KHYBER PAKHTUNKHWA

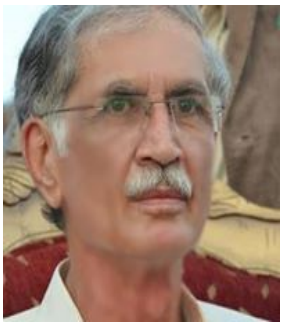
CLIMATE CHANGE POLICY

ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF KHYBER PAKHTUNKHWA

FORESTRY, ENVIRONMENT & WILDLIFE DEPARTMENT

Message:



Climate change poses a greater security threat to Pakistan than terrorism because it could affect temperatures, environment, economy and the future policies of the country. There is a growing evidence that climate change is very rapidly affecting the life-support systems on which humans and other species were dependent and its impact is arriving more faster than what we predict.

As the geographical location of the province makes it vulnerable and sensitive to the increasingly evident impacts of the climate change and recognizing climate change as a major threat to the provincial economy, the KP government developed the first Provincial Climate Change Policy. The policy aims to detect signs of climate change and assess impact of the change in the province so that preventative and corrective actions can be taken to steer the province towards its envisioned economic sustainability.

Developing a policy is the first step towards the larger goal of climate-compatible development and the government alone cannot combat climate change until all the stakeholders of the society including the youth, academician, experts from the Government and the civil society take steps to deal with the negative impacts of Climate Change. This is how the KP can build on its reputation as a trendsetter on environment and climate change issues in Pakistan and deepen its engagement on green growth for long-term sustainability.

Pervez Khattak
Chief Minister
Government of Khyber Pakhtunkhwa

Foreword:

Based on Scientific evidences, Khyber Pakhtunkhwa Province (KP) is assessed to be one of the most vulnerable and affected province of Pakistan towards the negative impacts of Climate Change. The present Government of Khyber Pakhtunkhwa began proactively responding to the Climate change impacts in the province, by initiating development of provincial climate change policy and action planning. This proactive response reflects the level of seriousness with which the KP government began addressing climate change impacts.

Environmental Protection Agency (EPA) launched an ADP scheme titled "Establishment of Climate Change Cell for Multilateral Environmental Agreements (MEAs) in EPA" in order to give recommendations and way forward on the issue and challenges of Climate change faced by the KP Province, therefore an Advisory Committee was constituted under the Chairmanship of Director General EPA, further supervised by Secretary Forestry, Environment and Wildlife Department Govt. of Khyber Pakhtunkhwa.

The Provincial Climate Change Policy is in line with the National Climate Change Policy, and it defines the road map of the KP government towards mitigating and adapting impacts of climate change in various sectors of life. A special feature of the Climate Change Policy is that it has considered the provincial and national efforts towards addressing climate change impacts and green growth. Recognizing the untapped potential for making development 'climate compatible' in KP, the policy also presents opportunities that come with addressing climate change, such as a developing market and new goods and services, increasing efficiency, protecting supply chains for natural resources and gaining reputational benefits.

Ishtiaque Urmar
Provincial Minister for Environment
Government of Khyber
Pakhtunkhwa

Acknowledgement:

Formulation of Provincial Climate Change Policy (PCCP) is a milestone in the history of KP Environment sector. In this regard the efforts of LEAD Pakistan Consultants in shaping the Provincial Climate Change policy with the coordination of the staff of Environmental Protection Agency (EPA), Government of Khyber Pakhtunkhwa, especially its Climate Change Cell and experts from the various Government Departments, academia and civil society who participated and showed their keen interest in suggesting measures and providing invaluable critique and feedback in refining this Policy document is acknowledgeable. The efforts and dedication of Dr. Muhammad Bashir Khan (Director General EPA) and Dr. Hussain Ahmad (Director EPA) for their supervision and endless support for completing and managing the whole task well in time is highly appreciated.

Special thanks to Mr. Hassan Akhtar Rizvi Chief Knowledge officer at Leads Pakistan for his proactive help, support and commitment in developing the Policy. Moreover, the valuable recommendations and guidance of the Advisory Committee throughout this process is remarkable.

I will also like to thank Dr. Qamar uz Zaman Chaudhry, leading author, National Climate Change Policy, Dr. Bushra Khan Chairperson of Environmental Sciences Department University of Peshawar, Dr. Seemi Malik, and Syed Nasir Mehmood, IG Forests, Ministry of Climate Change, Government of Pakistan for their indirect support, input and feedback for finalizing this document to its current shape

Syed Nazar Hussain Shah
Secretary to Government
Of Khyber Pakhtunkhwa
Forestry, Environment & Wildlife
Department

Message :

In the wake of the 18th Constitution amendment and the growing signs of the climate change in the province, the Environmental Protection Agency (EPA) took an initiative and established a “Climate Change Cell” which is mandated to interact with all other government agencies and departments.

To mainstream Climate Change considerations into their respective policies, strategies and actions and to combat the adverse impacts of the climate. The first step in this regard was to formulate the provincial Climate Change policy in line with the National Climate Change Policy.

The **Provincial Climate Change Policy** highlights how vulnerable the Khyber Pakhtunkhwa province is to Climate Change and how to take protective measures like adaptation and mitigation in relevant sectors of the economy. It focuses on the impacts of the Climate Change likely to affect the natural ecosystems of the province and emphasize on the need for the province to adapt and to mitigate impacts of Climate Change and also focuses on the Climate Change awareness in the province.

The synergic efforts of the Leads Pakistan, Climate change cell, provincial line departments and other relevant stakeholders from academia & civil society is highly acknowledged and appreciated in this regard. For the successful implementation of the policy measures in the KP province, the agency in future is looking forward for the support from all the stakeholders to make their contributions with the view to minimize the risks posed by climate variability and change and to build a resilient interrelated socio-economic and ecological system in the province for present and future generations.

Dr. Muhammad Bashir
Director General
Environmental Protection Agency
Government of Khyber Pakhtunkhwa

Preamble

As the effects of Climate Change are becoming more visible around the world, vulnerable countries including Pakistan are trying to understand the treats they will face in future. Pakistan has drafted its National Climate Change Policy in 2012. However, after the 18th amendment in the constitution of Pakistan, the subject of Environment was devolved to the Provinces. Keeping in view the possibility of high degree of vulnerability of Khyber Pakhtunkhwa (KP) Province to the visible impacts of Climate Change, the Govt. of KP decided to formulate a Provincial Climate Change Policy in consultation with Govt. line Departments to be more specific, target oriented and also in line with National Climate Change Policy of Pakistan 2012 - thus a Provincial Climate Change Policy was formulated for the first time in June, 2016, to the specific needs of the Province.

This Policy document provides two kinds of approaches, adaptation and mitigation to be adopted in the most relevant sectors prone to the impacts of Climate Change. The Policy was formulated in consultation with Govt. Line Departments such as Forestry, Wildlife, Irrigation, Agriculture, Livestock, and Food Department etc. For this purpose, an Advisory Committee, comprising of 17 members from different Line Departments and academia and headed by Director General Environmental Protection Agency (EPA), was constituted in order to make a Policy acceptable to all stakeholders.

The Policy highlights sectors that need mitigation measures such as energy, transport, wastes, industries and urban planning etc. The Policy has also described measures regarding capacity building and trainings of Govt. line departments for sustainable development. It also gives emphasis, to streamline Climate Change in different sectors of the economy and developmental projects in the Province to make a sustainable development and create resilience to natural disasters. Successful implementation of the Policy in relevant sectors of KP would lead to secure fragile economy of Khyber Pakhtunkhwa.

List of Abbreviations

AR5	Fifth Assessment Report of IPCC
CCD	Climate Compatible Development
CO2	Carbon Dioxide
CIP II	Community Infrastructure Program Phase 2
CSOs	Civil Society Organizations
DRR	Disaster Risk Reduction
GDP	Gross Domestic Product
GGI	Green Growth Initiative
GGV	Green Growth Vision
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GHG	Greenhouse Gases
Govt. of KP	Government of Khyber Pakhtunkhwa
Ha	Hectares
HLZ	Holdridge Life Zone
IPCC	Intergovernmental Panel on Climate Change
KP	Khyber Pakhtunkhwa
MAF	Million Acre Feet
NDMA	National Disaster Management Authority
NGOs	Non-Governmental Organizations
NTFP	Non Timber Forests Produce
NUDP	National Urban Development Policy
OECD	Organization for Economic Co-operation and Development
OCHA	Office for Coordination of Humanitarian Affairs
PCCPIC	Provincial Climate Change Policy Implementation Committee
PDMA	Provincial Disaster Management Authority
PRS	Poverty Reduction Strategy
PV	Photovoltaic
REDD	Reducing Emissions from Deforestation and Forest Degradation
RS	Remote Sensing
RWSSP	Rural Water Supply and Sanitation Project
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change

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1. VISION

The Policy envisions a sustainable development and climate resilient province for the people of Khyber Pakhtunkhwa.

1.1 Mission Statement

To create resilience in all sectors of economy of the province through adaptation and mitigation and ultimately contribute to the global efforts against Climate Change under the United Nation Frame Work on Climate Change Convention (UNFCCC).

1.2 Goal[1]

To ensure that the climate action is mainstreamed in developmental planning, especially in the economically and socially vulnerable sectors and to steer Khyber Pakhtunkhwa Province towards green growth[2]and climate compatible development[3].

2. POLICY OBJECTIVES

- Formulate a more appropriate and province specific policy that is in line with National Climate Change Policy of Pakistan 2012;
- Enhance awareness of the impacts of Climate Change among all stakeholders for necessary adaptation/mitigation measures to combat and minimize these impacts;
- Integrate adaptation and mitigation measures into the key relevant sectors' policies, strategies, and plans;
- Facilitate action in Khyber Pakhtunkhwa on climate adaptation and mitigation, while, promoting long term sustainable development;
- Enhance interdepartmental coordination and cooperation for effective actions against Climate Change phenomenon;
- Ensure water, food and energy security for Khyber Pakhtunkhwa province in the face of a changing climate;

[1]This policy goal has been stated so as to be completely in line with the National Climate Change Policy.

[2]As envisioned by the Government of Khyber Pakhtunkhwa. See chapter 10 for elaboration and details.

[3]Climate compatible development: While climate resilient development increases adaptive capacity against climate impacts it does not necessarily cater to the mitigation aspects. Climate compatible development, on the other hand, is a holistic approach that minimizes the harm caused by climate impacts, while maximizing human development opportunities presented by a low emission and resilient future. See chapter 10 for more comprehensive explanation.

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- Address Climate Change risks particularly those arising from climate induced disasters;
- Ensure that interests of vulnerable groups and communities are adequately addressed in climate development strategies and planning;
- Develop bases to secure sufficient financial and technological support, and strengthen institutional and human resource capacities to achieve policy objectives; and to be able to tap financial and technological opportunities available internationally.

3. INTRODUCTION TO CLIMATE CHANGE

The Earth's climate has changed frequently over long periods of geological time in responses to changes in the strength of the sun, the shape and tilt of the earth's orbit around the sun, the position and shape of the continents and the composition of the atmosphere. There is strong evidence that Greenhouse Gases(GHGs) emission from human activities are now raising the earth's temperature and causing other changes in climate. Emissions are projected to rise significantly over the next few decades leading to significant increase in global temperatures with profound risks for the natural environment and human society worldwide.

According to the latest report from the Intergovernmental Panel on Climate Change (IPCC), average global temperatures are likely to rise by another 0.3 to 4.8 degree centigrade by 2100. If aggressive actions are taken to reduce emissions, the temperature change could be modest. If the present course is continued, however, the amount of change will be substantial. Most experts agree that the changes are anthropogenic — caused by humans — largely from emissions of heat-trapping gases released to the atmosphere when fossil fuels are burned. Carbon dioxide (CO_2) is the most significant of these gases; CO_2 levels are at their highest in 650,000 years.

Climatic variations play a pivotal role in the development and survival of natural ecosystems and of human societies which place an additional stresses on natural systems. Climate change is also now considered as a significant factor in these increases4,it is one of the major challenges that the world is facing in the 21st century and is adversely affecting

What is the Greenhouse Effect?

The atmosphere is composed of nitrogen (78%), oxygen (21%), carbon dioxide (0.04%), argon (0.9%), water vapours (0-4%) and trace gases such as argon, xenon, neon, krypton and helium. Carbon dioxide and other gases such as methane and nitrous oxide trap the infra-red radiation from the sun and prevent it from escaping by a natural process called "the greenhouse effect". This phenomenon maintains the temperature of the earth allowing living things to survive.

Excessive burning of fossil fuels for anthropogenic activities releases additional CO_2which builds up and traps additional heat which would otherwise escape. This human-caused blanket effect leads to warming of the planet, disrupting the atmospheric balance that keeps the climate stable.

sustainable development and communities, people's livelihoods, health, shelters and in some cases, even lives.

Impacts of the changing climate are likely to include increased air and sea temperatures, progressive rise in sea-level, greater variability and seasonality in precipitation, and changes in the frequency and strength of floods, storms, cyclones and hurricanes. Within the last decade, Asia has witnessed the most natural and weather-related disasters in the world, suffering 27.5% of global economic loss (IPCC, 2014a). Pakistan, being an Asian country, experienced damages worth an estimated 10 billion US dollars as a result of the floods of 2010 (World Bank and Asian Development Bank, 2010). Not only have such recurring weather events become more frequent, their impacts on human health, livelihoods and economic development have stretched in magnitude and extent.

Proper responses are required to tackle the problems happening due to Climate Change. Responses to Climate Change can be divided into two aspects:

Mitigation — the term used to describe the process of reducing GHG emissions that contributes to Climate Change. It includes strategies to reduce GHG emissions and enhance GHG sinks.

Adaptation — is a process, or set of initiatives and measures, to reduce the vulnerability of natural and human systems against actual or expected Climate Change effects. Adaptation can also be thought of as learning how to live with the consequences of Climate Change.

Climate Change adaptation and mitigation are often considered as policy fields. The key aspects of International and National Climate Change policy instruments are summarized in Table 1 below.

Trends[4] of stresses on several natural systems and ecosystems due to Climate Change have been observed, recorded and debated upon by international organizations: UNESCO, IFAD, World Watch Institute, FAO, WHO, OECD, WWF & UNEP.

[4]Detailed information on climate-induced stresses is available on: http://www.igbp.net.

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Policy Response	Objectives and Targets
United Nation Framework Convention on Climate Change (UNFCCC)	UNFCCC seeks to reduce international GHG emissions by setting National level targets based on the concept of 'common but differentiated responsibility'. This means that nations which emit majority of GHGs need to reduce GHGs at a greater rate.
UNFCCC's Kyoto Protocol	Under the UNFCCC's Kyoto Protocol, developed countries agreed to reduce their overall emissions of a basket of GHG by 5.2 percent below 1990 levels over the period 2008-2012.
National Climate Change Policy 2012	It supports the shift to a resource-efficient, low-carbon economy to achieve sustainable growth. It provides a long-term framework for action to factor in resource efficiency in a balanced manner in many policy areas, including Climate Change, energy, transport, industry, agriculture, biodiversity and regional development.

Table 1: Key aspects of Climate Change policy

4. CLIMATE CHANGE IMPACTS IN KHYBER PAKHTUNKHWA

Khyber Pakhtunkhwa (KP), a topographically diverse province of Pakistan, is situated in the northwest region of the country. The land of KP is an abode to Hindu Kush, Himalayan and Karakoram mountain ranges predominantly in the Northern, North West and Eastern parts of the province. In contrast, southern parts of KP are dominated by central valley plains comprising agricultural land and rangelands. Extreme climate conditions range throughout the province. The northern region of KP experiences extremely cold and snowy winters, with heavy rainfall and pleasant summers, whereas the southern parts of KP experience fairly less severe winters, moderate rainfall and hotter summers. Chitral, the highest district of KP experiences the lowest temperatures in winter; hence many glaciers are found in this district. D.I Khan, the southernmost district of KP, experiences milder winters and therefore is dominated by agricultural and rangelands due to optimum climate conditions for agriculture.

4.1. Khyber Pakhtunkhwa – an Ecological Classification

KP is divided into four **agro-ecological zones**[5]based on climate, rainfall, temperature, altitude and topography in the Environmental Profile of KP developed by the Environmental Protection Agency of Khyber Pakhtunkhwa. This Zonal distribution (Table:2) has been used in this text to allow convenience in identifying potential future impacts from external forces such as Climate Change. (Source: EPA, Govt. of KP)

ZONE	DESCRIPTION	Districts
A	Higher northern mountains, northern mountains	Buner, Shangla, Dir/Lower and Upper, Swat and Chitral
B	Sub humid eastern mountains and wet mountain	Haripur, Batagram, Mansehra, Abbottabad, Kohistan, Torghar
C	Central Valley Plain	Peshawar, Mardan, Charsadda, Nowshera, Swabi, Kohat, Hangu
D	Piedmont plain, Suleiman piedmont	Bannu, Karak, Lakki Marwat, Tank, D.I. Khan

Table 2: Agro-ecological zones of KP with districts

[5]We have used the conventional system of agro-ecological zones as applied to the province in the available literature. However, recently, a new system based on bio-climatic zoning has been proposed for Pakistan which is more pertinent to monitoring and catering to the impacts of Climate Change. See: Nasir, S. M.; Afrasiyab M.; Athar M.: Application of Holdridge Life Zones (HLZ) in Pakistan; Pak. J. Bot., 47(SI): 359-366, 2015

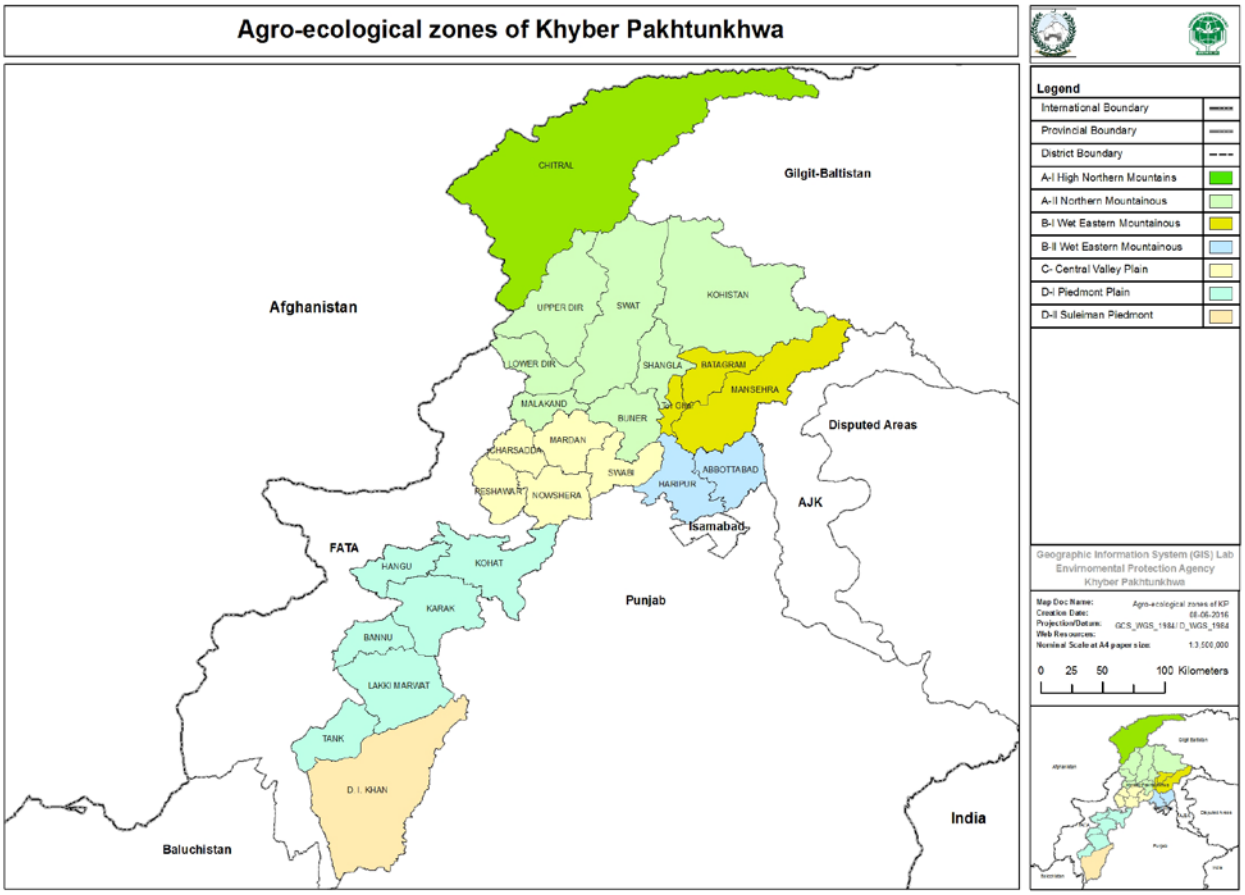

Figure 1: Agro-ecological zones of KP(Source: EPA, Govt. of KP)

In order to identify the types of impacts which each zone is prone to, it is important to identify the land cover and land use in each zone. 33% of the forests covers of Pakistan are located in KP (Atlas of Pakistan 2012). The land cover of KP has varying characteristics from north to south, therefore has different usage, 20.3% of KP is covered with forests, primarily the HinduKush Himalayan Region. (The description is given in Table-3).

Although KP has been divided into four agro-ecological zones, each zone can have cross cutting sectors, such as forests, agriculture, water and biodiversity. A description of these sectors and the zones in which they are most common is given below.

Forests

According to zonal distribution, north of the province forms Zone A. This is comprised mainly of snowcapped high northern mountains and forests. The high northern mountains of Chitral, Hazara and Swat above 4000m have low vegetative cover. Alpine zone forests are found between 3350-3360m. Dry temperate coniferous are present in

the dry ranges of Himalayas; Himalayan moist temperate forests are found in Hazara division (Kohistan, southern parts of Palas Valley, Lower Kaghan Valley) at an elevation of 1525-3660m. There is a narrow zone of subtropical forests between 900-2000m in the Southern parts of the Himalayan Mountains of Hazara and Swat Valley (Ahmad & Khan, n.d.).

Agriculture

Zone C and D comprising of Central Valley Plains and Piedmonts are used for agriculture and livestock grazing purposes. Livelihood is majorly based on agriculture and livestock in KP, with over 80% of the population dependent on agriculture for income. The agriculture sector also contributes to 20% of the provincial GDP and employs 44% of the labor force (Source: EPA, Govt. of KP). Major crops include wheat, rice and sugarcane. Livestock contributes approximately 52% to agriculture Sector.

Water

With the province heavily dependent on agriculture for livelihood, water plays an important role in the sustenance of the population. The Indus River and its tributaries are the main source of water for the province. The province has many lakes which contribute aesthetically to the region providing tourist attractions as well as freshwater. These lakes, such as Lake Saif-ul-malook, Lake Dodipat Sar, Lake Lolosar, Lake Shandur, Broghal Lake, etc. also come under protected wetland sites of KP wildlife biodiversity (Reference KP Wildlife Biodiversity Preservation, conservation and management Act 2015), whereas, Tanda Dam in Kohat District & Thaneidarwala inLakki Marwat District are the Ramsar sites identified under the Ramsar convention.

Glaciers are important reservoirs for KP. They feed into the Indus River and its tributaries and provide freshwater for agriculture and domestic use, moreover, they are important reservoirs for the future and indicators of Climate Change. The Karakoram-Himalayan ranges are snowbound throughout the year and have the greatest ice and snow cover in any mountainous system outside the Polar Regions. Glaciers are cold deserts however; their significance for the future and present of KP and Pakistan is immense.

Biodiversity

The topographic variety of Khyber Pakhtunkhwa makes the province diverse in species. The Himalayan forests are the habitats for many mammal and bird species. Out of 188

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species of mammals that occur in Pakistan, 98 mammal species are found in KP, amongst them endangered species are the Snow Leopard, Brown Bear, Ibex and Lion-eared bat. Moreover 456 species of birds, 56 species of reptiles and approximately 4500 species of plants are also found in KP (Source: EPA, Govt. of KP)

4.2. Land Cover of Khyber Pakhtunkhwa

Different agencies and reports have different estimates of land cover in Khyber Pakhtunkhwa. However, recently the “Land Cover Atlas of Pakistan 2012” prepared by Pakistan Forest Institute, estimated that the rangelands including alpine pastures and shrubs/bush lands)of Khyber Pakhtunkhwa Province as 1.978 million hectare.

Detail of land cover pertaining to KP is given in Table 3 and figure 2.

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Land Cover	Area (Ha)	Percentage
1. Forest Type		
Alpine Pasture	649,721	8.7
Sub Alpine	44,5425	0.6
Dry Temperate	532,591	7.1
Moist Temperate	391,668	5.3
Oak Forest	83,840	1.1
Sub-trophical Chir Pine	217,753	2.9
Sub-trophical broad-leaved Evergreen	222,373	3.0
Trophical Thorn Forest	12,007	0.2
Plantations	4,190	0.1
Sub-total (Excluding alpine pasture)	**1,508,604**	**20.3**
Sub-total (Including alpine pasture)	**2,158,325**	**29.0**
1. Other Land Cover		
Shrub & Bushes	533,523	7.2
Rangelands	794,471	10.7
Snow and Glaciers	813,530	10.9
Agriculture Land	2,224,739	29.8
Barren Land	646,305	8.7
Fruit Orchards	15,519	0.2
Settlements	110,536	1.5
Water bodies	151,688	2.0
Sub Total	**5,290,311**	**71.0**
Grand Total Including Alpine Pasture	**7,448,636**	**100**

Table-3 Source: Atlas of Pakistan 2012

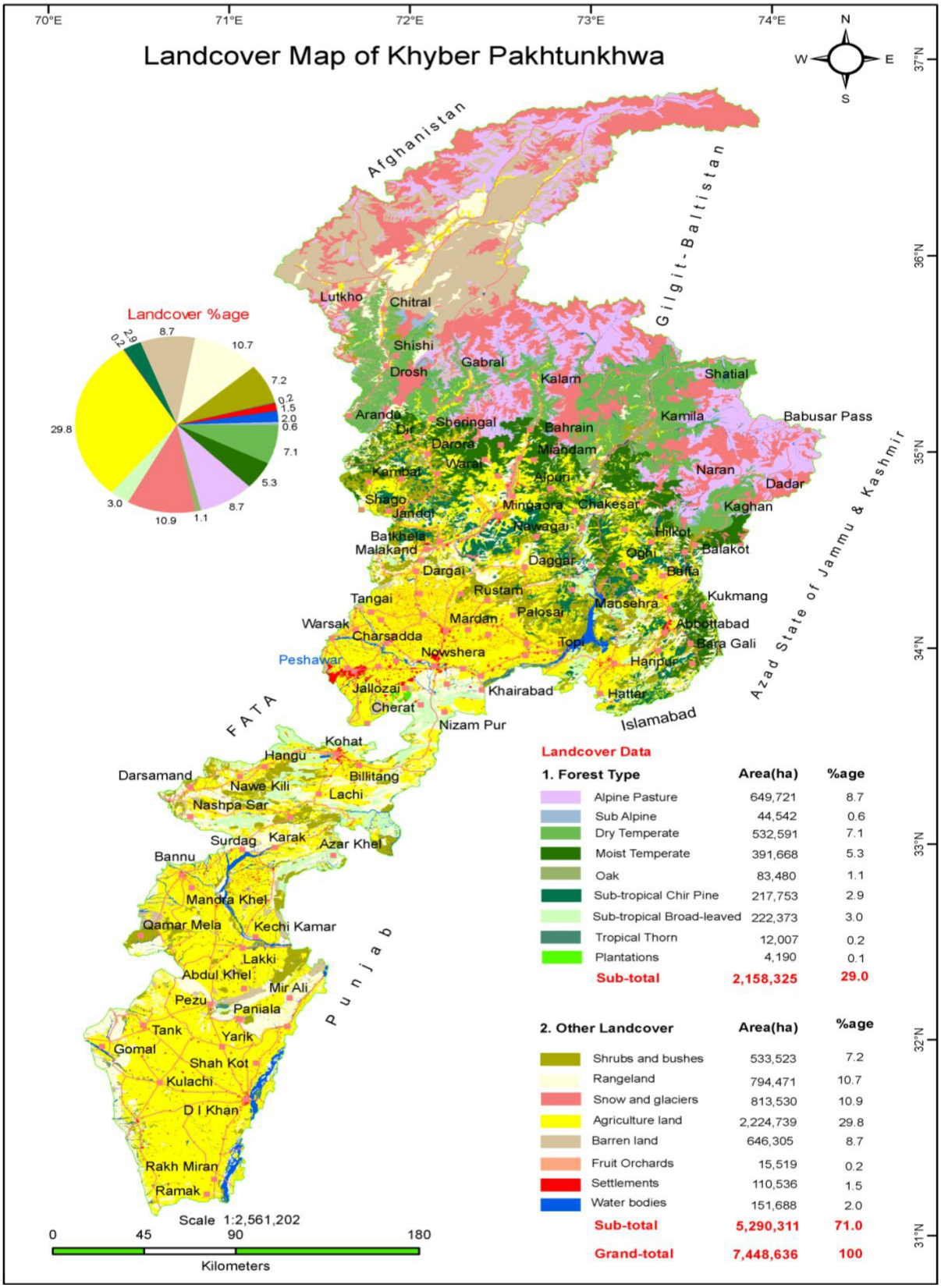

Figure 2: Atlas of Pakistan 2012

4.3. Climate Hazards in Khyber Pakhtunkhwa

The impacts of Climate Change are evident in many parts of the world. In the latest report by the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5) 2014, the linkage between Climate Change and its impacts on natural and human systems has been given strong recognition. Moreover, there is more strong evidence that Climate Change is responsible for the disruption of weather patterns catalyzing melting of glaciers, alterations in hydrological systems, species diversity by changes in migration pathways, changes to crop production and yield threatening existing food production patterns. The report states that the frequency of heat waves in Asia is expected to increase and stay for longer periods of time. The number of cold days and nights will decrease and warm days and nights will increase. Therefore, irrespective of what is causing Climate Change, there are evidences from past events all over the world that Climate Change is threatening the natural balance of nature and proving the dependence and sensitivity of human on nature(IPCC, 2014) (IPCC, 2014a).

Over the past decade, impacts of Climate Change have been experienced in the form of warming of the atmosphere and ocean, rise in sea level and increase in concentration of greenhouse gases. Therefore, there is no ambiguity related to the evidence that Climate Change is happening. Impacts of Climate Change also make the destruction caused by natural hazards even worse. Increase in events of heavy precipitation accompanied by rise in average surface temperature; alter the natural weather patterns & thus natural hazards become more intense in vulnerable areas. Natural hazards are defined as naturally occurring events which are potentially dangerous to communities in difficult and disaster prone terrains. Earthquakes, landslides, floods, droughts, hurricanes and volcanic eruptions can be classified as naturally occurring hazards. Without proper risk reduction, mitigation and adaptation methods, these natural hazards can turn into catastrophic disasters. KP Climate hazard are glaciers melting, drought, floods, avalanches and land sliding.

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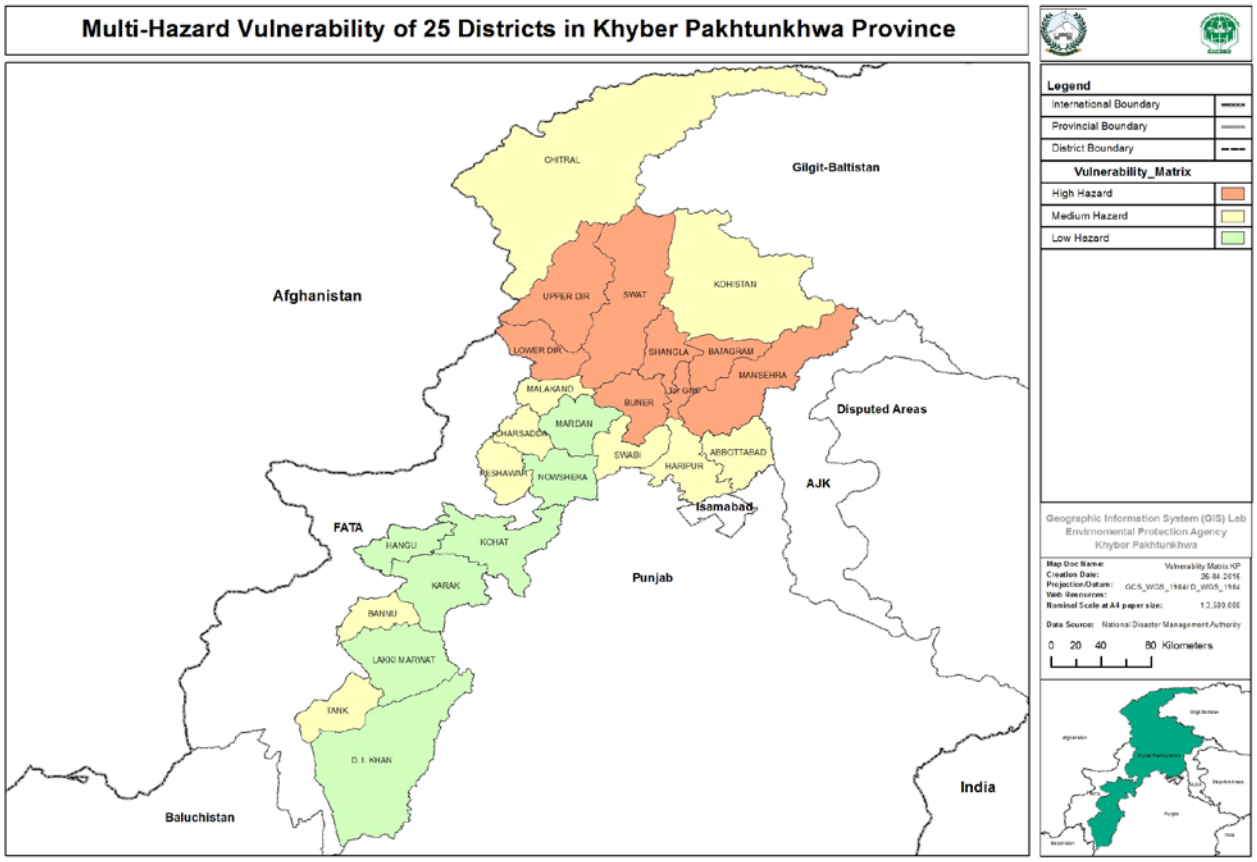

Figure 3: Multi-Hazard Vulnerability Assessment of 25 Districts in Khyber Pakhtunkhwa

Khyber Pakhtunkhwa is most likely prone to Climate Change impacts stated above. Figure 3 shows vulnerability of districts in Khyber Pakhtunkhwa to climate hazards based on National Disaster Management Authority's (NDMA) multi-hazard vulnerability assessment[6]. The detailed assessment is illustrated in Table 4.

Khyber Pakhtunkhwa is located in the mid-latitude region on the globe. In the fifth annual report of the IPCC, 2014, mid latitude regions have been warned of extreme weather pattern. Monsoon rainfall has been predicted to increase and go further up North due to warmer temperatures. Wet regions (such as the sub humid wet mountains of Zone B) will get more precipitation and dry regions (Central Valley and Piedmont Plains of Zone C and D) will receive less precipitation than before. These heavy precipitation patterns will accelerate glacial melting resulting in flash flooding and less precipitation in dry regions will contribute to droughts.

[6] NDMA, 2015. National Monsoon Contingency Response Directive 2015. Accessed from <http://www.ndma.gov.pk/PDF/Directive_2015.pdf>

District	Flood	Landslide	Avalanche	Drought	GLOF	Multi-hazard
Abbottabad	M	VH	VH	VL	-	M
Bannu	H	L	VL	L	-	M
Batagram	M	H	H	L	-	H
Buner	VH	H	H	L	-	H
Charsadda	VH	M	VL	L	-	M
Chitral	H	H	H	VL	H	M
D.I.Khan	H	VL	VL	L	-	L
Hangu	M	M	VL	L	-	L
Haripur	M	VH	H	VL	-	M
Karak	L	L	VL	VL	-	L
Kohat	M	L	VL	L	-	L
Kohistan	M	H	H	VL	-	M
LakkiMarwat	M	VL	VL	VL	-	L
Lower Dir	H	H	H	VL	-	H
Malakand	H	M	M	VL	-	M
Mansehra	H	VH	H	VL	-	H
Mardan	H	L	VL	VL	-	L
Nowshera	VH	L	VL	VL	-	L
Peshawar	VH	H	VL	VL	-	M
Shangla	H	H	H	L	-	H
Swabi	VH	L	VL	L	-	M
Swat	VH	H	H	L	-	H
Tank	H	VL	VL	L	-	M
Torghar	H	VH	H	VL	-	H
Upper Dir	H	VH	H	L	-	H

Table 4: KP Province District-wise Natural Hazards Vulnerability Assessment by NDMA
VH: Very High; H: High; M: Medium; L: Low; VL: Very Low

The natural hazards that are most likely to occur in the province in the coming years are discussed below in detail.

i. Floods

KP has an intricate river system, with many smaller rivers draining into the Indus River running through the province. The major rivers that cross the region are Indus River, Kabul River, Swat River, Kurram River and Gomal River. The Indus River and its tributaries have a capacity of 154 MAF (Million Acre Feet) of water annually, which includes 145 MAF from North Western Rivers (Indus, Jhelum, Kabul and their adjoining smaller rivers) and 9 MAF from eastern rivers (essentially Ravi and Sutlej) (EPA, Govt of KP).

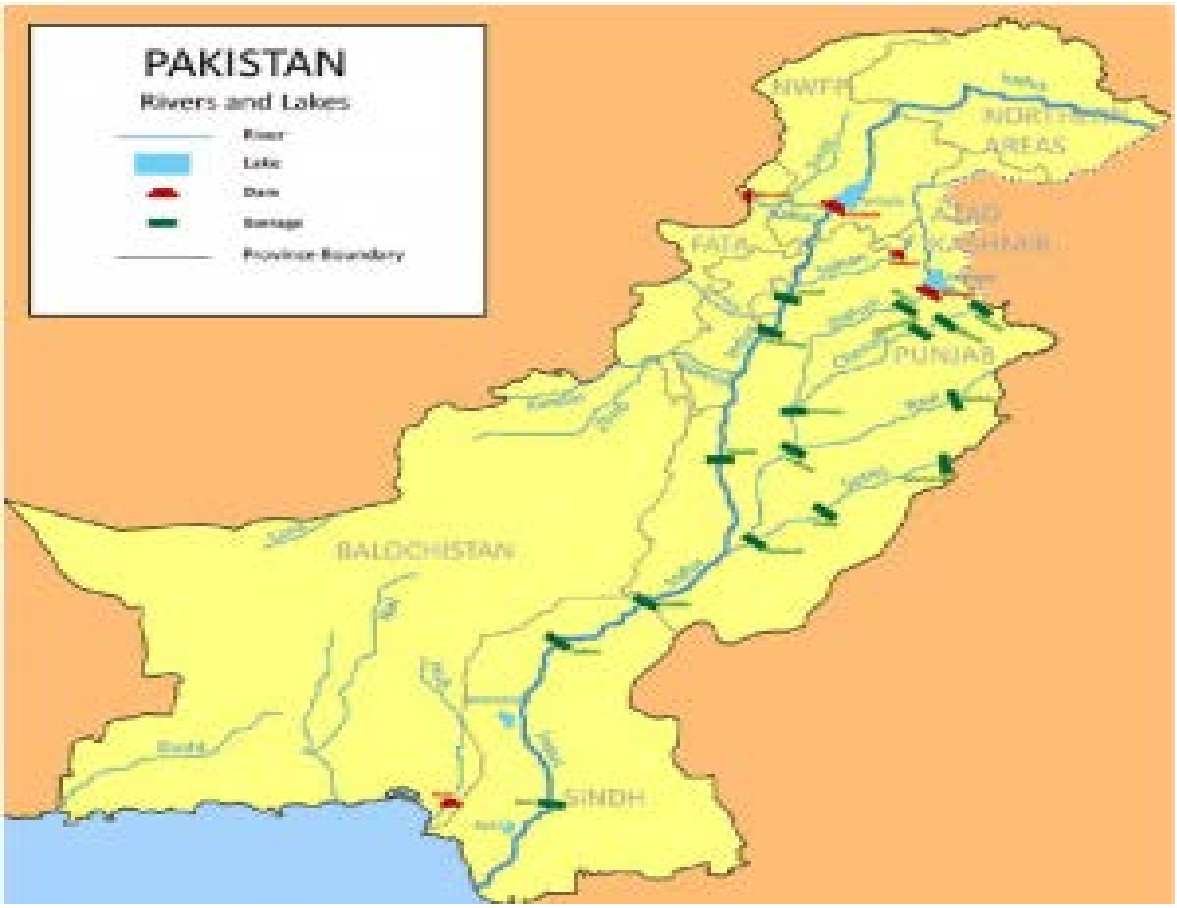

Figure 4: River systems in Pakistan (Shabir, 2013)

Due to these river systems, the region is prone to flash flooding during heavy monsoon season. Flood frequency has been increased in the KP region in the past few years. Almost every year, the region is flooded due to heavy precipitation. In 2007, Kohistan was badly flooded due to torrential rain and glacial melting in July and August. KP experienced even worse flooding in 2010 – the worst in recent history - resulting in

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displacement of hundreds of thousands of people. The following years - 2011, 2012, 2013, 2014 and 2015 - saw a repetition in the pattern, admittedly though, with less intensity. The repetitive flooding over the years with rehabilitation from previous floods still underway made conditions even more challenging and costly. In the flood of 2010, according to data collected by OCHA, 4,725,695 people were affected in Khyber Pakhtunkhwa. The flood of 2015 was one of the biggest GLOF events which affected 321, 644 people in Chitral and destroyed 1200 acres of standing crops (PDMA, 2015).

The main regions of KP which are expected to continue having flood hazards are the Himalayan moist temperature forests between 1525-3660m. It is highly likely that this region will experience intense precipitation especially in lower Kaghan Valley, Galiat and southern parts of Kohistan. Therefore, Zone A and Zone B of KP are at high risk of flooding and strategic actions to mitigate and adapt to these weather events is of great importance.

ii. Droughts

Droughts in the southern parts of KP (zone C and D) are more common as compared to the North (Zone A and B). The central valley plain, Piedmont plain and Suleiman Piedmont, Zone C and D are areas dedicated mostly to agriculture. Although agriculture is practiced throughout the province, if a comparison is drawn Zone C and Zone D together have a cultivated area of 1,115,000 ha, whereas Zone A and B have a cultivable area of 626,000 ha (EPA, Govt of KP). These numbers signify the magnitude of impact of a drought on food security in the province. With rising temperatures and decrease in rainfall in dry regions, Zones C and D are most likely going to be water stressed region in the coming years. The climate ranges from warm and sub-humid in Zone C to hot and arid in Zone D. Dera Ismail Khan is the area which will be most prone to droughts. Although, drought is a less common hazard compared to floods, the implications on food security cannot be ignored. Deserts in Southern parts like Karak Lakki Marwat& DI Khan may expand in case of prolonged droughts.

Zone C and D of the province receive less rainfall and higher temperatures in the summer and drier winters. Climate forecasts predict that dry regions will get drier and wet regions will get wetter. As these zones are drier especially during the winter and hot during the summers there is an expected increase in average temperatures in the summer. These high temperatures may be optimal for some crops to cultivate but high temperatures will increase evapotranspiration which in turn increases the demand of

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crops for water. Therefore, the quantity and availability of groundwater and irrigation water will be vital in determining water stress in the area.

iii. Earthquakes

Although earthquakes are not caused by Climate Change, they have severe impacts on communities and can alter natural ecosystems. Moreover, they can be the cause of many other natural hazards such as landslides, floods (due to cracks in dams, altering of river pathways), infrastructure damage which can pose as a challenge for rehabilitation efforts.

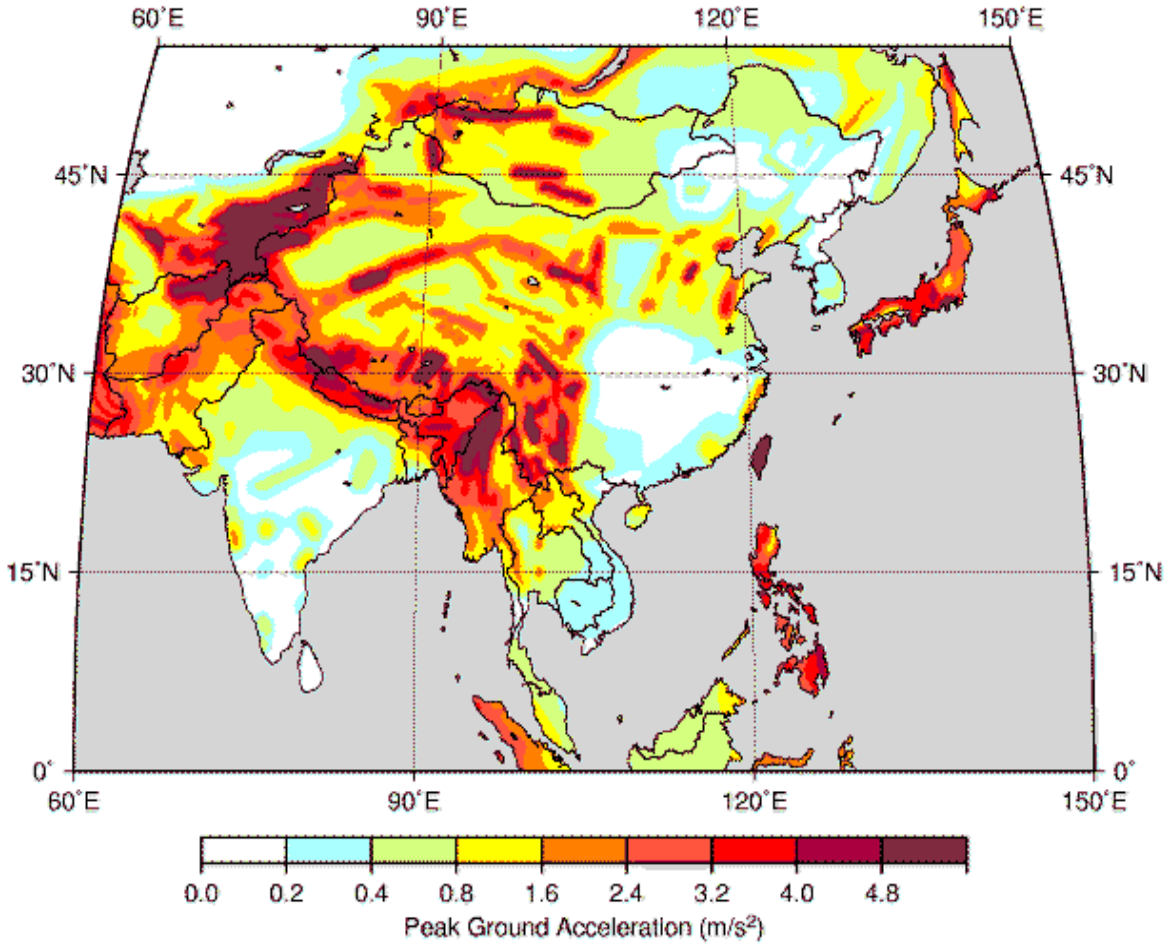

Figure 5: Map representing the red zones for earthquakes of South Asia (GSHAP, 2000)

Pakistan is located on two major tectonic plates, Eurasian and Indian Plate. This makes Pakistan at high risk from high magnitude earthquakes. This is evident by the red to orange color given to Northern part of Pakistan in the map above. The Northern regions, especially KP are at higher risk compared to the other parts of the country and have

experienced devastating earthquakes before. The Hindu Kush and Himalayan range are usually determined as the epicenters of earthquakes which affect this region. Therefore, disaster risk reduction (DRR) and climate compatible development is of utmost importance in KP to prevent loss of lives and infrastructure and create communities which are able to reduce as much damage as they can through safe buildings and better preparation through capacity building and access to rescue equipment.

4.4 Impacts of Climate Change

Natural hazards are not the only impacts of Climate Change which will be experienced by KP. In fact, there are other impacts as well which give rise to many development challenges. These impacts will be experienced across the four agro-ecological zones of KP.

Increase in surface temperature-The IPCC AR5 has reported that almost the entire globe has experienced surface warming. This will result in hotter, longer summers and shorter and milder winters having significant impacts on cropping patterns of KP. Higher temperatures also mean that monsoon rainfall will be more severe creating risks of flooding and induce glacial melting at a faster rate in zone A and B, which are the hub of glaciers and sub humid forests.

Increase in precipitation- More intense rainfall over a shorter period of time will cause flash flooding in the mountainous regions (zone A and B), while the floodplains - the main centers (zone C and D, i.e. central valley plain and piedmont plain) of population and agricultural activity due to alluvial soil – will be affected by massive Riverine floods. Intense rainfall can cause soil erosion and strips soil of nutrients. Moreover, shortage of rainfall in drier areas in higher parts of zone C and D will result in drought effecting crop yield.

Changes in food production- This impact is most significant on zone C and D where majority of the agricultural activity occurs. As weather patterns shift, temperatures fluctuate and rainfall becomes more erratic, therefore, changes in the type of crop and amount of crop produced will also change. Farmers will have to struggle with depleting water supplies and extreme temperatures unsuitable for a healthy crop. Moreover, they will have to deal with frequent insect infestation due to favorable warmer humid climate for insects. In the north with an increase in temperature, more crops will be able to be cultivated, such as cotton, wheat, maize, rice etc., whereas the Central Valley Plain, which is currently the main region for agriculture, and also the Southern Piedmont

region, will face water shortage due to decrease in rainfall, causing a decrease in crop production. These changes along with natural hazards such as floods (which completely destroy agricultural fields and ready to harvest crops) and droughts will cause food security issues in the province.

Shifting weather patterns- Changing weather patterns such as higher temperatures and more rainfall can have serious impacts on flora, fauna and people living in the province of KP. Higher temperatures and shorter winters allow insect forests to thrive thus weakening trees. Droughts can have the same weakening effects. Higher temperatures also provide more bacteria and viruses to thrive and can cause health issues to people, especially those who consume contaminate water. Moreover, flooding and droughts can cause shortage of potable drinking water.

Glacial melting- The Hindu Kush Himalayan range (in zone A) is dominated mostly by glaciers throughout the year. Glacial Lake Outburst Floods or GLOFs are one of the main natural hazards that affect all zones of the province. Due to longer summers and higher temperatures, glaciers melt at a higher rate (IPCC, 2014a). Spring season, where temperatures are cool to moderate are favorable for the freezing process of glaciers, which protects them from the summers. However, due to higher temperatures and almost nonexistent spring season, glaciers do not get enough time to freeze and therefore melt at a faster rate on the advent of summers. Glaciers are natural reserves of freshwater, which take hundreds of years to accumulate(Din, Rasul, Mahmood, & Tariq, 2014). Without these, freshwater crisis is expected to exacerbate.

Loss of species diversity- Climate Change is a threat to species diversity. In Pakistan, about 100 species are endemic and 90% of them occur in KP. The Himalayan range and the semi moist forests of KP, predominately zone A and B are the habitats of mammal species, moreover, seven bird species and 12 internationally endangered endemic and migratory birds are also found in this zone. Therefore, the biodiversity in zone A and B are most threatened by Climate Change (EPA, Govt of KP). Changes in temperature and precipitation are the basis for changes in ecosystems which are abode to many mammal, bird, forest and insect species. Most plant species cannot shift their geographic ranges or adapt to the rapid changes in climate. Mammals and other species will not be able to do either. Moreover, changes in ecosystems means changes in feeding patterns which can weaken animal species and lead to their extinction (IPCC, 2014).

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People and society- Climate Change and its implication on society means that people will have to change the way they live. They will have to adopt techniques which can help minimize impacts of Climate Change and the rate of Climate Change itself. Extreme weather patterns caused by the changing climate will cause a stress on human health, infrastructure, livelihoods and culture. Climate Change will increase the displacement and the need for resettlement of people who are subjected to extreme weather patterns.

Zone	Potential Impacts	Potential natural hazards	Vulnerable/sensitive sectors
A	Increase in rainfall, increase in temperatures, rapid glacial melting, loss of species diversity	Floods	Glaciers, forests, biodiversity
B	Increase in rainfall, increase in temperatures	Floods	Forests, biodiversity, agriculture
	Increase in crop production	-	Agriculture
	Increase in insect infestation	-	Agriculture, biodiversity
C	Decrease in rainfall, increase in temperatures	Droughts	Agriculture, biodiversity, water
	Decrease in crop production	-	Agriculture, water
	Increase in insect infestation	-	Agriculture, biodiversity
D	Decrease in rainfall, increase in temperatures	Droughts	Agriculture, water
	Decrease in crop production	-	Agriculture, water

Table 5: Summary table of potential impacts, climate hazards and vulnerable sectors for KP

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4.5. Need for a Provincial Climate Change Policy for Khyber Pakhtunkhwa

So far, the National Climate Change Policy has served as the guiding framework in Khyber Pakhtunkhwa (KP) Province on mitigation measures. A provincial policy is now required for the following reasons:

- Formulate overall Climate Change positions/objectives for KP Province.
- Provide guidance to sector strategies from climate perspectives.
- Identify policy priorities, guidelines, policy instruments and measures to address Climate Change as applicable and relevant to KP Province.
- Provide a KP-specific concise and accessible tool for policy makers for coordination of Climate Change activities as prescribed by the National Climate Change Policy 2012 (including technical assistance).

The Policy will provide an overarching (umbrella/high level) guidance for the Govt. of KP to implement the major Climate Change objectives of national and provincial priority related to adaptation and mitigation of GHG emissions.

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5. CLIMATE CHANGE ADAPTATION

Around 75% of the population of KP is dependent on agriculture and livestock as a source of income and livelihood. Dependence on agriculture as a source of livelihood is significantly higher in rural areas than in urban areas. By value, crops constitute about 70% of the agricultural produce whereas livestock rearing is around 30% of it (Planning and Development Department, 2010). Majority of the land owners are small farmers which depend on rain fed agriculture. Land for cultivation is irrigated through a network of canals and streams and also through rain. KP major crops include wheat, maize, sugarcane and tobacco etc. KP has a significant advantage in production of fruits namely water melon, apricot, guava, walnut, apple, mango etc. In KP livestock rearing is practiced mainly for meat, wool, dairy products and eggs from poultry. Cows, buffalo, goat and sheep etc. are some of the common livestock animals reared in KP.

Unpredictable weather due to change in climate is threatening the agriculture and livestock sector of KP. Climate variations affect growth duration, soil moisture, nutrient levels and water availability for crops. These can increase the chance of reduced yields or even crop failure. Heat waves can increase animal mortality, increase prevalence of pathogens, threaten pasture and feed supplies.

5.1 Agriculture and Livestock

Agriculture sector of KP faces a number of problems. One-fifth of the land is cultivatable and is owned by small farmers. The pressure on natural resources is mounting due to inefficiency of existing irrigation structures, fragility of uncultivated land and urbanization. There is high dependence on imported products mostly from other provinces, such as wheat. Productivity is low as seed and fertilizer quality is poor. Nearly 20% of cultivable land is unused while an increasing amount of this land is being lost to land degradation (water logging and salinity), inefficient use of water and urbanization. In order to improve yields the use of fertilizers and pesticides is rampant. Due to lack of awareness and regulation farmers tend to exceed prescribed limits or even in some cases use chemicals which are banned in the international markets. The institutional capacity of Govt. of KP departments and research is limited. Poor market structures, lack of financial and economic incentive to farmers and herders are also some of the problems faced by the agricultural sector of KP.

Livestock is one of the most climate-sensitive economic sectors. The possible effects of Climate Change on food production are not limited to crops and agricultural production. Climate Change will have far-reaching consequences for dairy, meat and wool production, mainly arising from its impact on grassland and rangeland productivity. Heat distress suffered by animals will reduce the rate of animal feed intake and result in poor growth performance. The impact of Climate Change is expected to heighten the vulnerability of livestock and reinforce existing factors that are affecting livestock production systems, such as rapid population and economic growth, rising demand for food (including livestock) and other products, conflict over scarce resources (land tenure, water, biofuels, etc). For rural communities, losing livestock assets could trigger a collapse into chronic poverty and have a lasting effect on livelihoods. The direct effects of Climate Change will include, for example, higher t7mperatures and changing rainfall patterns, which could translate into the increased spread of existing vector-borne diseases and macro parasites, accompanied by the emergence and circulation of new diseases.

Recommended Policy Measures

- Revise agriculture and livestock related legislations, policies and plans to incorporate Climate Change considerations.(H)[7]
- Strengthen regulatory and monitoring mechanisms to reduce the usage of harmful/banned fertilizers and pesticides while incentivizing usage of organic farming techniques, and conservation of water and soil. (H)
- Streamline agriculture extension services especially to include Climate Change adaptation for better productivity and enhance the use of capacity building instruments like farmer field schools. (M)
- Develop research on climate smart agriculture and livestock sector, exploring impacts of Climate Change on productivity of the two sectors, and ways these can be addressed and reduced. (H)
- Encourage measures to increase productivity including use of soil management techniques, organic farming land resource management, artificial insemination and livestock feed enrichment techniques.(H)

[7]H= High priority, M = Medium priority and L = Low priority

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- Assess, manage and reduce risks to crops by developing risk management systems for extreme temperatures and extreme weather events, water conservation strategies, desert cultivation and crop insurance.(H)
- Assess, manage and reduce risks to livestock by developing risk management systems for extreme temperatures and extreme weather events, livestock disease monitoring and surveillance system, livestock health units.(H)
- Strengthen capacities of relevant stakeholders including farming communities on sustainable farming techniques. (H)
- Monitor land-use and land-cover for KP, and develop land use planning to manage and plan for agricultural activities using GIS/RS remote sensing techniques. (M)
- Develop and propagate low cost food preservation and storage technologies. (M)
- Enhance veterinary extension services, and research technology development. (M)
- Enhance collaboration between the environmental agencies and livestock sector, to facilitate the farming communities for the upcoming environmental changes. (M)
- Conduct awareness campaign, which can enable farmers to focus their attention on adoption and change in livestock practices to meet the new challenges, will be helpful. (H)
- Re-defining/downscaling of agro-ecological zones in the provinces for more area specific and action oriented research, climate compatible planning & development (H).
- Development / downscaling of district wise climate scenarios to link climate adaptation and mitigation measures with district development plans (M)
- Diversification in the Livestock Sector by modern techniques / tools. (M)
- Fodder conservation and preparation of feed supplement for livestock. (H)
- Capacity building of farmers on appropriate animal husbandry practices & disease prevention. (H)
- Efficient utilization of crop residue & agro-industrial by products for animal feeding by using modern techniques. (M)

- Production of veterinary biologics on large scale for livestock / poultry disease prevention. (M)
- Recommendation of result based prophylactic measures in concerned area for remedial purpose. (H)
- Strengthening of coordinated R&D activities through sharing and access to resources and equipment, GIS,IT & Networking etc. (H)
- Prepare baseline for Climate Change measurement and monitoring at provincial level. (H)

5.2 Forestry

Food Security depends on water security and water security depends on forests. In this connection forests are one of the most important natural resources that have been gifted to mankind for their sustained existence on earth. Forests are essential for our survival on planet earth. It's well known fact that forests absorb carbon dioxide and are only source from which we produce oxygen to survive. Our freshwater reservoirs protection is dependent on healthy forests and people believed that forests were the 'mothers' of rivers.

About 33% of the forest covers of Pakistan lie in Khyber Pakhtunkhwa province (Pakistan Atlas 2012, PFI).Forests are a source of livelihood for the communities, a labor intensive sector and have huge potential for poverty reduction and income generation and also home to a variety of species.

Forests are directly and indirectly impacted by Climate Change. Climate Change not only affects growth and productivity of forests but can also increase the number of forest disturbances. Productivity of forests can be affected by changes in temperature, precipitation and the amount of carbon dioxide in the air. Forest disturbances such as weakened health of trees, droughts and storms can reduce forest productivity and change the distribution of tree species. In absence of suitable measures to improve forest health, valuable goods and services provided by forest ecosystem could be lost. Non timber Forests Produce (NTFP) is an important source of revenue for forests dwellers and are a source of medicinal plants, fodders, gums, resins, Mazri leaves and honey.

Climate Change and over-exploitation of forests has negatively impacted the forest cover of KP province. Rehabilitation of degraded natural forests, pasturelands and

watershed sources is a priority issue for the KP government. Moreover, promotion of NTFP is imperative in reducing poverty and improving the livelihood of people dependent on it.

Recommended Policy Measures

- Conduct research and gather data and information through modern techniques and technologies necessary to understand the current status of forests and the impacts of Climate Change on forestry. To this end, employ the latest knowledge on bioclimatic zoning for forest management, especially the application of Holdridge Life Zones (HLZ)[8], (Holdridge methodology) in the forest ecosystems of Khyber Pakhtunkhwa. (H)
- Develop mechanisms for more preservation and less conservation approaches to ensure more sustainable management of all types of forest by developing working plan codes and manuals of strategic, operational management plans as well as village land use plans (VLUPs) by including biodiversity working circle, community welfare working circle, ecotourism working circle and improvement working circle in addition to conventional/ traditional protection or commercial working circles through participatory integrated management approach. (H)
- Streamline legislation – if necessary - and undertake concerted legal action against the timber mafia to prevent poaching of forest timber and for adoption of new management approaches, regularization of mechanism for NTFP management, taking measures for the promotion of ecotourism, provision of magistrate power to forest staff and leasing plus mining within forest etc.(H)
- Maintain and enhance ecological and environmental values of forests that include but are not limited to water yield, carbon sink, land stabilization, and biodiversity conservation to stabilize ecosystem and nature conservation for recreation, games and sports. (H)
- Develop capacities for assessment, planning and monitoring of the forest resources, to remove threats to deforestation and loss of biodiversity so that adverse changes that may arise can be detected and redressed through revised codes and management plans. (H)

[8]Nasir, S. M.; Afrasiyab M.; Athar M.: Application of Holdridge Life Zones (HLZ) in Pakistan; Pak. J. Bot., 47(SI): 359-366, 2015.

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- Ensure forest land is not transferred or leased to any government institution or private entity for purposes other than preserving and enhancing the forest value.(M)
- Establish a network of forest protected areas, buffer zones and ecological corridors, where possible, to conserve biosphere reserves particularly in unique types of forests. (M)
- Promote urban forestry, for Landscape improvement, social forestry and farm forestry to increase woody biomass out of forest areas. (H)
- Develop capacities for assessment, planning and monitoring for the growing climate challenges. (H)
- Conserve and promote non-timber forest products (NTFP) through sustainable use practices and management of proper processing and marketing to increase income from these activities to improve livelihoods of poor people inhabiting forest zones. (H)
- Increase awareness of public and private sector on benefits of conservation and protection of existing forests, and benefits of afforestation. (H)
- Establishment of gene bank of forest species to preserve the genome in order to combat the possibility of erosion of any individual species or gene within the gene pool of Khyber Pakhtunkhwa forest. (H)
- Adopt tissue culture technique to combat the impact of climate on natural regeneration and seed viability issues. (H)
- Manage, develop and rehabilitate the rangeland through the creation of a new rangelands management circle. (M)
- Ban all the anthropogenic activities in the fragile areas of all ecosystems especially not to allow housing schemes inside or nearby forest areas. (H)
- The entire watershed area of Khyber Pakhtunkhwa needs to be treated simultaneously through the mechanism of complete valley treatment instead of patch plantation approach. (M)
- The regulation of proper ecological and environmental functions needs to adopt REDD++ approach along-with compensating the communities from their other natural resources like water cess (Tax) etc. (M)

- Encourage private sector for increasing forest cover on available wastelands particularly for enhancing timber production. (M)
- Fuel wood extraction being the main cause of forest depletion can be controlled by arranging alternative energy sources to the forest areas. (H)

5.3 Human Health

Vulnerability of human health to Climate Change depends on exposure, sensitivity and coping capacity. With increase in temperatures and frequency of natural disasters, disease prevalence is likely to rise particularly of water-borne illnesses (like dengue) and diseases vectors including diarrhea (IPCC, 2014b). Heat strokes, gastrointestinal problems, respiratory diseases, skin diseases, eye infections, malaria and mortality due to extreme weather events are likely to increase in severity, frequency and intensity. Storms, floods and droughts, caused by Climate Change, can force people to migrate to urban centers of the province. This can have spill-over effects such as lack of housing facilities, water and sanitation problems and an increase in transfer of diseases in high population density areas of KP. The province already suffers from high mortality rates for infants, children and women, and inadequacy of public health facilities and service, which are likely to be exacerbated by the impacts of Climate Change if not addressed effectively.

Recommended Policy Measures

- Conduct research to assess impacts of Climate Change on human health and health sector in KP Province, assessing risk of conditions, symptoms and diseases likely to affect human health in KP. (H)
- Develop plans and strategies to forecast, monitor and address impacts of Climate Change (extreme temperatures, extreme weather events and resulting effects) on health through both preventive - such as building more healthcare facilities in both urban and rural areas, providing vaccines, improving access to clean drinking water -and curative measures such as medications. (H)
- Identify the vulnerable communities of the province, improve their access toand upgrade quality of health services and build their knowledge and capacities to reduce their health vulnerability to Climate Change. (H)
- Inform, sensitize, educate and train health professionals and the public about Climate Change related health issues, especially for women and children. (H)

- Take necessary steps to incorporate “Health in All Policies, (HiAP)”. (H)
- Develop community bases rescue and first aid services. (M)

5.4 Water Resources

KP water resources are used by agriculture, domestic households, industries and power generation. Tarbela, Warsak and Dargai-Jaban dams, situated in KP, are vital for hydro-electric power generation. In KP, surface water is found in the form of springs, precipitation, lakes streams and rivers and glaciers. Ground water can be found as aquifers and alluvial deposits.

In KP water stress has been exacerbated by reckless dumping of municipal and industrial waste into surface-water bodies, exploitation of underground water and water intensive manufacturing processes, with increasing pressure generated by population growth, agriculture, deforestation and impacts of Climate Change. With losses to storage capacity of water and increasing water stress per capita, surface water availability in KP is likely to fall.

Climate Change is likely to increase water demand for cultivation and other uses, shrink water supplies and untreated waste dumped into the rivers can degrade water quality. Climate Change induced shifts in snowfall and precipitation patterns are likely to increase the stress on existing water resources. Changes in the hydrology are likely to impact the intensity, frequency and cost of extreme events. Flooding and droughts are likely to become more frequent and severe.

Water stress will disproportionately impact agriculture and food security. KP represents7.67% of the total cultivated area of Pakistan. Nearly half of the cultivatable land of the province is dependent on rain fed for agriculture (Planning and Development Department, 2010).A reduction in the supply of water from KP can have severe spill-over effects on KP and the neighboring provinces. This can have negative impacts on agriculture, livestock, industrial and domestic spheres, which may result in income losses and induce migration. Improved management of water resources can increase income from agricultural land and water scarcity mitigation.

The risk of Climate Change exacerbates the situation because water is the primary medium through which Climate Change will threaten the livelihoods and well-being of societies. Investing in water management contributes right now to poverty reduction and in longer term to climate resilience and sustainable development. Water security is the

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cornerstone of economic growth, it cuts across a wide range of sectors like agriculture, industry, mining, energy, domestic supplies, health, and education. The Khyber-Pakhtunkhwa province is endowed with vast water resources, which are essential for basic human needs, agriculture, hydropower, industries and to sustain aquatic environment. However, the Climate Change has impacted the water resources of the province to a great extent, threatening the human as well as ecological sustainability.

Recommended Policy Measures

Water Storage and Quality

- Assess and address the needs for additional water storages and distribution infrastructure, and the quantity and sources of water available in the province. (H)
- Establish and enforce quality management systems and surveillance for water resources. (H)

Water Conservation Strategies

- Encourage water conservation by promoting rain harvesting techniques, sustainable ground water exploitation, recycling of wastewater through proper treatment and its reuse.(H)
- Develop contingency plans for short term measures to adapt to water shortages that could help to mitigate droughts and floods.(H)
- Minimize water losses by rehabilitating the drains, removing sedimentation and constructing breeches.(M)
- Construct check dams, dry dams which in case of flood will store water for future use. (H)

Integrated Water Resource Management

- Protect groundwater through management and technical measures like regulatory frameworks, water licensing, slow action dams, artificial recharge especially for threatened aquifers, and adopt integrated water resources management concepts and practices.(H)
- Introduce environment-friendly pesticides and fertilizers to reduce run-off of toxic compounds into sources of over ground and underground water.(M)
- Assess the Climate Change impacts on water resources in the region including assessment of knowledge and strategy gaps in water resource management,

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spatial variability and vulnerability characteristics (among communities, locations and eco- systems). Identify best practices and techniques including traditional knowledge.(H)

- Develop local adaptation plans on pilot basis to increase resilience of local communities in participatory mode, and capacity to address critical water resources management issues. (M)
- Enhance water security and climate resilience through better water resources management in Khyber-Pakhtunkhwa province. (H)
- Build capacities of institutions and stakeholders to integrate water security and climate resilience in development planning and decision-making processes. (H)
- Improve sustainability of poverty alleviation, rural development and water resources development projects and programs. (H)
- Improve livelihoods of communities at local level through pilot projects on climate resilience with stress on agriculture and food security. (H)

Legislative Framework

- Legislate and enforce industrial and domestic waste management practices to protect water resources from further degradation.(M)
- Enact and enforce laws and regulations required for efficient water resource management.(H)

Enhancing Capacity

- Increase investment in research in the water sector to minimize water losses and encourage conservation practices and introduce financial mechanisms in the form of subsidies and tax exemptions.(H)
- Strengthen capacities of all relevant stakeholders for monitoring, protection and conservation of water resources.(H)

Increasing Awareness

- Promote awareness on the importance of conservation and sustainable use of water resources.(H)

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5.5 Biodiversity

Khyber Pakhtunkhwa biodiversity includes a diverse array of ecosystems and species, and provides for a wide range of ecosystem services, such as providing fresh water, regulating the climate, inhibiting soil erosion, regulating surface runoff and providing bio-resources.

Apart from Climate Change, the biodiversity in KP Province faces major threats like deforestation, overgrazing, soil erosion, salinity and water logging, non-sustainable agricultural practices and hunting. It is predicted, however, that, in future, Climate Change will be the single biggest driver of biodiversity loss next to land-use change[9].

Climate Change affects a range of environmental factors such as temperature and moisture, which in turn affect species habitat and health. Some species are more adaptive, but, for others, a changing environment is a threat to their ability to survive and therefore threatens their existence.

Efforts so far to address threats to biodiversity have mainly been in terms of management of protected areas for the preservation of flora and fauna in their natural state. The protected areas (Figure 6) including wildlife sanctuaries and game reserves spanning over 1.05 million hectares attract vast varieties of migratory species every year and they face similar threats to their survival including Climate Change. There are six national parks, three wildlife sanctuaries, 38 game reserves, 22 private game reserves,84 community game reserves, two wildlife refuges and eight wildlife parks in KP Province[10].

According to the Wildlife Department in KP Province[11], impacts of Climate Change are being observed which affect both migratory and indigenous flora and fauna. These include:

- Land degradation due to extreme weather events, natural hazards, and soil erosion that causes loss of soil fertility and agricultural productivity.
- Changes in water quality and quantity in inland freshwaters.
- Degradation of vegetation in watersheds due to Climate Change.

[9]Millennium Ecosystem Assessment (2005) Synthesis Report

[10]Information received from KP Wildlife Department as part of the consultative process adopted for development of this policy

[11]Information received from Wildlife Department as part of consultation process for development of this policy

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- Changes in terrestrial, inland, wetland and fisheries systems, their species and ecosystem services, due to changes in rainfall regimes, rising temperatures and natural hazards such as earthquakes and floods.
- Changes in growth rates, reproduction and geographic ranges of species and penology of plants due to climatic changes.

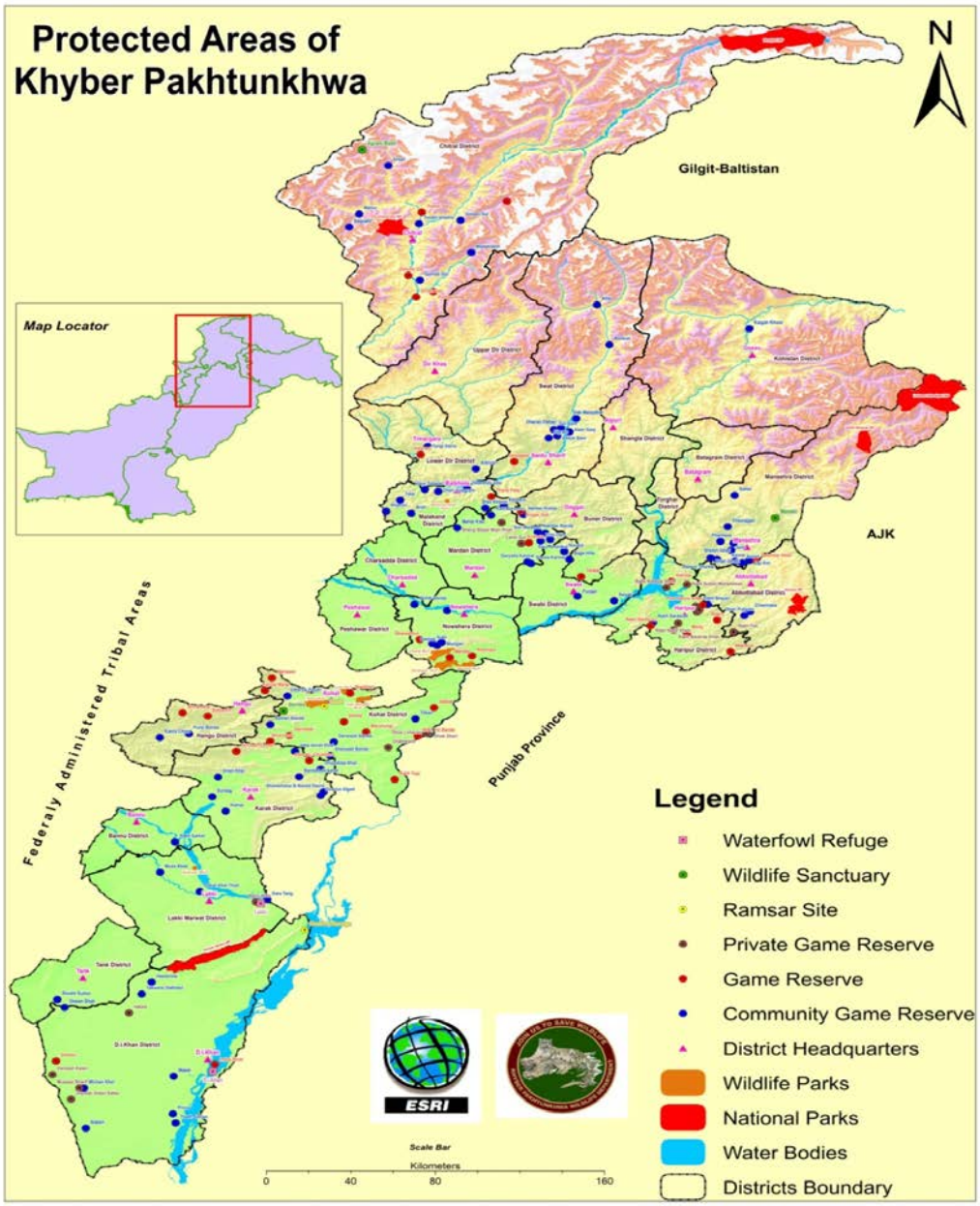

Figure 6: Protected Areas of Khyber Pakhtunkhwa **Source:** Wildlife Department Khyber Pakhtunkhwa

Recommended Policy Measures:

- Establish and manage protected areas, and increase their resilience for sustainable benefits of present and future generations, ensuring complementary schemes to mitigate adverse impacts on livelihoods of local communities. (H)
- Develop mechanisms to incentivize local communities to forge certain uses of land to be protected and to contribute to protection of such land. (H)
- Negotiate and agree on proper management of the protected areas and revise trophy hunting rules to further improve the transparency, governance and equitable sharing of resources among the communities. (H)
- Establish nature reserves, botanical gardens and gene banks in all the districts for recreational needs and educational purposes, and increase awareness and strengthen capacities of relevant institutions, NGOs, CSOs, communities and nature conservationists for conservation and sustainable use of biodiversity.(M)
- Improve understanding of the Climate Change impacts on biodiversity and monitor the impact on biodiversity due to the changing climate.(H)
- Facilitate ecosystem based adaptation[12]of biodiversity to Climate Change by increasing – in particular – the resilience of the protected areas and of fisheries. (H)
- Ensure implementation of hygiene regulations regarding aquatic habitats i.e. rivers, lakes, streams etc. (M)

5.6 Land and Vulnerable Eco-systems (Mountain Areas, Pastures, Arid and Semi-arid Areas, Wetlands, Rangelands)

Ecosystems provide valuable goods and environmental services for social and economic wellbeing. KP's natural ecosystems are experiencing degradation due to anthropogenic pressures and aggravation in the impacts of the Climate Change manifested by increase in extreme weather events and glacial melt, resulting in flash floods.

[12]**Ecosystem based adaptation** provides a cost-effective strategy that can be undertaken by parties, and is especially effective at local levels with community involvement. Ecosystem-based adaptation may also contribute to Climate Change mitigation through the preservation or sequestration of carbon

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The agro-biodiversity has suffered seriously due to introduction of high-yield varieties of food and cash crops, and use of agrochemicals. The major threats to terrestrial ecosystems are from overgrazing and deforestation due to increasing population pressure and poverty. Deserts in KP may expand. Due to prolonged droughts and extreme weather conditions, certain areas of KP in the southern districts may develop desert characteristics in the long run, while characteristics of cold deserts may arise in certain northern districts of KP.

In KP rangelands play an important role in Climate Change mitigation as they store and sequester large amount of CO_2 in the form of biomass and organic matter. Rangelands are very important for rural livelihoods and ecological stability of the Province.

Recommended Policy Measures

- Identify vulnerable ecosystems in KP Province and take measures to increase their resilience to changing climate while encouraging sustainable use of such ecosystems. (H)
- Promote eco-tourism as opposed to traditional forms of tourism restricting commercial activities to ensure assimilative capacities of vulnerable ecosystems are maintained and improved. (H)
- Establish coordination between relevant and appropriate stakeholders particularly forest, wildlife, irrigation and livestock departments for efficient management of ecosystems including rangelands, wetlands and other resources while ensuring the rights of the indigenous people.(H)
- Revive threatened ecosystems such as rangelands and enhance ecosystems by creating artificial wetlands wherever secondary water resources are available or rain harvesting is possible and by increasing grasslands in waterlogged zones.(H)
- Recognize the role played by wetlands in natural disaster protection and ensure controlled conversion of wetlands and their immediate surroundings for agriculture and grazing purposes. (M)
- Generate financial resources and take necessary measures for the establishment of a Provincial Range Development Fund. (M)
- Take measures for promotion of rangeland research technology and development in KP. (M)

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- Conduct Surveys to identify rangeland areas through GIS and Remote Sensing technology. (H)

5.7 Disaster Preparedness

KP is prone to multiple and frequent disasters of various types, predominantly floods, due to its geographical and topographical conditions, and droughts in some areas. Climate Change is making the occurrence of extreme climatic events more frequent. The magnitude of the calamity can be gauged from data compiled by the Federal Flood Commission, which states that the combined flow of rivers Swat and Kabul touched a new historical height of 400,000 as opposed to the previous figure of 250,000 cusecs recorded in 1929.

The increase in frequency of flash floods and floods are expected to cause river bank cuttings, surface runoff, soil erosion, avalanches and landslides thus damaging houses, agriculture lands, roads and properties.

Recommended Policy Measures

- Chalk out a Provincial DRR policy with a special emphasis on climate induced extreme events and disasters. (H)
- Clearly define roles and responsibilities of each concerned department, highlighting supervisory roles for public servants and representatives (local and provincial levels)during natural disasters to strengthen coordination and build their capacities to adequately plan for and address the impacts of extreme weather events. (H)
- Undertake hazard and risk mapping of existing infrastructure for telecommunication, power, utilities, transport, irrigation and agriculture and ensure their resilience against climate related hazards.(H)
- Strengthen forecasting, monitoring, early warning systems and evacuation planning for extreme weather events, for both humans and biodiversity (including livestock and fisheries), giving due focus to planning for vulnerable human population: old, children, disabled and women; ensuring community participation in the development process of such plans. (H)
- Maintain accurate records of seasonal patterns, temperature and precipitation for each agro-ecological zone and use this data and information to project Climate Change scenarios. (M)

- Develop an 'assessment and compensation mechanism' including insurance of losses and damages in the aftermath of disasters and measures for rehabilitation. (M)
- Plan, design, construct and strengthen appropriate flood embankments, dykes, protective bunds to protect flood plains and populations in view of likely floods. (H)
- Design, construct and upgrade disaster resilient multi-purpose buildings in relatively safer areas to use as shelter during natural calamities. (H)
- Ensure storm drainage system in major cities for intense rainfall events. (H)

5.8 Socio-economic Measures (Poverty and Gender, Youth Role)

5.8.1 Poverty

The rate and pattern of economic growth is a critical element in poverty eradication, and, climatic factors can have a powerful bearing on both. Rapidly growing population, poverty and Climate Change impacts are some of the key drivers that lead the process of desertification and land degradation causing significant threats to food and economic security.

The percentage of people living below the poverty line in KP is estimated to be 39%, much higher than the national level. Poverty is concentrated in rural areas where more than 80% of KP's population lives. A large proportion of the population lives on or slightly above the poverty line, and the vulnerability of this group worsens in the event of a natural disaster. An internal or external crisis including impacts of changing climate may push these people deeper below the poverty line.

Recommended Policy Measures

- Mainstream climate-poverty nexus in provincial planning, such as in Poverty Reduction Strategies (PRS), provincial population planning strategies and programs, and annual budgetary planning. (H)
- Conduct research to analyse the impact of Climate Change on poverty and on the development potential of province.(H)
- Improve governance, policy and decision making processes, which can have a critical bearing on the way in which policies and institutions respond to the impact of climatic factors on the poor. (M)

- Improve awareness of and access of poor communities to appropriate technologies for climate smart agriculture, energy and industrial development.(M)
- Share knowledge of local agricultural practices, yields, landholding size and other relevant information with departments responsible for social welfare, safety nets and poverty alleviation, to make poor agricultural households more resilient. (H)
- Investigate, plan for and implement measures on climate induced migration as it primarily affects populations in the low income group. (M)

5.8.2 Gender

While a large number of poor, rural women depend on climate sensitive resources for survival and their livelihoods, they are also less likely to have the education, opportunities, inclusion in decision-making process and access to resources they need to adapt to the changing climate. Women's vulnerability to Climate Change differs from men and Climate Change interventions that are not gender-responsive often result in deepening the existing gender divide. There has been little progress towards bridging the gender gap in recent years.

Nonetheless, Govt. of KP and its leadership have expressed a commitment to gender equity and women's empowerment (Government of Khyber Pakhtunkhwa, 2014). To this effect, the government has set up the Provincial Commission on the Status of Women and revived the Women's Parliamentarians Caucus.

Recommended Policy Measures

- Incorporate gender perspective in development, climate adaptation and mitigation planning. (H)
- Ensure to reduce the vulnerability of women to Climate Change impacts, particularly in relation to their critical roles in community. (H)
- Ensure equitable participation of women during every stage of decision making process on Climate Change mitigation and adaptation initiatives, using the local and indigenous knowledge of women to improve their welfare. (H)
- Develop gender-sensitive indicators related to adaptation to evaluate and monitor vulnerability of women to climate impacts and to address it accordingly. (M)
- Establish coherence among the institutions dealing with issues of Climate Change, gender, human rights, population planning and health policy. (H)

5.8.3 Youth Role

The Paris climate agreement, to keep global temperature below 2 Degrees Celsius, was reached in year 2015 at COP21. The agreement signed by more than 175 nations, includes national plans for embarking on the economic and social transformation from reliance on fossil fuels to using cleaner energy sources. The Paris Agreement has raised a big global hope in particular for the young generation, who will have to face Climate Change effects for a long-term. , and developed a White Paper to keep momentum going. In this connection, engaging young professionals and building their capacity to bring about positive changes in the society has become crucial. Youth could play a crucial role in combating Climate Change. The young generation inhabits the Earth and inherits the responsibility to protect the planet, in fighting against Climate Change. Educating youth is one of the most effective tools to combat the destructive potential of Climate Change and cultivate an international understanding among members of the next generation.

Youth are enthusiastic, innovative, quick learner and easily can adapt the low-carbon lifestyles and career choices as a part of their daily lives. However, it is the youth of the country who are going to suffer the most in future from impacts of Climate Change. Asia is home to 738 million young people and 61 percent of the world's youth but before the youth gets ready to take concrete steps, they need support to build their capacity and develop diverse knowledge about Climate Change. This requires appropriate education and relevant trainings. More efforts must be made to insure that young people are ready to take advantage of new environment oriented employment opportunities. Growing attention to Climate Change and sustainable development offers an ideal opportunity for green economic growth around the world. Green jobs not only provide much needed employment opportunities for youth, they also give young people an outlet to contribute directly in collective way to the fight against Climate Change by adopting green behaviors/strategies in the social, national and workplace as well.

Climate Change now has become a global challenge which is going to affect everyone in every corner of the globe. Governments would have to take strict measures to curb Climate Change and to prevent disasters.

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Recommended Policy Measures

- Involve youth in the decision- making in like formulation of adaptation & mitigation strategies on Climate Change at local and provincial level. (H)
- Raise awareness among youth to play role, how to combat Climate Change through mitigation and adaptation practices. (H)
- Establish Community based Organizations (CBOs) consisting young volunteers focusing on Climate Change adaptation practices. (H)
- Involve academia &youth organizations towards training & capacity building regarding Climate Change mitigation and adaptation. (H)
- Develop projects on pilot basis to motivate youth at optimum level to play active role in the spreading the information and knowledge regarding Climate Change in the backward areas of the province. (M)
- Involve Media including Electronic, Social & Print in all activities of youth for boosting up their role in combating Climate Change. (H)

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6. CLIMATE CHANGE MITIGATION

6.1 Energy

The energy sector in KP Province holds great importance in terms of electricity supply for the entire country due to its hydel power stations. The other provinces in Pakistan have rather limited primary energy resources, particularly potential sites for hydel power generation, and depend to a large extent on the energy produced in KP Province. Because of continued and rapid growth in population, urbanization and industrialization in recent years, the demand for electricity has increased more than its production resulting in a serious energy crisis. Due to economic growth and increase in population the electricity demand is further expected to rise in Pakistanto40,000 MW by 2020[13]. This will put further pressure on the province to cater to additional energy needs of the country.

Energy generation is the most significant contributor to GHGs emissions with vast majority of these emissions coming from the combustion of fossil fuel (oil, gas, coal), while energy consumption is a reliable indicator of economic development. Planning for energy is required in order to overcome energy shortages, to develop indigenous energy resources for sustainable and affordable energy, and to reduce GHG emissions.

Recommended Policy Measures

- Develop a provincial energy policy on the use of indigenous renewable energy resources to reduce dependency on imported fossil fuels, which can include hydropower, solar, wind, geothermal energy, waste to energy, bio-energy and indigenously produced natural gas. (H)
- Provide an enabling political, regulatory and financial environment for uptake of renewable energy, particularly for population of remote areas. (H)
- Assess GHG emissions resulting from proposed and adopted energy strategies and plans, and integrate this information in future energy planning. (H)
- Promote the use of solar water heating technologies to replace traditional natural gas fuelled water heating systems, in residential, commercial, and industrial buildings. (M)

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

- Capitalize on the opportunities presented by engaging private sector on renewable energy production and uptake. (M)
- Promote research on low carbon and renewable energy sources, technologies, and on the feasibility and cost-effectiveness of available sources. (H)
- Increase the effectiveness of existing financial support mechanisms, and provide further incentives such as carbon taxes, subsidies, and feed-in-tariffs and tax reforms for switching to renewable energy. (M)
- Promote zero emission building designs such as Passivhaus[14] especially for public sector that have minimal non-renewable energy requirements. (M)
- Develop capacities and knowledge of relevant stakeholders, including government departments, and local technicians for adoption, smooth operations and maintenance of renewable energy technologies. (M)
- Promote and improve access to technology for Waste Heat Recovery, Co-generation and Combined Cycle Power Generation. (M)

6.2 Energy Efficiency and Energy Conservation

Energy efficiency has a large potential to reduce GHGs emissions at low cost and to reduce the demand for energy ensuring sufficient energy supply is diverted to achieving economic development goals. Economically efficient use of energy causes less environmental impacts required for electricity generation, better health from improved heating or cooling and energy security protecting access to energy resources.

Recommended Policy Measures

- Promote uptake of energy efficient technologies and measures particularly for industries and strengthen the strategic and legal framework necessary for energy efficiency improvement in energy end-use sectors. (H)
- Link up the energy efficiency and conservation concept within the existing legislative regime especially exploring the possibility of integration with Khyber Pakhtunkhwa Environmental Protection Act (2014) and building codes, and enact new legislation as necessary for energy efficiency and conservation. (H)

[14]The term passive house (*Passivhaus* in German) refers to a rigorous, voluntary standard for energy efficiency in a building, reducing its ecological footprint. It results in ultra-low energy buildings that require little energy for space heating or cooling.

- Conduct research and energy audits to identify energy use by different sectors (commercial, industrial, residential) within KP and their relevant conservation potential. (H)
- Raise awareness on energy saving options including maximum use of natural day light, better insulation and use of energy efficient lighting and appliances and promote energy conservation through mass awareness campaigns. (M)
- Improve access to financing and provide financial incentives for energy efficiency practices and projects by coordination within government and with the financial sector. (M)
- Develop and implement energy efficiency standards for devices and appliances. (M)

6.3 Transport

The transport sector is a key economic sector, as well as a large and growing GHG emitter. The sector constitutes 10% of country's gross domestic product and provides 11 percent of the economic activity in the province (Government of Khyber Pakhtunkhwa, 2009). An efficient transport system with modern infrastructure will further improve the economic factor of production. Govt. of KP has created an independent transport department to develop the sector and to implement the Comprehensive Development Strategy 2010 - 2017.

Globally the transport sector contributes to a quarter of GHG emissions originating from energy consumption. Most of the sector emissions originate from road transportation. These emissions from road transportation are expected to increase to 90.17 Giga-tons of CO_2 by 2030 (Sanchez-Triana, 2013). In Khyber Pakhtunkhwa over 96% of passengers and 90% of freight travels by road. Demand for road transport has been expanding at a rate much greater than economic development as a whole. On the other hand, majority of the population does not use private transport and have to use the existing public transport which is not easily accessible, reliable or safe. Shifting investments to other alternate forms of transportation and strengthening the existing transport sector would complement efforts of the Govt. of KP for achievement of public service delivery improvement, socio- economic growth and, poverty and GHG emissions reduction.

Recommended Policy Measures

- Take into consideration Climate Change impacts in transport sector related planning (H)
- Develop and adopt strategies promoting clean energy mix, low carbon transport technologies, and low carbon transportation modes including mass transit systems and hybrid cars, non-motorized modes such as bicycling and walking.(H)
- Develop and enforce vehicle emission standards. In particular, encourage use of energy efficient transportation to reduce GHG emissions using principles such as vehicle fitness testing. (H)
- Provide financial, political and infrastructural enabling environment for energy efficient and low-carbon transport. (H)
- Conduct research to increase knowledge on current transport activity and related GHGs emissions, feasibility and cost-effectiveness of low carbon technologies and transportation modes. (H)
- Strengthen capacities in the province for improvement of transport efficiency, assessment of sustainability of transport modes and application of transport mitigation methodologies. (M)
- Explore opportunities and platforms for accessing domestic and international finance available for sustainable and low-carbon transport via carbon markets, climate funds, and interested donors. (M)
- Explore the feasibility for use of clean fuels such as bio-fuel and compressed/liquefied natural gas in the transport sector. (H)
- Explore and conduct feasibility studies to develop use of inland waterways transport. (M)
- Develop and adopt strategies for public transport management system (buses) in urban centres. (M)
- Adopt and develop polices to reduce travel demand by providing facilities at walking distance i.e. Health, Education, Shopping and other entertainments. (M)

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6.4 Waste

Solid waste comprises of municipal, industrial, hazardous, construction, packaging, agricultural and electrical and electronic equipment waste. In KP, municipal solid waste is estimated to be between 0.4 and 0.6 kilograms per day per capita. Nearly 40% of the waste generated is not disposed properly and ends up in streets and public spaces (Environmental Protection Agency, 2009). This creates a host of problems including environmental degradation, pollution of water and soil, exposure of humans and animals to toxins and air pollution.

Poor sanitation is a serious environmental health risk in KP. Waste water from households, rural and urban, is discharged untreated into the open. The untreated waste water pollutes the soil and underground water. This problem is particularly deleterious with respect to health and environment in rural areas where open defecation increases the exposure to human excretions (Planning and Development Department, 2010).

Lack of effective waste management systems is one of the biggest challenges being faced by the Government of KP at the moment. Weak waste management systems and increasing urban sprawl have exacerbated the waste management issues already faced by KP. Solid waste collection and disposal practices across the province need attention, especially in tourist districts of Hazara (Planning and Development Department, 2011).

Recommended Policy Measures

- Develop provincial solid waste standards for waste storage, collection, transport, treatment and disposal, in line with air and water standards, and ensure their implementation by all sub-sectors of the economy including any commercial activity, construction, industry and agriculture. (H)
- Develop proper collection, storage, transport and disposal system for municipal waste and wastewater and involve private sector in implementation of the system. (H)
- Ensure treatment of solid waste and waste water. (H)
- Formulate certified waste management systems for solid, hazardous and e-waste. (M)

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- Identify industries and sectors producing hazardous waste and e-waste, and monitor implementation of waste management systems for waste production, transportation and disposal. (M)
- Raise awareness about hazardous waste and inform all stakeholders of its toxic nature and impacts. (M)
- Conduct feasibility for waste-to-energy projects and promote the use of agricultural waste as industrial fuel. (H)

6.5 Industries

Industries in KP Province have a significant contribution to economic growth. The sector contributes 13.5% to provincial GDP[15], generates employment, and supplies some of the basic necessities through a competitive manufacturing sector.

KP has an extensive agriculture based industry that produces various products including tea, tobacco, match boxes, vegetable ghee and sugar. About 78% of national marble production, 27% of cement production and 20% of mining activities take place in KP province. There are approximately 12000 small, medium and large industrial units in Khyber Pakhtunkhwa out of which, 1821 are functioning and registered with the Directorate of Industries, Khyber Pakhtunkhwa[16].

The industrial sector is faced with many challenges which include shortage of electricity and lack of infrastructure. Changing climate and its impacts render additional set of challenges on industries when faced with extreme temperatures and climate induced temperatures particularly those that affect production or supply of raw materials.

Recommended Policy Measures:

- Mainstream Climate Change considerations in KP Industrial policy 2016 to ensure a climate resilient and compatible industrial sector is developed. (H)
- Provide evidence and information on GHG production, and GHG reduction potential in industrial sector. (H)
- Design incentives (financial and non-financial) to encourage GHG reduction, lowering energy intensity as well as renewable-energy based energy production systems in industries. (H)

[15]Khyber Pakhtunkhwa Board of Investment and Trade [Investment Guide]. Khyber Pakhtunkhwa the Unrevealed Story
[16]Bureau of Statistics (2015). Khyber Pakhtunkhwa in Figures 2015

- Conduct energy audits and promote energy efficiency measures in industries. (H)
- Promote and improve access to GHG emission reduction and capture technologies such as Coal Bed Methane Capture and Carbon Capture and Storage. (M)
- Encourage cleaner production and propagate 'circular economy' concept for efficient use of resources based on UNEP's Sustainable Consumption and Production guidelines. (M)

6.6 Urban Planning

Govt of KP wants to improve the access of public services in 22 urban areas of the province. These services include water, sanitation, drainage, streets and public infrastructure. Urban planning is of paramount importance to KP as the rate of migration, both rural to urban and urban to urban, is expected to rise. Spatial planning and management of urban land can help to reduce the number of environmental problems. Water supply, sewage and sanitation, drainage, vehicular emissions and solid waste management are amongst the top priority measures for urban planning for Govt. of KP. Unplanned urban development is likely to increase the environmental degradation in urban centers. It can increase water scarcity, exacerbate energy crisis, increase air pollution and produce social issues like crime and violence. Moreover, Environmental Impact Assessment (EIA) needs to be conducted before the construction of road networks, spatial planning and management of urban land.

For the fulfillment of these purposes Govt. of KP has initiated Community Infrastructure Program (CIP II), the provincial Urban Development Project (see National Urban Development Policy - NUDP) and the Rural Water Supply and Sanitation Project (RWSSP). Water conservation is a priority in urban planning since poor maintenance and construction results in high water losses.

Recommended Policy Measures

- Develop laws and regulations to manage urbanization and to prohibit conversion of land from one particular use to another. (H)
- Promote vertical growth, mixed land use, development of open spaces, efficient transport system, horticulture and landscaping and installation of energy efficient street lighting systems. (H)

- Develop and strengthen urban policy and planning institutions including city development agencies for improved urban planning, land use planning for commercial, residential and industrial activities, and resource mobilization. (H)
- Ensure provision of education, health, waste management, water and sanitation, and hygiene facilities particularly in urban slums. (H)
- Upgrade areas with high cultural, social and economic value in cities including historical architecture, slums, parks etc. (M)
- Develop, revise and update master plans for major cities to prepare for contingencies like climate-induced migration, and reduce risks from extreme temperatures, minimizing the heat island effect, where possible, in new settlements. (H)
- Ensure all urban planning is informed by appropriate disaster risk reduction (DRR).(H)

6.7 Carbon Sequestration and Forestry

Forests can act as carbon sinks and help to reduce the amount of carbon in the atmosphere by absorbing carbon dioxide. Removing forests can reduce the amount of carbon dioxide sequestered. Forests contain substantial carbon in the soil, trees, and other vegetation and are a key component in maintaining the GHG balance. KP province has great mitigation potential to sequester carbon via Aforestation and reforestation as highlighted by its provincial initiatives[17].

Recommended Policy Measures

- Limit deforestation and reduce GHG emissions associated with forestry operations. (H)
- Create more forests through Aforestation, re-forestation and establish new forests on abandoned agricultural land or other non-forested areas using indigenous species and avoiding foreign and invasive species. (H)
- Minimize disturbance to trees during harvesting activities and help trees get re-established faster after harvest. (M)

[17]Billion Trees Tsunami Afforestation Project managed by the Department of Forestry, Environment and Wildlife in Khyber Pakhtunkhwa Province.

- Improve monitoring and policing of forests to curb incidence of forest fires and to reduce the role of timber mafia in illegal felling and clearing of forest cover. (H)
- Promote urban forestry to adapt to extreme temperatures and to increase carbon sinks in cities. (M)
- Adopt agro-forestry practices to provide secondary carbon sinks and alternative sources of livelihood, fuel, timber and food. (H)
- Develop programmes to provide alternate fuel and livelihood options to forest dependent communities. (H)
- Explore international avenues to gain voluntary carbon credits from Aforestation and reforestation measures like REDD+. (M)

6.8 Agriculture and Livestock

Agricultural activities such as cultivation of crops and livestock contribute about 39% to national GHG emissions[18]. About 83% of the population in KP is dependent on agriculture and livestock for their income and livelihood (Government of Khyber Pakhtunkhwa, 2014). Management of various agricultural activities can help reduce GHG emissions and contribute towards mitigating Climate Change impacts. For Livestock sector, with feasible improvements in manure management, energy use, feed quality and animal performance, the emissions could be reduced by 14 to 17 percent of the baseline GHGs emissions (Source: Agriculture Department Govt. of KP).

Recommended Policy Measures

- Encourage agronomic practices that generate higher carbon residue and carbon storage in soil, such as crop rotation, re-vegetation, retaining crop residues for enhanced decomposition in soil, avoiding row crops and deep ploughing. (H)
- Adopt tillage management practices for minimal soil disturbance and reduced erosion. (H)
- Improve agro-forestry systems to increase carbon storage and reduce soil carbon losses stemming from erosion by combining crops with trees for timber, firewood, fodder and other products, and establishing shelter belts and riparian zones/buffer strips with woody species. (H)

[18] National Climate Change Policy 2012

- Employ integrated nutrient management techniques to reduce emissions on-site by reducing leaching and volatile losses, improving nitrogen use efficiency through precision farming and improving fertilizer application timing. (M)
- Improve water management through soil and water conservation by discouraging water drainage and encouraging shallower water table to increase water available in root zone (Freibauer et al. 2004); to enhance biomass production, increase the amount of above-ground and the root biomass returned to the soil. (M)
- Improve grassland and grazing management by controlling intensity and timing of grazing (e.g. stocking rate management, rotational grazing, and enclosure of grassland from livestock grazing). (H)
- Develop and propagate technologies for biogas production from agriculture/ livestock wastes. (H)
- Develop and adopt new breeds of cattle which are more productive in terms of milk and meat with lower methane production from enteric fermentation. (M)
- Encourage farmers to use appropriate feed mixes and additives to reduce methane production from enteric fermentation/ digestion in cattle. (H)
- Manage water in rice paddies to control releases of methane from agricultural soil and introduce low water delta rice varieties and fish/rice farming (M)
- Take measures for herd management, Improved breeding and animal health practices to shrink the herd overhead (i.e. unproductive part of the herd) and related emissions. (M)
- Allocate budget & incentives for farmers to reduce the risk in case of loss and damage caused by Climate Change. (M)

7. CAPACITY BUILDING

Capacity building is essential for development. It is a process of understanding obstacles that may inhibit communities, government, international organizations and non-government organizations from accomplishing their development goals. Policy implementation depends essentially on the ability of various stakeholders to understand the necessity of the policy and how to overcome hurdles in implementation. That can only be achieved by institutional development, including community participation, human resource development, strengthening of management systems and creating an enabling environment for appropriate policy implementation. The policy measures recommended below are an attempt to create an enabling environment for effective policy implementation.

Recommended Policy Measures

Institutional Enhancement

- Assess capacity needs that require capacity building to engage stakeholders in institutional capacity development. (H)
- Conduct baseline studies to assess capacity needs for conservation and resource management of important forest species, biodiversity, wetlands and agro-ecological zones. (M)
- Carry out capacity building of relevant organizations in the area on natural resource management, conservation of biodiversity, forests, water resources, sensitive ecosystems, risk reduction strategies and disaster preparedness. (H)
- Improve capacity of government departments to develop, implement and manage projects which increase climate resilience in vulnerable population and result in mitigation of and/or adaptation to changing climate. (M)
- Conduct training of government officials and stakeholders through workshops on Climate Change mitigation and adaptation; this could be technical or non-technical depending on requirements and the audience involved. (H)
- Forge partnership with training institutions and universities for regular training workshops for various capacity building exercises. (H)
- Engage stakeholders conducting projects within the region for assessing process and outcomes of environmental friendly development. (M)

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- Streamline Climate Change in provincial policy documents and development projects. (H)
- Establish and maintain / weather forecasting prediction centres for research. (M)
- Extension and capacity-building policies for Agriculture/livestock farmers can facilitate the transfer and use of more efficient practices/technologies that are readily available. (M)
- Train young scientists, faculty and government officials on simulation models, and adaptation planning and clean development mechanisms. (M)

Awareness Raising and Education

- Introduce concepts of Climate Change mitigation, adaptation and natural resources management in academic curriculums at all levels of education. (H)
- Mobilize and encourage young scientists and researchers to study Climate Change impacts and risk reduction strategies as human resource development to strengthen research and academic institutions. (H)
- Establish and strengthen Climate Change science related departments including universities through financial and technical support. (M)
- Ensure an institutional mechanism – like formation of the Climate Change cell - to conduct research and educate the public at large through campaigns and programmes about Climate Change impacts, mitigation and adaptation strategies. (H)
- Provide platforms and participate in knowledge and information sharing forums on Climate Change. (H)
- Provide necessary training and support to government officials and relevant departments regarding Climate Change impacts and development issues. (H)
- Support and encourage media and other relevant stakeholders in raising awareness campaigns including the use of social media. (H)

8. TECHNOLOGY TRANSFER

Technology transfer plays a critical role in facing the challenges of Climate Change. Although it is mostly associated with Climate Change mitigation strategies it is equally important for Climate Change adaptation. Technology transfer in mitigation strategies is usually restricted to specific sectors such as energy and industries, in which reduction in carbon emissions can be measured. However, in adaptation, technology transfer and techniques are relevant for a wide range of sectors, such as agriculture, water, health etc. Technology transfer is not restricted to exchange of machinery which reduces carbon emissions. It also includes indigenous coping techniques which are important for adaptation. Moreover, adaptation techniques are less capital intensive. Where technology pertaining to mitigation strategies can be used across countries, such as solar powered lights, adaptation techniques are environment and region specific (UNEP, 2011).

Transfer of technology is usually from developed to developing countries as a result of international climate negotiations which stipulate developed (industrialized) countries to assist developing (usually poor) countries in reducing emissions, in switching to alternate energy and adapting to Climate Change impacts. Developing countries with the help of national and international support can adopt environmentally friendly strategies and practices. Successful strategies practiced in other parts of the country can be adopted in other regions, whereas, exchange of technology within provinces would also help strengthen ties and pave the way for development at a national level. Technology is vital in ensuring effective implementation of policy recommendations for both climate mitigation and adaptation.

Recommended Policy Measures

- Determine technological needs in the province for climate mitigation and adaptation by conducting technology needs assessment. (H)
- Maintain records of progress/changes in technological needs. (M)
- Identify potential indigenous and international technologies for alternate energy sources such as solar, water and wind energy and promote uptake of this technology for use. (H)

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- Identify appropriate energy efficient technologies including efficient household appliances, solar water heaters, energy efficient chillers and lights for domestic and commercial buildings. (H)
- Identify potential technologies for energy efficient transportation and energy generation systems for domestic and commercial use. (H)
- Develop and introduce coping techniques and technology to aid sustainable agriculture practices and irrigation methods for water stressed conditions. (H)
- Promote partnership between international and national organizations whose Climate Change adaptation technologies in agriculture, energy, transport, forestry and water can be used in KP province. (M)
- Identify opportunities for uptake of low GHG emitting technologies such as photovoltaic power generation, natural gas turbines, biomass integrated gasification combined-cycle generation, and on-grid PV power production. (H)
- Promote research on GHG reduction and adaptation related technologies in universities and in other research institutes. (H)
- Encourage investments from domestic and international, private and public players to pilot projects on Climate Change mitigation and adaptation. (M)

9. IMPLEMENTATION

To guide implementation of recommended measures given in this policy for climate mitigation and adaptation, implementation strategies and action plans relevant to each sector and sub sectors need to be devised. Moreover, the successful implementation of the provincial Climate Change Policy depends significantly on governance, planning, risk management, resources, communication and monitoring. Some of the elements required for successful policy implementation are:

- Strong executive level support for delivery processes of the policy, which may even include making a provincial taskforce for policy implementation;
- Well established stakeholders engagement and communication plans for all departments;
- Supportive legal and financial services;
- Implementation road map/plan for the policy defining roles and responsibilities of relevant departments;
- Risk assessment and management;
- Effective and timely reporting, monitoring and performance evaluation; and
- Gap analysis of data to ensure accurate predictions for the future (for example in the case of weather data).

As per the National Climate Change Policy, to ensure effective implementation of the KP Climate Change Policy, a “Provincial Climate Change Policy Implementation Committee (PCCPIC)” needs to be set up whose task will be to implement Climate Change Policy and further to share the status of implementation according to action plans with the National Climate Change Policy implementation Committee. The committee shall meet at least once in a year to discuss strategic plans for implementation. The provincial policy is completely aligned with the national policy with some additional province-specific priorities and actions; therefore a single committee can be charged with the responsibility of overseeing the implementation of both Policies i.e. National & Provincial. As in the original scheme of things, the provincial committee will report to the National Committee, which in turn reports to the Prime Minister’s Committee on Climate Change.

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The composition as put forth in National Climate Change Policy for the Provincial Climate Change Policy Implementation Committees as below[19]:

- Secretary Forestry, Environment & Wildlife Department, Govt of KP **(Chairperson)**
- Secretaries to the Govt of Khyber Pakhtunkhwa:(i) Agriculture (ii) Irrigation (iii) Local Government (iv) Transport & mass Transit (v) Planning & Development (vi) Law& Parliamentary Affairs(Vii) Finance (viii) Industries (ix) Public Health Engineering Department. **(Members)**
  - Director General, Provincial Disaster Management Authority.**(Member)**
  - Director General, Environmental Protection Agency.**(Member/Secretary)**
  - One representative from corporate sector i.e. Chambers of Commerce and Industries.**(Member)**
  - One representative from Civil Society Organization. **(Member)**
  - Expert from the field. **(Member)**

[19]The composition of the PCCPPIC has been amended on the desire of the competent authority i.e. Secretary FE&W Letter No SO (Envt)/FE&wD/2-3/2016/PCCP dated February 10, 2017.

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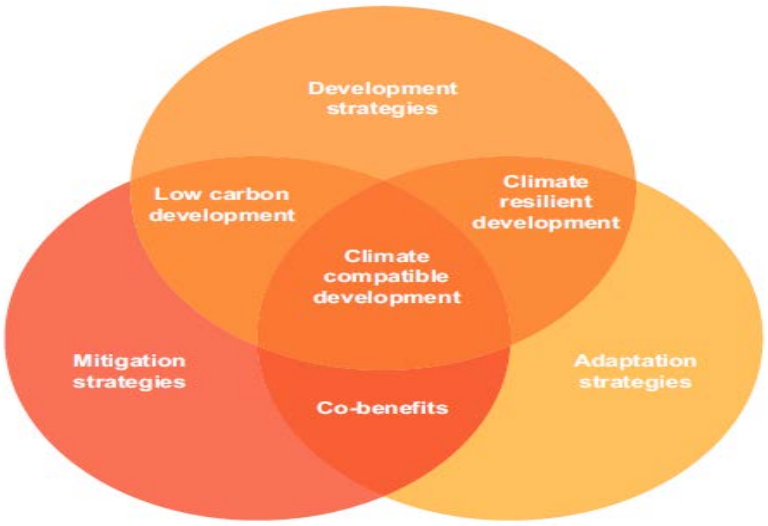
10. TOWARDS GREEN GROWTH AND CLIMATE COMPATIBLE DEVELOPMENT

Owing to its geographical location and topography, KP, even as compared to other provinces of Pakistan, is extremely vulnerable to the impacts of Climate Change.KP has been a front runner in initiating steps to 'greening' the growth of the province through the Green Growth Vision and Initiative (Khan, 2013). However, would this be sufficient to achieve the goal of Climate Compatible Development (see Figure 7).

What is Climate Compatible Development?

Climate Compatible Development (CCD) ensures development that minimizes the harm caused by climate impacts without compromising development goals. Growth that is fed through emission reductions and increasing climate resilience can increase opportunities and minimize threats. CCD helps integrate development goals and strategies into climate strategies.



Source: adapted from Zadek, 2009, and informal communication with staff from the UK Department for International Development

Figure 7: Climate Compatible Development

Climate Compatible Development (CCD) is an emerging concept which takes climate-centric approach to development as opposed to the economic development approach which forms the basis of Green Growth. Rather than focusing only on economic growth and Climate Change impacts, CCD relies more heavily on adaptation, mitigation, and development strategies and the synergies between these three main pillars required to address the Climate Change impacts. CCD is a way of addressing the fundamental

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questions posed by Climate Change to policy makers. As the need to adapt, mitigate, and develop increases, a new development landscape will emerge as new markets and opportunities will be created. CCD provides a more holistic approach for policy-makers to tap on these opportunities[20].

Background : The *Green Growth Vision* (GGV) of the provincial government provides a three-step strategy for a roadmap to enable green growth in the province. The vision addresses environmental challenges and solutions pertaining to key sectors of the province. The Government of KP (Govt of KP) aims to provide political ownership to GGV by integrating it into the policy. By creating Green Employment opportunities the Government of KP wants the *Green Growth Initiative* (GGI) to appeal to all political parties and stakeholders. GGI comprises a set of policy measures initiated by Govt of KP in order to fulfill the objectives of this Vision. The GGI aims at fulfilling the economic, social, and environmental objectives of green growth.

The Government of KP has set up a two-layered institutional structure to provide the GGV with buy-in from political parties. This institutional structure consists of Inter-Ministerial Committee on Green Growth and is supported by an Expert Task Force on Green Growth (Khan, 2013).GGI looks at the environmental issues faced by six focal sectors of the province, four priority areas, and provides thirteen quantifiable and measureable targets for the next five years. The thirteen targets identified will be met by kick-starting initiatives/projects in these four priority areas. This process has been described in the Figure 8 below.

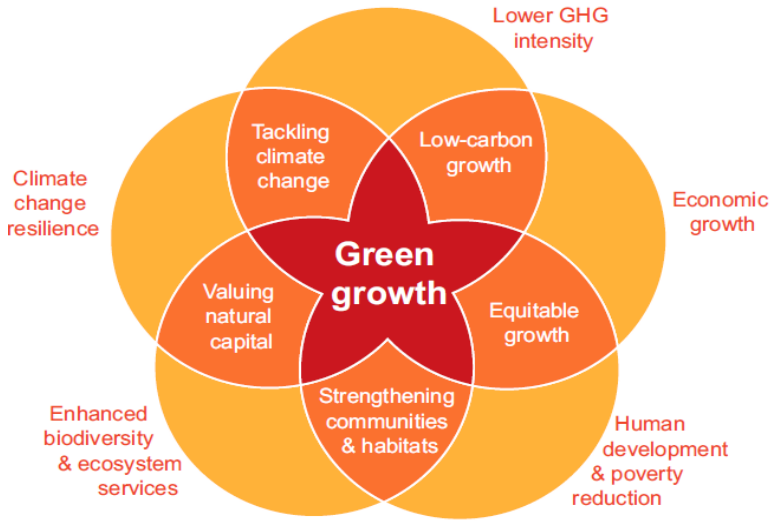

Figure 8: Potential Target outcomes for 'green economy'

[20] http://www.cdkn.org

Green Growth

According to the Organization of Economic Cooperation and Development(OECD), green growth means “fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities”.

Way Forward: Linking GGI to CCD

Through the priority areas identified and the initiatives undertaken, Govt of KP GGI seems to be supported by the key pillars of CCD. The co-benefits derived from adaptation and mitigation potential of these initiatives feed into the key sectors of CCD, namely development strategies, low carbon development, and climate resilience. Apart from meeting the targets set out by the GGI, these initiatives can also help to increase low carbon and climate resilient development.

KP contains nearly 33% of the forest cover of the country and is a major livelihood source for the people living in the province. Therefore the focus GGI places on Forestry and Protected Areas is neccesary to achieve green growth, and the targets set out by the initiative, are well-placed. The afforestation drive presents opportunities and enhances co-benefits through adaptation and mitigation measures. Developing and protecting national parks adds to these co-benefits by preseving biodiversity of the province, promotion of ecotourism, and job creation. The targets related to valuing the forests and treating them as natural capital can help in preserving and promoting afforestation drives. These initiatives and targets are already geared towards meeting the adaptation, mitigation, and development strategy related to the objectives of the CCD.

In order to target low carbon development, the ‘Clean Energy’ initiative taken by the province increases emphasis on mitigation and development strategies, which are at the heart of CCD.

Green Growth initiative creates employment opportunities, provides off-grid energy, and increases opporunities for public-private partnerships, which in turn enhances the resilience of the province to Climate Change impacts. Furthermore, the KP government has taken an initiative to combat Climate Change by introducing policy measures which reduce the vulnerabilities of affected populations to the impacts of Climate Change.Vulnerability mapping and climate proofing the provinces infrastructure by

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integrating it into the planing process is a way through which the KP government is increasing the resilience of the province to climate induced disasters (Khan, 2014). These measures feed into the CCD development stratgies and climate resilient development.

The targets identified by the GGI can be linked to the main pillars of CCD. Targets to increase forest cover, protecting and increasing national parks can help in adaptation, mitigation, and promoting low carbon development. Targets to increase the share of renewable energy in the energy mix of the province will help in mitigating the GHG release into the atmosphere. Through micro-hydel and solar energy the access of general public to decentralized and off the-grid supply of energy will help increase the sustainability of the policy measures in the long run. Green mass transit will help reduce GHG emissions from transport and help improve the urban planning measures to reduce the Climate Change impacts.

Although the targets identify climate resilient growth, and zero carbon development but in order to translate into actionable steps they need to be more clearly defined. Green Growth indicators include social and economic aspects to address Climate Change impacts, GGI struggles to address the length and breadth of these issues.

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Figure 8: Green Growth Initiative at a Glance

- **Forestry***
- **Protected areas/national parks***
- **Clean energy***
- **Climate resilience***
- Water/sanitation,
- Waste management

*Priority Areas

- 'Billion Tree Tsunami'
- 'KP National Parks'
- 'Combating Climate Change'
- '365 Community Micro-hydel'

- Forestry cover increase
- Billion tree Tsunami
- REDD+ operationalization

- Nature Valuation Bill
- Double National Parks
- Establish National Park Management Authority
- Wildlife Park in each district
- Natural Forest – Protected areas

- Renewable Energy reliance to increase to 80%
- 365 Community Micro-hydel Projects
- Green Mass Transit

- Climate Resilient Growth
- Zero Carbon

Way Forward: Linking GGI to the Climate Change Policy of Khyber Pakhtunkhwa

The Climate Change Policy for Khyber Pakhtunkhwa, through its proposed measures on adaptation and mitigation, can help actualize the Green Growth Vision (GGV) that drives the Green Growth Initiative (GGI). Through its proposed policy measures the Climate Change Policy would also be addressing the challenges in focus areas identified by the GGI, particularly forestry, protected areas, clean energy, water, waste management; and enhance the resilience of the province to Climate Change impacts.

Successful implementation of the Policy will not only helps to meet the targets set out by GGI and will generate spill-over benefits feeding into other sectors but will also help to achieve targets pertaining to climate resilience, clean energy, and renewable energy. As such the Policy becomes an instrument for implementation of GGI and can be used for tracking progress on it. The two instruments working hand-in-hand and complementing each other – for which we need to have an integrated implementation mechanism - can seed the process of green growth and put the province on the road to Climate Compatible Development with its attendant social and economic benefits to the people.

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11.CLIMATE FINANCE

Khyber Pakhtunkhwa province is following Federal Govt of Pakistan and has formulated its own specific Climate Change Policy. Its actual goal is to strengthen the efforts of Federal Govt on the common issue of Climate Change and further to contribute to the efforts of the global community on combating Climate Change. Adaptation, in relevant sectors, requires ample resources which are beyond the scope of fragile economy of KP.

For effective implementaion of the Climate Change Policy, Provincial Govt looks to the Federal Govt and International community like UNDP, World Bank, Green Climate Fund and other donors to invest in the field of adaptation and mitigations in the Climate sensitive sectors of economy of the Province. Climate Change challenges can be overcomed and reseliance in the Province can be achieved depending upon the resources allocated in the form of adaptation budget and mitigation budget.

By allocating budget for adaptaion whould help in preparedness against natural disasters, which is the main goal of the policy and further to contribute to the efforts of the National Government and the global community on SDGs, i.e. Goal 13 (UNFCCC).

Recommended Policy Measures:

- Climate specific budget needs to be allocated in every Financial Year, in the form of adaptation and mitigation budget.
- Efforts may be made to secure adaptation fund from Federal Govt, international donors like World Bank, Asian Bank and Green Climate Fund etc.
- Separate Section to be established under either P&D or Finance Department to deal with Climate Finance matters for keeping track record and facilitate foreign investors in the field of Climate Change.

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