pakistan National Human Development Report-2017. Accessed at https://www.pk.undp.org/content/pakistan/en/home/library/human-development-reports/PKNHDR.html

[9]Pakistan Water and Power Development Authority (WAPDA) cited in Economic Survey 2014-2015 by Ministry of Finance.

source of creating employment and providing basic necessities[10]. Aside from that, KP has a large agricultural industry that produces a range of products such as wheat flour, sugar, tobacco, vegetable ghee, and tea. In addition, the sector accounts for 78 percent of national marble output, 27 percent of cement production and 20 percent of mining operations. In 2015, the province had around 12,000 small, medium and large industrial establishments, of which 1,821 were operational and registered with the Directorate of Industries, KP[11]. Currently, the industrial sector is confronted with numerous challenges, including a lack of infrastructure and a power constraint. The effects of Climate Change exacerbate the problems linked with the industrial sector.

2.14 Transport

The transport industry is responsible for the country's economic development because it accounts for 10% of total national GDP and accounts for 11% of economic activity in KP[12]. The transportation sector, in addition to contributing to the economy, is a major generator of GHG emissions. The government of KP has formed an independent transport department to oversee transportation development and the implementation of the Comprehensive Development Strategy 2010-2017.

Globally, energy consumption in the transportation sector accounts for around 25% of GHG emissions. The majority of these emissions are linked to vehicle transportation. These road transportation emissions are expected to reach 90.17 gigatons of CO_2 by 2030[13]. In KP, more than 96% of people and 90% of freight travel by road. When compared to overall economic development, demand for road transportation has increased at a far faster rate. On the contrary, the majority of people use private transportation. There is an urgent need for the Government of KP to investigate alternative modes of transportation and ways to improve the existing transportation sector, such as the Peshawar BRT project and introduction of Electric Vehicles.

2.15 Waste

The quality and range of waste management services in KP confront challenges. Municipal solid waste is improperly disposed off and ends up in streets and public places. This causes a slew of issues, including environmental deterioration, water pollution, toxicity exposure and air pollution. Wastewater from homes, businesses and industries is released untreated, polluting the land, fresh water and ground water. Industrial activity emits toxic gases into the environment, resulting in air pollution.

Deficient planning, execution and urban sprawl have compounded KP's existing waste management challenges. Lack of funding, technical capacity andinadequate public sector investments impede the province's waste management networks' maintenance.

[10] Khyber Pakhtunkhwa Board of Investment and Trade [Investment Guide]. Khyber Pakhtunkhwa the Unrevealed Story
[11] Bureau of Statistics (2015). Khyber Pakhtunkhwa in Figures 2015
[12] Government of Khyber Pakhtunkhwa (2009), Comprehensive Development Strategy 2010 - 2017
[13] Sánchez-Triana, Ernesto; Afzal, Javaid; Biller, Dan; Malik, Sohail. 2013. Greening Growth in Pakistan through Transport Sector Reforms: Strategic Environmental, Poverty, and Social Assessment. Washington, DC: World Bank

2.16 Urban Planning

Urban planning is critical since the province's pace of migration, both from rural to urban and urban to urban, is expected to rise. The KP government is searching for ways to increase the accessibility of public services including as water, drainage, sanitation, public infrastructure and streets throughout the province's 22 metropolitan regions. Urban management and spatial planning can help to mitigate environmental consequences. Unplanned urban expansion, on the other hand, will result in greater environmental deterioration in urban areas, such as water scarcity, energy crisis, air pollution and social problems like violence and crime. Furthermore, Environmental Impact Assessments (EIAs) must be completed prior to the administration of urban lands, spatial planning and road network building. To achieve the goals of effective urban land planning, the Government of KP has initiated a number of projects, including the Community Infrastructure Program (CIP II), the Rural Water Supply and Sanitation Project (RWSSP) and the Provincial Urban Development Project.

3. ACTION PLAN

The province of KP is in the phase of formulation of policy and legal tools needed to link itself to the global paradigm of SDGs. The 18th amendment empowers the federating units to chalk out their policies and enact the legislative tools to assist the province in developing and executing Disaster Risk Reduction (DRR) and climate change mitigation strategies. The policy in hand is an endeavor on the part of the provincial government to overcome the disaster caused by the climate change through adaptation and mitigation strategies in line with the National Climate Change Policy 2021. These legislative tools and policies will ensure that climate action is mainstreamed into developmental planning and management, particularly for socially and economically vulnerable communities.

This action plan exhibited with the Policy outlines the strategies and measures that will be implemented for the designated sectors in order to incorporate NCCP 2021 into PCCP 2022. The actions are grouped into categories based on the NCCP Framework's objectives as:

Priority Actions: within 2-years,

Short term Actions: within 5-years,

Medium term Actions: within 10-years and

Long term Actions: within 20-years.

3.1 Climate ChangeAdaptation and Mitigation Measures

3.1.1 Agriculture

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 1.1: Developing a risk management system to provide protection against crop failures caused by extreme climate events such as floods and droughts

Actions	Priority	Implementing Partners
1. Establish a surveillance system for agricultural production in various arid, semi-arid and other susceptible locations to categorize them based on their vulnerability to extreme Climate Change events	Priority	Agriculture Department including Research Institutions
2. Involve farmers in the process of identifying local risks and devising safeguards	Priority	Same as above
3. Develop and commercialize drought and heat resistant crops based on research	Short-term	Agriculture universities in the province, Agriculture Research Institutions, Agriculture Department

Strategy 1.2: Preventing the conversion of fertile agricultural land to non-agricultural uses

1. Enact legislation to discourage the indiscriminate conversion of agricultural land for urban development	Short-term	LG&RDD, Agriculture Department, FE&WD
2. Conduct awareness campaigns for farmers and other stakeholders about the safe and efficient use of agricultural land	Priority	Same as above

Strategy 1.3: Encouraging farmers, particularly in rain-fed areas, to avoid monoculture and cultivate a diverse range of heat and drought-resistant crops to prevent crop failure

1. Identify susceptible locations within rain-fed agriculture systems that are prone to increased crop failure due to heat and drought	Priority	Agriculture Department and Universities
2. Transform the local market and agricultural extension system to accommodate changes in cropping patterns in rain-fed areas	Short-term	Same as above
3. Promote and introduce short rotation crops and hybrid maize	Short-term	Agriculture Department and Agriculture Universities

Strategy 1.4: Encourage farmers to adopt agricultural drought management strategies as part of a highly variable climate, rather than as an unusual natural disaster

1. Cultivate and introduce drought-tolerant crops	Short-term	Agriculture Department, Agriculture Research Institutions
2. Involve the farming community in managing recurring droughts caused by climatic variations	Medium-term	Agriculture Department, RR&SD
3. Provide incentives for the reuse of domestic and sewage water for kitchen gardening	Short-term	Agriculture Department, FE&WD
4. Identify the agricultural areas that are prone to drought	Priority	Agriculture Department, RR&SD, FE&WD

Strategy 1.5: Ensure an enabling financial environment for farmers to invest in and implement necessary technology to address climate-related challenges

1. Improve existing financial services for farmers in order to accommodate the technical innovation required owing to anticipated Climate Change-related droughts	Medium-term	Agriculture Department and Universities

2. Develop institutions that educate farmers about available funds for technology, equipment and new crops that will be required in their regions as a result of Climate Change scenarios	Short-term	Agriculture Department, FE&WD
3. Reduce taxes on all agricultural activity and tree plantation	Short-term	Agriculture Department, Finance Department

Strategy 1.6: Improving crop yield by improving the efficiency of various agricultural inputs, particularly irrigation water input

1. Investigate novel cropping patterns to improve agricultural yield under water-stressed conditions	Short-term	Agriculture Department
2. Encourage community participation in the sustainable management of irrigation water and the rehabilitation of field water courses	Short-term	Irrigation Department, Agriculture Department, CSOs
3. Discourage the use of traditional flood irrigation practices	Medium-term	Same as above
4. Encourage contour farming in mountainous regions	Short-term	Irrigation Department, Agriculture Department

Strategy 1.7: Conservation of water and energy through efficient farming techniques and field mechanization

1. Encourage the use of low delta crop varieties	Priority	Irrigation Department, Agriculture Department
2. Ensure the systematic mechanization of agricultural production processes based on energy-efficient equipment	Medium-term	Agriculture Department, Finance Department
3. Invest in tools and equipment that boost yields while saving labor force for processing and other farming operations	Medium-term	Same as above
4. Adopting regenerative agriculture	Priority	Agriculture Department
5. Encourage use of raised bed agriculture	Priority	Same as above

Strategy 1.8: Adopting modern farming techniques to improve farm practices		
1. Develop and implement advanced and innovative farming techniques	Medium-term	Agriculture Department.
2. Introduce the intercropping system (also known as ally cropping) and soil conservation practices	Short-term	Same as above
Strategy 1.9: Promoting organic and urban farming		
1. Promote kitchen gardening, climate green agriculture, roof-top farming and vertical farming	Priority	LG&RDD,Agriculture Department
Strategy 1.10: Promoting biotechnology in terms of more carbon-responsive crops through genetic engineering and other relevant domains		
1. Develop the capacity of relevant provincial institutions for the introduction of carbon-responsive plants and crops	Short-term	P&DD, FE&WD, Agriculture Department
2. Improve infrastructure to absorb biotechnology and genetic engineering for crops in order to improve varieties and make them drought resistant	Medium-term	Agriculture Department, Universities
3. Strengthen and promote agriculture based research activities in KP through cross-sectorial actions	Priority	Agriculture Department, FE&WD Universities
Strategy 1.11: Promoting horizontal extension of cultivated fields through wasteland development and rainwater harvesting with the participation of local communities		
1. Develop scientific skills in order to locate cultivable wastelands in the province	Short-term	Agriculture Department, Irrigation, FE&WD
2. Educate local communities on how to harvest rainwater in small ponds, storage tanks, sunken fields and reservoirs	Priority	P&DD, LG&RDD, Irrigation, Agriculture Department

3. Enact legislation to discourage the conversion of agricultural areas to non-agricultural uses	Priority	LG&RDD, Agriculture Department, FE&WD
4. Raise funds for the development of irrigation and rainwater dam infrastructure	Medium-term	Finance Department, P&DD, Irrigation Department

Strategy 1.12: Developing a smart agriculture plan and models to assess the impacts of Climate Change on agricultural production systems across all agro-ecological zones

1. Formulate a climate-smart agriculture plan for KP	Priority	Agriculture DepartmentFE&WD
2. Enhance institutional capacity to create digital simulation models of Climate Change impact on present and future agricultural productivity	Short-term	Same as above
3. Conduct an assessment of the effects of Climate Change on the physical, chemical, nutritional and biological elements of agricultural production systems across all agro-ecological zones	Priority	Same as above
4. Conduct a detailed evaluation of the existing agricultural product system and provide recommendations for increasing productivity	Priority	Same as above
5. Assist the relevant agriculture and livestock research programs at provincial research institutions and universities	Short-term	P&DD, Finance Department, Agriculture Department

Strategy 1.13: Developing high-quality datasets on crop, soil and climate-related characteristics to aid in Climate Change impact assessment and productivity projection studies

1. Strengthen the capacity of the Bureau of Statistics and allied departments to collect data on crop, soil and climate-related characteristics for various aspects of agricultural production systems in all agro-ecological zones	Short-term	Finance Department, P&DD, Agriculture Department, FE&WD

2. Improve research facilities at selected agricultural research institutions for assessing the impact of Climate Change and projecting agricultural productivity	Short-term	Agriculture Department, Agriculture Research Institutions, Universities

Strategy 1.14: Establishing Climate Change Units in agriculture research organizations to develop adaptation strategies for Climate Change impacts on agriculture

1. Establish Climate Change units or centers at agricultural research institutions	Short-term	Agriculture Department, Agriculture Research Institutions
2. Establish meteorological and crop information hubs	Priority	Agriculture Department, RR&SD, FE&WD
3. Involve farmers in policy development and strategic dialogues	Priority	Local Government Department

Strategy 1.15: Improving the extension system to allow for more effective and timely communication of weather, climatic predictions and appropriate agro-advices

1. Establish communication hubs at the village and Tehsil levels for the translation of weather and climatic information into local language for the farming community	Priority	Mass Media
2. Establish an effective communication mechanism between farmers and Government Departments by developing an efficient agriculture extension system	Short-term	Agriculture Department, Information Department

Strategy 1.16: Selection of suitable crops on steep slopes

1. Avoid water intensive crops to avoid degradation of slopes	Priority	Agriculture Department

Strategy 1.17: Gender inclusiveness farming and awareness

1. Promote gender inclusive plantation and nurseries	Priority	Forest Department, Agriculture Department, Civil Society
2. Gender awareness regarding storage and use of pesticides, herbicides, insecticides, seeds and crops	Priority	Agriculture Department, FE&WD, Civil Society

Mitigation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 1.18: Reducing greenhouse gas emissions in the agriculture sector through better management and techniques

Actions	Priority	Implementing Partners
1. Establish Integrated Pest Management (IPM) that initially utilizes the indigenous solutions to prevent the pest attacks	Short-term	Agriculture Department
2. Develop and communicate best management methods for methane and nitrogen management in agriculture	Priority	Same as above
3. Encourage the optimum use of chemical fertilizer and pesticides to achieve mitigation objectives	Short-term	Same as above
4. Organize pest management training sessions for farmers	Short-term	Same as above
5. Develop optimum tillage and soil management practices that increase soil carbon storage	Short-term	Same as above
6. Introduce rice and sugarcane varieties that are low water dependent	Priority	Agriculture Department, Universities
7. Encourage the use of green manure in agriculture	Priority	Agriculture Department

8. Identify and encourage improved manure storage and management practices	Priority	Same as above
9. Increase energy efficiency in agriculture sector to reduce carbon emissions	Short-term	Same as above
10. Grow bio-fuel crops on a modest pilot scale to assess their viability	Priority	Same as above
Strategy 1.19: Developing a climate model to predict the impact of Climate Change on agricultural activities at the local level		
1. Strengthen institutional capacity of relevant organizations to develop climate models in order to generate future climate projections	Priority	Finance Department, P&DDD, FE&WD, AgricultureDepartment
2. Down scale the output of regional climate models to a scale appropriate for farmers and local planners	Short-term	Same as above
3. Use these Climate Change scenarios for informed agricultural decision-making	Priority	FE&WD, Agriculture Department
Strategy 1.20: Tax relaxation for agricultural sector		
1. Reduce taxes for any kind of agricultural activities and plantation of trees	Priority	Finance Department, FE&WD, Agriculture Department

3.1.2 Livestock

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 2.1: Ensuring the access of livestock to high-quality feed and fodder to supplement their grazing in the rangelands

Actions	Priority	Implementing Partners
1. Classify the fodder production quality and grazing potential of rangelands in the province	Short-term	FE&WD, Agriculture Department
2. Develop an effective transportation system from feedstock regions to farm areas in order to supply these livestock feed and fodder supplement products	Short-term	Agriculture Department
3. Reduce livestock impact on vegetation and crops considering expected Climate Change challenges	Short-term	Same as above

Strategy 2.2: Promoting biotechnology in terms of improving livestock breeds and production through genetic engineering and other relevant fields

1. Establish biotechnology labs in the livestock sector	Short-term	Agriculture Department
2. Improve infrastructure to allow for the adoption of biotechnology and genetic engineering for livestock in order to improve types and breeds and make them drought resistant	Medium-term	Same as above
3. Establish vaccination facilities for viral diseases in livestock induced by Climate Change	Priority	Same as above

Strategy 2.3: Developing and introducing improved livestock breeds that are more productive and less vulnerable to the unavoidable impacts of Climate Change

1. Enhance veterinary facilities at the local level in order to prepare for potential livestock epidemics	Priority	Agriculture Department
2. Develop capacity to use "Embryo Transfer Technology" to improve livestock reproduction	Priority	Same as above

3. Conduct research on producing new livestock breeds that are less susceptible to heat stress and more drought tolerant	Medium-term	Same as above

Strategy 2.4: Improving the nutritional quality of livestock feed

1. Improve livestock feed quality by producing supplements of Multi-Nutrient Blocks (MNB) from urea, molasses, vitamins and minerals	Priority	Agriculture Department
2. Supervision of livestock feed and fodder production enhancement activities	Short-term	Agriculture Department, Universities
3. Encourage and support farmers in developing cost-effective livestock feed using "Silage Making" procedures and "Urea Treatment" of low-quality maize, rice and wheat roughages	Priority	Agriculture Department
4. Develop and improve rangelands with community involvement	Short-term	AgricultureDepartment, FE&WD

Strategy 2.5: Promoting feed conservation measures and fodder banks in arable areas

1. Adopt innovative technology to boost livestock production in the arable areas of the province	Medium-term	Agriculture Department
2. Involve the business community in the promotion of feed conservation measures and fodder banks for the dairy and poultry sectors	Short-term	Same as above

Mitigation measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 2.6: Reducing greenhouse gas emissions in the livestock sector through better management and techniques

Actions	Priority	Implementing Partners
1. Develop and communicate best management techniques for methane and nitrogen management in the livestock sector	Priority	Agriculture Department

2. Develop an efficient biogas and manure digester for methane reduction and energy production	Short-term	Same as above
3. Develop and introduce appropriate feedstock mixes and additives to reduce methane production from livestock enteric fermentation/digestion	Short-term	Same as above

3.1.3 Forestry Sector

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 3.1: Addressing the essential knowledge gap about the impact of Climate Change on KP forests through forest adaptation research

Actions	Priority	Implementing Partners
1. Conduct 'forest ecosystem' based research and identify ecosystems with high and low resilience to Climate Change	Short-term	P&DD, FE&WD
2. Promote research studies on the responses of different forest types to rising temperatures and drought spells	Short-term	Same as above
3. Conduct forest pathology and entomology studies in sensitive forest types/areas to control insect and disease outbreaks	Short-term	FE&WD
4. Conduct research on forest management systems to explore new tools and adaption strategies for managing forest areas in the wake of Climate Change	Medium-term	Same as above
5. Develop an effective 'Risk Management Framework', including research findings	Medium-term	Same as above

Strategy 3.2: Taking suitable actions to adapt to the anticipated adverse impacts of Climate Change and strengthen the ecological resilience of forest ecosystems

1. Implement forest protection measures to minimize the damage caused by forest fires	Priority	FE&WD, RR&SD
2. Encourage the use of native and locally adapted flora	Priority	FE&WD
3. Identify suitable forest management strategies based on scientific studies to address the probable implications caused by Climate Change	Medium-term	Same as above

4. Increase forest cover in uphill watershed areas through rapid afforestation and reforestation initiatives in response to increased rainfall intensity and flood risks	Priority	Same as above
5. Promote the use of GIS/RS techniques in mapping Climate Change vulnerable forests, as well as in monitoring and implementing ecosystem-based adaptation	Priority	FE&WD, P&DD
Strategy 3.3: Promoting best practices of Sustainable Forest Management (SFM) through the development of appropriate Criteria and Indicators (C&I) to secure the social and environmental values and services provided by forests		
1. Develop and implement criteria and indicators that clearly define SFM; provide manuals and guidelines to track progress towards it	Short-term	FE&WD
2. Formulate and implement appropriate forest legislation, regulation and incentives to encourage sustainable forest management	Medium-term	Same as above
3. Promote the exchange of best practices and experiences, particularly among forest communities and civil society organizations, through networking, workshops, seminars and exposure visits	Priority	FE&WD, CSOs
4. Launch specific projects and programs to promote the sustainable use of non-timber forest produce (NTFP) with community engagement, with a special focus on livelihood improvement	Priority	FE&WD
5. Incorporate land use planning and community participation in forest land management	Priority	Same as above
6. Strengthening and reorganizing Forest Department to establish manageable forest management units	Medium-term	Same as above
7. Take proper measures to prevent forest encroachment	Priority	Same as above
8. Emphasize on 'self-sustenance' in the use of forest resources for local communities	Short-term	Same as above

Strategy 3.4: Raising awareness among the general public, forest communities and enhance capacities of forest experts about forestry and Climate Change adaptation

1. Develop joint programs in collaboration with civil society to highlight the role of forests in combating Climate Change, particularly among forest-dependentcommunities and students	Priority	FE&WD
2. Promoting faith-based awareness campaigns	Priority	FE&WD, CSOs
3. Establish 'Communication' wings in the relevant departments	Short-term	FE&WD
4. Conduct public opinion polls on a regular basis to assess public understanding of forestry's role in combating Climate Change	Short-term	FE&WD, Information Department
5. Create and promote 'Forest and Climate' expert groups to disseminate new ideas and information to the public, forest communities and professional foresters based on the latest forestry and Climate Change research	Short-term	Same as above
6. Promote the role of forestry in combating Climate Change by participation in appropriate government, sectorial and cross-sectorial forums	Priority	FE&WD, P&DD
7. Formulate and implement curricula on forest ecosystems, biodiversity and their relevance to Climate Change at all levels of education	Short-term	FE&WD, HED, E&SED

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 3.5: Enhancing the capacity of Forest Department and other stakeholders for the effective development and implementation of innovative mechanisms aimed at preventing deforestation and increasing forest carbon stocks

Actions	Priority	Implementing Partners
1. Set up institutional and legislative frameworks to clearly define the rights to carbon stored in forests	Short-term	FE&WD
2. Develop a strategy for establishing a regulatory, governance and legal framework for REDD+[14] mechanisms in consultation with all stakeholders, including communities that rely on forests for their livelihood	Short-term	Same as above
3. Enhance the capacity of Forest Department officials in "Reduced Impact Logging" (RIL) to limit damages to forest trees and soil, thereby saving future carbon stocks	Short-term	Same as above
4. Arrange trainings for expert foresters and officials from FEWD on preparing paperwork for CDM[15] and REDD+ projects	Priority	Same as above
5. Make Climate Change a mandatory part of the forestry education system, with a focus on understanding the principles of REDD+ and CDM mechanisms	Short-term	FE&WD, HED, E&SED

Strategy 3.6: Developing and implementing strategies to prevent deforestation, reduce carbon emissions and improve forests' ability to sequester more emissions from the atmosphere

1. Pursue major afforestation and reforestation efforts to increase forest cover in the province and establish forest areas as effective carbon sinks	Priority	FE&WD
2. Encourage low delta plants along canal systems	Priority	FE&WD, Irrigation Department

[14] REDD+: Reducing Emissions from Deforestation and ForestDegradation
[15] CDM: Clean Development Mechanism

3. Strongly promote farm forestry and agro-forestry practices through the plantation of multipurpose and fast-growing tree species to meet the local population's demand for fuel, timber and livestock feed	Priority	FE&WD, Agriculture Department
4. Develop effective strategies to prevent illegal forest cutting and effectively implement such measures in all forest types throughout the province	Medium-term	FE&WD
5. Launch projects and programs to provide alternative fuel and livelihood options for forest-dependent communities in order to compensate avoiding deforestation	Priority	Same as above
Strategy 3.7: Creating effective mechanisms to track the progress from the start and throughout the implementation of the recommended actions		
1. Create and maintain a suitable Climate Change and forestry monitoring framework for the forestry sector	Short-term	FE&WD
2. Assess the proposed MRV[16] system at regular intervals to see if emission reductions as part of the REDD+ process are progressing	Medium-term	Same as above
3. Publish annual progress reports and share with the Ministry of Climate Change (MoCC)	Short-term	Same as above

[16] MRV: Monitoring, Reporting and Verification

3.1.4 Urban Planning

Adaptation and Mitigation Measures

The following proposed adaptation and mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 4.1: Updating town planning design principles for a lower carbon footprint

Actions	Priority	Implementing Partners
1. Conduct research to determine the future expansion requirements of current municipalities	Short-term	LGE&RDD,P&DD, FE&WD
2. Determine the fuel and energy requirements of growing cities	Short-term	LGE&RDD, P&DD, FE&WD, Transport Department
3. Undertake the emission profiles of key urban areas	Short-term	LGE&RDD, P&DD, FE&WD, Transport Department, Industries Department
4. Upgrade existing public-sector buildings to minimize energy demand and urge private property owners to do the same	Short-term	LGE&RDD, FE&WD
5. Provide alternative and low-emission fuels for heating and energy in the new settlements and suburbs	Medium-term	Energy and Power Department
6. Develop and implement Energy Efficiency and Conservation Codes for buildings	Short-term	LGE&RDD, P&DD
7. Convert tall buildings to solar radiation receptors, where possible, by installing solar panels and making them energy self-sufficient	Medium-term	Energy and Power Department
8. Design transportation corridors for fast and efficient urban mobility	Medium-term	Transport and Mass Transit Department
9. Promote low-energy lifestyles, adaptations	Priority	Energy and Power Department, CSOs

10. Modify building codes to guarantee that all new buildings are built with designs that are suitable for the local climate	Priority	LGE&RDD
Strategy 4.2: Providing infrastructure and support facilities in smaller agro-based towns and peri-urban areas to reduce rural-to-urban migration		
1. Develop small agro-based townships in rural areas with modern amenities to discourage rural-to-urban migration	Short-term	LGE&RDD, FE&WD, P&DD
2. Establish industrial estates and large-scale agricultural farms to provide rural residents with job opportunities in their vicinity	Medium-term	KPEZDMC, FE&WD, P&DD, Industries Department, Agriculture Department
Strategy 4.3: Promoting proper "Land Use Planning" and vertical expansion of urban housing projects rather than horizontal expansion		
1. Develop Land Use plan at provincial level	Priority	LGE&RDD, FE&WD, P&DD
2. Increase the density of town centers and suburbs near popular business and commercial areas	Medium-term	Same as above
3. Construct planned high-density communities near parks, gardens and nature reserves	Medium-term	LGE&RDD
Strategy 4.4: Undertaking hazard mapping and zoning of areas prior to construction		
1. Any new township location should be subject to required geological and seismic surveys	Short-term	LGE&RDD, FE&WD
2. Limit the growth of existing towns and construction in environmentally sensitive areas	Short-term	Same as above
3. Formulation of a Vulnerability-Index for the province's urban areas	Short-term	Same as above

Strategy 4.5: Limiting the industries in major urban cities to designated locations		
1. Establish segregated regions for industries near towns and cities, keeping wind and storm directions in view	Priority	LGE&RDD, P&DD, FE&WD, Industries Department
2. Provide vegetative barriers and nature reserve areas to serve as buffers between cities and industrial zones	Short-term	Same as above
3. Plan and design transportation corridors between residential regions and industrial zones to ease commute and traffic congestion	Short-term	LGE&RDD, P&DD, FE&WD, Industries Department, Transport Department
Strategy 4.6: Installing solar water heaters in large commercial and public buildings		
1. Evaluate the availability of solar radiation in selected cities and launch a pilot project to replace fuel-based water heaters in government/public buildings with solar water heaters	Priority	LGE&RDD, P&DD
2. Encourage the business sector to form a public-private partnership in commercial areas and shopping malls to replace fuel-based water heating and energy needs with solar energy	Short-term	Same as above
Strategy 4.7: Installing wastewater treatment plants as a component of all sewerage schemes		
1. Link sewerage systems to wastewater treatment plants	Short-term	LGE&RDD, P&DD, FE&WD
2. Identify the rivers, lakes and estuaries where the treated water will be discharged	Short-term	LGE&RDD, P&DD, FE&WD, Irrigation Department
3. Ensure that all wastewater is treated in a systematic manner	Short-term	Same as above

4. Install water quality monitors near all water reserves to assure water safety	Priority	Same as above
5. Development of integrated waste management solutions for municipal, industrial, hazardous and hospital wastes	Short-term	LGE&RDD, P&DD, FE&WD, Industries Department, Health Department
6. Appropriate solid and liquid waste treatment facilities should be made mandatory for all development projects	Medium-term	Same as above
Strategy 4.8: Separate collection, disposal and re-use of recyclable, composite and biodegradable waste		
1. Ensure that non-biodegradable solid waste is collected separately for disposal and recycling	Priority	LGE&RDD
2. Encourage each municipality to separate glass, metal, paper and plastic in separate containers	Priority	Same as above
3. Switch scavenger solid waste collection into a regular and efficient system	Short-term	Same as above
4. Ensure that biodegradable waste is collected, preferably at the source, for the composite and waste-to-fuel processes	Short-term	Same as above

3.1.5 Fisheries

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 5.1: Developing a habitat preservation program for various fish species

Actions	Priority	Implementing Partners
1. Periodically monitor the biological, chemical and physical qualities of water for existing and potential fishery sites	Short-term	Agriculture Department
2. Monitor and report unexpected fish migration/movement caused by Climate Change or any other factor	Short-term	Same as above
3. Create an inventory/baseline dataset for aquatic resources	Short-term	Same as above

Strategy 5.2: Developing a program for aquatic resource habitat preservation

1. Environmental Impact Assessment (EIA) for all commercial fisheries and hydropower projects	Medium-term	Agriculture Department, FE&WD
2. Manage existing natural habitat and find new potential sites for introduction of fisheries	Medium-term	Agriculture Department
3. Plan and implement habitat preservation for indigenous fish fauna by establishing fish protected areas (sanctuaries and reserves)	Medium-term	Same as above
4. Develop habitat management plans for commercially viable fish species	Medium-term	Same as above
5. Promote private fish farming practices through Public-Private Partnership Schemes (PPPS)	Medium-term	Same as above
6. Plan the rehabilitation programs for degraded aquatic resources	Medium-term	Same as above
7. Develop and propagate successful community-based fishery conservation models	Medium-term	Same as above

8. Ban on the use of blasting and micro-nets for fishing	Priority	Same as above
Strategy 5.3: Improving the resilience of fish farming and hatchery infrastructure		
1. Strict criteria for hatchery and fish farming site selection should be developed to avoid disaster and flood-prone areas	Medium-term	Agriculture Department
2. The design of the hatchery and fish farming structures should be strong enough to withstand any potential disasters	Medium-term	Same as above
3. Promote knowledge and information sharing among relevant stakeholders, preferably local populations and sensitize them to the need of conserving valuable flora and fauna through various programs	Medium-term	Agriculture Department, FE&WD

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 5.4: Reduction of GHG emissions caused by the boats used for fishing		
Actions	**Priority**	**Implementing Partners**
1. Complete ban on substandard fuel used in boats for fishing	Short-term	Agriculture Department, FE&WD

3.1.6 Climate Change Inclusiveness

Adaptation and Mitigation Measures

The following proposed adaptation and mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 6.1: Incorporating and enhancing Climate Change inclusiveness

Actions	Priority	Implementing Partners
1. Conduct studies and research on carbon footprint estimation in various sectors	Priority	FE&WD
2. Conduct studies and research on water footprints, including blue, green and grey water	Priority	FE&WD, PHED
3. Develop district-level inventories of sectorial GHG emissions and develop action plans based on downscaled NDCs	Priority	FE&WD
4. Prepare a checklist for climate inclusiveness feasibility studies and designs; and it should be made mandatory part of PC-I	Priority	P&DD, FE&WD
5. Public awareness and mobilization on Climate Change challenges, adaptation and mitigation measures	Priority	FE&WD
6. Awareness programs for gender inclusiveness, marginalized groups and civil society involvement in Climate Change assessments, adaptation and mitigation measures	Priority	Same as above

3.1.7 Climate Change Cells and Coordination

Adaptation and Mitigation Measures

The following proposed adaptation and mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 7.1: Capacity building of institutions andcoordination

Actions	Priority	Implementing Partners
1. Establish departmental Climate ChangeCells and Research Centers	Priority	FE&WD, Agriculture Department
2. Upgrade existing Climate Change Cell at EPA to Directorate level	Priority	FE&WD
3. Financial support for departmental Climate Change Cells and R&D	Priority	Federal Government, Provincial Government
4. Inter and intra-departmental coordination	Priority	All line-departments
5. Strengthening bi-lateral coordination of line departments, EPA and federal Climate Change ministry	Priority	Ministry of Climate Change, EPA and line-departments
6. Establishment of provincial Climate Change committee	Priority	FE&WD and P&DD

3.2 Climate ChangeAdaptationMeasures

3.2.1 Water Resources

The IMF has placed Pakistan as the third most water strained country, with per capita water availability of 5000 cubic meters in 1947, which has been reduced to approximately 1000 cubic meters and is expected to further decrease to 800 cubic meters per capita by 2025[17]. Water resources are critical for the survival of the people in the province; they also play an important part in the agro-based livelihoods of millions of people in KP.

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 1.1: Encourage the use of more efficient irrigation techniques

Actions	Priority	Implementing Partners
1. Encourage the development of water conservation strategies	Priority	LGE&RDD, FE&WD, Agriculture Department, Irrigation Department
2. Enhance the capacity of line departments and the private sector to produce indigenous low-cost energy and water efficient techniques such as Responsive Drip Irrigation (RDI), trickle andsprinkle irrigation system	Short-term	Irrigation department, Agriculture department
3. Priority should be given to complete ongoing canal lining projects in order to reduce irrigation losses	Short-term	Irrigation department, Agriculture department
4. Review the current cropping pattern to conserve as much water as possible	Short-term	Agriculture department
5. Facilitate technology transfer to small farmers by providing incentives through subsidies etc.	Short-term	Same as above

[17]a)Framework for implementation of Climate Change Policy, 2013; b)Nabi, Ghulam, Murad Ali, Suliman Khan, and Sunjeet Kumar. "The crisis of water shortage and pollution in Pakistan: Risk to public health, biodiversity, and ecosystem." Environmental science and pollution research 26, no. 11 (2019): 10443-10445.c) Aziz D, Masood A, Hashmi Z (2018) Turning the tide, The News International. https://www.thenews.com.pk/print/328174-turning-the-tide. Accessed 8/02/2021

6. Implement appropriate measures to provide additional storage capacity while maintaining minimum base flows in all rivers	Medium-term	Irrigation department, LGE&RDD
7. Explore the possibility of introducing irrigation water pricing in order to generate financial resources for the long-term sustainability of irrigation infrastructure	Medium-term	Same as above
Strategy 1.2: Developing local rainwater harvesting strategies		
1. Assess the potential for harvesting rainwater in various areas and agricultural farms	Priority	Irrigation Department, Agriculture Department
2. Encourage rainwater harvesting in both rural and urban areas, as well as at the household level	Priority	LGE&RDD, Irrigation Department, Agriculture Department
3. Enhance social capacity for rainwater harvesting practices at domestic, village and local level	Short-term	LGE&RDD, Irrigation Department, Agriculture Department, FE&WD
4. Incorporate rainwater harvesting systems in building codes	Medium-term	LGE&RDD
5. Plant tree species in watersheds that do not have an adverse effect on the water table	Short-term	FE&WD, Agriculture Department
Strategy 1.3: Raising public awareness of the necessity of water resource conservation and sustainable use		
1. Conduct regular media campaigns and host seminars and workshops to emphasize the need of water resource conservation and sustainable use at all levels	Priority	FE&WD, Information Department, Irrigation Department, PHED, Academia
2. Assist non-governmental organizations (NGOs) and civil society organizations (CSOs) in emphasizing conservation and judicious use of water resources	Priority	Same as above

3. Initiate joint ventures, involving line departments, civil society, academia as well as print and electronic media to raise public awareness about water conservation, water availability, drainage systems and other water-related issues	Priority	Same as above
Strategy 1.4: Ensuring that water allocations are adjusted in response to changes in sectorial demand caused by Climate Change		
1. Determine medium and long-term sectorial water demands for future	Short-term	LGE&RDD, Irrigation Department, PHED
2. Re-allocate water based on future projected water demand for each sector of the economy	Short-term	Same as above
3. Encourage community participation and empowerment in the planning, implementation, monitoring and operation & maintenance of water supply systems	Short-term	Same as above
4. Priority will be given to water allocation for drinking purposes over other uses	Short-term	Same as above
Strategy 1.5: Groundwater protection through management and technical methods such as regulatory frameworks, water licensing and artificial recharge, particularly for threatened aquifers		
1. Identify the locations, quality and quantity of groundwater resources in the province	Short-term	LGE&RDD, FE&WD, PHED, Irrigation Department
2. Develop a groundwater integrated water resources management plan at the district and tehsil levels for each aquifer by location	Short-term	P&DD, LGE&RDD
3. Develop regulatory frameworks and water licensing to control groundwater depletion and degradation and assure its sensible use	Priority	LGE&RDD, FE&WD, PHED, Irrigation Department
4. Promote and standardize water-saving plumbing equipment and water-efficient appliances and techniques	Short-term	Same as above

Strategy 1.6: Developing wastewater recycling facilities and reuse in agriculture, green belts, artificial wetlands and groundwater recharge

1. Develop the technology and estimate the cost of effective wastewater treatment and reuse, particularly at car wash centers and mosques	Short-term	Agriculture Department, LGE&RDD, FE&WD
2. Determine the sources of wastewater in the province and estimate the amount of wastewater that can be recycled	Short-term	LGE&RDD
3. Install wastewater treatment facilities throughout the urban sewerage system	Short-term	Same as above
4. Encourage the reuse of drain water in both rural and urban areas	Short-term	Same as above
5. Pilot testing of wastewater reuse in potential agricultural areas	Priority	LGE&RDD, Irrigation Department, Agriculture Department

Strategy 1.7: Encouraging farmers' active participation in water management in collaboration with line departments

1. Identify the line departments and civil society organizations that may train and engage the farmer community to participate in irrigation water management and distribution	Priority	Irrigation Department, Agriculture Department
2. Encourage public-private partnerships to improve access to safe drinking water and the sustainable operation and maintenance of water supply systems	Short-term	PHED, LGE&RDD
3. Enhance communication between the irrigation department and farmer communities regarding irrigation water distribution and management	Short-term	Irrigation Department, Agriculture Department

Strategy 1.8: Water distribution based on crop sowing timing		
1. Estimate the available water and crop water requirements throughout the sowing and planting seasons	Short-term	Irrigation Department, Agriculture Department
2. Decide the allocated water share for crop sowing based on the planting season	Short-term	Same as above
3. Prioritize the allocation of water for drinking and industrial use	Priority	PHED, Irrigation, LGE&RDD
Strategy 1.9: Preparing contingency plans for short-term strategies to adapt to water scarcity, which could aid in drought mitigation		
1. Identify the places that could be severely affected by seasonal or prolonged drought	Priority	Agriculture Department, FE&WD
2. Assess water storage capacity of that region	Short-term	Agriculture Department, FE&WD, Irrigation Department
3. Allocate water from existing gross national water availability to water storages that could aid in drought mitigation in these prone regions	Short-term	Agriculture Department, IrrigationDepartment
Strategy 1.10: Legislating and enforcing rules and regulations necessary for effective water resource management, conservation and groundwater regulatory framework		
1. Review all relevant existing legislation to find gaps in water conservation and management	Priority	FE&WD,Irrigation Department, Agriculture Department, LGE&RDD
2. Amend and adopt new legislation, wherever necessary, to achieve effective water resource management in agriculture, residential and industrial sectors	Priority	Same as above
3. Effectively enforce all environmental rules pertaining to water conservation and protection through the provincial EPA	Short-term	Same as above

4. Conduct a review and harmonize existing water sector legislation, policies and plans to include Climate Change adaptation and mitigation measures	Short-term	Same as above
5. Ensure that regulations regarding groundwater extraction are strictly enforced	Short-term	Same as above
Strategy 1.11: Upgrading the existing hydrological network for monitoring river flows and flood warning systems		
1. Conduct a comprehensive assessment of the hydrological network to identify any flaws in the monitoring of river flow changes and flood warning systems	Priority	RR&SD, Irrigation Department
2. Based on this assessment, plan enhancements to the hydrological network monitoring system	Short-term	Same as above
3. Upgrade and extend snow and rain monitoring system, and set-up remote sensing and ground-based mechanism to monitor the development of GLOF events	Short-term	WAPDA[18], PMD, RR&SD, FE&WD
Strategy 1.12: Developing and extending domestic and drinking water conservation technologies and techniques		
1. Introduce and implement domestic and drinking water conservation techniques and technologies i.e., use of auto operating taps	Priority	LGE&RDD, PHED, Irrigation Department
2. Encourage the installation of water meters in order to prevent the indiscriminate use of drinking water supplies	Short-term	Same as above
3. Encourage the use of cost-effective and appropriate water-supply technology options	Short-term	Same as above
Strategy 1.13: Enhancing water storage capacities		
1. Locate new prospective dam sites	Short-term	Irrigation Department
2. Ensure that these locations are not exploited for construction projects other than agricultural and forestry in order to retain the option of constructing new dams, if necessary	Short-term	Same as above
3. Conduct detailed feasibility and design studies, as well as cost estimates, for the proposed new dams	Short-term	Same as above

[18] WAPDA: Water and Power Development Authority

Strategy 1.14: Assuring the early rehabilitation, remodeling and upgrading of the province's existing irrigation infrastructure so that it can withstand the expected extreme weather events caused by Global Warming and Climate Change

1. Assess the probability and range of projected extreme weather events caused by Global Warming and Climate Change	Priority	RR&SD
2. Evaluate the range and potential of existing irrigation infrastructure in terms of sustaining these extreme events	Short-term	Irrigation Department
3. Remodel and upgrade existing irrigation infrastructure to accommodate the projected range of extreme weather events	Medium-term	Same as above

Strategy 1.15: Promoting integrated watershed management practices in uphill watersheds

1. To identify the environmental threats to the uphill watersheds and catchment areas of rivers flowing in the plain areas of the province	Short-term	Irrigation Department, FE&WD
2. Identify the technical possibilities, such as artificial glacial recharge, to improve water quantity and quality	Short-term	Same as above
3. Train the local community to identify and manage artificial glacial recharge sites	Short-term	Same as above

Strategy 1.16: Enhancing provincial capacity for tracking temporal changes in glaciers, snow cover and meteorological parameters

1. Establish and develop high-altitude meteorological observation stations to monitor changing climatic parameters	Short-term	FE&WD, RR&SD
2. Conduct research to prepare a detailed and comprehensive inventory of glaciers in Pakistan using satellite imagery and build institutional capacity to keep it updated regularly	Priority	Same as above

3.2.2 Wildlife and Biodiversity

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 2.1: Strengthening of legal and institutional frameworks to materialize efforts towards biodiversity conservation

Actions	Priority	Implementing Partners
1. Encourage the enhancement of biodiversity conservation efforts; support public and political sensitization activities to make biodiversity conservation as one of the top priority agendas	Short-term	P&DD, FE&WD, WWF
2. Take concrete steps to implement the previously developed Biodiversity Strategy and Action Plan	Short-term	Same as above
3. Review and update the existing plans regularly based on lessons learned during the practical implementation phases	Short-term	Same as above

Strategy 2.2: Improving scientific research and biodiversity conservation implementation

1. Conduct applied research on biodiversity conservation in KP in the wake of Climate Change	Medium-term	P&DD, FE&WD, WWF
2. Document and incorporate indigenous knowledge into the latest scientific research findings/information for use in conservation planning and activities	Medium-term	P&DD, FE&WD, LGE&RDD, Agriculture Department, Energy & Power, Irrigation Department, WWF

3. Extend conservation techniques in collaboration with local communities, utilizing their knowledge from a local perspective	Medium-term	Same as above
4. Integrate biodiversity conservation strategies into all relevant sectors including forestry, wildlife, aquatic and agriculture	Medium-term	Same as above
5. Encourage both in-situ and ex-situ conservation of valuable species for research and other uses in biodiversity-rich areas	Medium-term	FE&WD, Agriculture Department

3.2.3 Vulnerable Ecosystems

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 3.1: Institutional strengthening and the implementation of existing biodiversity conservation measures

Actions	Priority	Implementing Partners
1. Strengthen provincial institutional capacity in terms of financing, politics and public support to enhance biodiversity conservation activities	Short-term	Finance Department, P&DD, FE&WD, Agriculture Department
2. Encourage public and political sensitization campaigns to make biodiversity conservation a top priority agenda	Short-term	Finance Department, P&DD, FE&WD, Agriculture Department, Information Department
3. Establish provincial focal points and steering committees to develop and implement Biodiversity Conservation Plans at the provincial and municipal levels	Priority	P&DD, LGE&RDD, FE&WD,

Strategy 3.2: Promoting and conducting latest research in the field of biodiversity with a focus on the effects of Climate Change in order to bridge the knowledge gap between policy and practice

1. Strengthen the capacity of research institutions and academia to explore and promote the sustainable use of natural resources and biological diversity	Short-term	FE&WD, Agriculture Department, Universities
2. Conduct significant applied research on biodiversity conservation in the context of Climate Change	Short-term	Same as above
3. Incorporate biodiversity conservation practices into all relevant fields such as forestry, wildlife and agriculture	Short-term	Same as above
4. Extend conservation techniques in collaboration with local communities, utilizing their knowledge from a local perspective	Medium-term	Same as above

5. Encourage both in-situ and ex-situ conservation of valuable species for research and other uses in biodiversity-rich areas	Medium-term	Same as above
Strategy 3.3: Enhancing the capacity of existing and yet to be established provincial monitoring units		
1. Establish provincial resource bases to collect, share and monitor information and biodiversity conservation actions	Short-term	FE&WD, Agriculture Department,
2. Strengthen institutions and organizations participating in various activities related to flora and fauna conservation (e.g., data collection, information dissemination and conservation)	Short-term	Same as above
3. Encourage transfer of knowledge and information among key stakeholders, preferably local communities and sensitize them to the need of conserving valuable flora and fauna through various programs	Short-term	Same as above
4. Enhance the capacity of research institutions, government departments, civil society and local communities to monitor biodiversity conservation activities	Short-term	FE&WD, Agriculture Department, Universities, CSOs
Strategy 3.4: Conducting extensive scientific research in mountain areas to identify the most vulnerable and resilient ecosystems to the adverse effects of Climate Change and addressing identified challenges with tangible measures		
1. Initiate reforestation programs in the mountainous regions to stabilize slopes and reduce flood intensity	Priority	FE&WD, Agriculture Department
2. Establish a research institution dedicated solely to coordinating and disseminating scientific information on mountain ecosystems	Short-term	Same as above
3. Initiate integrated watershed management projects at the sub-catchment level to reduce runoff and soil erosion, resulting in reduced flood intensities	Short-term	FE&WD, Agriculture Department, Irrigation Department
4. Examine the effects of Climate Change on mountain biodiversity, as well as the role of science in conjunction with indigenous knowledge in preserving it	Medium-term	FE&WD, Agriculture Department,

5. Build a network of small multi-purpose dams in mountain regions to minimize flood intensity, generate electricity and serve irrigation purposes	Priority	Irrigation Department, Energy & Power Department

Strategy 3.5: Discouraging activities that lead to the depletion of mountain ecology while supporting those that contribute to the rejuvenation of a viable climate at higher altitudes

1. Promote ecotourism and develop procedures to prevent the accumulation of solid waste, garbage and other undesired material in major tourist spots and hill stations	Short-term	LGE&RDD, Tourism Department, CSOs
2. Organize localized programs for the removal and disposal of solid waste in mountain areas	Short-term	Same as above
3. Introduce and promote the usage of biodegradable products	Short-term	FE&WD, LGE&RDD, Tourism Department, CSOs
4. Sensitize and engage local communities in the promotion of ecotourism	Priority	Same as above
5. Conduct GLOF related research and, as a result, devise projects to conserve northern glaciers	Priority	P&DD, FE&WD, RR&SD, Agriculture Department
6. Efforts to remove and prevent the accumulation of undesired biomass at higher altitudes in order to prevent clogging of mountain water channels	Short-term	FE&WD, LGE&RDD, Tourism Department, CSOs

Strategy 3.6: Protecting the soil from erosion through vegetation barriers and maintaining optimum livestock densities

1. Provide vegetative barriers for rangelands that are especially prone to erratic precipitation, strong winds and increased soil erosion	Short-term	FE&WD, Agriculture Department
2. Improve soil quality by utilizing native and hybrid soil nutrient fixing vegetation	Short-term	Same as above
3. Establish communication channels between local communities and livestock research institutes in order to stay informed about the latest innovations in the field of livestock research	Short-term	Agriculture Department,Academia

4. Develop and implement strategies to ensure optimal livestock densities in accordance with the carrying capacity of the rangelands	Medium-term	Agriculture Department
5. Establish effective coordination between the forest and livestock departments to ensure efficient rangeland management	Priority	FE&WD, Agriculture Department

Strategy 3.7: Grazing system promotion in accordance with research findings to facilitate regeneration of rangeland grasses and improve livestock production

1. Conduct research in the province to identify 'fragile' and 'resilient' rangelands and pastures	Priority	FE&WD
2. Through extensive study, discretely compute the carrying capacities of both fragile and resilient rangelands and pastures based on their local climatic conditions	Short-term	Same as above
3. Strengthen relationships between local communities, veterinary services and livestock markets to ensure effective livestock turnover	Short-term	Agriculture Department
4. Develop experimental plots of indigenous, hybrid and adapted vegetation species for increased fodder availability and improved rangeland and pasture management	Medium-term	Same as above
5. Enhance control grazing and plan a rotational program for transferring livestock from fragile to resilient rangelands and pastures on a regular basis in order to restore fodder quality, grass and shrubs based on local conditions	Medium-term	FE&WD, Agriculture Department

Strategy 3.8: Investigating the causes of wetlands' ecosystem depletion in the province

1. Take steps to safeguard the associated biodiversity of the wetlands	Priority	FE&WD, Agriculture Department, Irrigation Department
2. Limit the use of pesticides and fertilizers in the close vicinity of wetlands	Priority	Agriculture Department,Irrigation Department,CSOs

3. Promote the use of biological control for disease and weed management in agricultural crops	Priority	Agriculture Department
4. Establish research organizations to monitor the immediate and long-term impact of Climate Change on the province's wetlands	Medium-term	P&DD, FE&WD, Agriculture Department, Irrigation Department
Strategy 3.9: Providing the necessary contribution to the wetlands through resource management efficiency		
1. Initiate programs to plan and allocate water levels for ecosystem maintenance	Short-term	FE&WD, Irrigation Department
2. Develop adaptation strategies for wetlands and communities who rely on these and are endangered by Climate Change	Short-term	Same as above
3. Establish an institutional setup to monitor changes in the quality of water entering the wetlands	Medium-term	Same as above
Strategy 3.10: Taking remedial actions to reduce wetland siltation		
1. Control siltation of wetlands by reducing deforestation and timber felling in catchment areas	Priority	FE&WD, Irrigation Department
2. Introduce wetlands maintenance programs that involve local communities in order to control siltation and other debris	Short-term	Same as above
3. Conduct studies to identify further sources of siltation in the wetlands and implement appropriate remedial measures	Medium-term	Same as above
Strategy 3.11: Developing legal procedures to regulate organic and inorganic contamination of wetlands in line with scientific studies		
1. Examine the water quality in all drainage systems to wetlands for excessive fertilizer and pesticide contamination	Priority	FE&WD, Irrigation Department,
2. Implement a monitoring and control mechanism to keep wetlands from absorbing excessive chemicals	Short-term	Same as above

Strategy 3.12: Seeking innovative water conservation and irrigation techniques for fodder shrubs and crops		
1. Organize 'farmers' awareness' programs to sensitize local farmers about the necessity of water conservation measures	Short-term	Agriculture Department
2. Develop experimentation plots for local and hybrid vegetation cover which use the least amount of water while maximum utilization	Medium-term	Agriculture Department, Universities
3. Arrange proper training programs for local communities to adopt and maintain advanced equipment for drip irrigation	Medium-term	Agriculture Department, Irrigation Department, CSOs
Strategy 3.13: Explore technological breakthroughs in irrigation systems to increase vegetative cover in extremely harsh areas of arid zone		
1. Identify the best suitable irrigation equipment and technologies for arid areas	Short-term	AgricultureDepartment, Irrigation Department, Universities
2. Establish local community connections with irrigation and agricultural research organizations in order to pursue the best appropriate technology for arid zones with diminishing water resources	Short-term	Agriculture Department, Irrigation Department, Universities, CSOs
3. Arrange adequate training programs for local communities to maintain advanced equipment for drip irrigation and alternate energy (solar and wind) systems for tube-wells	Medium-term	Agriculture Department, Irrigation Department,
Strategy 3.14: Supporting the development of technological advances that increase agricultural water efficiency, as well as efficient equipment for the artificial groundwater recharge		
1. Collaborate with an irrigation research institute focused to develop technology and equipment to improve the traditional irrigation system	Short-term	Agriculture Department, Irrigation Department, Universities

2. Maintain vegetative cover by ensuring irrigation technological innovations that are most suited for arid zones with hot climate	Medium-term	Same as above
Strategy 3.15: Research and commercialization of "low delta crops," as well as drought and pest resistant crops		
1. Ensure the development of low delta and drought-resistant, high-yield crop variants for the province's arid and hyper-arid regions	Short-term	Agriculture Department
2. Develop special initiatives for pest-resistant crops or implement Integrated Pest Management (IPM) to protect crop productivity	Short-term	Same as above
Strategy 3.16: Develop drought-resistant shrubs, fodder crops and pasture grass for livestock		
1. Carry out research studies to improve feed and fodder in arid area	Short-term	FE&WD, Agriculture Department
2. Collaborate with local communities and nomadic tribes to develop experimental plots of improved grasses and shrubs for livestock	Medium-term	Same as above

3.2.4 Disaster Preparedness

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 1.1: Giving priority to the development and promotion of hydropower generation

Actions	Priority	Implementing Partners
1. Conduct pre-feasibility studies on potential hydropower project sites	Priority	Energy & Power Department
2. Improve recovery procedures for individuals/ departments that do not pay utility bills, thereby eliminating mismanagement on the side of the government and implement a stringent monitoring system to generate revenue	Priority	PESCO
3. Promote updated energy technologies	Priority	Energy & Power Department
4. Develop and promote massive scale run-of-river hydropower power plants on rivers and canal	Short-term	Energy & Power Department, Irrigation Department
5. Conduct an assessment of water resources to improve their potential for energy generation	Short-term	Same as above
6. Ensure that the rights of the local community are preserved wherever hydropower projects are launched	Short-term	FE&WD, Energy & Power Department
7. Set up a framework to legislate water usage and water rights at the provincial level, involving all stakeholders	Short-term	FE&WD, Energy & Power Department, Irrigation Department,IPC Department
8. Enhance the capacity of all concerned departments to develop project proposals based on need assessment and actual problem understanding at the governance level	Short-term	All Relevant Departments

9. Develop and promote hydropower projects through dams in KP	Short-term	Energy & Power Department
10. Investigate solar energy generation possibilities	Short-term	Same as above
11. Initiate energy generation initiatives by diverting rivers into energy-production units	Medium-term	Energy & Power Department, Irrigation Department
Strategy 1.2: Encourage the development of renewable energy resources and technologies such as solar, wind, small-hydropower and bio-fuel energy		
1. Provide incentives for introducing solar water heaters in the province	Priority	Energy & Power Department
2. Encourage installation of solar panels above irrigation canals and reservoirs	Short-term	Energy & Power Department, Irrigation Department
3. Enhance the capacity of public-sector scientific and engineering technology institutions and universities to develop and design renewable energy technologies for solar, wind, small-hydropower and bio-fuel energy sources	Short-term	Energy & Power Department, Universities
4. Identify potential sites for small hydropower project installation in mountain areas as well as along major irrigation canals	Short-term	Energy & Power Department,
5. Provide investment-friendly incentives to encourage the private sector to invest in renewable energy projects	Short-term	Energy & Power Department, Industries Department, Chamber of Commerce
6. Establish clean energy disciplines in universities to enhance awareness and encourage the usage of renewable energy alternatives	Short-term	Energy & Power Department, HED, Universities
7. Develop a database with experts from all energy-related sectors	Short-term	Energy & Power Department,
8. Encourage the manufacturing of power generation equipment locally	Medium-term	Same as above

9. Promote indigenous low-cost technologies (renewable energy) through Research and Development (R&D) initiatives	Medium-term	Energy & Power Department, Universities
Strategy 1.3: Promoting solar-panel-equipped building designs for energy self-sufficiency, particularly in public-sector buildings		
1. Adopt an energy conserving strategy to promote and install solar panels in both public and private sector buildings	Priority	LGE&RDD, Energy & Power Department, Irrigation Department, PHED
2. Develop and introduce energy-efficient building materials, designs and technologies	Short-term	Energy & Power Department, Industries Department
3. Encourage enterprises to generate energy-efficient products and assure their availability in the local market	Short-term	Same as above
4. Develop appropriate building construction codes for energy conservation according to climatic conditions	Short-term	LGE&RDD
Strategy 1.4: Obtaining technological know-how and transferring it for the installation of Near-Zero Emission Clean Coal Technologies		
1. Enhance the capacity of local scientific institutes for the development of pulverized coal Integrated Gasification Combined Cycle (IGCC) systems	Short-term	Minerals Development Department, Industries Department, FE&WD
2. Develop strategies for utilizing all fossil fuels, including coal, in the most efficient and low-emission levels	Short-term	Same as above
3. Develop indigenous capacity in technologies such as waste heat recovery and co-generation, coal bed methane capture, coal fluidized bed combustion and combined cycle power generation	Medium-term	Same as above
4. Enhance the technological and scientific capacities of relevant institutions in order to develop and operate coal-fired power plants with carbon capture and storage facilities	Long-term	Same as above

Strategy 1.5: Setting up plants to generate power from municipal waste

1. Conduct research on waste conversion into energy; establish major units in the province to generate power from waste in order to promote alternate energy practices	Priority	LGE&RDD, FE&WD
2. Promote the use of low-carbon and low-sulfur fuels	Priority	Ministry of Power Govt. of Pakistan, Industries Department, Transport Department
3. Enhance the capacity of all municipal agencies to build waste-to-heat conversion plants	Short-term	LGE&RDD
4. Involve local and provincial energy suppliers to ensure that energy supply transmission from these plants is as efficient as possible	Short-term	Energy & Power, Industries Department
5. Encourage the private sector to install waste-to-energy plants at the local and district levels	Short-term	LGE&RDD

Strategy 1.6: Promoting and providing incentives for the activities necessary for energy-mix and fuel-switching strategy to low-carbon fuels

1. Develop plans and build infrastructure to convert waste to heat energy by all municipalities	Short-term	LGE&RDD, Energy & Power Department,
2. Equip local universities and research institutions to design and develop indigenous and hybrid technology for carbon dioxide capture and storage	Medium-term	Industries Department, HED, Universities
3. Locally develop coal bed methane capture technology for future energy needs	Long-term	Same as above

Strategy 1.7: Improving energy efficiency and conserving energy

1. Provide subsidy for the promotion of low-energy-consumption devices for residential and commercial use, such as energy-saving lights	Priority	Energy & Power Department, Chamber of Commerce
2. Develop mechanisms for conducting energy audits in order to improve energy efficiency during transmission	Priority	Energy & Power Department

3. Create new transportation strategies to encourage both fuel conservation and fuel efficiency	Short-term	Transport Department
4. Provide economic incentives for energy conservation in the industrial sector by replacing high energy-consuming machines with energy-efficient machines	Medium-term	Industries Department, Chamber of Commerce

Strategy 1.8: Enacting and enforcing energy conservation legislation and audit standards

1. Formulation of energy conservation legislation by enacting energy sector specific laws that ensure control of energy wastage	Priority	Energy & Power Department
2. Strengthen the current legal framework that ensures energy efficiency audits and conservation	Priority	Same as above
3. Ensure proper legislation and policy implementation at each level through identified check and balance	Short-term	Same as above

Strategy 1.9: Ensuring quality energy production and supply management, including reduction of transmission and distribution losses

1. Improve energy production efficiency by enhancing the quality management system	Priority	Energy & Power Department
2. Conduct audits of the energy supply and transmission system to control distribution losses	Short-term	Same as above

Strategy 1.10: Improving energy efficiency in buildings and use of energy-efficient electric appliances

1. Encourage building design modifications for better insulation	Priority	LGE&RDD, Energy & Power Department
2. Provide incentives for energy-efficient products, which commonly cost more than less-efficient versions, particularly when they are initially commercialized	Priority	LGE&RDD, Energy & Power Department, Industries Department, Chamber of Commerce

3. Improve energy efficiency in buildings by standardizing building and construction codes	Short-term	Finance Department, P&DD, LGE&RDD, C&W, UET Peshawar
4. Promote the design and manufacturing of energy-efficient boilers and appliances	Short-term	Industries Department
5. Design and introduce energy-efficient ground water pumping units for agricultural, industrial and residential applications	Short-term	LGE&RDD, PHED, Agriculture Department, Industries Department

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 4.1: Raising public awareness of challenges related to mitigation of Climate Change induced disasters

Actions	Priority	Implementing Partners
1. Advise the decision-makers regarding the likely rise in the frequency and intensity of natural disasters as a result of Climate Change, as well as the proposed mitigation strategy	Priority	RR&SD, FE&WD
2. Develop a mechanism to establish and promote effective sectorial coordination among sectors responsible for DRM[19]	Priority	RR&SD & Relevant line Departments
3. Arrange awareness campaigns for various parts of society, particularly vulnerable communities, via radio, television, print media and participatory workshops	Priority	RR&SD, Information Department, FE&WD, CSOs
4. Conduct special emergency response training sessions for non-governmental organizations (NGOs) and volunteer organizations	Short-term	P&DD, FE&WD, CSOs
5. Include disaster management as a discipline in university curricula	Short-term	FE&WD, RR&SD, Universities, CSOs

[19] DRM: Disaster Risk Management

6. Establish an integrated information system to manage temporal and spatial information on Climate Change and disaster risk reduction	Short-term	P&DD, FE&WD, RR&SD
Strategy 4.2: Addressing the critical gaps in understanding of the natural mechanisms that cause hazards		
1. Collaborate with the Ministry of National Health Services, Regulations and Coordination to extend research on the connections between Climate Change, gender, disasters and health	Short-term	Health Department, P&DDDepartment, RR&SD
2. Develop remote sensing and in-situ techniques for monitoring the temperature and moisture content of the atmosphere at various levels utilizing satellites and weather radars	Medium-term	PMD, FE&WD, RR&SD
3. Enhance capacity to predict quantitative precipitation	Short-term	Same as above
4. Upgrade numerical weather models and visualization techniques in order to deliver more accurate and timely products that forecasters and researchers can use	Short-term	Same as above
5. Improve expertise and knowledge of available technologies for disaster risk reduction among professional engineers and building contractors etc.	Priority	Same as above
Strategy 4.3: Developing hazard zoning and mitigation strategies through management, formulation and law enforcement		
1. Develop an integrated natural hazard zoning map of KP	Short-term	LGE&RDD, FE&WD, RR&SD
2. Map low-flood risk zones for future land use planning	Short-term	LGE&RDD, FE&WD, RR&SD, Irrigation Department
3. Locate safe sites for people and livestock evacuation in each sensitive locality.	Priority	LGE&RDD, RR&SD, Agriculture Department
4. Define and develop collection points for livestock during disaster	Priority	Same as above

5. Develop waste management plans for post-disaster situations	Priority	LGE&RDD, RR&SD, Health Department, FE&WD
6. Develop and provide incentives to encourage disaster-resistant construction, especially in rural areas	Priority	Same as above
7. Develop effective rescue plans, relief and rehabilitation options and their execution strategies before a disaster occurs	Priority	Same as above
8. Include water, food hygiene and sanitation management in disaster preparedness and evacuation plans	Short-term	Same as above
9. Initiate development and enforcement of "River Flood Plan" regulations and laws	Short-term	RR&SD, Irrigation Department, FE&WD
10. Identify susceptible areas at local level and devise mitigation strategies for such sensitive areas and communities	Short-term	Same as above
11. Identify the mountain areas that are prone to avalanches and landslides	Medium-term	Same as above
12. Through zoning regulation, incorporate hazard zoning into land use and urban development	Short-term	Same as above
13. Establish a system to ensure that the policy and regulatory framework is followed and enforced	Short-term	Same as above
Strategy 4.4: Developing and enhancing a natural hazard early warning system to provide users with reliable alerts		
1. Improve and expand the network of weather monitoring stations and Early Warning System (EWS)	Medium-term	PMD, RR&SD
2. Establish regional flood forecasting and warning centers throughout the province, as well as sub-regional centers in each vulnerable district	Medium-term	RR&SD, LGE&RDD, District Administrations
3. Develop updated early warning system that utilizes radio, television, SMS, mosque loudspeakers etc.	Priority	Same as above

4. Develop Standard Operating Procedures (SOPs) that clearly define the roles and responsibilities of each relevant department during natural disaster	Priority	Same as above
5. Upgrade and install a Flood Early Warning System (FEWS) model in Tarbela and Warsak Dam, as well as provide appropriate staff training	Priority	Ministry of Water Resources, RR&SD, Irrigation Department
6. Improve and enhance the flash flood response mechanisms of local and district disaster managers in order to minimize damages while keeping in view the generally rapid onset of flash floods with short warning lead-time	Short-term	LGE&RDD, District Administrations, Irrigation Department, RR&SD, PMD
7. Establish local warning centers in mountainous areas prone to flash floods	Medium-term	PMD, P&DD, District Administrations
8. Establish a remote sensing and ground-based monitoring system to track the development of Glacial Lake Outburst Floods (GLOF)	Priority	FE&WD, RR&SD, PMD
9. Prepare evacuation plans for susceptible areas in the case of a GLOF event	Priority	RR&SD, District Administrations
10. Allocate contingency/emergency funds to district administration	Priority	Finance Department, RR&SD, District Administrations
Strategy 4.5: Developing and strengthening the infrastructure that is resilient to Climate Change, particularly extreme weather events		
1. Carry out detailed studies to assess the requirements of flood embankments, dykes and protective bunds to safeguard vulnerable areas, particularly densely populated urban areas, in light of predicted flood levels	Priority	P&DD, LGE&RDD, , Irrigation Department, RR&SD
2. Strengthen existing flood embankments, dykes and protective bunds	Priority	Same as above
3. Redesign and construct disaster-resilient multipurpose school buildings to serve as shelters during natural disasters	Short-term	P&DD, LGE&RDD C&W, District Administrations
4. Improve, restore and enhance the capacity of headworks	Medium-term	P&DD, Irrigation Department

5. Construct escape structures along existing flood embankments, dykes and protective bunds and locate suitable places for recharging depleting aquifers from surplus flood water	Medium-term	Same as above
6. Water supply systems must be designed and constructed with due consideration to natural disasters and emergency situations	Medium-term	P&DD, LGE&RDD, Irrigation Department, PHED, RR&SD
7. In accordance with Sphere Standards, emergency preparedness and response plans may be developed to ensure the availability of safe water to those affected by events such as floods, earthquakes, droughts and conflicts	Medium-term	LGE&RDD, PHED, RR&SD
Strategy 4.6: Provision of Multi Hazard Vulnerability Risk Assessment (MHVRA)		
1. Carry out district-level climate inclusive Multi-Hazard Vulnerability and Risk Assessment (MHVRA) studies	Priority	FE&WD, RR&SD, PMD
2. Identification of safe locations against various hazards	Priority	RR&SD, District Administration
3. Preparation of Emergency Evacuation Plans (EEPs)	Priority	Same as above

3.2.5 Public Health

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 5.1: Assessing and mitigating health vulnerabilities to Climate Change, as well as implementing the "One Health" policy

Actions	Priority	Implementing Partners
1. Assess the province's vulnerability, particularly the population and regions most susceptible to vector-borne diseases	Priority	Health Department
2. Develop health-system outreach programs that can reach the targeted areas and provide quick emergency health services	Priority	Same as above
3. Develop a resource mobilization strategy for identifying and securing international funding for climate and health resilience and adaptation projects (e.g., GCF, GEF and bilateral donor agencies)	Short-term	Health Department, FE&WD, P&DD, CSOs,
4. Determine the baseline conditions of human health risk from current climatic variability and recent Climate Change	Short-term	Health Department, WHO
5. Analyze the health and WASH coordination for an integrated approach to maximize synergies	Priority	Health Department, WHO, Academia, PHED.
6. Develop effective infrastructures and communication channels to promptly counter any epidemic spread caused by a Climate Change induced natural hazard	Short-term	Health Department, FE&WD, RR&SD, District Administrations
7. Implement the "One Health" policy	Short-term	Health Department

Strategy 5.2: Educating and sensitizing health professionals and the general public on the Climate Change induced health implications		
1. Develop communication strategies to inform the general public about Climate Change-related health hazards and their geographical spread, particularly alerting health professionals in the area	Priority	Health Department, FE&WD, CSOs, Print & Mass Media
2. Assess the effects of Climate Change onvector/waterborne and nutritional diseases	Short-term	Health Department
Strategy 5.3: Ensuring that medications and safe drinking water is easily and affordably available to the generalpublic, particularly during climate related extreme events		
1. Establish emergency vaccine and medicine storage facilities near each DC[20] office for use in the case of injuries and epidemics caused by natural disasters	Priority	Health Department, RR&SD
2. Provide mobile water purification facilities that can be quickly deployed to disaster-stricken areas	Short-term	LGE&RDD, PHED, District Administrations
3. Develop and promote options for domestic water treatment	Short-term	Health Department, PHED, CSOs
Strategy 5.4: Upgrading and extending disease outbreak monitoring and forecasting systems to mitigate the potential Climate Change induced health implications		
1. Enhance disease monitoring and forecasting systems to allow for prior planning and timely, effective interventions	Priority	Health Department, RR&SD
2. Develop an effective response system to cope with any vector-borne diseases, such as malaria and dengue epidemics, which are likely to increase in changing climatic patterns	Short-term	Health Department, RR&SD, District Administrations

[20] DC: Deputy Commissioner

3.2.6 Socio-economic Development

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 6.1: Mitigate the socioeconomic impacts of Climate Change on vulnerable communities

Actions	Priority	Implementing Partners
1. Incorporate the climate-poverty nexus into provincial planning, such as Poverty Reduction Strategies (PRS), provincial population planning strategies and programs and annual budgetary planning	Short-term	P&DD, Finance Department, LGE&RDD, Population Welfare, FE&WD,CSOs
2. Conduct studies to assess the impact of Climate Change on poverty and the development potential of province	Priority	P&DD, Finance Department, LGE&RDD, FE&WD,
3. Enhance governance, policy and decision-making processes, which can have a significant impact on how policies and institutions respond to the impact of Climate Change on the underprivileged communities	Short-term	Same as above
4. Create coherence among institutions dealing with Climate Change, poverty, gender, human rights, population planning and health policy issues	Short to medium-term	Same as above
5. Introduce social-safety nets for socioeconomic growth, with a focus on Climate Change adaptation, through cash transfers and social pensions, particularly for disaster-affected communities	Short term	P&DD, Finance Department, LGE&RDD, RR&SD, CSOs
6. Raise awareness of and provide access to, relevant technology for climate-smart agriculture, energy and industrial development in underprivileged communities	Short-term	Agriculture, Food, Irrigation, Industries and Local Government Department

7. Share knowledge of local agriculture practices, yields, landholding size and other relevant information with departments responsible for social welfare, safety nets and poverty alleviation in order to strengthen the resilience of impoverished agricultural households	Short-term	Agriculture, Food, Irrigation and Local Government Department
8. Investigate, plan and execute measures to address climate-induced migration, which mainly impacts low-income communities	Priority	Planning and Development Department, Local Government Department
9. Diversify job opportunities to reduce unemployment through both supply and demand side policies	Priority	Same as above
10. Ensure social, resource and climate synergies in industrial development	Short-term	Industries Department

3.2.7 Youth and Gender Development

Adaptation Measures

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 7.1: Sustained access to safe drinking water

Actions	Priority	Implementing Partners
1. Encourage youth and women to participate in ensuring access to safe drinking water	Priority	CSW[21], LGE&RDD, PHED, Health Department, CSOs
2. Improve access to safe drinking water	Short-term	Same as above
3. Encourage reforms in health and hygiene training and awareness campaigns	Medium-term	Same as above
4. Develop a grievance redressal mechanism that is gender sensitive	Medium-term	Same as above
5. Encourage the use of green manure in agriculture	Medium-term	Agriculture Department

Strategy 7.2: Sewage water disposal and treatment that is environmentally safe

1. Youth and gender inclusive communication strategy/awareness and trainings for women	Medium-term	CSW,FE&WD, LGE&RDD, CSOs

Strategy 7.3: Solid waste collection and management system

1. Encourage youth and women to participate in SWM[22] planning	Priority	CSW, FE&WD, LGE&RDD, CSOs
2. Ensure that youth and women have access to credit, finance and services for waste management and recycling entrepreneurships	Short-term	Same as above

[21] CSW: Commission on the Status of Women
[22] SWM: Solid Waste Management

Strategy 7.4: Sustained access to green and affordable energy		
1. Disseminate information on environment-friendly and green technology, as well as the positive impact these technologies have on women's health	Short-term	P&DD, CSW, LGE&RDD, Finance Department, Chamber of Commerce, CSOs
2. Train and provide women with access to renewable alternate energy solutions	Short-term	Same as above
3. Demonstrate ideas involving energy-efficient, low-cost cooking technology	Priority	Same as above
4. Soft credits/loans for youth and women to adopt green technology	Short-term	Same as above
Strategy 7.5: Agriculture and livestock		
1. Identify and introduce gender-responsive technologies, as well as strengthen women's capacities through trainings and financing	Short-term	P&DD, CSW, LGE&RDD, Agriculture Department, CSOs
2. Introduce a legal reform that a. Enables female farmers to purchase or sell land b. Favorable environment for female farmers to sell their products at farmers markets c. Enable female farmers to access loans and financial assistance d. Ensure that governmental incentives target women farmers as well	Short to medium term	P&DD, CSW, LGE&RDD, Finance Department, Law Department, Agriculture Department, CSOs
Strategy 7.6: Utilize youth roles for effective climate action		
1. Develop and disseminate a climate education curriculum that could be propagated across the province through an advocacy campaign including seminars, trainings, certifications, formal education etc.	Short- to medium-term	Sports and Youth Affairs, Education Department, FE&WD
2. Encourage the use of digital Climate Change awareness tools, apps and services in order to attract and educate youth	Short-term	Same as above

3. Create opportunities for youth to play a role in climate action	Priority	Same as above
4. Develop a Climate Change Advocacy Strategy thatfocuses on youth and vulnerable communities	Short-term	Same as above
5. Encourage and support young Climate Change entrepreneurs through trainings, workshops, contests and bootcamps	Priority	Same as above
6. Create funding opportunities for expanding youth climate initiatives	Short-term	Same as above

3.3 Climate ChangeMitigation Measures

3.3.1 Energy
3.3.2 Industry

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 2.1: Providing economic incentives and financial subsidies to reduce GHG emissions by upgrading industrial processes and technologies

Actions	Priority	Implementing Partners
1. Conduct an initial survey to identify industries that require technological advancements to reduce emissions	Priority	Industries Department, FE&WD, Chamber of Commerce
2. Develop financial schemes for those industries to purchase or develop technological innovation to reduce emissions/liquid effluents	Short-term	Same as above

Strategy 2.2: Developing voluntary Corporate Social Responsibility (CSR) guidelines and encouraging the corporate sector to establish a CSR fund to cover carbon emission reduction efforts in the industrial sector

1. Identify the industries in the province that require emission reduction technology	Priority	Industries Department, FE&WD, Chamber of Commerce
2. Appoint an expert to formulate CSR guidelines	Priority	Same as above
3. Encourage the corporate sector to develop CSR specifically for reducing emissions in the province's industrial sector	Medium-term	Same as above

Strategy 2.3: Promoting the integrated "Cleaner Production" strategy in the industrial sector by making more efficient use of inputs such as energy, water, raw materials etc.		
1. Identify the industrial processes that generate the most emissions	Priority	Industries Department, FE&WD
2. Identify the technologies that could be used to replace these processes, inputs and raw materials in order to reduce emissions	Short-term	Same as above
3. Allocate financial resources for this technological innovation and replacement of machinery and equipment	Short-term	Same as above
Strategy 2.4: Encouraging the use of energy-efficient motors in the industrial sector		
1. Assess the quality of machinery and motors used in the industrial sector of the province	Priority	Industries Department, FE&WD, Energy & Power Department
2. Develop energy-efficient motors and generators and promote their use in the industrial sector	Short-term	Same as above
3. Provide financial incentives to encourage industries to adopt energy-efficient motors voluntarily	Short-term	Same as above
Strategy 2.5: Encouraging the industrial sector to conduct "Energy Efficiency Audits" regularly		
1. Plan voluntary energy efficiency audits for the industrial corporate sector to coincide with emission audits	Priority	Industries Department, FE&WD, Energy & Power Department
2. Provide technical assistance to the industrial sector to carry out "energy efficiency audits" of small and large industries regularly	Short-term	P&DD, Industries Department, FE&WD, Energy & Power Department

Strategy 2.6: Enhancing the capacity of each industry to monitor and estimate emissions locally		
1. Develop and install instrumentation to estimate industrial emissions	Priority	Industries Department, FE&WD
2. Train technicians to operate and maintain emission monitoring devices	Short-term	Same as above
Strategy 2.7: Ensuring that technology transfer is accelerated in industries such as cement manufacturing plants and brick kilns in order to control emissions without hampering the production process		
1. Identify the technologies that reduces emissions in industries such as brick kilns (zig zag technology, Bio brick etc) and cement manufacturing	Short-term	Industries Department, FE&WD, UET Peshawar
2. Assess the financial requirements for transferring these technologiesto the industrial sector of KP	Short-term	Same as above
Strategy 2.8: Enforcing industrial wastewater treatment and Solid Waste Management (SWM)		
1. Enforce the installation of industrial wastewater treatment plants as responsibility of the industries, wherever possible	Priority	FE&WD, KPEZDMC[23], Industries Department
2. Develop SWM strategies and plansat the industrial level on their part, wherever possible	Priority	Same as above
Strategy 2.9: Capacity building of KP energy sector		
1. Establish KP Energy Efficiency and Conservation Authority (KPEECA)	Priority	Energy and Power Department

[23] KP Economic Zones Development And Management Company

3.3.3 Transport

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 3.1: Sensitizing public on the importance of proper vehicle maintenance in order to improve fuel efficiency and reduce emissions

Actions	Priority	Implementing Partners
1. Launch media campaigns to raise public awareness on how proper vehicle maintenance can help with fuel efficiency and emissions reduction	Priority	PKHA, FE&WD, Industries Department, Transport Department
2. Involve civil society and the corporate sector in the campaign to reduce emissions and improve fuel efficiency through proper vehicle maintenance	Priority	Transport Department CSOs
3. Establish vehicle maintenance service centers in all urban areas	Short-term	Transport Department, FE&WD

Strategy 3.2: Ensuring the provision of efficient public transportation system in the province

1. Develop and maintain a high-quality and efficient public transportation system in the province to encourage people to gradually switch from private cars to public transport	Medium-term	P&DD, Transport Department, FE&WD
2. Create a public-private partnership to provide fuel-efficient local transport services	Short-term	Same as above

Strategy 3.3: Investigating and implementing the actions required for the use of biofuel in local transport systems

1. Identify the biofuels that can be used in combination with fossil fuels in the province	Short-term	Transport Department, FE&WD, Agriculture Department, Industries Department

2. Make these biofuels available in at least major urban areas	Medium-term	Same as above
3. Develop technology to convert existing vehicles to run on a mixture of gasoline and bio-fuels	Medium-term	Same as above
Strategy 3.4: Supporting the private transport sector through emission-reduction incentives and environment-friendly transport services		
1. Raise public awareness that improperly inflated tires reduce fuel efficiency and increase emissions	Priority	National Highway Authority, PKHA, Transport Department
2. Encourage hybrid and e-cars	Priority	Industries Department, Transport Department
3. Develop and provide financial incentives for private commercial transport systems to reduce emissions	Short-term	Transport Department
4. Promote the use of Low Rolling Resistance (LRR) tires	Short-term	Same as above
Strategy 3.5: Promoting the development and use of environment-friendly transportation technologies		
1. Identify funding sources for the development of environment-friendly transportation technologies and services, such as mass transit	Short-term	P&DD, Transport Department, FE&WD
2. Encourage the adoption of environment-friendly technologies by raising awareness in collaboration with civil society and the corporate sector	Short-term	PKHA, Transport Department, FE&WD, CSOs
Strategy 3.6: Securing financial support for technological innovations in urban planning and transportation sectors, specifically to address mitigation issues		
1. Develop and adopt emission control technology for the transportation sector using CDM and other funding sources	Short-term	Ministry of Industry, Industries Department, Transport Department, FE&WD

2. Utilize CSR to engage the corporate sector in raising funds for transportation technology innovation in the province	Short-term	Industries Department, Transport Department, CSOs
3. Establish a special fund for technological innovations that have a direct impact on human health, such as emission control and water quality	Short-term	P&DD, Finance Department, Industries Department, FE&WD
Strategy 3.7: Setting-up and enforcing vehicle emission standards through Vehicle Emission Testing Stations (VETS)		
1. Establish advanced VETS facilities at the provincial level	Priority	Transport Department, FE&WD
2. Develop annual certification system and link it with excise department for registration/token	Priority	Transport Department,
3. Develop separate categories and fee structure for E-cars, hybrid, CNG and other vehicles	Priority	Transport Department, Finance Department
4. Update and strictly regulate vehicle emission standards	Priority	Same as above
5. Establish a regulatory authority with a strong mandate to enforce vehicle emission standards	Priority	Transport Department, FE&WD
Strategy 3.8: Improvements in existing transportation infrastructure to reduce GHG emissions		
1. Ensure proper Maintenance and Rehabilitation (M&R) of roads in order to reduce GHG emissions	Priority	National Highway Authority, PKHA, Transport Department, LGE&RDD, C&W Department
2. Reduce conflict points by constructing subways and flyovers	Priority	Same as above
3. Install traffic signals at the intersections to avoid additional delay during peak hours	Priority	Transport Department, LGE&RDD
4. Optimize the traffic signals at the signalized intersections to improve the Level-of-Service (LOS) and eventually, the delay time	Priority	Same as above

5. Provide extra lanes for peak hour morning and evening traffic	Priority	Same as above
6. Ensure median plantation	Priority	Same as above
Strategy 3.9: Adopting innovative and recycling techniques for the improvement of transportation infrastructure		
1. Promote use of rubber as an asphalt binder in asphalt mixtures	Priority	P&DD, National Highway Authority, PKHA, Transport Department, FE&WD, C&W Department
2. Use Hot and Cold recycling techniques for the Maintenance and Rehabilitation (M&R) of the pavements	Priority	Same as above
Strategy 3.10: Encouraging national and other local airlines to consider fuel-efficient new technology aircrafts with low carbon emissions, while planning new fleet		
1. Keep a track on emerging fuel-efficient aircraft engine technologies for adaptation at the right time	Priority	Aviation Division, OGRA
2. Identify funding sources for technology development to improve aviation efficiency	Short-term	Same as above
Strategy 3.11: Ensuring the provision of efficient railway system in the province		
1. Develop a railway efficiency plan to improve service quality and facilitate the systematic transition of cargo and passengers from road to rail transport	Short-term	Ministry of Railways
2. Arrange sufficient financial resources for the purchase of new train engines and cabins to improve the efficiency and comfort of rail travel	Priority	Same as above

Strategy 3.12: Upgrading and expanding the province's railway network

1. Identify fuel-efficient engines for trains	Priority	Ministry of Railways
2. Build infrastructure to improve train service quality	Medium-term	Same as above
3. Locate new routes and construct rail lines to connect areas that are difficult to access.	Long-term	Same as above
4. Build rail lines parallel to roads to reduce cargo load and control emissions	Long-term	Same as above

3.3.4 Waste Sector

Mitigation Measures

The following proposed mitigation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action plan:

Strategy 4.1: Introducing innovations in town planning to adapt and mitigate the impacts of Climate Change

Actions	Priority	Implementing Partners
1. Create job opportunities in waste management and recovery through research and establishing collaboration among various stakeholders	Short term	LGE&RDD,FE&WD, P&DD
2. Improve municipal solid waste management and promote the concept of 3Rs to enhance waste management sustainability	Priority	Same as above
3. Collaborate with stakeholders and establish partnerships to promote waste management and the adoption of circular economy business models	Short term	Same as above
4. Develop provincial solid waste standards for waste storage, collection, transport, treatment and disposal that are consistent with air and water quality standards	Priority	LGE&RDD,FE&WD
5. Promote the decentralization of the disposal system to the local environment and organization of the collection system along the lines of a resource recovery system	Short term	LGE&RDD
6. Raise public awareness on sustainable waste management through electronic and print media, street campaigns, community organizations like schools, institutions and households, a public-address system, leaflet distribution and by using division's public-awareness team	Short term	LGE&RDD, Information Department, E&SED
7. Ensure proper labelling and handling of hazardous industrial waste, as well as the prevention of illegal dumping	Short term	FE&WD, Industries and Commerce Department, LGE&RDD

8. Promote waste management technologies that provide co-benefits (e.g., anaerobic digestion)	Short term	Same as above
9. Develop plastic waste management strategy with defined targets and a monitoring plan for the next 5 to 10 years	Priority	Same as above
Strategy 4.2: Developing and acquiring clean energy technologies and applications to achieve low-carbon growth in the energy sector		
1. Promote energy-from-waste projects	Short term	LGE&RDD, FE&WD
Strategy 4.3: To preserve and protect mountain ecosystems and plain areas from degradation and pollution		
1. Rationalize environmental quality standards in context of assimilation capacities receiving environment	Priority	FE&WD, Industries Department, Agriculture Department
Strategy 4.4: Developing and implementing an integrated water resource management system		
1. Make existing water treatment schemes (industrial and municipal) more effective and functional and install new schemes on a need-basis	Priority	FE&WD, Industries Department, LGE&RDD, PHED
2. Promote wastewater treatment and reuse from manufacturing, commercial and industrial processes	Priority	Same as above
Strategy 4.5: Mitigating GHG emissions from the waste sector		
1. Create waste inventories from various sectors and devise waste-to-energy conversion strategies	Short-term	LGE&RDD,FE&WD
2. Arrange capacity building, technical assistance and financial resources to develop a robust landfill design	Short-term	Same as above
3. Behavioral change and communication at all levels in society	Priority	All line departments

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