Climate Change

Adaptation Action Plan

2024

Chitral

Upper and Lower Districts

FINAL-2

ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF KHYBER PAKHTUNKHWA

CLIMATE CHANGE, FORESTRY, ENVIRONMENT AND WILDLIFE DEPARTMENT

Acknowledgments:
This Climate Change Adaptation Action Plan for Chitral districts is developed under Scaling-up of Glacial Lake Outburst Floods Risk Reduction in Northern Pakistan-GLOF-II Project administered by UNDP, financed by Green Climate Fund and executed by Khyber Pakhtunkhwa Environmental Protection Agency, Forestry, Environment and Wildlife Department, Government of Khyber Pakhtunkhwa.

The cooperation and support extended by line departments of Government of Khyber Pakhtunkhwa are duly acknowledged. The efforts by the team of consultant firm the Contemporary Associates Islamabad is also acknowledged.

Disclaimer:
The views expressed in this publication are those of the author(s) and do not necessarily represent those of the United Nations, including the United Nations Development Programme (UNDP), donor agencies or the UN Member States.

Preface

Addressing the challenges of climate change, through prioritizing adaptation measures is a top political and administrative priority to safeguard the unique natural assets and protect the life and livelihoods of people in both districts of Chitral. The KP Climate Change Policy (2022), KP Climate Change Adaptation Plan (2022) in line with the updated National Climate Change Policy (NCCP) of 2021 provided sufficient policy provisions for initiating priority adaptation actions in Chitral districts. Guidance from other plans like Framework for Implementation of National Climate Change Policy (2013-2030), Youth and Climate Change Perception Report (2018), Climate Change Gender Action Plan (2022) and National Adaptation Plan (2023) of Government of Pakistan are also taken and all such resources were utilized in preparation of this Climate Change Adaptation Action Plan for Chitral districts.

The measures taken so far, for implementation of these policies, plans and commitments resulted in Pakistan emerging as one of the countries to achieve SDG-13 set for Climate Action by 2020 and is still maintaining it as the first SDG, which Pakistan achieved. Pakistan's SDG index score increased from 54.9 in 2018 to 71.1 in 2024, according to the SDG Dashboard. As a result, Pakistan's ranking dropped from fifth most vulnerable country in 2021 to eighth in 2024 as per report of German-watch Climate risk index.

The Ministry of Climate Change and Environmental Coordination is supporting provinces in incorporating these policies and commitments into their mandates. Formulation of this Climate Change Adaptation Action Plan by Government of Khyber Pakhtunkhwa is to assist districts of Chitral in maximizing their efforts on adaptation actions in agriculture, livestock, forestry, ecotourism, urban planning, fisheries, water resources and glaciers, wildlife and biodiversity, disaster preparedness, GLOF, public health, pasture and rangelands, youth and gender development and overall socio-economic development.

This Climate Change Adaptation Action Plan for Chitral districts is developed after carrying out a baseline study to develop the context of the socio-economic and environmental profile of both districts of Chitral and Multi Hazard Vulnerability and Risk Assessment (MHVRA) to identify the key vulnerable sectors. Based on this baseline study and MHVRA this Climate Change Adaptation Action Plan for both districts of Chitral is formulated with priority actions and implementing partners to take actions.

A through consultation with the concerned officials in various departments of the KP government, NGOs and community through focus group discussions and workshops was done. The strategic direction provided by the KP Climate Change Policy of 2022, the road map drawn in the KP Climate Change Action Plan of 2022 and the objectives of support of Scaling-up of Glacial Lake Outburst Floods Risk Reduction in Northern Pakistan-GLOF-II Project of UNDP were considered in preparation of this Climate Change Adaption Action Plan for Chitral Districts.

This adaptation action plan prioritizes actins to initiate adaptative measures to cope with the impact of climate change and elaborates various objectives. It is expected that implementation of this action plan would help to reduce vulnerabilities and support adaptation efforts of the government and the people in both districts of Chitral.

Message

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

Foreword

PROVINCIAL MINISTER FOR
Environment Government of Khyber Pakhtunkhwa

Acknowledgements

DG EPA KP

List of Abbreviations

AKDN	Aga Khan Development Network
BHU	Basic Health Unit
CCAAP	Climate Change Adaptation Action Plan
CCFWED	Climate Change, Forestry, Wildlife & Environment Department
CPEC	China Pakistan Economic Corridor
C&W	Communication & Works
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DDMA	District Disaster Management Authority
DDMU	District Disaster Management Unit
DRM	Disaster Risk Management
EPA KP	Environmental Protection Agency Khyber Pakhtunkhwa
EWS	Early Warning Systems
FE&WD	Forestry, Environment & Wildlife Department
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS/RS	Geographic Information System/Remote Sensing
GLOF	Glacier Lake Outburst Flood
IPC	Inter Provincial Coordination
IMF	International Monetary Fund
IPCC AR-6	Intergovernmental Panel on Climate Change Assessment Report 6
KP	Khyber Pakhtunkhwa
LGE&RDD	Local Government, Election & Rural Development Department
MoCC&EC	Ministry of Climate Change and Environmental Coordination
NARC	National Agriculture Research Centre
NCCP	National Climate Change Policy
NDMA	National Disaster Management Authhority

NGO	Non-Governmental Organization
NHA	National Highway Authority
NTFP	Non-Timber Forest Produce
OFWM	On Farm Water Management
PEC	Pakistan Engineering Council
P&DDD	Planning & Development Department
PDMA	Provincial Disaster Management Authority
PEDO	Pakhtunkhwa Energy Development Organization
PFI	Pakistan Forest Institute
PHED	Public Health Engineering Department
PKHA	Pakhtunkhwa Highway Authority
PMD	Pakistan Meteorological Department
RMS	Regional Metrological Centre
RR&SD	Relief, Rehabilitation & Settlement Department
SDG	Sustainable Development Goal
SFM	Sustainable Forest Management
ST&ITD	Science Technology & Information Technology Department
UIB	Upper Indus Basin
UNOCHA	United Nation's Office for the Coordination of Humanitarian Affairs
VETS	Vehicle Emission Testing Stations
WAPDA	Water & Power Development Authority
WASH	Water, Sanitation & Hygiene
WSS	Water & Sanitation Services
WWF	World Wide Fund for Nature (Formerly, World Wildlife Fund)

Table of Contents

1. Introduction 1
2. Socioeconomic and Environmental Baseline Study 3
2.1 Background and Rationale 3
2.2 Objectives of Baseline Study 3
2.3 Scope and Limitations (Focus on Secondary Data) 3
2.4 Methodology and Data Sources 4
2.5 Context of Chitral 4
2.6 Case Study Districts 4
3. District Profile of Upper Chitral 6
3.1 Location, Boundary and Topography 6
4.1 Geographic Overview 7
4.1.1 Location, Boundaries, and Topography 7
3.2 Key Landscape Features 7
3.3 Administrative and Socioeconomic Overview 7
3.3.1 Administrative Structure 7
3.3.2 Geography and Infrastructure 8
3.3.3 Socioeconomic Landscape 9
3.3.4 Demographics and Culture 9
3.3.5 Education and Health Services 9
3.3.6 Challenges and Opportunities 9
3.3.7 Monsoon Adaptation Measures for Chitral 10
3.4 Infrastructure and Services in Upper Chitral 10
3.4.1 Transportation and Accessibility 10
3.4.2 Water Supply, Sanitation, and Healthcare Facilities 11
3.5 Cultural and Historical Context 12
3.5.1 Language and Traditions 12
3.5.2 Religious Influence 12
3.5.3 Historical Background 12
3.5.4 Cultural Heritage Sites 13
3.5.5 Cross-Border Cultural Influences 13
3.5.6 Modern Cultural Evolution 13
3.6 Climate and Environmental Overview of Upper Chitral 13
3.6.1 Climate Profile 13
3.6.2 Temperature and Precipitation Trends 13
3.6.3 Seasonal Weather Patterns and Extremes 16

3.6.4 Natural Resources and Environmental Features 16
3.6.5 Forests, Rangelands, and Agriculture 17
3.6.6 Key Biodiversity Areas and Protected Sites 17
3.6.7 Environmental Challenges 17
3.6.8 Land Degradation and Soil Erosion 18
3.6.9 Deforestation and Water Resource Issues 18
3.7 Climate Vulnerability and Risks for Upper Chitral 19
3.7.1 Overview of Climate Risks Based on Secondary Data 19
3.8 Key Sectors Affected by Climate Change 20
3.8.1 Agriculture and Food Security 20
3.8.2 Water Resources and Glacial Changes 20
3.8.3 Health and Wellbeing 20
3.8.4 Infrastructure and Settlements 20
3.8.5 Housing 21
3.9 Sectoral Impacts of Climate Change on Upper Chitral 21
3.9 Agriculture and Livestock 22
3.9.1 Impact on Crop Yields and Agricultural Practices 22
3.9.2 Vulnerability of Livestock to Climate Change 22
3.10 Water Resources 24
3.10.1 Changes in Water Availability and Supply Patterns 24
3.10.2 Impact of Flooding on Irrigation Channels: 25
3.10.3 Glacier Melt and Water Stress Risks 26
3.11 Changes in Forest Health and Rangeland Quality 26
3.12 Infrastructure and Human Settlements 26
3.12.1 Impact on Roads, Bridges, and Energy Supply 26
3.13 Potential Human Health Impacts 28
4.1.2 Unique Landscape Features 28
4.2 Administrative and Socioeconomic Overview 28
4.2.2 Population Distribution and Demographics 28
4.2.3 Socioeconomic Indicators (Income, Education, Health) 29
4.2.4 Major Livelihoods and Employment Trends 29
4.3 Infrastructure and Services 29
4.3.2 Transportation and Accessibility 29
4.3.3 Water, Sanitation, and Healthcare Access 29
4.3.4 Cultural and Historical Context 29
4.4 Climate and Environmental Overview of Lower Chitral 30
4.4.2 Climate Profile 30
4.4.3 Natural Resources and Environmental Features 30
4.4.4 Environmental Challenges 31

4.5 Climate Vulnerability and Risks for Lower Chitral 31
4.5.2 Overview of Climate Risks Based on Secondary Data 31
4.5.3 Key Sectors Affected by Climate Change 32
4.6 Sectoral Impacts of Climate Change on Lower Chitral 34
4.6.2 Agriculture and Livestock 34
4.6.3 Water Resources 36
4.6.4 Glacier Melt and Seasonal Water Shortages 37
4.6.5 Forestry and Natural Resources 37
4.6.6 Infrastructure and Settlements 38
4.6.7 Climate-Related Human Health Risks 41
5.1 GLOF Hazards in Chitral 42
5.2 Recent GLOF events in Chitral 43
5.3 Causes of GLOFs in Chitral 43
5.4 Vulnerabilities to GLOF in Chitral 43
6.1 Geographical Context of Chitral 46
6.2 Natural Hazards 46
6.2.1 Floods 46
6.6.3 Landslides 46
6.2.5 Snow Avalanches 47
6.2.6 Drought 47
6.3 Socioeconomic Vulnerabilities 47
6.3.1 Poverty and Unemployment 47
6.3.2 Limited Infrastructure 47
6.3.3 Lack of Preparedness and Awareness 47
6.3.4 Deforestation 47
6.4 Vulnerability Analysis 48
6.4.1 Physical Vulnerability 48
6.4.2 Social Vulnerability 48
6.4.3 Economic Vulnerability 48
6.4.4 Vulnerable Sectors (Upper Chitral) 48
6.4.5 Vulnerable Sectors (Upper Chitral) 48
6.5 Climate Change as a Cross-Cutting Risk 49
6.5.1 Risk Profile of Upper Chitral District 49
6.5.2 Risk Profile of Lower Chitral District 49
6.6 Risk Mitigation Strategies 50
6.6.1 Disaster Preparedness and Early Warning Systems 50
6.6.2 Infrastructure Development 50
6.6.3 Climate Adaptation Programs 50
6.6.5 Strengthening Governance and Policy 50

6.6.6 Investment in Glacial Lake Outburst Flood Mitigation 50
7.1 Prioritizing Actions 52
7.2 Aim and Objectives 52
7.3 Approaches to Climate Resilience 53
7.3.1 Improvement of Water Resource Management 53
7.3.2 Promotion of Climate Resilient Agriculture 53
7.3.3 Strengthening of Infrastructure 53
7.3.4 Improvement of Early Warning System 53
7.3.5 Integration of climate adaptation in local development planning 53
7.4 Climate Change Adaptation Action Plan 53
7.5 Implementation Mechanisms 81
7.5.1 Governance and Institutional Coordination 81
7.5.2 Resource Mobilization 81
7.5.3 Monitoring, Evaluation, and Reporting (M&E) 81
7.5.4 Community Participation 81
7.5.5 Sustainability and Scaling Up 81
7.6 Conclusion 82
Annex-1 83
Annex-2 85
Bibliography 86

List of Figures

Figure 1: Location of Case Study Districts 5
Figure 2: Annual Temperature Change in Chitral (1971 – 2030) 14
Figure 3: Trends in Annual and Seasonal Precipitation 15
Figure 4: Trends in Annual Precipitation 15
Figure 5: Impact of 2023 Flooding on Housing in Upper Chitral 21
Figure 6: Impact of 2023 Flooding on Agriculture Sector of Upper Chitral 23
Figure 7: Impact of 2023 Flooding on Livestock and Poultry - Upper Chitral 24
Figure 8: Impact of 2023 Flooding on Water Supply Infrastructure - Upper Chitral 25
Figure 9: Impact of 2023 Flooding on Irrigation Channels - Upper Chitral 25
Figure 10: Impact of 2023 Flooding on Road infrastructure - Upper Chitral 27
Figure 11: Impact of 2023 Flooding on Bridges - Upper Chitral 28
Figure 12: Impact of 2023 Flooding on Housing - Lower Chitral 33
Figure 13: Impact of 2023 Flooding on Water Infrastructure - Lower Chitral 34
Figure 14: Impact of 2023 Flooding on Agriculture - Lower Chitral 35
Figure 15: Impact of 2023 Flooding on Livestock and Poultry - Lower Chitral 36
Figure 16: Impact of 2023 Flooding on Irrigation Channels - Lower Chitral 37
Figure 17: Impact of 2023 Flooding on Road Infrastructure - Lower Chitral 38
Figure 18: Impact of 2023 Flooding on Bridges - Lower Chitral 39

Blank Back Page

1. Introduction

Chitral, situated in the northern part of Khyber Pakhtunkhwa province of Pakistan. Chitral is the province's highest district, with the coldest winter temperatures. As a result, the Chitral has a large number of glaciers and is particularly vulnerable to climate change due to its high-altitude location, glacial melt, extreme temperature variations, and dependence on agriculture and natural resources. The effects of climate change are becoming more pronounced, manifesting as increasing glacial lake outburst floods (GLOFs), droughts, shifting weather patterns, and erratic rainfall. These changes severely affect agriculture, water availability, infrastructure, and livelihoods in the region. As climate change exacerbates these conditions, it is essential to develop a comprehensive adaptation action plan for both the Upper and Lower districts of Chitral to ensure the sustainability of livelihoods and resilience of ecosystems.

Keeping in view the increasing impacts of Climate Change in northern districts of Chitral in Khyber Pakhtunkhwa (KP) it has become necessary to formulate a Climate Change Adaptation Action Plan (CCAAP) to implement KP Climate Change Policy of 2022 following the KP Climate Change Action Plan 2022, in line with the National Climate Change Policy of 2021 and National Adaptation Plan, 2023. So that the challenges posed by changing climate may be addressed proactively to protect human and ecological well-being, and to build resilient and sustainable communities in vulnerable sectors; leading to a reduction of expected socio-economic losses.

Prior to develop this CCAAP, a baseline study was conducted to comprehend the socio-economic profile of both districts of Chitral and to assess the vulnerabilities of various sector to develop this CCAAP. This plan will serve to develop a climate-resilient Chitral through a comprehensive approach that integrates adaptation and knowledge management in various sectors vulnerable to Climate Change. This will not only address local climate vulnerabilities but also enhance the KP’s role in national and international climate discussions, ultimately contributing to global climate action.

The overarching objectives of Climate Change Adaptation Action Plan for the Chitral districts is to:

a) reduce the vulnerability of people, livelihoods, physical assets and natural systems to the adverse effects of climate change;

b) strengthen institutional and technical capacities for effective climate change adaptation;
c) integrate climate change adaptation into relevant policies, plans and associated processes; and
d) promote climate-related research, and knowledge dissemination to facilitate informed decision-making and advocacy.

This Climate Change Adaptation Action Plan is designed to strengthen the resilience of the Upper and Lower districts of Chitral to the adverse impacts of climate change. The plan is rooted in the principles of sustainability, equity, and community participation, aiming to create a future where the local communities can thrive despite the challenges posed by the changing climate.

Before formulating specific actions, understanding the climate vulnerabilities specific to the Upper and Lower districts of Chitral is critical. Upper Chitral's unique mountainous terrain and reliance on natural resources make it highly vulnerable to the impacts of climate change. In addition to the impacts such as temperature rise, water scarcity, damage to agriculture production and degradation of ecosystems, some of the other unique impacts are already being felt in the form of glacial melt and the phenomenon of Glacial Lake Outburst Floods (GLOFs).

The ongoing China-Pakistan Economic Corridor (CPEC) brings additional trade and commercialization challenges to the region and has entered in the second phase of implementation. A narrow strip of the Wakhan Corridor separates Upper Chitral from Tajikistan to the north. In this context, construction of a 50 km stretches of the Silk Road, extending from the Wakhan district of Afghanistan to the Chinese border that could extend the CPEC from Pakistan to Tajikistan through Afghanistan, and link the landlocked Central Asian states with the Karachi and Gwadar ports. If CPEC were extended through Afghanistan to Central Asia, the benefits for Pakistan could be significant. It could further enhance Pakistan's strategic position as a trade hub, increase connectivity with Central Asian markets, and boost economic growth.

2. Socioeconomic and Environmental Baseline Study

2.1 Background and Rationale

The Chitral Districts, located in the mountainous regions of northern Pakistan, face unique vulnerabilities to Climate Change due to their geographical, ecological, and socio-economic characteristics. These areas are particularly susceptible to climate-induced risks such as glacial melt, flash floods, unpredictable weather patterns, and droughts, impacting local communities' livelihoods and sustainability. This study aims to create an actionable adaptation plan, addressing both immediate and long-term needs, and to support Chitral's resilience against climate impacts.

The document in hand is the Baseline Study Report for the Formulation of Climate Change Adaptation Action Plan for Chitral Districts. This is the 2nd deliverable of the consultancy services. It is being submitted under the clause 2(ii) of the signed contract dated 30-10-2024. It will contribute to the 1st installment of the payment under the clause 5 of the contract.

2.2 Objectives of Baseline Study

The primary objectives of this baseline study are to:

1. comprehend the socio-economic and environmental profile of Chitral districts to assess vulnerabilities of different sectors for developing a Climate Change Adaptation Action Plan;
2. engage local stakeholders and to assess the need for building their capacity for effective implementation of climate change adaptation plan; and
3. assess the current and projected impacts of Climate Change on key sectors within Chitral, including agriculture, water resources, infrastructure, and public health.

2.3 Scope and Limitations (Focus on Secondary Data)

This study primarily relies on secondary data sources, including government reports, previous climate studies, and data from relevant non-governmental organizations and academic institutions. Due to limitations in primary data collection in remote areas and the availability of only historical data, there may be challenges in capturing the most recent climate impacts. The study is therefore limited by the quality, coverage, and currency of existing data sources.

2.4 Methodology and Data Sources

The methodology includes a comprehensive review of secondary literature, analysis of climate models and historical weather data, and a synthesis of existing vulnerability assessments. Key data sources include government publications, climate risk assessments, meteorological data from local stations, and relevant academic research. Where possible, data is validated through consultation with local experts and stakeholders.

2.5 Context of Chitral

Chitral, located in northern Pakistan, is renowned for its stunning landscapes and remarkable geographical diversity. Its elevation ranges from 1,094 meters to the towering 7,726 meters of Tirich Mir, with over 40 peaks rising above 6,100 meters. This terrain, covering 76% mountainous and glacial areas, presents a captivating mix of rugged mountains and glaciers. Chitral is bordered by Afghanistan to the west and north, Swat and Dir to the south, and Gilgit-Baltistan to the east, adding to its unique allure. The region is home to 523 villages spread across 34 valleys and contains 542 glaciers, which heighten its vulnerability to Climate Change[1].

Divided into Lower and Upper Chitral, the district spans an area of 14,850 square kilometers. According to the 2023 census, the total population of Lower Chitral is 320,407 while total population for Upper Chitral is 195,528[2]. Agriculture is the primary livelihood, with staple crops such as maize, wheat, and barley, supplemented by fruit and vegetable production. Additionally, around 40% of the population works in government, the private sector, commerce, or entrepreneurship.

2.6 Case Study Districts

Upper and Lower Chitral districts serve as critical case study areas for assessing climate vulnerability and adaptation needs in Pakistan's mountainous regions. Situated in the northernmost reaches of Khyber Pakhtunkhwa province, these districts share a distinct geography marked by rugged terrain, high-altitude ecosystems, and a reliance on glacial and snow-fed rivers, all of which make them exceptionally sensitive to climate shifts. Upper Chitral, with its remote settlements and limited accessibility, faces pronounced risks from glacial melt, seasonal water scarcity, and extreme weather events like landslides. Lower Chitral, while relatively more accessible, contends with similar challenges, particularly in relation to

[1] Post Disaster Damages and Need Assessment (PDNA) Report, SIF Pakistan. (https://www.preventionweb.net/media/89652/download?startDownload=20241126)
[2] Pakistan Bureau of Statistics (https://www.pbs.gov.pk/sites/default/files/population/2023/KP.pdf)

agricultural productivity, water availability, and infrastructure resilience. Both districts are home to communities that rely heavily on agriculture, livestock, and natural resources, making their livelihoods vulnerable to the impacts of rising temperatures, changing precipitation patterns, and biodiversity loss. By examining climate vulnerabilities and adaptation options within these two districts, this study provides insights into the broader challenges and resilience strategies relevant to other high-altitude, climate-sensitive regions across Pakistan. The location of case study districts can be understood from following map:

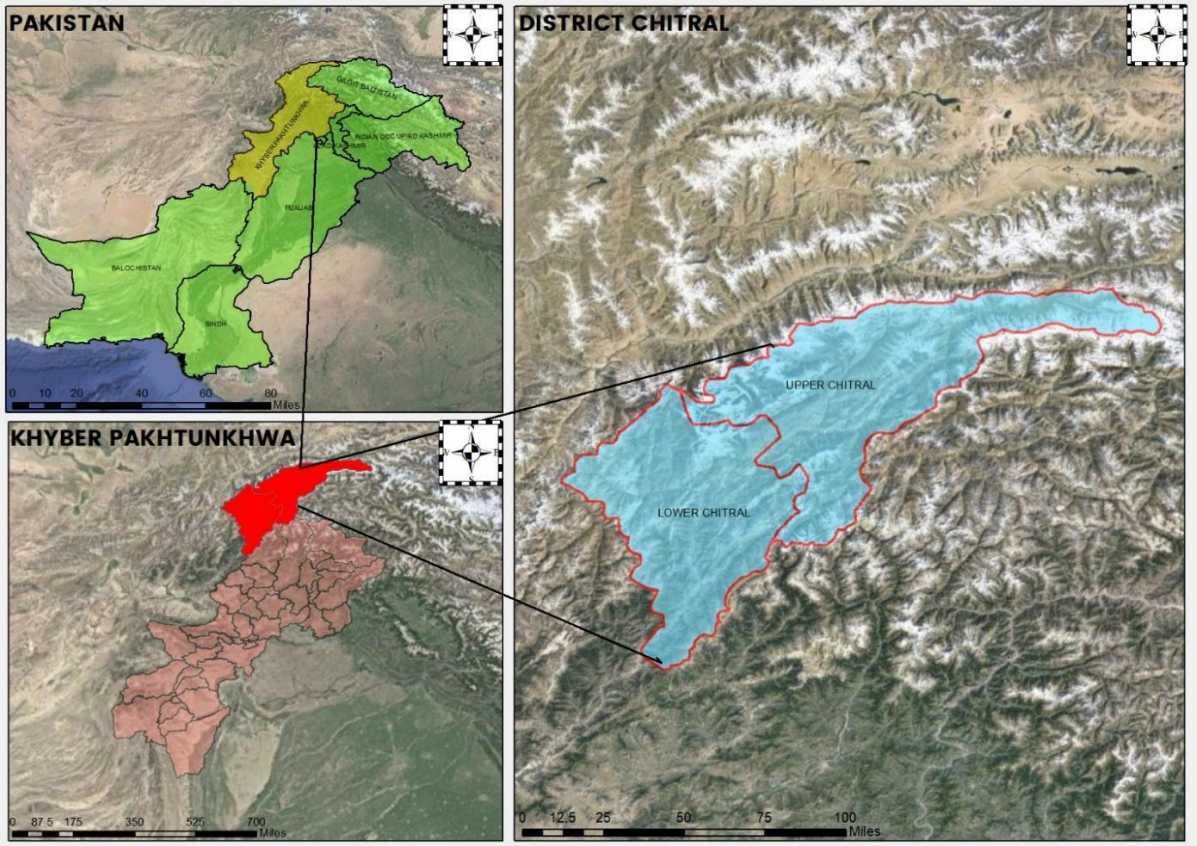

Figure 1: Location of Case Study Districts

3. District Profile of Upper Chitral

3.1 Location, Boundary and Topography

Upper Chitral District is an administrative region in Pakistan's Khyber Pakhtunkhwa province, predominantly inhabited by the Kho people, who constitute 99.84% of the population.

The Chitral River runs through the district, which, along with Lower Chitral District, was previously part of the larger Chitral District. This former district was the largest in Khyber Pakhtunkhwa, spanning 14,850 square kilometers. Historically, the area was part of the Chitral

4. District Profile of Lower Chitral

Lower Chitral, with its distinct geographic, cultural, and socioeconomic characteristics, represents a vital part of the Chitral region in Khyber Pakhtunkhwa. This section presents an overview of Lower Chitral's geography, administrative setup, infrastructure, and cultural heritage.

4.1 Geographic Overview

4.1.1 Location, Boundaries, and Topography

Lower Chitral District is located in the northwestern part of Khyber Pakhtunkhwa, bordered by Upper Chitral to the north, Dir to the south, and Afghanistan to the west. The district features rugged mountainous terrain, deep valleys, and river systems, primarily shaped by the Chitral River that flows southward through the region. This topography not only defines its natural beauty but also influences its climate, accessibility, and livelihood practices.

princely state until its integration into Pakistan on August 14, 1947. In November 2018, the former Chitral District was divided into Upper and Lower Chitral Districts.

The administrative center of Upper Chitral District is the town of Buni. The district is bordered by Gilgit-Baltistan to the east, Afghanistan's Badakhshan province to the north, Upper Dir District to the southwest, and Swat District to the southeast. A narrow strip of the Wakhan Corridor separates Chitral from Tajikistan to the north.

3.2 Key Landscape Features

Upper Chitral District is divided into two tehsils: Mastuj and Mulkhow/Torkhow. Located at the northeastern edge of Khyber Pakhtunkhwa, the district shares its eastern border with Gilgit-Baltistan and its northern boundary with Afghanistan's Wakhan Corridor, a narrow strip that also separates Upper Chitral from Tajikistan. To the south, the district is bordered by Swat and Upper Dir districts of Khyber Pakhtunkhwa, while to the west, it neighbors Lower Chitral District. This strategic location places Upper Chitral at the crossroads of key regional boundaries, making it both geographically significant and culturally diverse.

3.3 Administrative and Socioeconomic Overview

3.3.1 Administrative Structure

Upper Chitral District, established in 2018 after the division of the former Chitral District, is part of Khyber Pakhtunkhwa province. It comprises two tehsils: Mastuj and Mulkhow/Torkhow, with the administrative headquarters in the town of Buni. This district holds a strategic location, bordered by Gilgit-Baltistan to the east, Afghanistan's Wakhan Corridor to the north, and the

Khyber Pakhtunkhwa districts of Upper Dir and Swat to the south, while Lower Chitral lies to the west. The administrative layout supports local governance and development, helping the region manage its remote and mountainous terrain effectively.

3.3.2 Geography and Infrastructure

The district spans a rugged landscape marked by high mountains, deep valleys, and the Chitral River, which runs through its length and is central to local agriculture and water needs. Infrastructure development in Upper Chitral remains a challenge, with roads and transport networks often affected by harsh weather and challenging topography. However, recent investments aim to improve connectivity with neighboring regions, which is critical for trade, tourism, and local socioeconomic growth.

3.3.3 Socioeconomic Landscape

Upper Chitral's economy is primarily agrarian, with livestock rearing, small-scale farming, and handicrafts forming the backbone of household income. Due to limited arable land and harsh winters, agriculture is mostly subsistence-based, with crops like wheat, barley, and potatoes, along with fruits such as apricots and apples. Animal husbandry, including sheep and goats, is a critical component of the rural economy and provides supplementary income for local families.

Tourism is an emerging sector due to the district's breathtaking landscapes, rich cultural heritage, and proximity to the Hindu Kush mountain range. Trekkers, mountaineers, and cultural tourists are increasingly attracted to Upper Chitral, which brings seasonal employment opportunities in hospitality and guiding services.

3.3.4 Demographics and Culture

Upper Chitral is predominantly inhabited by the Kho people, who speak Khowar as their primary language and maintain a rich cultural heritage marked by traditional music, festivals, and crafts. The district's population is largely homogeneous, with Kho people representing over 99% of residents. The community values close-knit social ties, and cultural identity is deeply rooted in local customs, traditional dress, and folk practices. Islam, particularly Ismaili and Sunni branches, is the dominant religion, which influences social structures, festivals, and community events.

3.3.5 Education and Health Services

Educational and healthcare services have historically been limited due to the region's isolation, but efforts by the government and NGOs are steadily improving these areas. Primary and secondary education facilities are now accessible in most villages, while higher education options remain limited. The Aga Khan Health Services and other local health organizations provide primary healthcare services, though advanced medical care often requires travel to larger cities or neighboring districts.

3.3.6 Challenges and Opportunities

Upper Chitral faces several challenges, including vulnerability to Climate Change (such as glacial melting and flash floods), limited access to modern infrastructure, and economic reliance on agriculture, which is vulnerable to environmental risks. However, there are also opportunities for growth through sustainable tourism, improved education and healthcare access, and community-driven development initiatives. Enhanced regional connectivity and

strategic investments in renewable energy and climate adaptation can support socioeconomic advancement, offering resilience and long-term prosperity for the district.

3.3.7 Monsoon Adaptation Measures for Chitral

The shift of the monsoon toward Chitral due to climate change offers opportunities to enhance water availability and agricultural productivity in this historically rain-shadowed region. To harness this opportunity sustainably while minimizing risks, the following adaptation measures may be considered:

Category	Adaptation Measures	Benefits
Water Resource Management	i. Rainwater harvesting systems ii. Check dams iii. Micro-watershed development iv. Floodplain management	a) Enhanced water availability b) Groundwater recharge
Agriculture and Livelihood	i. Climate-resilient crops ii. Agroforestry iii. Efficient irrigation systems iv. Crop diversification	c) Improved productivity d) Reduced risk
Infrastructure Development	i. Improved drainage ii. Erosion control (bioengineering) iii. Flood protection structures	e) Reduced waterlogging f) Protection from flash floods
Ecosystem-Based Adaptation	i. Wetland restoration ii. Afforestation iii. Watershed rehabilitation	g) Soil stabilization h) Increased water retention
Community-Based Adaptation	i. Early warning systems ii. Capacity building iii. Community water committees	i) Enhanced preparedness j) Sustainable resource use
Policy and Institutional Support	i. Policy advocacy ii. Public-private partnerships iii. Research and monitoring	k) Long-term sustainability l) Data-driven decision-making

3.4 Infrastructure and Services in Upper Chitral

3.4.1 Transportation and Accessibility

Upper Chitral faces significant transportation and accessibility challenges due to its mountainous terrain and extreme weather conditions. The district is connected to neighboring regions primarily through a network of narrow, winding roads, many of which are prone to landslides and closures during winter. The Chitral-Mastuj Road serves as a major artery, linking the district to Lower Chitral and further to Dir and Peshawar. However, infrastructure

upgrades are needed to ensure safe, reliable year-round access, as most roads remain unpaved and vulnerable to seasonal damage.

Air transport is limited, with the nearest airport located in Lower Chitral, which offers limited flights subject to weather conditions. Consequently, residents and visitors often rely on long road journeys, which can be challenging due to unpredictable weather and difficult terrain. Improvements in transport infrastructure are essential for enhancing mobility, reducing travel times, and promoting economic activities such as tourism and trade.

3.4.2 Water Supply, Sanitation, and Healthcare Facilities

1. **Water Supply**: Upper Chitral's water supply system relies mainly on natural sources, including glacial melt, rivers, and springs. However, the availability of clean drinking water is a critical issue in some areas, where water sources may be contaminated or insufficient to meet growing community needs[3]. Seasonal fluctuations in water availability, combined with the impacts of Climate Change on glaciers, have made water scarcity a growing concern. There is a need for improved water management infrastructure, including water storage and filtration systems, to ensure sustainable and safe access to potable water.

2. **Sanitation**: Sanitation facilities in Upper Chitral are basic, with limited infrastructure for waste management and proper sewage systems in rural areas. Open defecation and inadequate sanitation facilities pose health risks, particularly for children and vulnerable populations. Efforts to promote hygienic practices and provide access to basic sanitation infrastructure are ongoing but need to be scaled up to reach more remote communities.

3. **Healthcare Facilities**: Healthcare access in Upper Chitral is constrained by the limited availability of facilities and medical staff. The district has a small number of basic health units (BHUs) and rural health centers that provide primary healthcare, though they are often understaffed and lack specialized care. More advanced treatments and emergency medical care typically require travel to Lower Chitral or larger cities, which can be difficult and time-consuming. The Aga Khan Health Services and other NGOs play a significant role in supplementing government healthcare efforts by offering maternal and child health services, vaccinations, and health awareness programs. Strengthening healthcare infrastructure, expanding mobile health services, and

[3] Baig, Shams & Mahmood, Qaisar & Bahadar, Nawab & Hussain, Altaf & Mohammad, Nafees. (2010). Assessment of Seasonal Variations in Surface Water Quality of Chitral River, North West Frontier Province (NWFP), Pakistan. World Applied Sciences Journal. 674-680.)

retaining trained healthcare professionals are essential steps to improve health outcomes in Upper Chitral.

3.5 Cultural and Historical Context

Upper Chitral possesses a rich cultural and historical heritage shaped by its unique geographic location and the deep-rooted traditions of the Kho people, who make up the majority of the district's population. This region, historically part of the Chitral princely state, has a distinct cultural identity influenced by centuries-old customs, religious practices, and cross-border interactions with Central Asia.

3.5.1 Language and Traditions

The Khowar language, spoken predominantly by the Kho people, serves as a cultural cornerstone and is widely used in daily life, poetry, and storytelling. Traditional music, dance, and folklore are important aspects of social life, with musical instruments such as the sitar (a type of lute) playing a central role in celebrations and gatherings. Festivals like Jashn-e-Chitral and Pathak, which mark the arrival of spring and winter, showcase local dances, songs, and rituals that have been passed down through generations. The district's festivals, with their vibrant traditional attire and local crafts, attract both domestic and international visitors, providing a glimpse into Chitral's rich heritage.

3.5.2 Religious Influence

Islam is the dominant religion in Upper Chitral, with the population practicing either the Ismaili or Sunni branches. Religious identity plays an influential role in shaping the community's social structure, values, and practices. The Ismaili community, in particular, has contributed to the district's social development through education and healthcare initiatives supported by the Aga Khan Development Network (AKDN). Respect for diversity in religious beliefs and practices is a prominent feature of the local culture, contributing to the district's social cohesion.

3.5.3 Historical Background

Historically, Upper Chitral was part of the Chitral princely state, a semi-autonomous region that retained its sovereignty until it was integrated into Pakistan in 1947. The Chitral state held a unique position as a cultural and trade bridge between the Indian subcontinent and Central Asia, with influences from neighboring Afghanistan, Tajikistan, and Xinjiang. The region's rulers, known as Mehtars, played a significant role in Chitral's history, overseeing the region's governance and cultural patronage until its merger with Pakistan.

3.5.4 Cultural Heritage Sites

Upper Chitral is home to a number of historical and cultural landmarks that reflect its rich past. The Mastuj Fort, dating back to the 18th century, served as a strategic military outpost and a residence for local rulers. Similarly, ancient mosques and shrines scattered across the district hold historical and spiritual significance, attracting visitors and pilgrims alike. These heritage sites not only represent the district's architectural legacy but also serve as symbols of the community's enduring cultural identity.

3.5.5 Cross-Border Cultural Influences

Due to its proximity to the Wakhan Corridor and its historical connections with Central Asia, Upper Chitral has absorbed diverse cultural influences, including elements from Persian, Afghan, and Tajik cultures. These influences are evident in local cuisine, attire, and certain cultural practices, blending with indigenous Kho traditions to create a distinct cultural fabric unique to Chitral. This cross-border heritage enriches Upper Chitral's identity and fosters a sense of connectedness with neighboring regions.

3.5.6 Modern Cultural Evolution

While Upper Chitral's culture is rooted in tradition, it is also evolving with modernization and the influence of tourism. Increased educational opportunities, the presence of non-governmental organizations, and improved connectivity have introduced new perspectives and practices into the community, particularly among younger generations. The blend of modern and traditional influences is gradually shaping a unique cultural landscape in Upper Chitral, preserving core customs while embracing progressive ideas and development.

3.6 Climate and Environmental Overview of Upper Chitral

3.6.1 Climate Profile

Upper Chitral's climate is influenced by its high-altitude, mountainous terrain and location within the Hindu Kush range. The district experiences a continental climate with sharp seasonal contrasts, including cold, harsh winters and relatively mild summers.

3.6.2 Temperature and Precipitation Trends

Temperatures in Upper Chitral vary significantly by season and elevation. Winter temperatures can drop well below freezing, especially in the northern highlands, while summer temperatures remain moderate, rarely exceeding 30°C. Annual precipitation levels are relatively low, with most rainfall occurring in the spring and early summer. The district also receives significant

snowfall during the winter, which contributes to glacial accumulation. Over recent years, trends indicate increasing temperature and irregular precipitation patterns, which have begun to impact the region's water resources and agricultural practices.

3.6.2.1 Temperature Trends

Decadal temperature analysis for Chitral reveals distinct seasonal trends compared to the 1971–2000 baseline:

Annual Trends:

i. Maximum temperatures are increasing (hotter days).
ii. Minimum temperatures are decreasing (cooler nights).
iii. Average annual temperature rises by 0.6°C per decade.

Seasonal Trends:

i. Spring: Both maximum and minimum temperatures are increasing (0.7°C per decade), leading to warmer days and nights.
ii. Summer: Mean temperature rises by 0.3°C per decade, indicating warmer summers.
iii. Fall: No significant temperature changes observed.
iv. Winter:
    a. Mean temperature increases by 0.45°C per decade.
    b. Daytime temperatures rise sharply (1.0°C per decade), while nighttime temperatures decrease slightly, resulting in warmer days and cooler nights.

This pattern highlights increasing temperature variability, with the most notable changes in winter and spring and can be observed in the Graph below:

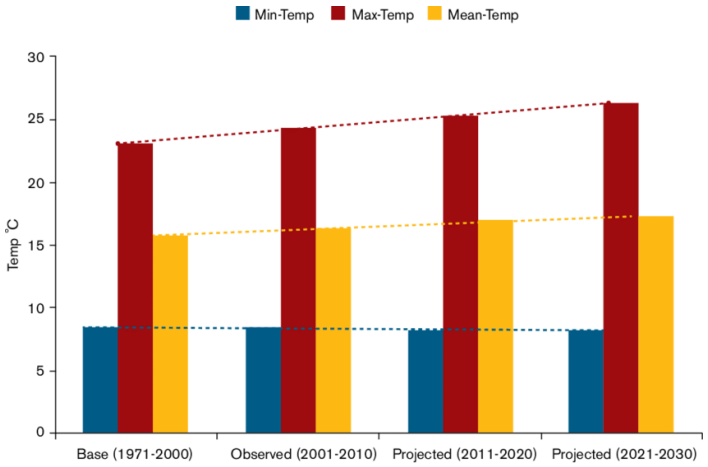

Figure 2: Annual Temperature Change in Chitral (1971 – 2030)[4]

[4] Hussain, Syed & Hussain, Shabir & Hanif, Muhammad. (2013). Climate Change Scenarios and Possible Adaptation Measures, Chitral and DIK districts of KPK, Pakistan. 10.13140/RG.2.1.3123.7849.

3.6.2.2 Precipitation Trends

Decadal precipitation trends for Chitral, reveal the following:

Annual Rainfall

i. An increasing trend compared to the 1971–2000 baseline, projected to rise further by 2030.

ii. This growth is primarily driven by increased winter rainfall, while other seasons show a declining trend.

It is imperative to mention that these projections should be interpreted cautiously, as current simulation models provide inconsistent predictions for precipitation.

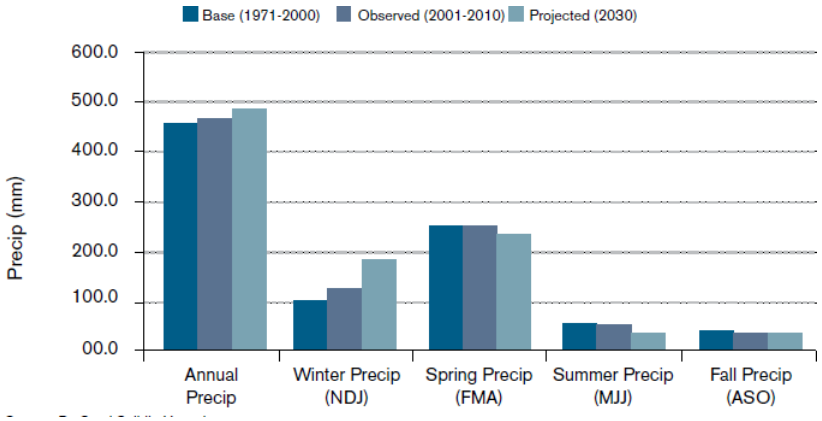

Figure 3: Trends in Annual and Seasonal Precipitation[5]

However, 60 year's actual precipitation data for Chital region is collected from meteorology department (Annexure – 2). Its trend graph is given below;

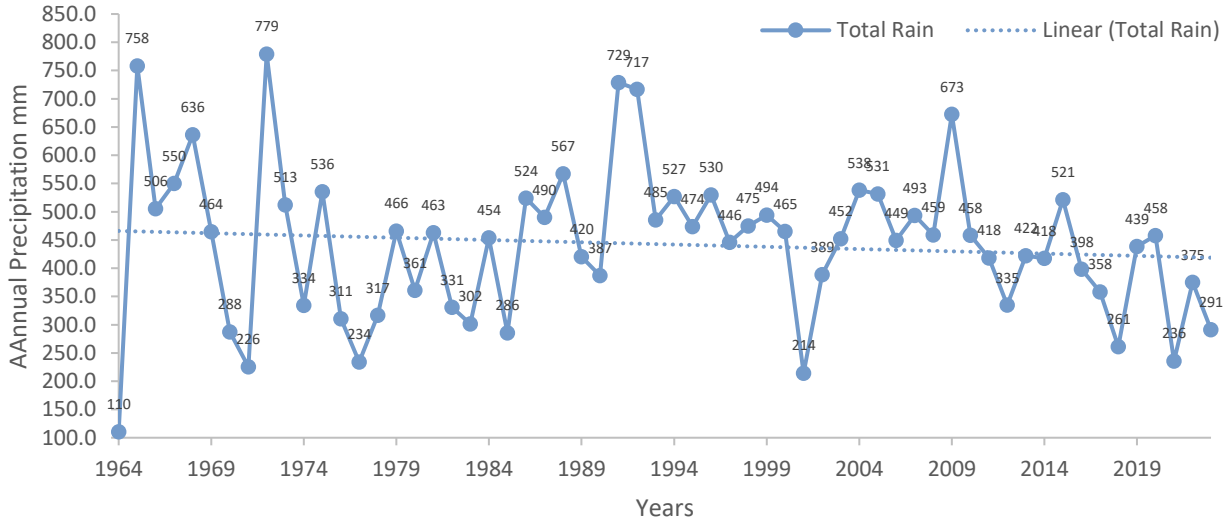

Figure 4: Trends in Annual Precipitation

3.6.3 Seasonal Weather Patterns and Extremes

Upper Chitral experiences four distinct seasons. Winters (December to February) are extremely cold, with heavy snowfall in high-altitude areas, which often isolates villages and restricts mobility. Spring (March to May) brings moderate temperatures and the melting of snow, replenishing rivers and water sources. Summers (June to August) are mild and marked by short bursts of rainfall, which support limited agriculture and grazing. Autumn (September to November) is generally dry and cool, with vegetation entering dormancy as temperatures drop. The district is vulnerable to weather extremes such as flash floods triggered by heavy rains or rapid snowmelt and glacial lake outburst floods (GLOFs), which pose risks to local communities and infrastructure.

3.6.4 Natural Resources and Environmental Features

Upper Chitral's diverse environment supports a range of natural resources, including forests, rangelands, and unique biodiversity areas.

[5] Hussain, Syed & Hussain, Shabir & Hanif, Muhammad. (2013). Climate Change Scenarios and Possible Adaptation Measures, Chitral and DIK districts of KPK, Pakistan. 10.13140/RG.2.1.3123.7849.

3.6.5 Forests, Rangelands, and Agriculture

Forests cover portions of Upper Chitral's mountainous areas, consisting primarily of juniper, birch, and wild fruit trees. However, forest cover is limited and declining due to deforestation. Rangelands serve as vital grazing areas for livestock, supporting the district's pastoral economy. Agricultural land is sparse, confined mainly to valley floors where irrigation from rivers and streams supports small-scale farming of crops such as wheat, barley, potatoes, and fruits like apricots and apples. The agricultural calendar is closely linked to seasonal water availability and weather patterns, making it vulnerable to climate variability.

3.6.6 Key Biodiversity Areas and Protected Sites

Upper Chitral is rich in biodiversity, home to various species adapted to high-altitude ecosystems. Wildlife includes species such as the snow leopard, Himalayan ibex, and Markhor, which are crucial to the region's ecological balance and conservation efforts. Protected areas and community-managed conservation sites help safeguard these species and their habitats, though more support is needed to effectively protect and manage these areas in the face of increasing human activity and climate-related stresses.

3.6.7 Environmental Challenges

Upper Chitral faces multiple environmental challenges, including land degradation, deforestation, and water resource pressures that impact local livelihoods and ecosystems. Chitral district is home to a diverse range of ecosystems shaped by its unique topography, climate, and biodiversity. The mountain ecosystems dominate the region, featuring snow-capped peaks, glaciers, and alpine meadows that support endemic flora and fauna. Forest ecosystems are found in the lower elevations, primarily consisting of coniferous forests with species such as deodar, fir, and juniper, providing habitats for wildlife like snow leopards and Himalayan ibex. The riverine ecosystems along the Chitral River and its tributaries sustain aquatic life and are vital for agriculture and livelihoods. Grassland ecosystems, particularly in the high-altitude valleys, serve as grazing grounds for livestock and support wild herbaceous plants. Additionally, wetland ecosystems, including glacial-fed lakes, play a crucial role in water regulation and serve as stopover points for migratory birds. These ecosystems collectively contribute to the ecological richness and socio-economic sustenance of the district.

3.6.8 Land Degradation and Soil Erosion

Land degradation and soil erosion are serious concerns in Upper Chitral, driven by overgrazing, deforestation, and the fragile mountain terrain. Soil erosion is accelerated by seasonal rains, melting snow, and flash floods, which wash away topsoil, reduce agricultural productivity, and increase sedimentation in rivers. This erosion affects both agriculture and infrastructure, particularly in valley areas, where landslides and soil instability disrupt daily life and economic activities.

3.6.9 Deforestation and Water Resource Issues

Deforestation is a pressing issue in Upper Chitral, as local communities rely on forest resources for fuelwood, construction, and grazing. Forest loss reduces soil stability, exacerbates erosion, and disrupts local ecosystems, threatening biodiversity. Water resources are also under strain, with seasonal fluctuations affecting both the quantity and quality of available water. Climate Change is further impacting glacial melt patterns, potentially reducing long-term water availability in rivers and streams. Sustainable forest management, reforestation efforts, and water conservation measures are critical to addressing these challenges and ensuring environmental resilience for Upper Chitral.

Chitral District lies in Pakistan's dry temperate zone, with elevations ranging from 1,070 to 7,708 meters, creating diverse climatic and vegetation zones. Despite its arid nature, the region hosts a wide variety of forest and non-forest vegetation due to its ecological diversity. Vegetation patterns reflect a gradient of decreasing annual precipitation from southeast to northwest and are characterized by elevation-based zonation. The eastern Hindukush serves as an "ecotone zone," linking Irano-Turanian, Sino-Himalayan, and Central Asiatic floristic regions.

Southern Chitral features West Himalayan montane coniferous forests, while northern Chitral and valley floors are largely treeless. Subalpine and alpine zones are dominated by thorn-cushion and dwarf-scrub vegetation with Irano-Turanian and Pamirean elements. The region includes six conifer species; *Cedrus deodara* (Pakistan’s national tree), *Pinus gerardiana*, *Pinus wallichiana, Abies pindrow, Picea smithiana*, and *Juniperus excelsa* along with dominant broadleaf species like *Betula utilis* and *Quercus* species. These plants provide vital resources for local communities, though their condition is deteriorating due to illegal logging, land-use changes, and overgrazing.

3.7 Climate Vulnerability and Risks for Upper Chitral

Upper Chitral's unique mountainous terrain and reliance on natural resources make it highly vulnerable to the impacts of Climate Change. This section provides an overview of the district's primary climate risks and the key sectors affected, based on secondary data sources.

3.7.1 Overview of Climate Risks Based on Secondary Data

3.7.1.1 Temperature Increase and Heat Waves

Rising temperatures in Upper Chitral are already noticeable, with average temperatures increasing more rapidly than in other parts of Pakistan. This warming trend contributes to accelerated glacial melt and reduced snowpack, which affects water availability. Prolonged heatwaves, though less frequent at higher altitudes, could impact ecosystems, increase evaporation rates, and lead to reduced crop yields, particularly in low-lying areas. Warmer temperatures also encourage the spread of vector-borne diseases, posing risks to both human and animal health.

3.7.1.2 Changes in Rainfall and Precipitation Patterns

Climate Change has led to irregular precipitation patterns in Upper Chitral, with more frequent and intense rainfall events interspersed with periods of drought. These fluctuations impact water resource reliability for agriculture and drinking water and disrupt the seasonal cycles critical for agriculture. Unpredictable rainfall contributes to soil erosion and increases the likelihood of natural hazards, including landslides and floods, that threaten infrastructure and livelihoods.

3.7.1.3 Frequency of Natural Hazards (Flooding, Landslides)

Upper Chitral is highly susceptible to natural hazards such as floods, landslides, and glacial lake outburst floods (GLOFs). Intense rainfall, coupled with rapid glacial melt, increases the risk of flash floods that can devastate communities and disrupt transportation. Landslides, triggered by heavy rains and soil instability, further endanger infrastructure and settlements located in vulnerable areas. These hazards are expected to become more frequent with continued Climate Change, placing additional pressure on local resilience and emergency response systems.

3.8 Key Sectors Affected by Climate Change

3.8.1 Agriculture and Food Security

Agriculture in Upper Chitral is climate-sensitive, with crop yields dependent on seasonal water availability. Changes in temperature and precipitation patterns directly affect crop productivity, with irregular rainfall leading to reduced soil moisture and increased drought stress on crops. Warmer temperatures can reduce the yield of staple crops and impact fruit orchards, which are crucial to local food security and income. Livestock, another pillar of Upper Chitral's rural economy, faces risks from reduced grazing areas, increased disease prevalence, and unpredictable water availability, all of which threaten household food security and income stability.

3.8.2 Water Resources and Glacial Changes

Upper Chitral's water resources rely heavily on glacial melt and seasonal snowfall, which are highly vulnerable to warming temperatures. Accelerated glacial melt due to rising temperatures can initially lead to increased water flows, but the long-term effect will likely be reduced water availability as glaciers continue to recede. This reduction poses significant challenges for irrigation, drinking water supply, and hydropower generation, all of which depend on reliable water sources. Climate-related changes to water availability can thus undermine the district's agricultural and energy sectors and exacerbate water scarcity issues.

3.8.3 Health and Wellbeing

Climate Change impacts human health and wellbeing in Upper Chitral through multiple pathways. Temperature increases and altered rainfall patterns have heightened the risk of waterborne and vector-borne diseases, particularly during warmer months. Health risks are compounded by limited healthcare infrastructure, which constrains the community's ability to respond to new or more frequent health threats. Climate-induced displacement due to flooding and landslides also contributes to mental health stresses, with displaced populations facing disruptions to their social networks and support systems.

3.8.4 Infrastructure and Settlements

Upper Chitral's infrastructure is vulnerable to the physical impacts of Climate Change, particularly in areas prone to flooding and landslides. Roads, bridges, and community facilities frequently sustain damage from seasonal flooding and soil erosion, which disrupts connectivity and essential services. Settlements situated in floodplains or on unstable slopes are particularly at risk, with climate hazards threatening both residential areas and public infrastructure. Increased investment in climate-resilient infrastructure is essential to protect

communities from recurrent damages and reduce the economic burden associated with frequent repairs and reconstruction efforts.

3.8.5 Housing

The catastrophic floods of 2023 had a profound effect on housing and settlements across Chitral, causing extensive damage in both Upper and Lower Chitral. Rural homes were particularly hard-hit, with traditional *katcha* houses proving more susceptible to destruction than pucca structures. Since most homes in Chitral are *katcha*, the damage significantly impacted household assets and severely disrupted family life. In total, 390 houses were affected in Chitral, with 55 houses in Upper Chitral completely destroyed and 74 partially damaged[6].

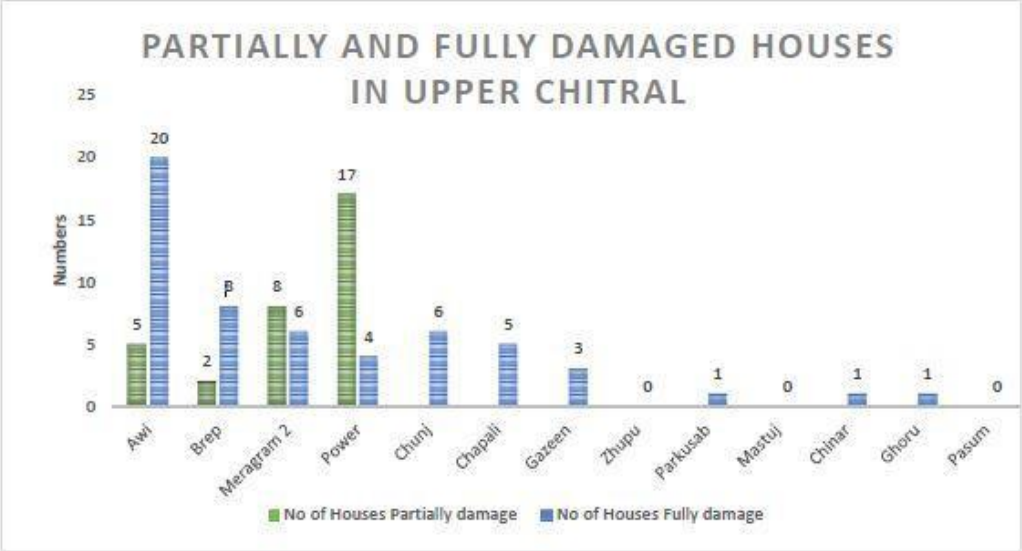

Figure 5: Impact of 2023 Flooding on Housing in Upper Chitral[6]

3.9 Sectoral Impacts of Climate Change on Upper Chitral

Climate Change has far-reaching effects across various sectors in Upper Chitral, impacting agriculture, water resources, forestry, infrastructure, and human health. This section examines these impacts in detail, focusing on the unique challenges posed by the region's geography, economy, and reliance on natural resources.

3.9 Agriculture and Livestock

3.9.1 Impact on Crop Yields and Agricultural Practices

Agriculture in Upper Chitral is highly climate-sensitive, with crop yields heavily dependent on seasonal water availability and favorable temperatures. Increased temperatures and irregular precipitation patterns disrupt traditional agricultural practices, with longer droughts reducing soil moisture and placing stress on crops such as wheat, barley, and fruits. Seasonal shifts have already prompted farmers to adapt by changing crop varieties, planting dates, or moving to higher altitudes, but these adaptations have limitations. The risk of crop failure and reduced productivity has serious implications for food security and income stability in rural communities.

The floods in Upper Chitral severely disrupted the water supply network, causing extensive damage to pipelines, storage tanks, and distribution points. Many water supply lines, often exposed and running along vulnerable mountain slopes and riverbanks, were damaged or completely washed away, cutting off access to clean drinking water for numerous communities. In several areas, storage reservoirs were contaminated or destroyed, further aggravating water shortages and forcing residents to rely on unsafe sources. The breakdown of the water supply network not only impacted daily household needs but also posed significant health risks due to limited access to safe water and sanitation. This widespread damage underscores the fragility of Upper Chitral's water infrastructure in the face of extreme flooding and highlights an urgent need for resilient, climate-adaptive systems to safeguard essential water resources.

3.9.2 Vulnerability of Livestock to Climate Change

Livestock, a critical component of Upper Chitral's economy, faces multiple climate-related risks. Warmer temperatures and reduced grazing areas increase stress on livestock, leading to lower productivity in milk and meat. Changes in rangeland quality impact feed availability, while climate-related diseases, such as vector-borne illnesses, can spread more easily in warmer conditions. These impacts threaten the livelihoods of livestock-dependent households, reducing food and income sources and making it harder for families to recover from climate-related shocks.

The floods in Upper Chitral had a devastating impact on the livestock and poultry sectors, which are essential to the livelihoods of many rural households. Rising floodwaters swept away livestock pens and sheds, leaving animals exposed to harsh weather conditions. Many farmers lost cattle, sheep, goats, and poultry, either through drowning or displacement,

[6] Post Disaster Damages and Need Assessment (PDNA) Report, SIF Pakistan. (https://www.preventionweb.net/media/89652/download?startDownload=20241126)

severely affecting their ability to sustain their livelihood. In addition, the floods destroyed grazing lands, limiting access to food and water for remaining livestock and further exacerbating food security concerns. The disruption of local markets and transport routes also made it difficult for farmers to sell or buy animals, impacting the economy of the region. The damage to livestock and poultry infrastructure and resources highlights the vulnerability of this sector to flooding and underscores the need for more resilient systems and protective measures to safeguard both animals and their owners from future climate-related shocks.

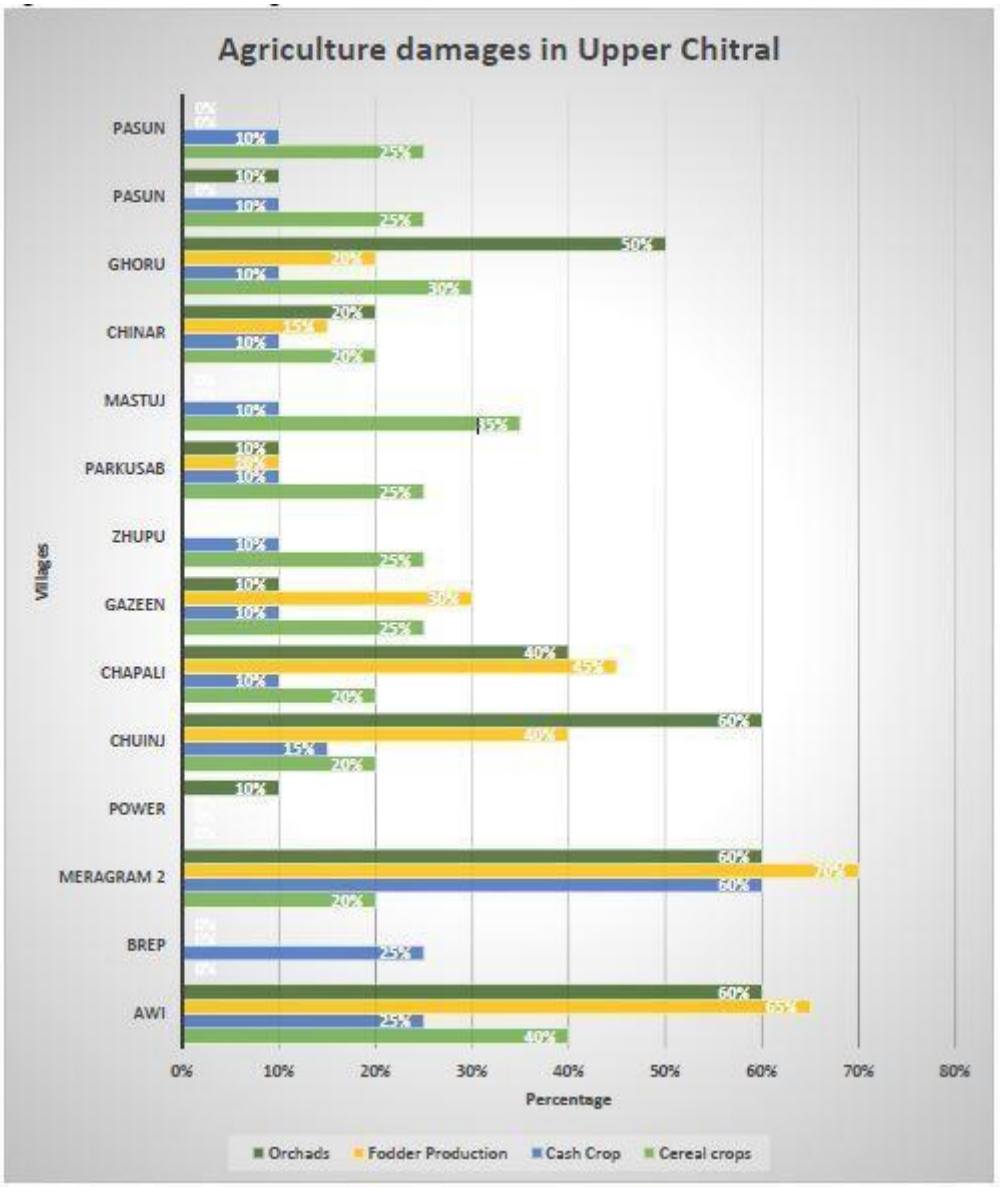

Figure 6: Impact of 2023 Flooding on Agriculture Sector of Upper Chitral[6]

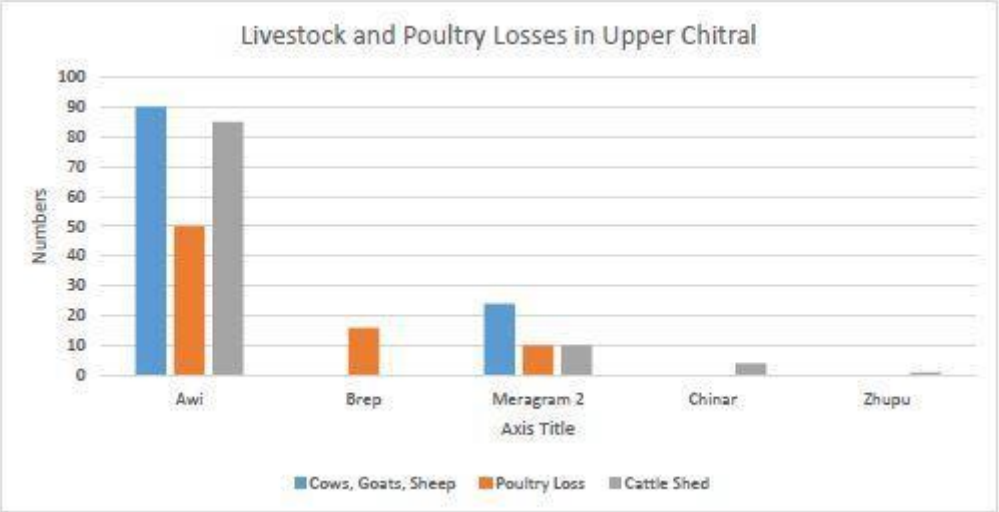

Figure 7: Impact of 2023 Flooding on Livestock and Poultry - Upper Chitral[6]

3.10 Water Resources

3.10.1 Changes in Water Availability and Supply Patterns

Climate Change significantly affects Upper Chitral's water resources, which depend on seasonal glacial melt and snowpack. Irregular precipitation and warmer winters result in reduced snowfall and early snowmelt, altering seasonal water flows. These shifts disrupt irrigation schedules and reduce water availability for crops, livestock, and household needs. Water scarcity during critical agricultural periods threatens local food security and forces residents to adapt by either finding alternative water sources or reducing water use.

The floods in Upper Chitral severely disrupted the water supply network, causing extensive damage to pipelines, storage tanks, and distribution points. Many water supply lines, often exposed and running along vulnerable mountain slopes and riverbanks, were damaged or completely washed away, cutting off access to clean drinking water for numerous communities. In several areas, storage reservoirs were contaminated or destroyed, further aggravating water shortages and forcing residents to rely on unsafe sources. The breakdown of the water supply network not only impacted daily household needs but also posed significant health risks due to limited access to safe water and sanitation. This widespread damage underscores the fragility of Upper Chitral's water infrastructure in the face of extreme flooding and highlights an urgent need for resilient, climate-adaptive systems to safeguard essential water resources.

[6] Post Disaster Damages and Need Assessment (PDNA) Report, SIF Pakistan. (https://www.preventionweb.net/media/89652/download?startDownload=20241126)

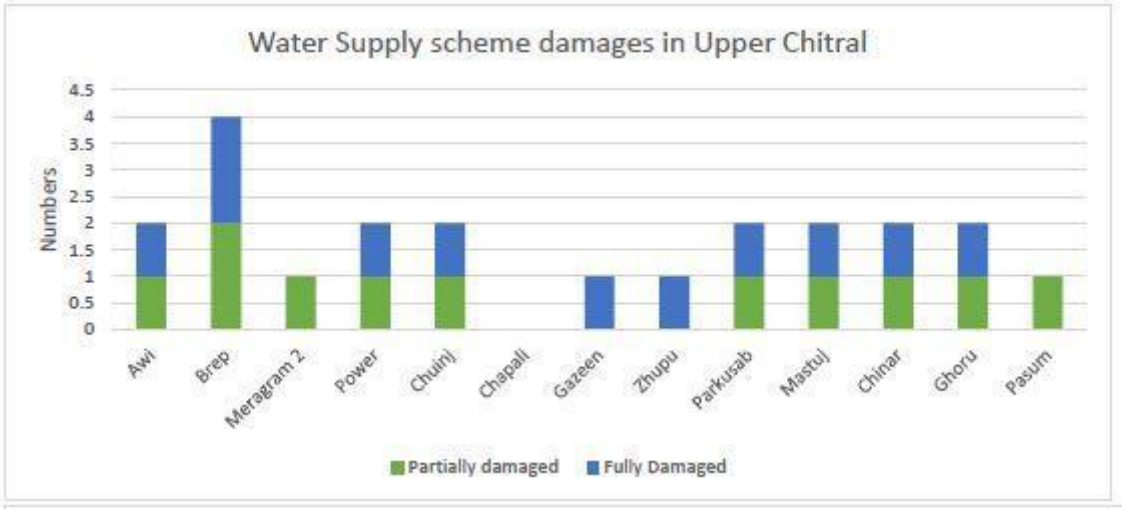

Figure 8: Impact of 2023 Flooding on Water Supply Infrastructure - Upper Chitral[6]

3.10.2 Impact of Flooding on Irrigation Channels:

The floods in Upper Chitral caused extensive damage to the region's irrigation channels, which are crucial for supporting agricultural activities in the area. Many irrigation systems, particularly those built along riverbanks or in flood-prone areas, were either washed away or severely damaged by the rushing floodwaters. The destruction of these channels disrupted the regular flow of water to agricultural fields, leading to water shortages for crop irrigation during critical growing periods. As a result, farmers faced challenges in sustaining their crops, further exacerbating food security concerns. Additionally, sedimentation and debris blocked remaining irrigation pathways, making it difficult to restore water flow quickly. The damage to irrigation infrastructure highlights the vulnerability of Upper Chitral's agricultural system to flooding and the urgent need for climate-resilient irrigation solutions to protect and support the region's farming communities.

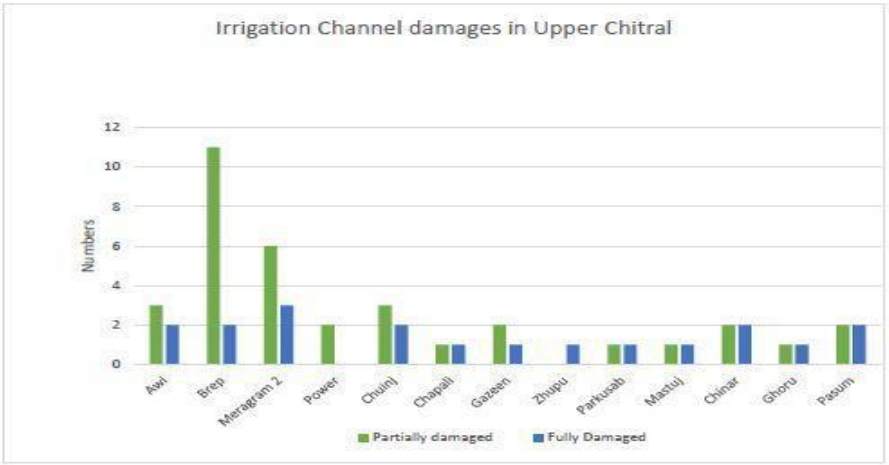

Figure 9: Impact of 2023 Flooding on Irrigation Channels - Upper Chitral[6]

3.10.3 Glacier Melt and Water Stress Risks

Accelerated glacial melt due to rising temperatures increases river flows in the short term but poses a long-term risk of water stress. As glaciers retreat, Upper Chitral's reliance on meltwater becomes unsustainable, threatening not only agriculture but also drinking water supplies. Glacial lake outburst floods (GLOFs) are another risk associated with rapid melting, as these events can release large volumes of water and sediment downstream, damaging infrastructure, homes, and arable land.

3.11 Changes in Forest Health and Rangeland Quality

Forests and rangelands in Upper Chitral are vital for maintaining soil stability, providing timber, and supporting biodiversity. Climate Change, however, has led to decreased forest regeneration rates due to drought stress and changing soil conditions, weakening forest health. Rangelands, which support livestock grazing, are also affected by reduced rainfall and overuse, leading to soil erosion and loss of vegetation. Declining forest and rangeland quality disrupts local ecosystems and reduces available resources for communities reliant on wood and grazing lands for their livelihoods.

3.12 Infrastructure and Human Settlements

3.12.1 Impact on Roads, Bridges, and Energy Supply

Upper Chitral's infrastructure, including roads, bridges, and energy facilities, is vulnerable to climate-related hazards such as floods, landslides, and glacial lake outbursts. Seasonal flooding can wash out roads and bridges, isolating communities and disrupting access to essential services, while landslides further endanger transportation routes. Energy infrastructure, often reliant on hydropower, is also at risk from reduced water flow in drought periods or increased sedimentation from floods. Frequent infrastructure damage places economic strain on the region and limits development by increasing repair costs and reducing connectivity.

The flooding in Upper Chitral severely impacts the region's road infrastructure, causing widespread damage that disrupted connectivity and access to essential services. Key roads, many of which are already narrow and vulnerable due to the mountainous terrain, suffered extensive washouts and structural erosion. Landslides triggered by the heavy rainfall further blocked major routes, isolating communities and making it challenging to reach markets, schools, and healthcare facilities. Several bridges, which are crucial for connecting remote areas, were either washed away or damaged, adding to the isolation and slowing down relief efforts. The damage to the road infrastructure not only affected daily commuting but also hampered economic activities by delaying the transportation of goods and services, thereby straining local livelihoods. This extensive destruction underscores the vulnerability of Upper

Chitral's road network to extreme weather events and the urgent need for resilient infrastructure improvements in the region.

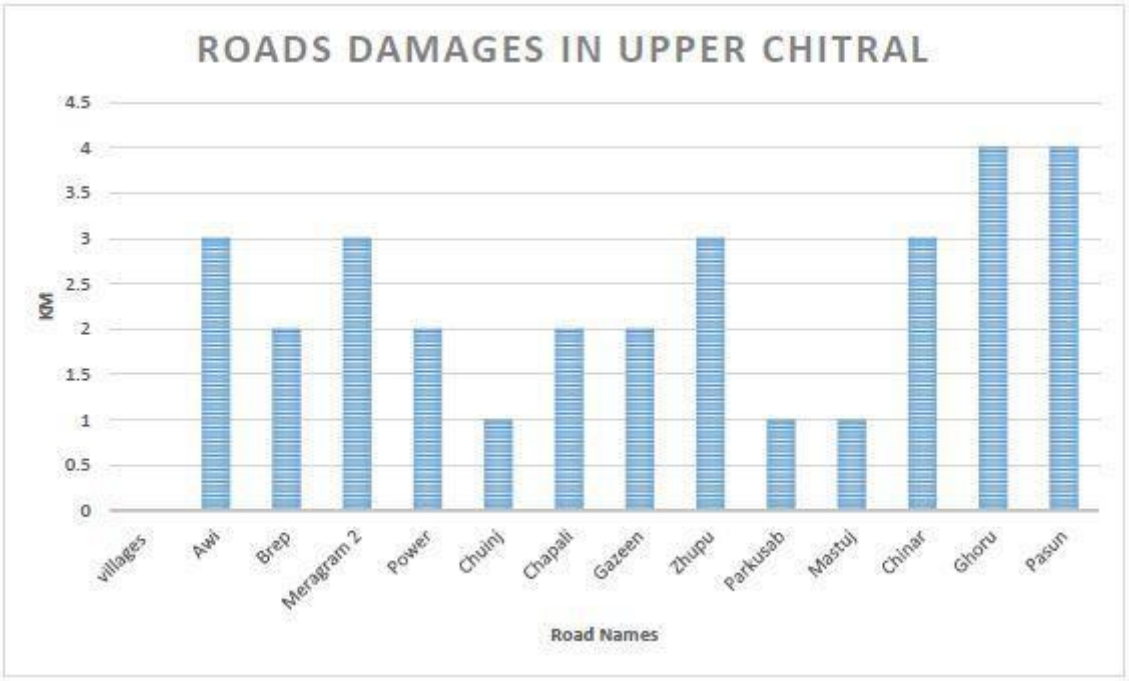

Figure 10: Impact of 2023 Flooding on Road infrastructure - Upper Chitral[6]

The floods in Upper Chitral inflicted significant damage on the region's bridges, which serve as vital connections across rivers and valleys in this mountainous landscape. Numerous bridges were either partially damaged or completely swept away, cutting off entire communities and isolating them from neighboring areas. The loss of these structures disrupted essential travel routes, making it difficult for residents to access critical resources such as food, healthcare, and education. Additionally, the destruction of these bridges severely hindered relief and rescue operations, as they play a key role in linking remote areas to main roads and facilitating the transport of aid and supplies. The damage underscores the vulnerability of Upper Chitral's bridge network to extreme flooding events, highlighting the need for reinforced, flood-resilient designs to ensure sustainable connectivity in future climate-related disasters.

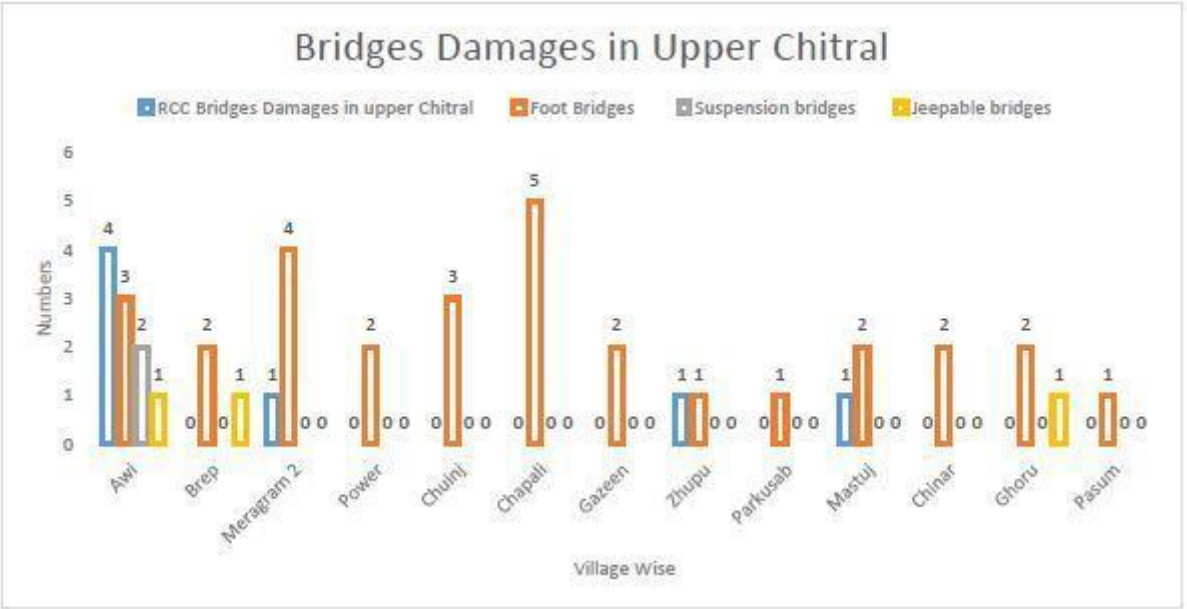

Figure 11: Impact of 2023 Flooding on Bridges - Upper Chitral[6]

3.13 Potential Human Health Impacts

Climate Change poses significant risks to public health in Upper Chitral. Rising temperatures increase the likelihood of heat stress, particularly in warmer months, affecting vulnerable populations such as the elderly and children. Changes in climate conditions also contribute to the spread of vector-borne diseases like malaria and dengue, as warmer temperatures and increased rainfall create favorable breeding conditions for mosquitoes. Limited healthcare facilities in the district further exacerbate these health challenges, as they struggle to handle new disease patterns or increased patient loads resulting from climate-induced health issues.

4.1.2 Unique Landscape Features

The landscape of Lower Chitral is defined by dramatic mountain ranges, lush valleys, and scenic rivers. Key natural landmarks include the Tirich Mir mountain, the highest peak in the Hindu Kush range, which draws both national and international visitors. The district is also home to unique ecosystems that support diverse flora and fauna, with many areas considered important for ecological conservation due to their rich biodiversity.

4.2 Administrative and Socioeconomic Overview

4.2.2 Population Distribution and Demographics

Lower Chitral has a diverse population, with the majority of residents belonging to the Kho ethnic group and speaking Khowar. Other ethnic groups, such as the Kalash, are also present, contributing to the district's rich cultural tapestry. The population is primarily rural, with settlements distributed along river valleys and mountain slopes, and many communities relying on subsistence agriculture and small-scale livestock farming.

4.2.3 Socioeconomic Indicators (Income, Education, Health)

Lower Chitral faces socioeconomic challenges, with high poverty rates and limited access to essential services. Income levels are generally low, with most households dependent on agriculture, labor, or remittances. Educational attainment remains below the national average, particularly for women and rural populations, while health facilities are limited and often require residents to travel long distances for care. Improving access to education and healthcare remains a priority to support socioeconomic development in the district.

4.2.4 Major Livelihoods and Employment Trends

Agriculture, livestock farming, and tourism are the primary livelihoods in Lower Chitral, with many households engaged in multiple income-generating activities. The district's natural beauty attracts tourism, offering economic opportunities, especially during peak seasons. However, employment opportunities remain limited, and seasonal migration for work, particularly among young men, is common. Developing sustainable livelihood options, such as ecotourism and value-added agricultural products, could help boost the local economy.

4.3 Infrastructure and Services

4.3.2 Transportation and Accessibility

The mountainous geography of Lower Chitral poses challenges for transportation and connectivity. Roads are the primary means of transport, with routes linking Chitral to neighboring districts and Afghanistan. However, frequent landslides, floods, and harsh winter conditions disrupt accessibility, especially in remote areas. Efforts to improve road infrastructure and establish reliable transport services are essential to enhancing economic opportunities and access to services.

4.3.3 Water, Sanitation, and Healthcare Access

Access to water and sanitation in Lower Chitral is limited, with many communities relying on traditional water sources, which may be vulnerable to seasonal changes and contamination. Sanitation facilities are often rudimentary, impacting public health. Healthcare services are also limited, with few well-equipped facilities and a shortage of medical staff, making it difficult to address health issues effectively. Increasing investment in water supply, sanitation, and healthcare infrastructure is crucial to improving living standards and health outcomes.

4.3.4 Cultural and Historical Context

Lower Chitral boasts a rich cultural heritage, deeply rooted in the traditions of the Kho people and enriched by the presence of the Kalash community, known for their distinct customs, festivals, and traditional attire. The district's history dates back centuries, with influences from the ancient Hindu Kush civilizations, Islamic traditions, and historical trade routes connecting Central Asia and South Asia. This unique cultural blend is reflected in local music, dance,

language, and festivals, contributing to Chitral's identity as a place of vibrant cultural diversity.

4.4 Climate and Environmental Overview of Lower Chitral

Lower Chitral's climate and environmental landscape are defined by its high-altitude geography, seasonal weather patterns, and a natural environment that supports a range of ecosystems. This section details the climate profile, natural resources, and environmental challenges unique to the district.

4.4.2 Climate Profile

4.4.2.1 Temperature and Precipitation Trends

Lower Chitral experiences a semi-arid mountain climate with significant temperature variations across seasons. Summers are generally mild, while winters are cold, with average temperatures often dropping below freezing in higher altitudes. Precipitation patterns are irregular, with most rainfall occurring during the monsoon season, although Lower Chitral receives less rain than other areas due to its location on the leeward side of the Hindu Kush mountains. In recent years, warming trends have been observed, with more intense summer temperatures and warmer winters, impacting snow cover and water availability in the region.

4.4.2.2 Seasonal and Extreme Weather Patterns

Seasonal weather in Lower Chitral includes distinct summer and winter periods. Winters are harsh, with snowfall common in higher elevations, impacting accessibility and livelihoods. In summer, occasional heavy rains and the monsoon season can lead to flash floods, which disrupt transportation and damage infrastructure. Extreme weather events like flooding, drought, and landslides are becoming more frequent, attributed to changing climate patterns and increasing the vulnerability of local communities.

4.4.3 Natural Resources and Environmental Features

4.4.3.1 Forests, Rangelands, and Agricultural Land

Lower Chitral has forests and rangelands that are critical to the livelihoods of local communities. The region's forests, primarily composed of pine and cedar, provide timber, fuelwood, and fodder. Rangelands support grazing livestock, a primary livelihood in the district. However, overgrazing and limited agricultural land contribute to the degradation of these resources, reducing productivity. Farming is mainly subsistence-based, with crops such as wheat, barley, and maize grown on terraces, but arable land is limited due to the rugged terrain.

4.4.3.2 Protected Areas and Key Wildlife Species

Lower Chitral is home to several protected areas aimed at conserving biodiversity and fragile ecosystems. Key wildlife species include the snow leopard, ibex, and various bird species endemic to the region. Conservation efforts are in place, but they face challenges due to habitat loss, poaching, and limited resources. Maintaining these protected areas is essential

for preserving the unique biodiversity and natural heritage of Lower Chitral, especially given the pressures of Climate Change on wildlife habitats.

4.4.4 Environmental Challenges

4.4.4.1 Soil Erosion and Land Degradation

Soil erosion is a serious issue in Lower Chitral, exacerbated by steep slopes, deforestation, and unsustainable agricultural practices. Seasonal rains and floods accelerate soil loss, while overgrazing and limited vegetation cover contribute to land degradation. This erosion reduces the fertility of agricultural land, leading to lower yields and impacting food security. Strategies to reduce soil erosion, such as terracing and reforestation, are necessary to maintain land productivity and prevent further degradation.

4.4.4.2 Deforestation and Water Management Challenges

Deforestation is a persistent issue in Lower Chitral, driven by demand for firewood, timber, and grazing land. Loss of forest cover worsens soil erosion, disrupts local ecosystems, and reduces water retention in the soil. Water management challenges are also significant, as water resources are primarily derived from seasonal snowmelt and glacial streams. Irregular precipitation and warmer temperatures threaten the availability of water during critical agricultural periods, impacting irrigation and drinking water supplies. Addressing these challenges requires integrated approaches to forest conservation, sustainable water use, and community-based resource management to safeguard the environmental resilience of Lower Chitral.

4.5 Climate Vulnerability and Risks for Lower Chitral

Lower Chitral is increasingly vulnerable to climate-induced risks, with key sectors like agriculture, water resources, public health, and infrastructure facing significant challenges. This section examines the climate risks specific to Lower Chitral and their implications across critical sectors.

4.5.2 Overview of Climate Risks Based on Secondary Data

4.5.2.1 Increase in Temperature and Heatwaves

Lower Chitral has experienced a gradual rise in average temperatures, a trend projected to continue due to global warming. Higher temperatures lead to early snowmelt and reduce seasonal snow cover, affecting water availability during dry months. Heatwaves are also becoming more frequent, impacting crop yields, livestock health, and human wellbeing. Prolonged heat stress threatens food security and places additional pressure on public health services.

4.5.2.2 Variability in Rainfall and Changing Precipitation Patterns

Climate Change has increased the variability and unpredictability of rainfall patterns in Lower Chitral. The district has witnessed both prolonged dry spells and intense rainfall events.

Irregular rainfall impacts water availability for irrigation and drinking water supplies, while intense rainfall events can lead to flash floods and disrupt agricultural cycles. These shifts challenge traditional farming practices and create uncertainty for local communities dependent on seasonal rains.

4.5.2.3 Natural Hazards (Floods, Landslides, etc.)

Lower Chitral's mountainous terrain makes it particularly susceptible to natural hazards such as floods and landslides. Climate Change has intensified these hazards, with flash floods becoming more common due to rapid snowmelt and heavy rains. Landslides, exacerbated by soil erosion and deforestation, endanger lives, disrupt transportation, and damage infrastructure. These hazards also isolate remote communities, limiting access to essential services and markets.

4.5.3 Key Sectors Affected by Climate Change

4.5.3.1 Agriculture and Food Security

Agriculture in Lower Chitral is vulnerable to climate variability, with changing temperatures, unpredictable rainfall, and more frequent extreme events reducing crop productivity. Heat stress and water scarcity impact staple crops, while flash floods and soil erosion damage arable land. These challenges threaten food security for communities relying on subsistence farming. Shifting climate patterns may also lead to pest infestations and crop diseases, further jeopardizing yields and food supplies.

4.5.3.2 Water Resources and Glacial Melting

Lower Chitral's water resources are heavily dependent on glacial melt and seasonal snowfall, which are increasingly threatened by warming temperatures. Glaciers that supply critical water during dry periods are retreating, leading to fluctuating river flows and water shortages, particularly in the summer months. Reduced water availability affects both domestic and agricultural needs, intensifying competition for limited resources. Glacial melt also contributes to glacial lake outburst floods (GLOFs), which pose significant risks to downstream communities and infrastructure.

4.5.3.3 Public Health and Safety

Climate Change poses serious health risks to Lower Chitral's population. Rising temperatures increase the risk of heat stress and heat-related illnesses, while changing rainfall patterns can create conditions favorable to vector-borne diseases like malaria and dengue. Flash floods and landslides also impact public safety, threatening lives and displacing communities. The region's limited healthcare infrastructure is already stretched, and increased climate-related health risks will further strain these resources.

4.5.3.4 Infrastructure and Human Settlements

Infrastructure in Lower Chitral, particularly roads, bridges, and public buildings, is vulnerable

to climate-related hazards. Flooding and landslides regularly damage roads, cutting off communities from essential services and economic opportunities. Rising temperatures and more frequent extreme weather events also threaten housing stability, as traditional building materials may be less resilient to these changes. Addressing these vulnerabilities is essential to ensure safe, accessible, and resilient human settlements in the face of ongoing climate shifts.

4.5.3.5 Housing

The floods in Lower Chitral caused widespread damage to housing, particularly affecting rural communities where katcha houses are more prevalent. These traditional mud-and-stone homes were highly susceptible to the floodwaters, with many completely washed away or severely damaged. The destruction of homes not only displaced families but also led to significant losses in household assets and personal belongings. With a large portion of the population living in vulnerable settlements along riverbanks and low-lying areas, the flooding disrupted daily life, leaving many without shelter and forcing them to seek temporary accommodations. The loss of housing also disrupted local economies, as many families relied on their homes for both living and income-generating activities. This extensive damage underscores the need for resilient and flood-proof housing solutions to safeguard communities in Lower Chitral against future climate-related events.

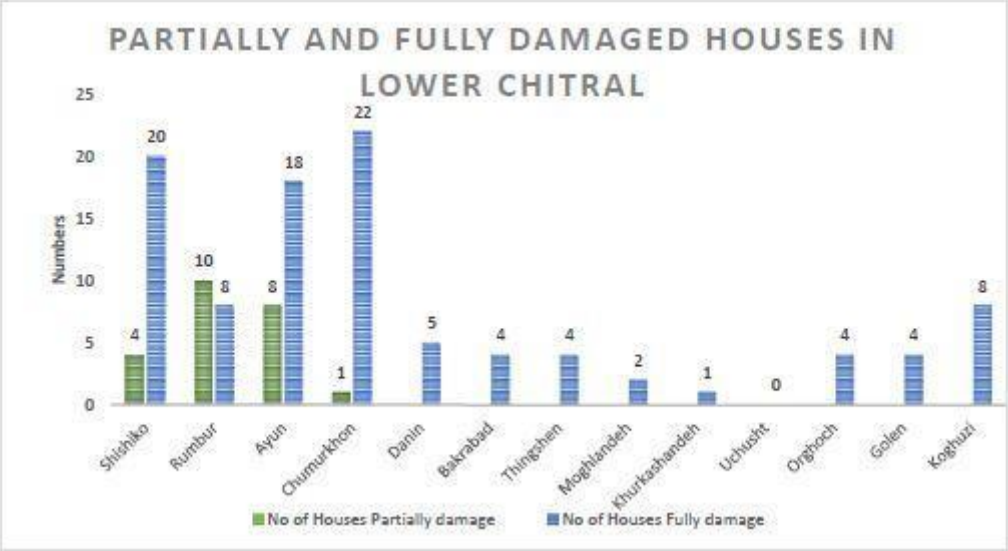

Figure 12: Impact of 2023 Flooding on Housing - Lower Chitral[6]

4.5.3.6 Water Supply Infrastructure

The floods in Lower Chitral caused extensive damage to the water supply infrastructure, significantly affecting access to clean drinking water. Many water supply lines, storage tanks, and distribution systems were either damaged or completely washed away by the floodwaters, leaving communities without a reliable source of clean water. In some areas, the contamination of water sources further exacerbated the crisis, posing serious health risks to

the population. The destruction of the water supply network not only disrupted daily life but also hindered efforts to control waterborne diseases, which are common in flood-affected regions. The damage to this critical infrastructure highlights the vulnerability of Lower Chitral's water systems to flooding and emphasizes the urgent need for more resilient, climate-adaptive water infrastructure to safeguard public health in the future.

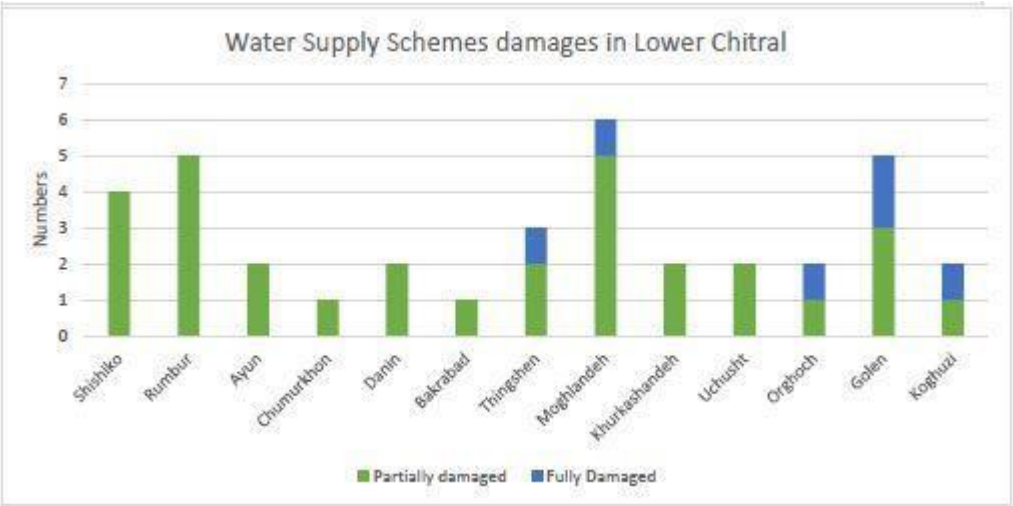

Figure 13: Impact of 2023 Flooding on Water Infrastructure - Lower Chitral[6]

4.6 Sectoral Impacts of Climate Change on Lower Chitral

The impacts of Climate Change in Lower Chitral are diverse and widespread, affecting agriculture, water resources, natural habitats, infrastructure, and public health. Understanding these sectoral impacts is essential for developing effective adaptation strategies.

4.6.2 Agriculture and Livestock

4.6.2.1 Climate Impacts on Crop Production and Livestock

In Lower Chitral, agriculture and livestock are key livelihoods that face growing threats from climate variability. Rising temperatures and irregular precipitation patterns have already led to reduced crop yields, affecting staple crops such as wheat, barley, and maize. Climate stress, including extreme heat and seasonal water scarcity, reduces soil productivity, impacting the viability of traditional crops. Similarly, livestock are vulnerable to heat stress and decreased pasture availability due to shifting climate conditions, which can lead to decreased milk and meat production and lower household incomes.

The floods in Lower Chitral caused significant damage to the agriculture sector, severely affecting crop production and livelihoods. Many agricultural fields, especially those located in low-lying and flood-prone areas, were inundated, resulting in the loss of staple crops like wheat, maize, and barley. Floodwaters eroded fertile topsoil, which is essential for maintaining soil fertility, further compromising future agricultural productivity. In addition to crop damage,

the floods also disrupted irrigation systems, leaving fields without the water needed for cultivation. The destruction of agricultural infrastructure, combined with the loss of livestock and poultry, dealt a heavy blow to local farmers who rely on agriculture as their primary source of income. This event underscores the vulnerability of Lower Chitral's agriculture sector to flooding and highlights the need for climate-resilient farming practices and infrastructure to ensure food security in the future.

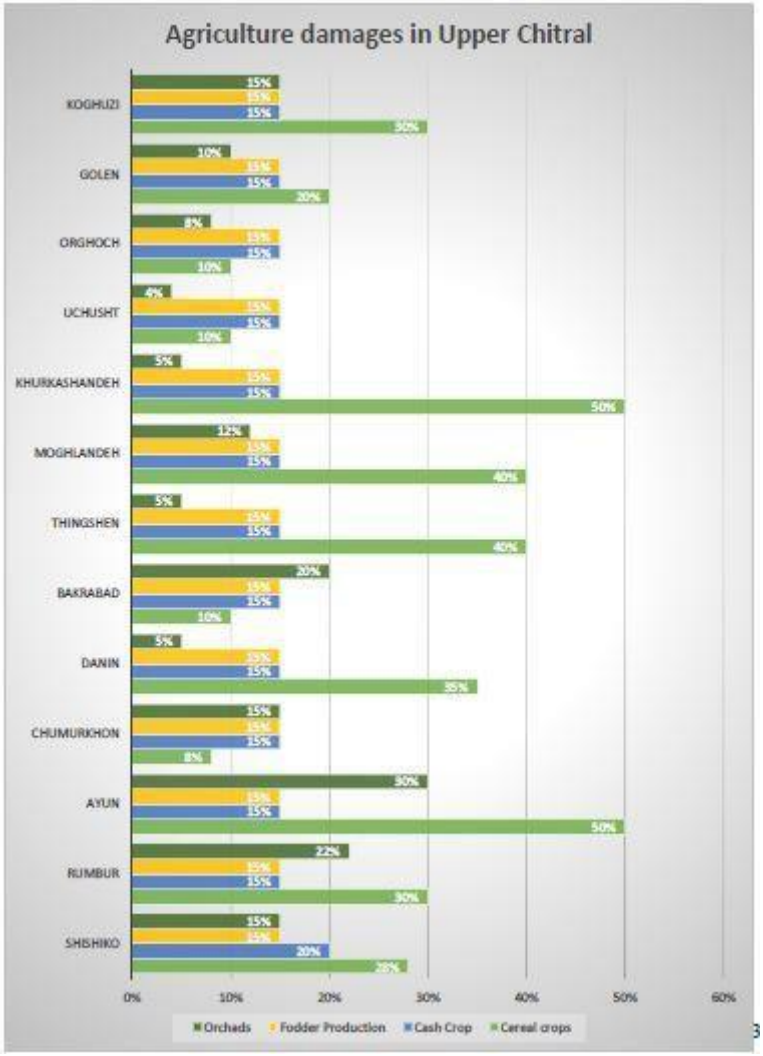

Figure 14: Impact of 2023 Flooding on Agriculture - Lower Chitral[6]

The floods in Lower Chitral had a devastating impact on the livestock and poultry sectors, which are vital to the livelihoods of many rural households. Floodwaters destroyed livestock pens, sheds, and grazing lands, leaving animals exposed to harsh weather conditions and, in many cases, leading to the drowning or displacement of livestock such as cattle, goats, sheep, and poultry. The loss of livestock not only diminished farmers' assets but also disrupted the availability of milk, meat, and other animal products, which are essential for local consumption and income generation. Additionally, the damage to poultry farms and the destruction of feed and veterinary infrastructure compounded the challenges faced by farmers. The floods highlighted the vulnerability of the livestock and poultry sectors to extreme weather events, underscoring the need for stronger, climate-resilient strategies to protect these critical

resources and ensure the sustainability of rural livelihoods in Lower Chitral.

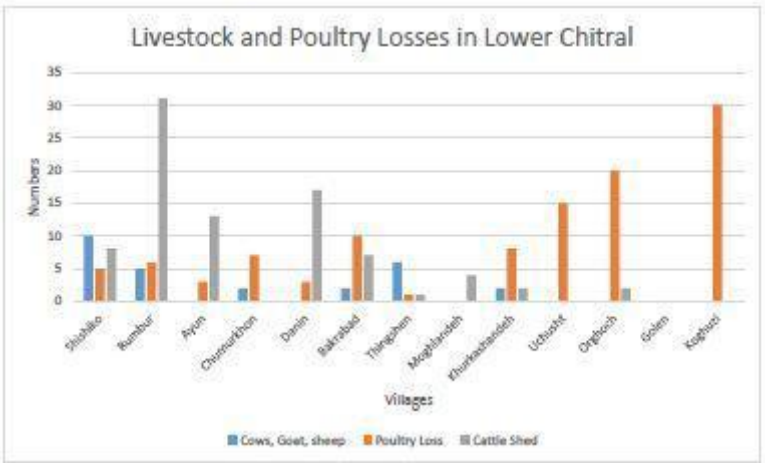

Figure 15: Impact of 2023 Flooding on Livestock and Poultry - Lower Chitral[6]

4.6.2.2 Adaptation Needs in Agricultural Practices

To address these challenges, there is an urgent need to adapt agricultural practices in Lower Chitral. Climate-resilient crop varieties, improved irrigation techniques, and soil conservation methods can help enhance agricultural productivity. Diversifying crops, incorporating drought-tolerant varieties, and shifting planting cycles to adapt to changing seasonal patterns are important steps for resilience. Additionally, developing better grazing management strategies will support livestock health and reduce the risk of overgrazing.

4.6.3 Water Resources

4.6.3.1 Changes in River Flow and Water Availability

Lower Chitral's water resources, primarily from snowmelt and glacial rivers, are under pressure from Climate Change. Increased temperatures lead to irregular river flows, with reduced water availability in critical summer months due to rapid spring snowmelt. This has direct impacts on drinking water supplies, irrigation, and hydropower generation, leading to seasonal shortages that affect both household and agricultural needs.

The floods in Lower Chitral caused significant damage to the region's irrigation channels, which are essential for maintaining agricultural productivity. Many of the irrigation systems, particularly those relying on riverbanks or vulnerable to heavy rainfall, were either washed away or severely damaged by the floodwaters. This disruption resulted in the loss of water supply for crops, especially during critical planting and growing seasons, leading to crop failures and reduced yields. The floodwaters also carried away sediment, debris, and rocks, which blocked or altered the flow of existing irrigation channels, making it difficult for farmers to restore their water access. The damage to irrigation infrastructure has left many agricultural areas without the water needed to sustain crops, highlighting the need for more resilient

irrigation systems and flood protection measures to support farmers and ensure food security in the future.

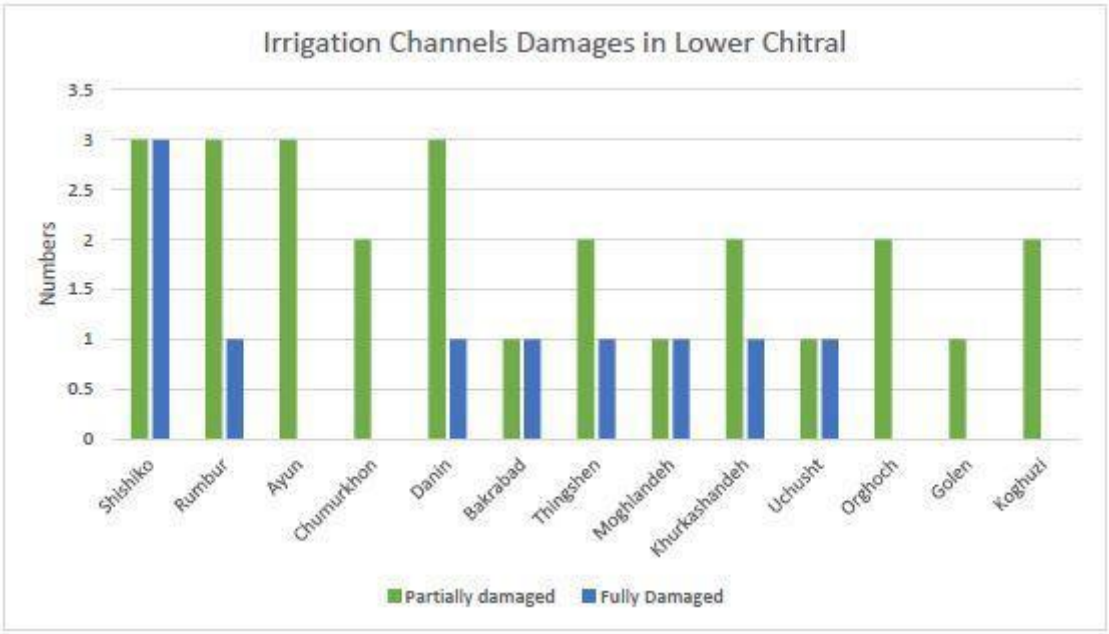

Figure 16: Impact of 2023 Flooding on Irrigation Channels - Lower Chitral[6]

4.6.4 Glacier Melt and Seasonal Water Shortages

As glaciers continue to melt at an accelerated pace, there are heightened risks of glacial lake outburst floods (GLOFs), which threaten downstream communities and infrastructure. Glacial retreat also results in reduced long-term water availability, affecting the seasonal water balance essential for agriculture and daily life. Lower Chitral's reliance on glacial resources makes it highly susceptible to these seasonal shortages, necessitating strategies for sustainable water use and efficient distribution.

4.6.5 Forestry and Natural Resources

4.6.5.1 Effects on Forest Coverage and Biodiversity

Forests in Lower Chitral play a crucial role in maintaining biodiversity, protecting watersheds, and stabilizing the soil. Climate Change, along with deforestation for fuel and timber, has reduced forest cover, impacting species habitats and contributing to soil erosion. Biodiversity loss is a growing concern, as shifts in temperature and precipitation affect local flora and fauna, potentially altering ecosystems. Addressing these impacts requires conservation efforts, reforestation initiatives, and sustainable forest management to protect natural resources.

4.6.6 Infrastructure and Settlements

4.6.6.1 Impact on Roads, Buildings, and Public Services

Climate Change poses significant challenges for Lower Chitral's infrastructure, especially due to frequent flooding and landslides. Roads, bridges, and other transportation infrastructure are often damaged during extreme weather events, cutting off communities and limiting access to markets, healthcare, and other essential services. Housing and public buildings face increased risk, especially as traditional materials may not withstand the stress from extreme weather. Strengthening infrastructure resilience, improving drainage systems, and updating building codes are necessary steps to enhance community safety and accessibility.

The floods in Lower Chitral caused significant damage to the region's road infrastructure, disrupting transportation and isolating communities. Many roads, which are already vulnerable due to the challenging mountainous terrain, were washed away or severely damaged by the floodwaters. Key routes connecting villages to markets, healthcare facilities, and other essential services were blocked or destroyed, making it difficult for residents to access basic needs and for relief efforts to reach affected areas. Additionally, several smaller bridges and culverts were either damaged or swept away, further hindering mobility. The loss of road infrastructure not only impacted daily commuting but also disrupted the local economy by delaying the transportation of goods and services. This damage highlights the need for improved, climate-resilient road infrastructure in Lower Chitral to ensure continued connectivity and support recovery in the face of future climate-related disasters.

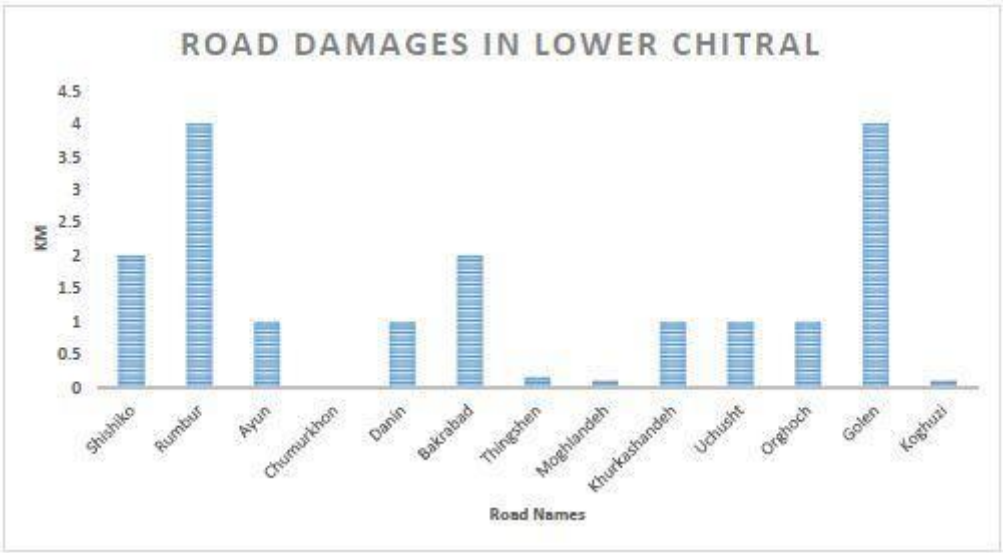

Figure 17: Impact of 2023 Flooding on Road Infrastructure - Lower Chitral[6]

The floods in Lower Chitral caused severe damage to the region's bridges, which are critical for connecting remote communities and facilitating transportation across rivers and valleys.

Many bridges were either partially damaged or completely destroyed by the floodwaters, cutting off access between key areas and leaving several villages isolated. The destruction of these vital structures also disrupted the flow of goods and services, hindered relief operations, and made it difficult for residents to access essential resources like healthcare and markets. The damage to the bridge network underscores the vulnerability of Lower Chitral's infrastructure to extreme weather events and highlights the need for more resilient bridge designs that can withstand future floods and provide safe passage for communities.

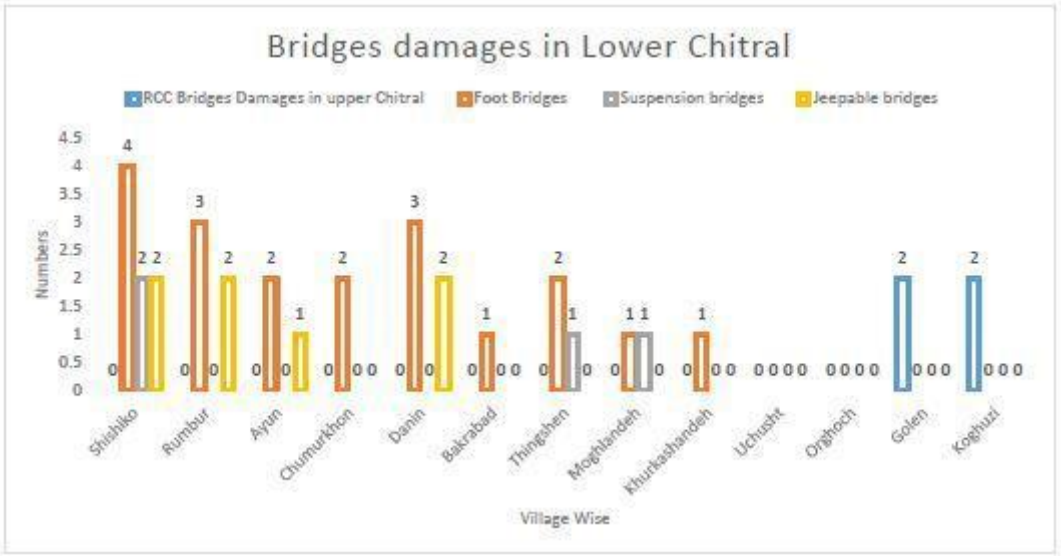

Figure 18: Impact of 2023 Flooding on Bridges - Lower Chitral[6]

The documentation of damages from disasters in Chitral District, especially in disaster-prone areas, remains inconsistent and incomplete. There is no comprehensive mechanism at the district or provincial level to systematically record the cumulative impacts of disasters over time. Most available information pertains only to villages recently affected by specific disasters, such as the 2024 floods. For instance, the damages summarized in the table above reflect data collected through rapid assessments of eight severely impacted villages. However, these assessments are event-specific and do not provide a holistic picture of the district's overall vulnerability or historical disaster impact. The table summarizes the 2024 Chitral Flood damages in majorly hit villages of Chitral in terms of settlements and Infrastructure.

Table 1: Chitral 2024 Flood Damages - ACF-HEADS Rapid Needs Analysis Report 2024[7]

Category	Damage/Impact	Locations/Villages Affected
Shelter and Housing	1,145 completely damaged, 335 partially damaged shelters.	Booni, Brep, Dizg, Harchin, Khurzh, Mehtring, Rech, Reshun
Education	3 schools with WASH facilities damaged.	Booni (1), Rech (1), Dizg (1)
Water Supply	11 water supply schemes damaged.	Reshun (2), Booni (3), Rech (2), Brep (1), Dizg (1), Khurzh (1), Mehtring (1)
Livestock Losses	40 animals lost.	Rech, Khurzh
Infrastructure	54 pieces of infrastructure (roads, bridges, irrigation channels, protection walls) damaged.	Reshun (8), Booni (9), Rech (25), Brep (5), Dizg (2), Khurzh (3), Mehtring (2)
Food Security	50% of food stocks lost.	All surveyed villages
Health	Outbreaks of waterborne diseases; limited accessibility to health services.	All surveyed villages
Environmental Impact	Widespread deforestation, soil erosion, and increased landslide risks.	Rech, Booni, Dizg

Similarly, the table summarizes the damages caused by the July 2023 floods in Chitral District, as documented in the SIF Post-Disaster Needs Assessment Report. It highlights the extensive destruction across multiple sectors, including housing, transport, energy, agriculture, and water supply systems. The floods significantly affected both Upper and Lower Chitral, displacing families, disrupting livelihoods, and damaging critical infrastructure such as roads, bridges, schools, and hydroelectric power stations. This data provides a concise overview of the flood's impacts and affected locations, serving as a basis for recovery and resilience-building efforts.

Table 2: Quantitative Summary of Damages in Chitral from the SIF Report (July 2023 Floods)[8]

Category	Damage/Impact	Locations/Villages Affected
Housing	390 houses damaged: 155 fully and 235 partially.	Upper Chitral: 55 fully, 74 partially. Lower Chitral: 100 fully, 161 partially
Transport	- 36 km of roads damaged. - 69 bridges destroyed: 62 pedestrian, 7 jeep-able.	Koghuzi, Kari, Nerdit Gol, Shahidas Laspur
Energy	2 hydro power stations (Awi Bala: 500 kV, Awi Payen: 750 kV) fully damaged, affecting 1,030 HHs.	Awi Bala and Awi Payen
Education	2 schools partially damaged, affecting 480 students.	Power and Chumerkhon
WASH	Water supply systems destroyed in 26 villages in Lower Chitral and 35 in Upper Chitral.	Shishiko, Rumbur, Ayun, Chumurkhon, Golen, Uchusht, and others

[7] ACF-HEADS Rapid Needs Analysis Report 2024 (https://reliefweb.int/report/pakistan/floods-rapid-needs-analysis-report-2024-chitral-pakistan)
[8]Quantitative Summary of Damages in Chitral from the SIF Report (July 2023 Floods) (https://www.preventionweb.net/media/89652/download?startDownload=20241127)

Agriculture	Crop damages: 22–28% cereal, 15% cash crops, 13–24% orchards.	Upper Chitral: Awi, Brep, Meragram 2, Mastuj. Lower Chitral: Ayun, Rumbur
Livestock	141 cows, goats, sheep; 184 poultry; and 185 cattle sheds lost.	Awi, Brep, Chinar, Zhupu (Upper), Ayun, Koghuzi (Lower)
Fisheries	50% loss of fish population in flood-hit streams.	Streams and rivers across Chitral
Cultural Heritage	Loss of a 400-year-old Chinar tree in Lower Chitral near Shahi Fort.	Shahi Fort, Lower Chitral
Shops and Mills	Upper Chitral: 33 shops, 33 water mills damaged. Lower Chitral: 18 shops, 4 water mills.	Spread across the district

4.6.7 Climate-Related Human Health Risks

Rising temperatures and changing precipitation patterns present several health risks to Lower Chitral's population. Heat-related illnesses are increasing, particularly among vulnerable groups such as the elderly and outdoor laborers. Additionally, waterborne diseases like diarrhea and cholera become more common during periods of heavy rainfall and flooding when sanitation facilities are compromised. Limited healthcare facilities in the district are strained by these additional health risks, underscoring the need for climate-adapted healthcare planning and improved public health infrastructure to manage disease outbreaks and heat stress.

5. GLOF and Avalanches in Chitral Districts

The Chitral district, situated in the northernmost region of Pakistan, has long faced recurring natural disasters, notably Glacial Lake Outburst Floods (GLOFs) and avalanches. Chitral is particularly vulnerable to Glacial Lake Outburst Floods (GLOFs) due to its extensive glacial coverage and the impacts of climate change. The region's geography, socio-economic conditions, and reliance on natural resources exacerbate the risks posed by GLOFs, making it a critical area for disaster preparedness and climate adaptation.

Climate Change has exacerbated these hazards across the Hindu Kush Himalayan region, increasing their frequency and severity, with devastating impacts on lives, livelihoods, infrastructure, and ecosystems. The Upper Indus Basin (UIB), including the Upper and Lower Chitral districts, has been particularly vulnerable to these shifts due to its unique topography and harsh climatic conditions.

GLOFs occur when water from a glacial lake breaches its natural or man-made dam, resulting in a sudden release of large volumes of water. These events can be triggered by various factors, including:

- **Rapid melting of glaciers** due to rising temperatures.
- **Avalanches or landslides** into glacial lakes.
- **Seismic activity** that destabilizes the dam structure.

GLOFs present a persistent danger in Chitral, frequently causing significant damage to human settlements and infrastructure. In recent decades, many villages have been wholly or partially destroyed by such events. For example, the village of Sonoghur was entirely wiped out in 2005, forcing residents to relocate to Parwak. In 2019, a GLOF in the Golain Valley led to the partial destruction of three villages, severely damaged a 108-megawatt hydropower station, and caused extensive agricultural losses (DDMU, 2019). Chitral’s 543 glaciers, including 116 sensitive and 10 hyper-sensitive ones, are a constant threat due to their proximity to human settlements.

5.1 GLOF Hazards in Chitral

Chitral's mountainous terrain, abundant glaciers, and rapidly forming glacial lakes due to climate change make it a hotspot for GLOF hazards. The region is home to over **500 glaciers** and several glacial lakes, many of which are identified as potentially dangerous. Key hazards associated with GLOFs in Chitral are:

1) **Flash Floods**: GLOFs cause sudden, high-velocity floods that can devastate downstream communities, infrastructure, and agricultural lands.
2) **Destruction of Infrastructure**: Roads, bridges, irrigation systems, and power plants are highly susceptible to damage, disrupting livelihoods and access to essential

services.

3) **Loss of Life and Property**: GLOFs can result in fatalities and significant economic losses, displacing vulnerable populations living near glacial lakes or in river valleys.
4) **Environmental Impact**: The sudden release of water can lead to erosion, sediment deposition, and changes in river channels, affecting ecosystems and biodiversity.

5.2 Recent GLOF events in Chitral

Chitral has witnessed several GLOF events in recent years:

2015 GLOF in Reshun Valley: This event destroyed several villages, roads, and bridges, leaving thousands displaced.

2017 GLOF in Garam Chashma: Triggered by glacial melting, this event caused severe flooding, destroying homes and farmlands.

2020 GLOF in Yarkhun Valley: A glacial lake breach caused extensive damage to agricultural fields and disrupted local livelihoods.

5.3 Causes of GLOFs in Chitral

1) **Climate Change**: Rising temperatures are accelerating glacial melting, leading to the formation and expansion of unstable glacial lakes.
2) **Topography and Geology**: The steep slopes and fragile geology of Chitral increase the likelihood of landslides and avalanches, which can trigger GLOFs.
3) **Seismic Activity**: Chitral lies in a seismically active zone, and earthquakes can destabilize glacial dams.
4) **Lack of Preparedness**: Insufficient early warning systems, infrastructure, and community awareness exacerbate the impacts of GLOFs.

5.4 Vulnerabilities to GLOF in Chitral

1) **Settlements in Hazard Zones:** Many communities live in low-lying areas near rivers and glacial lakes, increasing their exposure to floods.
2) **Weak Infrastructure**: Roads, bridges, and communication networks in Chitral are often poorly maintained and vulnerable to extreme weather events.
3) **Limited Access to Resources:** Remote areas in Chitral lack the resources and capacity to respond effectively to disasters.

6. Multi-Hazard Vulnerability Risk Assessment

Multi-Hazard Vulnerability Risk Assessment (MHVRA) of Chitral districts (Chitral Upper and Chitral Lower) involved evaluating the susceptibility of the two districts to various natural and human-induced hazards. It provides insights into the risks faced by these areas, assessing their capacity to cope with such threats and identifying vulnerabilities. Chitral is particularly prone to multiple natural hazards due to its mountainous terrain, climatic conditions, and socio-economic factors.

Over the past 12 years, the district has experienced more than eight GLOF events, with notable occurrences in Yarkhoon Lasht (2003), Brep (2005), Sonoghur Valley (2007), Bindo Gol (2010), Booni (2011), Reshun (2013), and Golen Gol (2019) (Chitral Today, 2013). Worryingly, these valleys are repeatedly affected by such events. Rising temperatures, driven by Climate Change, are accelerating glacier melt rates, further increasing the likelihood of GLOFS.

Avalanches pose another significant threat, particularly in areas with steep terrain. Sub-valleys such as Karimabad, Parsan, Terich, Rech, Oveer, Madak Lusht, Washich, and Yarkhoon are especially susceptible during heavy snowfall. In 2004, an avalanche in Washich village, Torkhow, killed 18 people when it struck their homes. In 2007, another series of avalanches in the same village claimed 41 lives. A tragic avalanche in 2016 killed 10 children returning from school. More recently, in 2017, two avalanches in the Sher Shal area near Gharam Chashma resulted in 10 deaths, including women and children, while heavy snowfall blocked roads.

Between 2010 and 2020, a study in Chitral analyzed 11 avalanche incidents and assessed their damage. Using GIS technology and digital elevation models, the study mapped high-risk avalanche zones, offering critical tools for risk management and preventive measures. These incidents underscore the recurring nature of avalanches and their impact on road access, crops, and fruit orchards, highlighting the urgent need for effective disaster management strategies.

The glacial lake outburst floods (GLOFs) and avalanches have led to substantial damage in Chitral, including loss of lives, property, and infrastructure. To reduce the impact of these natural hazards, it is crucial to continuously monitor and adopt preventive measures. As these events become more frequent and intense, local and national governments must implement effective disaster management plans.

Between July 15 and 28, 2015, glacial floods swept through various parts of Chitral district, unleashing massive volumes of water that devastated villages, roads, bridges, and other

critical infrastructure. The floods also severely disrupted drinking water supplies. While such events are infrequent, Climate Change has heightened the vulnerability of northern districts in Khyber Pakhtunkhwa, including Chitral, Mansehra, Battagram, Kohistan (Upper and Lower), Torghar, and Shangla. These regions have been identified as high-risk areas by NDMA and PDMA during monsoon contingency planning. In Chitral alone, 32 fatalities were reported due to flood-related incidents.

Glacial Lake Outburst Floods (GLOFs) pose significant threats to livelihoods, triggering sudden floods that destroy croplands and disrupt communication networks in communities situated below and across the glaciers. The damage caused by these events often extends far beyond the initial outburst, impacting settlements and agricultural areas across vast regions. In Golain Valley, a region already prone to flood hazards, the situation has worsened in recent years due to the increasing frequency of such events, likely driven by global Climate Change.

The primary impact of glacial floods is on agricultural land, which directly affects the economy and livelihoods of local communities. Additionally, the destruction of infrastructure disrupts tourism, trade, and transportation. For example, when a bridge was damaged during a flood, the resulting blockage of the Mastuj road forced residents to manually transport goods, causing significant physical and mental strain. Much of the damage caused by GLOFs stems from the debris carried by floodwaters. In a particularly severe event in the Golain basin, heavy debris flows, including large boulders, destroyed critical infrastructure and severely damaged the Golain hydropower plant.

In August 2024, a Glacial Lake Outburst Flood (GLOF) struck the district headquarters town of Booni in Upper Chitral, sweeping away six suspension bridges and effectively severing the town into two disconnected parts. The total number of GLOFs affecting various areas of Upper and Lower Chitral districts rose to eight since the onset of the recent spell of heavy rains.

As flood warnings were announced, panic ensued among residents living near the nullah, triggering a desperate stampede as people scrambled to evacuate. According to locals, the floodwater breached the nullah’s walls, devastating maize crops, vegetable fields, and apple orchards while severely disrupting daily life.

In another incident, a GLOF struck Madak Lasht village in the Sheshi Koh sub-valley, wreaking havoc on the villages of Karash, Tar, and Tingel. Over 20 families were left homeless as the floodwaters swept away homes and infrastructure. The valley's road was washed away along a significant stretch, while power poles sustained extensive damage, cutting off the electricity supply to the area.

6.1 Geographical Context of Chitral

Chitral is located in the northern part of Khyber Pakhtunkhwa province and borders the mountainous regions of Gilgit-Baltistan and Khyber Pakhtunkhwa, as well as Afghanistan to the west. It consists of two administrative districts:

Chitral Upper: A mountainous and rugged area with high-altitude terrain.
Chitral Lower: A relatively more urbanized and accessible region along Chitral River valley.

The region is characterized by its mountainous geography, glacial systems, river networks, and exposure to various natural and socio-political hazards.

6.2 Natural Hazards

Chitral is exposed to a variety of natural hazards, driven by its mountainous topography, climate change effects, and hydrology.

6.2.1 Floods

Types of Floods

a) Riverine floods caused by the melting of glaciers and heavy rainfall.
b) Flash floods triggered by sudden glacial melting or upstream heavy rainfall.

Causes

1) Melting of glacial ice due to rising temperatures.
2) Landslides blocking rivers and creating temporary lakes that later burst (known as Glacial Lake Outburst Floods, or GLOFs).
3) Urbanization and deforestation that lead to poor water retention.

6.2.2 Earthquakes

1) Chitral is located in a seismically active region, and earthquakes are a recurring risk.
2) The area's mountainous terrain increases susceptibility to landslides and secondary hazards triggered by earthquakes.

6.6.3 Landslides

1) Landslides are a serious hazard, especially during heavy rainfall periods or following earthquakes.
2) They can be triggered by steep slopes, deforestation, and unstable soils.

6.2.4 Glacial Lake Outburst Floods (GLOFs)

1) GLOFs are prominent hazards due to the presence of glacial lakes formed from melting ice.
2) The melting of glaciers due to climate change poses risks of sudden, large-scale flooding, threatening settlements and infrastructure.

6.2.5 Snow Avalanches

Heavy snowfall and steep mountain slopes make the region vulnerable to snow avalanches, especially in winter months.

6.2.6 Drought

Climate change and changes in seasonal rainfall patterns have made Chitral vulnerable to periods of drought, which impact agriculture, water supplies, and food security.

6.3 Socioeconomic Vulnerabilities

Socioeconomic factors contribute to the overall risk and vulnerability of the districts in Chitral. These include:

6.3.1 Poverty and Unemployment

1) Many residents in the Chitral districts rely on subsistence agriculture, which is highly dependent on climatic conditions.
2) Limited access to employment opportunities increases dependence on natural resources, heightening risk during environmental shocks.

6.3.2 Limited Infrastructure

1) Poor road infrastructure hampers access to emergency services and aid during disasters.
2) Lack of access to hospitals, education facilities, and markets compounds vulnerability.

6.3.3 Lack of Preparedness and Awareness

A lack of disaster risk reduction (DRR) awareness and preparedness programs leaves communities unprepared for hazards.

6.3.4 Deforestation

1) Deforestation for agricultural expansion and fuelwood extraction reduces the natural buffer against floods and landslides.

2) Forest loss leads to soil erosion, making the terrain unstable and vulnerable to natural hazards.

6.4 Vulnerability Analysis

The Multi-Hazard Vulnerability Risk Assessment includes identifying and evaluating the interaction between natural hazards, physical infrastructure, and socioeconomic conditions:

6.4.1 Physical Vulnerability

Many settlements are located in flood-prone and landslide-prone areas so mountainous and rural communities have limited access to safe drinking water and proper sanitation, worsening health risks during a disaster.

6.4.2 Social Vulnerability

Disadvantaged groups such as women, children, and the elderly are more vulnerable due to limited mobility, economic status, and unequal access to resources.

6.4.3 Economic Vulnerability

A reliance on agriculture, which is vulnerable to changing climatic conditions, impacts food security and insufficient financial resources reduce the ability to respond to emergencies.

6.4.4 Vulnerable Sectors (Upper Chitral)

1) Agriculture (crops and livestock)
2) Water resources
3) Infrastructure (roads, bridges)
4) Biodiversity (forest ecosystems)
5) Livelihoods (agriculture-based communities)

6.4.5 Vulnerable Sectors (Upper Chitral)

1) Urban infrastructure
2) Water Resources: supply and sanitation
3) Public health: stress and waterborne diseases)
4) Agriculture: crop production and livestock
5) Agricultural lands and Villages in flood-prone areas

6.5 Climate Change as a Cross-Cutting Risk

Climate change exacerbates the severity and frequency of hazards in Chitral in following ways:

1) Melting glaciers lead to increased flooding and glacial lake outburst floods.
2) Changing rainfall patterns affect agricultural patterns and local food security.
3) Rising temperatures lead to changes in snow patterns and snowmelt timing, affecting river flows and the availability of water.

6.5.1 Risk Profile of Upper Chitral District

High altitude valleys, glacial regions, and remote communities. Upper Chitral's climate is influenced by its high-altitude, mountainous terrain and location within the Hindu Kush range. The district experiences a continental climate with sharp seasonal contrasts, including cold, harsh winters and relatively mild summers.

Glacial Lake Outburst Floods (GLOFs): Melting glaciers increase the risk of catastrophic floods.

Flooding and Landslides: Flash floods, particularly during the monsoon season, cause soil erosion and damage infrastructure.

Water Scarcity: Reduced water availability due to glacial melt and changing rainfall patterns.

Temperature Increase and Erratic Rainfall: Shifts in cropping patterns due to erratic rainfall and temperature variations impact the agriculture.

6.5.2 Risk Profile of Lower Chitral District

Includes urban centers like Chitral town, agricultural lands, and river valleys.

Flooding and Urbanization: Increased flood risks due to rapid urbanization and deforestation.

Water Shortages: Reduced water flows in rivers and groundwater due to glacial retreat.

Heat Stress: Extreme heat and temperature variation affecting human health, especially in urban areas.

6.6 Risk Mitigation Strategies

To address the risks and vulnerabilities identified in Chitral through the MHVRA process, key strategies include:

6.6.1 Disaster Preparedness and Early Warning Systems

1) Strengthening meteorological services for flood and avalanche forecasts.
2) Creating community-based disaster risk reduction awareness programs.

6.6.2 Infrastructure Development

1) Building roads, bridges, and flood protection infrastructure that can withstand natural hazards.
2) Improving the resilience of health facilities and schools.

6.6.3 Climate Adaptation Programs

1) Promoting reforestation and afforestation to combat soil erosion and reduce flood risks.
2) Encouraging sustainable agricultural practices to counteract climate change impacts.

6.6.4 Livelihood Diversification

Reducing reliance on agriculture by promoting alternative income opportunities.

6.6.5 Strengthening Governance and Policy

1) Establishing stronger disaster response policies and integrating climate change adaptation into development planning.
2) Coordinating multi-agency responses to address risks effectively.

6.6.6 Investment in Glacial Lake Outburst Flood Mitigation

Monitoring high-risk glacial lakes for early warning systems and implementing technical interventions like controlled drainage to mitigate the risk of catastrophic GLOFs.

The Multi-Hazard Vulnerability Risk Assessment (MHVRA) of Chitral Upper and Chitral Lower reveals that these districts are highly vulnerable to multiple hazards such as floods, glacial lake outburst floods, earthquakes, landslides, and avalanches. Vulnerability is heightened by

socioeconomic challenges, infrastructural deficits, climate change effects, and limited preparedness.

Effective mitigation requires a multi-sectoral approach, involving government agencies, local communities, climate experts, and NGOs. Addressing underlying vulnerabilities through preparedness, infrastructure development, climate adaptation, and sustainable socio-economic programs is essential for building resilience against natural hazards in both Chitral Upper and Chitral Lower.

7. Climate Change Adaptation Action Plan

The province of KP has developed its Climate Change Policy along with its Action Plan in 2022. The KP Climate Change Policy of 2022 provides for development / downscaling of district wise climate scenarios to link climate adaptation and mitigation measures with district development plans under its medium-term plan in line with the National Climate Change Policy 2021 to link itself to the SDGs. This action plan will ensure that climate action (SDG-13) is mainstreamed into developmental planning and management at district level, particularly for socially and economically vulnerable communities.

7.1 Prioritizing Actions

Prioritizing actions for implementation of Climate Change Adaptation Action Plan for Chitral Districts requires a comprehensive, context-specific approach that considers local vulnerabilities, socio-economic conditions, and available resources. Chitral, located in the mountainous region of Khyber Pakhtunkhwa province, faces several challenges due to its geographical location and exposure to climate-related risks such as flash floods, glacial lake outburst floods (GLOFs), droughts, and shifts in precipitation patterns. This action plan outlines strategies and measures that will be implemented for the designated sectors in line with the National Climate Change Policy, 2021 into KP Climate Change Policy, 2022. The actions are grouped into categories based on the NCCP Framework's objectives as:

Priority Actions:	within 02-years
Short term Actions:	within 05-years
Medium term Actions:	within 10-years
Long term Actions:	within 20-years

7.2 Aim and Objectives

The overarching aim of this Climate Change Action Plan is to achieve the targets set to achieve the Sustainable Development Goal13 (Climate Action) in line with districts' adaptation strategies with provincial, national and international climate change policies and frameworks. Whereas, the specific objectives are to:

1) reduce the vulnerability to climate change of communities, ecosystems, and infrastructure in both districts of Chitral while enhancing the adaptive capacity of the local population; and

2) identify and prioritize districts' adaptation strategies that can minimize climate-related risks and promote climate-resilient sustainable development.

7.3 Approaches to Climate Resilience

Enhancement of climate resilience of local communities, ecosystems and infrastructure in Chitral districts against climate-induced hazards is the fundamental approach that will be implemented by taking following steps:

7.3.1 Improvement of Water Resource Management

Improve sustainable management of water resources to address water scarcity for agriculture and consumption.

7.3.2 Promotion of Climate Resilient Agriculture

Promote climate-resilient agriculture to ensure food security and sustainable livelihoods.

7.3.3 Strengthening of Infrastructure

Strengthen infrastructure to withstand extreme weather events, such as floods and landslides.

7.3.4 Improvement of Early Warning System

Enhance early warning systems for natural hazards and increase community preparedness.

7.3.5 Integration of climate adaptation in local development planning

Integrate climate change adaptation into local development policies and plans**.**

7.4 Climate Change Adaptation Action Plan

This action plan outlines the strategies, actions and implementing partners that will be implemented for the selected sectors in order to incorporate NCCP 2021 into PCCP 2022 to ensure that climate action is mainstreamed into developmental planning and management, particularly for socially and economically vulnerable communities at districts of Chitral.

7.4.1 AGRICULTURE

Climate change poses significant challenges to the agriculture sector in Chitral, necessitating targeted adaptation strategies to ensure sustainable livelihoods. As adapting agriculture to new climate realities can reduce vulnerability and increase resilience. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 1.1: Promoting climate resilient agriculture to ensure food security and sustainable livelihoods.

Actions	Priority	Implementing Partners
1. Introduce drought-resistant, flood-tolerant, and early-maturing crop varieties to reduce vulnerability to shifting weather patterns.	Short term	Agriculture Department and Agriculture Research Institutions in KP
2. Train farmers on climate-smart agricultural practices such as crop rotation, conservation tillage, and organic farming techniques to enhance soil fertility and resilience.	Short term	Directorate of Agriculture Extension, Agriculture Department
3. Promote the establishment of seed banks and community-based seed exchange systems to increase local access to climate-resilient seeds.	Medium term	Agriculture Department
4. Promote short-duration crop varieties suitable for Chitral's changing climatic conditions.	Short term	Agriculture Department
5. Distribute seeds and planting materials for these resilient varieties through subsidized schemes.	Short term	Agriculture Department
6. Conduct field demonstrations and training sessions for farmers on cultivating these crop varieties.	Short term	Agriculture Department
7. Adopting regenerative agriculture	Priority	Agriculture Department

Strategy 1.2: Conserving water through efficient irrigation techniques to improve irrigation and water management

Actions	Priority	Implementing Partners
1. Install efficient irrigation systems such as drip and sprinkler irrigation to optimize water usage.	Short-term	LG Department Directorate of Agriculture Extension, Agriculture Department Irrigation Department
2. Construct small water reservoirs and channels for rainwater harvesting and storage.	Short-term	LG Department Irrigation Department
3. Selection of suitable crops on steep slopes and avoid water intensive crops to avoid degradation of slopes	Priority	Agriculture Department

4. Provide training to farmers on water conservation techniques and best irrigation practices.	Short-term	Directorate of Agriculture Extension, Agriculture Department
Strategy 1.3: Controlling soil erosion to improve soil health		
Actions	**Priority**	**Implementing Partners**
1. Promote organic farming practices, including composting and the use of natural fertilizers, to maintain soil fertility.	Short-term	Agriculture Department
2. Implement soil conservation measures such as terracing, contour farming, and agroforestry to prevent erosion.	Short-term	Agriculture Department
3. Organize awareness programs for farmers on sustainable land management and soil health improvement techniques.	Short-term	Agriculture Department
Strategy 1.4: Improving extension system for effective and timely communication of weather, climatic predictions and appropriate advices		
Actions	**Priority**	**Implementing Partners**
1. Develop localized climate monitoring systems for flood, drought, and extreme weather events.	Priority	PDMA RMC, PMD
2. Disseminate timely weather forecasts and climate advisories to farmers through mobile technology.	Priority	IPR Department ST&IT Department
3. Train communities in disaster preparedness and response strategies.	Priority	PDMA CSOs
Strategy 1.5: Gender inclusiveness farming and awareness		
1. Promote gender inclusive plantation and nurseries	Priority	CCFE&WD (Forest), Agriculture Department, Civil Society
8. Gender awareness regarding storage and use of pesticides, herbicides, insecticides, seeds and crops	Priority	Agriculture Department, CCFE&WD, Civil Society
Strategy 1.6: Livelihood diversification		
Actions	**Priority**	**Implementing Partners**
1. Encourage agroforestry and integrated farming systems combining crops, livestock, and forestry.	Short term	Agriculture Department LF&C Department CCFE&W Department
2. Provide vocational training in alternative income-generating activities, such as apiculture and handicrafts.	Short term	Agriculture Department
3. Establish community-based cooperatives to support small-scale agro-industries.	Short term	LF&C Department

Strategy 1.7: Strengthening farmers' capacity		
Actions	**Priority**	**Implementing Partners**
1. Establish farmer field schools to educate on climate-resilient agricultural practices.	Short term	Directorate of Agriculture Extension, Agriculture Department
2. Develop mobile applications or SMS services to provide farmers with timely weather forecasts and agricultural advice.	Short term	Agriculture Department RMC-PMD
3. Facilitate access to microfinance and credit for purchasing climate-resilient inputs and technologies.	Short term	Agriculture Department Microfinance Institutions
Strategy 1.8: Institutional Capacity Building		
Actions	**Actions**	**Actions**
1. Create Climate Adaptation Cells within District Office of Agriculture Department and EPA, Malakand Division for focused policy implementation.	Priority	Agriculture Department CCFE&W Department
2. Facilitate interdepartmental coordination for integrated planning and resource mobilization.	Short-term	P&D Department
3. Engage local NGOs and community organizations to build grassroots capacity.	Short-term	LG Department Social Welfare Department
Strategy 1.9: Diversification of Cropping Systems		
Actions	**Actions**	**Actions**
1. Encourage intercropping and crop rotation practices to enhance resilience against climatic variability.	Short-term	Directorate of Agriculture Extension, Agriculture Department
2. Promote the cultivation of high-value crops such as medicinal plants, nuts, and fruits suited to Chitral's climate.	Short-term	Directorate of Agriculture Extension, Agriculture Department Local NDGOs
3. Establish market linkages to ensure farmers can sell diversified crops at competitive prices.	Priority	Directorate of Agriculture Extension, Agriculture Department Local NDGOs

7.4.2 LIVESTOCK

Livestock, a critical component of Upper Chitral's economy, faces multiple climate-related risks. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 2.1: Improving Livestock Breeds		
Actions	**Priority**	**Implementing Partners**
1. Promote and introduce climate-resilient livestock breeds that are more tolerant to temperature variations and diseases.	Medium-term	Livestock, Fisheries & Cooperative Department Agriculture Research Station, Chitral

2. Establish local breeding programs and artificial insemination centers to improve livestock genetics.	Short-term	Livestock, Fisheries & Cooperative Department
3. Provide training to farmers on the management of improved breeds for enhanced productivity.	Short-term	Livestock, Fisheries & Cooperative Department
Strategy 2.2: Enhancing fodder and feed management		
Actions	**Priority**	**Implementing Partners**
1. Develop and promote drought-resistant fodder crops suited to Chitral's climate.	Short-term	Livestock, Fisheries & Cooperative Department Agriculture Department
2. Establish community silage and hay storage facilities to ensure year-round feed availability.	Short-term	Livestock, Fisheries & Cooperative Department
3. Train farmers in improved feed preparation and nutrient management practices.	Short-term	Livestock, Fisheries & Cooperative Department
Strategy 2.3: Disease Surveillance and Veterinary Services		
Actions	**Priority**	**Implementing Partners**
1. Strengthen veterinary infrastructure to provide timely disease diagnosis and treatment.	Priority	LF&C Department
2. Conduct regular livestock vaccination and deworming campaigns to prevent climate-induced disease outbreaks.	Priority	LF&C Department
3. Develop early warning systems for livestock disease outbreaks in collaboration with meteorological services.	Short-term	LF&C Department RMC-PMD
Strategy 2.4: Sustainable Grazing and Pasture Management		
Actions	**Priority**	**Implementing Partners**
1. Promote rotational grazing systems to prevent overgrazing and degradation of rangelands.	Short-term	LF&C Department CCFE&W Department
2. Restore degraded pastures through reforestation and reseeding of native grasses.	Short-term	LF&C Department CCFE&W Department
3. Establish grazing management committees at the community level to regulate livestock movement and pasture use.	Short-term	LF&C Department CSOs
Strategy 2.5: Livelihood Diversification and Climate Awareness		
Actions	**Priority**	**Implementing Partners**
1. Provide vocational training in supplementary activities such as poultry farming, beekeeping, and dairy processing.	Short-term	LF&C Department CSOs
2. Develop small-scale milk collection and	Short-term	LF&C Department

processing units to create market linkages for livestock products.		CSOs
3. Conduct awareness campaigns on the impacts of climate change and sustainable livestock management practices.	Short-term	LF&C Department CSOs

7.4.3 FORESTRY

Forest cover helps in soil and biodiversity conservation, water retention. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 3.1: Improving watershed management and forest restoration

Actions	Priority	Implementing Partners
1. Implement watershed management programs to protect and rehabilitate forests in upland areas, which serve as critical water catchments.	Short-Term	CCFW&ED
2. Promote agroforestry techniques by encouraging the planting of trees on farmlands to improve water retention, reduce soil erosion, and enhance biodiversity.	Short-Term	CCFW&ED and Agriculture Department
3. Implement forest protection measures to minimize the damage caused by forest fires.	Priority	CCFW&ED and RR&SD
4. Strictly enforce regulatory provisions to prevent forest encroachments.	Priority	CCFW&ED
5. Implement watershed management programs to protect and rehabilitate forests in upland areas, which serve as critical water catchments.	Short-Term	CCFW&ED

Strategy 3.2: Promoting best practices of Sustainable Forest Management by developing objective criteria and indicators to secure social and environmental values and services of forests.

Actions	Priority	Implementing Partners
1. Launch programs to promote sustainable use of non-timber forest produce with community engagement, with a special focus on livelihood improvement.	Priority	CCFE&W Department
2. Emphasize on 'self-sustenance' in the use of forest resources for local communities.	Short-term	CCFE&W Department
3. Ensure community participation in land use planning and forest land management.	Priority	CCFE&W Department

Strategy 3.3: Identifying essential knowledge gaps about the impact of Climate Change on Chitral's forests through research

Actions	Priority	Implementing Partners
1. Conduct 'forest ecosystem' based research and identify ecosystems with high and low resilience to Climate Change.	Priority	Agriculture Department CCFE&W Department
2. Map the forests, vulnerable to Climate Change using GIS/RS techniques.	Priority	Agriculture Department CCFE&W Department
3. Monitor implementation of ecosystem-based climate change adaption actions.	Short-term	Agriculture Department CCFE&W Department
Strategy 3.4: Raising awareness among the general public, forest communities and enhance capacities of forest experts about forestry and Climate Change adaptation		
Actions	**Priority**	**Implementing Partners**
1. Promoting faith-based awareness campaign	Priority	CCFW&ED
2. Create and promote 'Forest and Climate' expert groups to disseminate new ideas and information to the public, forest communities and professional foresters based on the latest forestry and Climate Change research.	Short-term	CCFW&ED
3. Develop joint programs in collaboration with civil society to highlight the role of forests in combating Climate Change, particularly among forest dependent communities and students.	Priority	CCFW&ED
Strategy 3.5 Adapting to the anticipated adverse impacts of Climate Change and strengthening the ecological resilience of forest ecosystems		
Actions	**Priority**	**Implementing Partners**
1. Identify suitable forest management strategies based on scientific studies to address the probable implications caused by Climate Change.	Medium-term	CCFW&ED
2. Increase forest cover in uphill watershed areas through rapid afforestation and reforestation initiatives in response to increased rainfall intensity and flood risks.	Priority	CCFW&ED

4.4 ECOTOURISM

Ecotourism in Chitral has great potential to contribute to both the local economy and environmental conservation, especially as the region is rich in natural beauty, cultural heritage, and biodiversity. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 4.1: Discouraging activities that lead to the depletion of mountain ecology while supporting those that contribute to the rejuvenation of a viable climate at

higher altitudes		
Actions	**Priority**	**Implementing Partners**
1. Promote ecotourism and develop procedures to prevent the accumulation of solid waste, garbage and other undesired material in major tourist spots and hill stations	Short-term	LGE&RDD, Tourism Department, CSOs
2. Sensitize and engage local communities in the promotion of ecotourism	Short-term	LGE&RDD, Tourism Department, CSOs
3. Encourage the use of sustainable, locally sourced, and energy-efficient materials for building eco-friendly accommodations and tourist facilities.	Short-term	LG Department Tourism Department
Strategy 4.2: Enhancing the resilience of ecotourism infrastructure		
Actions	**Priority**	**Implementing Partners**
1. Construct and upgrade tourism-related infrastructure (e.g., lodges, trekking paths, and transportation facilities) to be more resistant to extreme weather events such as floods, landslides, and heavy snowfall.	Short-term	LG Department Tourism Department
2. Implement flood and landslide control measures along popular tourist routes (such as building retaining walls, drainage systems, and flood barriers) to protect both tourists and infrastructure.	Short-term	LG Department Tourism Department C&W Department
3. Introduce water-efficient systems for ecotourism businesses, including rainwater harvesting, wastewater treatment, and the use of eco-friendly plumbing and sanitation facilities.	Short-term	LG Department Tourism Department
Strategy 4.3: Promoting low-impact tourism		
Actions	**Priority**	**Implementing Partners**
1. Develop certification systems for eco-friendly tourism businesses that encourage sustainable practices, such as energy conservation, waste reduction, and responsible wildlife tourism.	Medium-term	Tourism Department
2. Implement awareness programs for tourists on sustainable travel practices, such as reducing waste, avoiding littering, and respecting local wildlife and traditions.	Short-term	Tourism Department
3. Establish a visitor quota system for high-traffic ecotourism sites to prevent over-tourism and degradation of natural and cultural resources. This could include the use of permits and pre-booking systems.	Short-term	Tourism Department

4. Promote ecotourism activities during the off-peak seasons to reduce pressure on local ecosystems and tourist facilities during peak seasons.	Short-term	Tourism Department
Strategy 4.4: Diversification of ecotourism offerings		
Actions	**Priority**	**Implementing Partners**
1. Develop ecotourism activities that are less vulnerable to climate change, such as cultural tours, wildlife watching, and community-based tourism, which are not directly dependent on weather patterns.	Short-term	Tourism Department
2. Integrate cultural and heritage tourism into the ecotourism package by highlighting Chitral's unique traditions, festivals, and handicrafts. This provides alternative sources of income when environmental conditions might limit nature-based tourism.	Short-term	Tourism Department
3. Promote other nature-based tourism experiences such as bird watching, fishing, eco-camping, and nature walks, which could help diversify the tourism economy and reduce dependence on glacier or mountain-based activities.	Short-term	Tourism Department
Strategy 4.5: Promoting ecosystem-based adaptation and conservation		
Actions	**Priority**	**Implementing Partners**
1. Develop mountain-specific conservation programs for Chitral's rich biodiversity, focusing on areas impacted by climate change, such as the loss of glaciers and changing alpine meadows.		Tourism Department CCFE&W Department
2. Preserve and manage freshwater resources (rivers, lakes, and streams) that are central to both ecotourism activities and the region's biodiversity. This could involve controlling pollution, protecting watersheds, and restoring wetlands.		Tourism Department CCFE&W Department
3. In upper Chitral districts, implement programs to protect and increase the population of iconic species such as the Snow Leopard, Markhor, Himalayan ibex and other endemic wildlife, which are central to the region's appeal to ecotourists.		Tourism Department CCFE&W Department

7.4.5 URBAN PLANNING

As resilient infrastructure ensures continued access to markets, healthcare, and education during climate-related events. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 5.1: Enhancing climate resilience of infrastructure against climate- induced hazards.

Actions	Priority	Implementing Partners
1. Design and construct flood-resistant infrastructure, including flood walls, reinforced bridges, and drainage systems in flood-prone areas.	Short-Term	Communication & Works Department
1. Retrofit urban infrastructure in Chitral town and other population centers to withstand increased heat and floods due to urban expansion.	Short-Term	Communication & Works Department
2. Promote resilient housing through training programs for local builders in constructing homes that can withstand flooding and landslides.	Short-Term	Housing Department,

Strategy 5.2: Integrating climate change adaptation measures in development planning

Actions	Priority	Implementing Partners
1. Ensure that adaptive measures to climate change impact have been incorporated in any project's PC-1 submitted for approval or recommendation to the higher forum	Short-Term	P&D Department
2. Consider internalization of the cost of climate change adaptation measures the in budget.	Medium-term	P&D Department

Strategy 5.3: Enhancing Disease Surveillance and Early Warning Systems

Actions	Priority	Implementing Partners
1. Develop robust disease monitoring systems for climate-sensitive diseases (e.g., malaria, dengue, diarrhea).	Priority	Health Department
2. Establish early warning systems for health risks linked to extreme weather events.	Short-Term	Health Department RMC-PMD
3. Deploy GIS-based tools for mapping and monitoring disease outbreaks.	Short-Term	Health Department

Strategy 5.4: Improving Water, Sanitation, and Hygiene (WASH)

Actions	Priority	Implementing Partners
1. Develop community-level water purification and storage systems.	Priority	PHE Department

2. Promote awareness about personal and community hygiene practices.	Priority	Social Welfare Department
3. Strengthen regulations on water quality monitoring and management.	Priority	CCFE&W Department

Strategy 5.5: Raising community awareness and resilience		
Actions	**Priority**	**Implementing Partners**
1. Conduct health education campaigns on heat stress, vector-borne diseases, and disaster preparedness.	Priority	Health Department Information & Public Relation
2. Train community volunteers in first aid and health response during emergencies.	Priority	Health Department NGOs
3. Develop culturally sensitive materials to disseminate health-related climate information.	Short-Term	Health Department Information & Public Relation NGOs

7.4.6 FISHERIES

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 6.1: Developing a habitat preservation program for various fish species		
Actions	**Priority**	**Implementing Partners**
1. Periodically monitor the biological, chemical and physical qualities of water for existing and potential fishery sites.	Short-term	Agriculture Department
2. Monitor and report unexpected fish migration/movement caused by Climate Change or any other factor	Short-term	Same as above
2. Create an inventory/baseline dataset for aquatic resources.	Short-term	Same as above

Strategy 6.2: Improving resilience of fish farming and hatchery infrastructure		
Actions	**Priority**	**Implementing Partners**
1. Strict criteria for hatchery and fish farming site selection should be developed to avoid disaster and flood-prone areas.	Medium- term	Agriculture Department
2. The design of the hatchery and fish farming structures should be strong enough to withstand any potential disasters.	Medium- term	Same as above
3. Promote knowledge and information sharing among relevant stakeholders, preferably local populations and sensitize them to the need of conserving valuable	Medium- term	Agriculture Department, CCFE&WD

flora and fauna through various programs.		
Strategy 6.3: Developing a program for aquatic resource habitat preservation		
Actions	**Priority**	**Implementing Partners**
1. Manage existing natural habitat and find new potential sites for introduction of fisheries.	Medium-term	Agriculture Department
2. Plan and implement habitat preservation for indigenous fish fauna by establishing fish protected areas (sanctuaries and reserves).	Medium-term	Same as above
3. Develop habitat management plans for commercially viable fish species.	Medium-term	Same as above
Strategy 6.4: Research, Monitoring, and Data Collection		
Actions	**Priority**	**Implementing Partners**
1. Invest in research on the effects of climate change on freshwater ecosystems and fish species in Chitral. This will help identify the vulnerabilities of local fish populations and inform adaptive strategies.	Short-term	LF&C Department
2. Research and promote fish species that are more resilient to climate change, such as species that can tolerate warmer water temperatures or varying flow conditions.	Short-term	LF&C Department
3. Establish data collection systems to monitor key indicators of fish health, including population size, reproductive success, and migration patterns. Regular monitoring will help detect early signs of stress and enable timely interventions.	Short-term	LF&C Department
Strategy 6.5: Water Temperature Regulation and Cooling Solutions		
Actions	**Priority**	**Implementing Partners**
1. aquaculture practices, explore the use of artificial cooling systems (e.g., aerators or shaded areas) to maintain optimal water temperatures in fish ponds during hot periods when water temperatures rise.	Short-term	LF&C Department
2. Promote aquaculture techniques that minimize the impacts of rising water temperatures, such as selecting cold-water species or implementing systems that help maintain temperature stability	Short-term	LF&C Department

in ponds.		

7.4.7 WATER RESOURCES AND GLACIERS

Enhance water conservation and improve irrigation systems to manage water scarcity and fluctuating water availability due to changing rainfall patterns. As Chitral districts rely heavily on agriculture, and inconsistent rainfall, along with glacier retreat, threatens water availability. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 7.1: Improving sustainable management of water resources to address scarcity for agriculture and consumption.

Actions	Priority	Implementing Partners
1. Develop early warning systems (EWS) that provide timely alerts to communities about imminent floods and water shortages, particularly in GLOF-prone areas.	Priority	RMC-PMD
2. Collaborate with meteorological departments to establish weather stations and integrate data with community-level warning systems.	Priority	RMC-PMD

Strategy 7.2: Promoting technologies and techniques for water conservation

Actions	Priority	Implementing Partners
1. Promote rainwater harvesting technologies inhouse holds and community centers, particularly in areas with unreliable water access.	Medium-term	Irrigation Department
2. Introduce efficient irrigation systems such as drip and sprinkler irrigation to optimize water usage in agriculture.	Medium-term	Irrigation Department
3. Develop and maintain community-managed small-scale water reservoirs, check dams, and ponds for water storage during the dry season.	Medium-term	Irrigation Department
4. Reinforce traditional water management systems like Karez (underground irrigation channels) in specific alleys.	Medium-term	Irrigation Department

Strategy 7.3: Developing local rainwater harvesting techniques

Actions	Priority	Implementing Partners
1. Assess the potential for harvesting rainwater in various areas and agricultural farms.	Priority	Irrigation Department, Agriculture Department
2. Encourage rainwater harvesting in both rural and urban areas, as well as at the	Priority	LGE&RDD, Irrigation Department,

household level.		Agriculture Department
3. Enhance social capacity for rainwater harvesting practices at domestic, village and local level	Short-term	LGE&RDD, Irrigation Department, Agriculture Department, CCCCFE&WD
4. Assess the potential for harvesting rainwater in various areas and agricultural farms.	Priority	Irrigation Department, Agriculture Department
Strategy 7.4: Raising public awareness on necessity of water conservation and sustainable use		
Actions	**Priority**	**Implementing Partners**
1. Conduct regular media campaigns and host seminars and workshops to emphasize the need of water resource conservation and sustainable use at all levels.	Priority	CCCCFE&WD, Information Department, Irrigation Department, PHED and Academia
2. Assist non-governmental organizations (NGOs) and civil society organizations (CSOs) in emphasizing conservation and judicious use of water resources.	Priority	Same as above
3. Initiate joint ventures, involving line departments, civil society, academia as well as print and electronic media to raise public awareness about water conservation, water availability, drainage systems and other water-related issues.	Priority	Same as above
Strategy 7.5: Encouraging farmers' active participation in water management in collaboration with line departments		
Actions	**Priority**	**Implementing Partners**
1. Identify the line departments and civil society organizations that may train and engage the farmer community to participate in irrigation water management and distribution.	Priority	Irrigation Department Agriculture Department
2. Encourage public-private partnerships to improve access to safe drinking water and the sustainable operation and maintenance of water supply systems.	Short-term	PHED LGE&RDD
3. Enhance communication between the irrigation department and farmer communities regarding irrigation water distribution and management.	Short-term	Irrigation Department Agriculture Department

Strategy 7.6: Enhancing water storage capacities		
1. Locate new prospective dam sites.	Short-term	Irrigation Department
2. Ensure that these locations are not exploited for construction projects other than agricultural and forestry in order to retain the option of constructing new dams, if necessary.	Short-term	Same as above
3. Conduct detailed feasibility and design studies, as well as cost estimates, for the proposed new dams	Short-term	Same as above

7.4.8 WILDLIFE AND BIODIVERSITY

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 8.1: Improving biodiversity conservation		
Actions	**Priority**	**Implementing Partners**
1. Extend conservation techniques in collaboration with local communities, utilizing their knowledge from a local perspective	Short-term	CCFW&ED
2. Document and incorporate indigenous knowledge into the latest scientific research findings/information for use in conservation planning and activities.	Short-term	CCFW&ED
3. Document and incorporate indigenous knowledge into the latest scientific research findings/information for use in conservation planning and activities		P&D Department CCFE&W Department LGE&RD Department Agriculture Department Irrigation Department, WWF
4. Extend conservation techniques in collaboration with local communities, utilizing their knowledge from a local perspective	Medium- term	Same as above
5. Integrate biodiversity conservation strategies into all relevant sectors including forestry, wildlife, aquatic and agriculture	Medium-term	Same as above
Strategy 8.2: Improving scientific research and biodiversity conservation implementation		
Actions	**Priority**	**Implementing Partners**
1. Document and incorporate indigenous knowledge into the latest scientific research findings/information for use in conservation planning and activities	Medium-term	P&DD CCCCFE&WD LGE&RDD Agriculture Department Irrigation Department WWF
2. Extend conservation techniques in	Medium-term	Same as above

collaboration with local communities, utilizing their knowledge from a local perspective.		
3. Integrate biodiversity conservation strategies into all relevant sectors including forestry, wildlife, aquatic and agriculture.	Medium-term	Same as above
4. Encourage both in-situ and ex-situ conservation of valuable species for research and other uses in biodiversity-rich areas.	Medium-term	CCFE&WD Agriculture Department
Strategy 8.3: Conserving critical habitats		
Actions	**Priority**	**Implementing Partners**
1. Identify and map critical biodiversity hotspots and ecologically sensitive areas.	Short-term	CCFE&WD
2. Establish and expand protected areas, including national parks, wildlife reserves, and community-managed conservation zones.	Short-term	CCFE&WD
3. Promote ecosystem restoration in degraded habitats such as alpine meadows, forests, and wetlands.	Short-term	CCFE&WD
Strategy 8.4: Community Engagement and Capacity Building		
Actions	**Priority**	**Implementing Partners**
1. Establish community-based wildlife monitoring groups and conservation committees.	Short-term	CCEF&W Department
2. Provide alternative livelihoods (e.g., eco-tourism, handicrafts) to reduce dependency on natural resources.	Short-term	LGE&RD Department
3. Conduct awareness campaigns and workshops on the importance of biodiversity.	Short-term	EPA
Strategy 8.5: Protecting Endangered Species		
Actions	**Priority**	**Implementing Partners**
1. Establish anti-poaching patrols and strengthen wildlife laws.	Short-term	CCEF&W Department
2. Implement livestock insurance schemes and compensation for wildlife damage.	Medium-term	LF& C Department CCEF&W Department
3. Set up monitoring and research programs for key species.	Medium-term	CCEF&W Department

7.4.9 VULNERABLE ECOSYSTEMS

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:		
Strategy 9.1: Conducting research in mountain areas to identify ecosystems, the most vulnerable and resilient to the adverse effects of Climate Change and addressing identified challenges with tangible measures		
Actions	**Priority**	**Implementing Partners**
1. Initiate reforestation programs in the mountainous regions to stabilize slopes and reduce flood intensity.	Priority	CCCCFE&WD Agriculture Department
2. Establish a research institution dedicated solely to coordinating and disseminating scientific information on mountain ecosystems.	Short-term	Same as above
3. Initiate integrated watershed management projects at the sub-catchment level to reduce runoff and soil erosion, resulting in reduced flood intensities.	Short-term	CCFE&W Department Agriculture Department Irrigation Department
4. Examine the effects of Climate Change on mountain biodiversity, as well as the role of science in conjunction with indigenous knowledge in preserving it.	Medium-term	CCFE&W Department Agriculture Department
Strategy 9.2: Conservation and restoration of critical ecosystems		
Actions	**Priority**	**Implementing Partners**
1. Conduct ecosystem mapping to identify climate-sensitive areas and prioritize conservation efforts.	Priority	CCFE&W Department
2. Implement reforestation and afforestation programs using native and climate-resilient species.	Short-term	CCFE&W Department
3. Restore degraded wetlands and riparian zones to improve water regulation and biodiversity.	Short-term	CCFE&W Department Irrigation Department
Strategy 9.3: Preventing overexploitation of natural resources through sustainable land management practices.		
Actions	**Priority**	**Implementing Partners**
1. Develop and implement participatory land-use plans with local communities.	Short-term	LG Department
2. Introduce agroforestry practices that integrate tree planting with agriculture.	Short-term	CCFE&W Department

3. Promote rotational grazing systems to prevent overuse of rangelands.	Short-term	CCFE&W Department LF&C Department
Strategy 9.4: Enhancing the adaptive capacity of ecosystems to withstand climate impacts.		
Actions	**Priority**	**Implementing Partners**
1. Establish climate corridors to facilitate species migration and genetic diversity.	Medium-term	CCFE&W Department
2. Introduce water conservation techniques, such as check dams and water harvesting systems.	Short-term	CCFE&W Department Irrigation Department
3. Monitor ecosystem health using GIS and remote sensing technologies.	Medium-term	CCFE&W Department
Strategy 9.5: Safeguard the region's unique biodiversity, including endemic and endangered species.		
Actions	**Priority**	**Implementing Partners**
1. Create and strengthen protected areas, such as community-managed conservation zones.	Short-term	CCFE&W Department
2. Develop species-specific action plans for iconic species like snow leopards, Himalayan ibex, and Markhor.	Short-term	CCFE&W Department
3. Control invasive species that threaten native flora and fauna.	Priority	CCFE&W Department

7.4.10 DISASTER PREPAREDNESS

As early warnings can save lives, reduce economic losses, and support timely evacuations. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 10.1: Mitigating land sliding		
Actions	**Priority**	**Implementing Partners**
1. Undertake geotechnical surveys to identify landslide-prone areas and develop risk maps.	Priority	LGE&RD Department ST & IT Department
2. Implement slope stabilization techniques, such as terracing, reforestation, and the installation of protective netting, in areas at high risk of landslides.		LGE & RD Department
Strategy 10.2: Improving Early Warning System for natural hazards and increase community preparedness.		
Actions	**Priority**	**Implementing Partners**
1. Strengthen the communication infrastructure for EWS, ensuring real-time alerts via SMS, mobile apps, and loudspeakers in vulnerable	Priority	District Office Information & Public Relations,

areas.		
2. Establish a feedback mechanism to assess the effectiveness of warning systems and improve their reach.	Priority	District Office Information & Public Relations,
3. Establish communication channels to disseminate early warning information through mobile phones, radio, and local community networks	Priority	District Office Information & Public Relations,
Strategy 10.3: Raising public awareness of challenges related to mitigation of Climate Change induced disasters		
Actions	**Priority**	**Implementing Partners**
1. Develop a mechanism to establish and promote effective sectorial coordination among sectors responsible for DRM.	Priority	RR&S Department & Relevant line Departments
2. Arrange awareness campaigns for various parts of society, particularly vulnerable communities, via radio, television, print media and participatory workshops.	Priority	RR&SD, Information Department, CCFE&W Department CSOs
3. Conduct special emergency response training sessions for non-governmental organizations (NGOs) and volunteer organizations.	Short-term	P&DD, FE&WD, CSOs
Strategy10.4: Developing hazard zoning and mitigation strategies through management, formulation and law enforcement		
Actions	**Priority**	**Implementing Partners**
1. Develop an integrated natural hazard zoning map of Chitral districts.	Short-term	LGE&RD Department CCFE&W Department RR&S Department
2. Map low-flood risk zones for future land use planning.	Short-term	LGE&RD Department CCFE&W Department RR&S Department Irrigation Department
3. Locate safe sites for people and livestock evacuation in each sensitive locality.	Priority	LGE&RDD, RR&SD, Agriculture Department
4. Define and develop collection points for livestock during disaster.	Priority	Same as above
Strategy 10.5: Developing and strengthening infrastructure resilient to extreme weather events		
Actions	**Priority**	**Implementing Partners**
1. Carry out detailed studies to assess the requirements of flood embankments, dykes and protective bunds to safeguard vulnerable areas, particularly densely populated urban areas, in light of predicted	Priority	P&DD, LGE&RDD, , Irrigation Department, RR&SD

flood levels.		
2. Strengthen existing flood embankments, dykes and protective bunds.	Priority	Same as above
5. Water supply systems must be designed and constructed with due consideration to natural disasters and emergency situations.	Medium-term	P&DD, LGE&RDD, Irrigation Department, PHED, RR&SD

7.4.11 PUBLIC HEALTH

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into CCAAP of Chitral districts:

Strategy 11.1: Assessing and mitigating health vulnerabilities to Climate Change, as well as implementing the "One Health" policy

Actions	Priority	Implementing Partners
1. Determine the baseline conditions of human health risk from current climatic variability and recent Climate Change.	Short-term	District Health Department
2. Develop effective infrastructures and communication channels to promptly counter any epidemic spread caused by a Climate Change induced natural hazard.	Short-term	Health Department, CCCCFE&WD, RR&SD, District Administrations

Strategy 11.2: Improving resilience of health infrastructure to climate-induced risks (e.g., floods, landslides).

Actions	Priority	Implementing Partners
1. Construct and retrofit health facilities to withstand extreme weather events.	Priority	LG Department C&W Department
2. Establish mobile health units to reach remote areas during emergencies.	Priority	Health Department
3. Ensure uninterrupted power supply to health facilities through solar or hybrid energy systems.	Priority	Local Government C&W Department

Strategy 11.3: Enhancing Disease Surveillance and Early Warning Systems

Actions	Priority	Implementing Partners
1. Deploy GIS-based tools for mapping and monitoring disease outbreaks.	Priority	Health Department
2. Train health workers in disease surveillance and response protocols.	Priority	Health Department
3. Collaborate with meteorological departments to link weather data with health alerts.	Short-term	Health Department PDMA

Strategy 11.4: Build community resilience through preparedness and adaptive practices.		
Actions	**Priority**	**Implementing Partners**
1. Conduct health education campaigns on heat stress, vector-borne diseases, and disaster preparedness.	Priority	Heath Department Social Welfare Department
2. Train community volunteers in first aid and health response during emergencies.	Short-term	Health Department LG Department
3. Develop culturally sensitive materials to disseminate health-related climate information.	Short-term	Health Department LG Department
Strategy 11.5: Incorporate climate change adaptation into health education and training programs.		
Actions	**Priority**	**Implementing Partners**
1. Organize workshops and training programs on climate change and public health for healthcare providers.		EPA Social Welfare Department
2. Include climate adaptation and mitigation topics in medical and public health curricula.		E&SE Department and HED
3. Develop partnerships with national and international organizations for capacity-building initiatives.		EPA Health Department AKRSP SRSP WWF

7.4.12 YOUTH AND GENDER DEVELOPMENT

Climate change poses a significant threat to women and girls disproportionately affected. Climate-induced disasters such as floods and droughts exacerbate challenges related to sexual and reproductive health, family planning, and gender-based violence. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 12.1: Sustained access to safe drinking water		
Actions	**Priority**	**Implementing Partners**
1. Encourage youth and women to participate in ensuring access to safe drinking water.	Priority	C&W Department LGE&RD Department PHE Department Health Department
2. Improve access to safe drinking water.	Short-term	Same as above
3. Encourage reforms in health and hygiene training and awareness campaigns.	Medium-term	Same as above
4. Develop a grievance redressal mechanism that is gender sensitive.	Medium-term	Same as above
5. Encourage the use of green manure in	Medium-term	Agriculture Department

agriculture.		
Strategy 12.2: Utilize youth roles for effective climate action		
Actions	**Priority**	**Implementing Partners**
1. Encourage the use of digital Climate Change awareness tools, apps and services in order to attract and educate youth.	Short- term	Same as above
2. Create opportunities for youth to play a role in climate action.	Priority	Same as above
3. Develop a District Climate Change Advocacy Strategy that focuses on youth and vulnerable communities.	Short- term	Same as above
4. Encourage and support young Climate Change entrepreneurs through trainings, workshops, contests and boot camps.	Priority	Same as above
5. Create funding opportunities for expanding youth climate initiatives.	Short- term	Same as above
6. Create opportunities for youth to play a role in climate action.	Priority	Same as above
Strategy 12.3: Agriculture and livestock		
Actions	**Priority**	**Implementing Partners**
1. Identify and introduce gender-responsive technologies, as well as strengthen women's capacities through trainings and financing	Short- term	P&D Department C&W Department LGE&RD Department Agriculture Department CSOs
2. Youth and gender inclusive communication strategy/awareness and trainings for women	Medium- term	C&W Department CCFE&W Department LGE&RD Department CSOs
Strategy 12.4: Sustained access to green and affordable energy		
Actions	**Priority**	**Implementing Partners**
1. Train and provide women with access to renewable alternate energy solutions.	Short-term	Same as above
2. Demonstrate ideas involving energy-efficient, low-cost cooking technology.	Priority	Same as above
3. Soft credits/loans for youth and women to adopt green technology.	Short-term	Same as above
Strategy 12.5: Solid waste collection and management system		
Actions	**Priority**	**Implementing Partners**
1. Encourage youth and women to participate in SWM planning	Priority	CSW CCFE&W Department

		LGE&RD Department CSOs
3. Ensure that youth and women have access to credit, finance and services for waste management and recycling entrepreneurships.	Short-term	Same as above

7.4.13 PASTURE AND RANGELANDS

Adapting to climate change in pastures and rangelands in Chitral districts is critical for sustaining livestock grazing, conserving biodiversity, and maintaining rural livelihoods. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 13.1: Promoting rotational grazing for sustainable rangeland management

Actions	Priority	Implementing Partners
1. Implement rotational grazing practices to prevent overgrazing of pastures and promote the regeneration of vegetation. This allows rangelands to recover and maintain their productivity.	Short-term	CCFE&W Department
2. Regularly assess the grazing capacity of pastures to avoid overgrazing and ensure that grazing levels are sustainable given the changing climate conditions.	Priority	CCFE&W Department
3. Designate and enforce specific periods for resting rangelands, allowing vegetation to regenerate, which improves soil fertility and forage availability during dry spells.	Short-term	CCFE&W Department

Strategy 13.2: Soil conservation and erosion control

Actions	Priority	Implementing Partners
1. Build soil conservation structures such as check dams, terraces, and stone walls to reduce soil erosion and protect pasturelands from degradation caused by floods and heavy rainfall.	Short-term	LF&C Department CCFE&W Department
2. Promote the planting of drought-resistant grasses, shrubs, and other vegetation species that prevent soil erosion, enhance soil fertility, and improve pasture quality.	Short-term	LF&C Department CCFE&W Department
3. In areas prone to gully formation, implement gully plugging techniques to prevent further erosion and loss of valuable pasture land.	Priority	CCFE&W Department

Strategy 13.3: Livestock Management Adaptation

Actions	Priority	Implementing Partners

1. Promote the use of livestock breeds that are better adapted to changing climate conditions, such as heat-tolerant, drought-resistant, and disease-resistant breeds.	Short-term	LF&C Department
2. Enhance veterinary services, provide vaccinations, and ensure proper health management for livestock to reduce the impact of climate-induced diseases and stress.	Priority	LF&C Department
3. Develop systems for supplementing natural grazing with stored fodder and alternative feed sources, especially during droughts or times of forage scarcity.	Short-term	LF&C Department
4. Establish and manage community-based grazing areas where local herders can collectively manage pasture resources, improving access and reducing.	Short-term	LF&C Department
Strategy 13.4: Promoting climate-smart agroforestry and silvopastoral systems		
Actions	**Priority**	**Implementing Partners**
1. Promote silvopastoral systems, which integrate trees, pasture, and livestock to enhance productivity, protect soil, and increase carbon sequestration.	Short-term	LF&C Department CCFE&W Department
2. Introduce drought-resistant, fodder-producing trees (e.g., acacia, mulberry) along pasturelands to provide a supplementary source of feed for livestock during periods of forage scarcity.	Short-term	LF&C Department CCFE&W Department
3. Encourage the planting of multi-purpose trees that not only provide fodder but also offer other products like timber, fruits, or medicinal plants, diversifying income sources for local communities.	Short-term	LF&C Department CCFE&W Department
Strategy 13.5: Strengthening Community-Based Management Systems		
Actions	**Priority**	**Implementing Partners**
1. Establish local rangeland management committees that include community members, herders, and local government representatives to make decisions regarding the management, use, and protection of rangelands.	Priority	LF&C Department
2. Incorporate indigenous and local knowledge into modern rangeland management practices, as local herders often have valuable insights into sustainable land use and pasture	Short-term	LF&C Department

management.		
3. Provide training programs to local communities and pastoralists on climate adaptation strategies, sustainable grazing practices, and the use of climate-smart technologies.	Priority	LF&C Department

7.4.14 CAPACITY BUILDING AND COMMUNITY ENGAGEMENT

As local capacity building and awareness can save lives and reduce economic losses. The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming PCCP 2022 into Provincial Action Plan:

Strategy 14.1: Collaborating with meteorological department to establish weather stations and integrating data with community-level warning systems.

Action	Priority	Implementing Partners
1. Establish and train local disaster response teams and community emergency groups, focusing on GLOF and flood preparedness.	Priority	District DRM Committee and PDMA
2. Develop community-level emergency plans that include evacuation routes, shelter locations and first aid protocols.	Priority	District DRM Committee and PDMA
3. Organize simulation exercises for floods, landslides and GLOFs to enhance community preparedness.	Priority	District DRM Committee and PDMA

Strategy 14.2: Organizing training programs for Climate Change awareness

Action	Priority	Implementing Partners
1. Conduct community-level workshops and seminars to raise awareness about climate change impacts and adaptive practices.	Priority	KP EPA Directorate of Agri Exten Local NGOs
2. Train local farmers, herders, and entrepreneurs on climate-resilient techniques, such as sustainable agriculture, livestock management, and resource conservation.	Short-term	Directorate of Agri Exten LF&C Department Local NGOs
3. Develop educational materials and localized content in local languages for better comprehension and outreach.	Short-term	KP EPA Local NGOs

Strategy 14.3: Forming and Strengthening of Community-Based Organizations (CBOs)

Action	Priority	Implementing Partners
1. Facilitate the establishment of CBOs to enable collective action on climate adaptation projects.	Short-term	LG Department CCEF&W Department Social Welfare Dept.
2. Provide capacity-building sessions for CBOs on project planning, resource mobilization, and	Short-term	P&D Department CCEF&W Department Social Welfare Dept.

disaster risk management.		
3. Encourage participatory decision-making processes to incorporate local knowledge and priorities into climate adaptation strategies.	Short-term	CCEF&W Department Local NGOs
Strategy 14.4: Skill Development for Climate-Resilient Livelihoods		
Action	**Priority**	**Implementing Partners**
1. Conduct vocational training in sustainable practices like eco-tourism, renewable energy installations, and agroforestry.	Short-term	KP-TEVTA Tourism Department
2. Partner with microfinance institutions to provide resources for implementing learned skills.	Short-term	Agriculture Department LF&C Department
3. Develop community-run demonstration projects to showcase successful climate-resilient livelihood strategies.	Short-term	Agriculture Department LF&C Department
Strategy 14.5: Community-Based Disaster Risk Management (CBDRM)		
Action	**Priority**	**Implementing Partners**
1. Establish local disaster response teams and provide them with training on emergency preparedness and response.	Priority	PDMA LG Department Red Crescent
2. Develop community-level early warning systems and evacuation plans tailored to specific hazards in Chitral.		PDMA LG Department
3. Organize mock drills and simulations to ensure community readiness for natural disasters.		PDMA LG Department Red Crescent

7.4.15 SOCIO-ECONOMIC DEVELOPMENT

The following proposed adaptation measures in line with NCCP 2021 will help in mainstreaming KPCCP 2022 into CCAAP of Chitral for socio-economic development:

Strategy 15.1: Mitigate the socioeconomic impacts of Climate Change on vulnerable communities		
Actions	**Priority**	**Implementing Partners**
1. Conduct studies to assess the impact of Climate Change on poverty and the development potential of province	Priority	P&D Department Finance Department LGE&RD Department CCFE&W Department
2. Raise awareness of and provide access to, relevant technology for climate-smart agriculture, energy and industrial development in underprivileged communities.	Short-term	Agriculture, Food, Irrigation, Industries and Local Government Departments
3. Introduce social-safety nets for socioeconomic growth, with a focus on Climate Change adaptation, through cash transfers and social pensions, particularly for	Short term	P&DD, Finance Department LGE&RD Department RR&S Department

disaster- affected communities.		CSOs
4. Investigate, plan and execute measures to address climate-induced migration, which mainly impacts low- income communities.	Priority	Planning and Development Department, Local Government Department
Strategy 15.2: Promoting diversification of means of livelihoods		
Actions	**Priority**	**Implementing Partners**
1. Promote vocational training programs in fields such as eco-tourism, handicrafts, and small-scale entrepreneurship.	Short term	Social Welfare Department Tourism Department SMEDA
2. Support value chain development for local products, including walnuts, apricots, and handmade textiles, to access broader markets.	Short term	Social Welfare Department SMEDA
3. Facilitate microfinance and grant programs to empower small businesses and women entrepreneurs.	Short term	Social Welfare Department SMEDA
Strategy 15.3: Educating people and raising awareness for climate adaptation		
Actions	**Priority**	**Implementing Partners**
1. Incorporate climate change and adaptation education into school curricula and community awareness programs.	Short term	Education Department EPA Local NGOs
2. Organize workshops and training sessions to educate communities on climate risks and preparedness.	Priority	Education Department EPA Local NGOs
3. Support the establishment of community-based organizations (CBOs) to facilitate knowledge sharing and collaboration.	Short term	Education Department EPA Local NGOs
Strategy 15.4: Developing social safety nets and risk reduction mechanisms		
Actions	**Priority**	**Implementing Partners**
1. Expand social safety net programs like cash transfers and food support for vulnerable populations affected by climate change.	Short term	Social Welfare Department BISP
2. Implement community-level insurance schemes to mitigate economic losses from climate-induced disasters.	Short term	Social Welfare Department BISP
3. Develop targeted programs for marginalized groups, including women, to enhance their resilience and participation in decision-making.	Short term	Social Welfare Department PDMA
Strategy 15.5: Strengthening Local Governance and Institutional Capacity		
Actions	**Priority**	**Implementing Partners**

1. Establish district climate adaptation cells/ committees/council to coordinate planning and implementation across sectors.	Priority	P&D Department LG Department
2. Provide training for local government officials on climate adaptation strategies and funding mechanisms.	Priority	LG Department EPA
3. Ensure that district annual development plans integrate climate resilience measures.	Priority	P&D Department LG Department EPA
Strategy 15.6: Promoting sustainable resource management		
Actions	**Priority**	**Implementing Partners**
1. Implement community-based natural resource management programs to protect forests, rangelands, and water resources.	Short term	LG Department CCFE&W Department
2. Promote renewable energy sources, such as micro-hydropower and solar energy, to reduce dependency on traditional fuels.	Short term	Energy & Power Department
3. Develop programs to reduce waste and encourage recycling in urban and rural communities.	Priority	Local Govt Department EPA

7.5 Implementation Mechanisms

The successful implementation of this action plan requires coordination, adequate resources, and community participation. The following key steps will be taken to implement the plan with specific roles:

7.5.1 Governance and Institutional Coordination

Climate Change Adaptation Task Force (CCATF) will be formed at the district level, including local government officials, climate experts, NGOs, and community representatives.
The CCATF will establish collaboration with Forestry, Environment and Wildlife Department, Government of Khyber Pakhtunkhwa, Ministry of Climate Change and Environmental Coordination, Pakistan Meteorological Department (PMD) and relevant local institutions.

7.5.2 Resource Mobilization

Funding from provincial and federal government budgets, international donors, climate adaptation funds from provincial government and through Climate Finance Unit at Ministry of Climate Change and Environmental Coordination, and private sector investments will be pursued to access finance from Green Climate Fund for projects. Local financial mechanisms for community-level projects, such as revolving funds for water infrastructure and crop insurance schemes will be developed.

7.5.3 Monitoring, Evaluation, and Reporting (M&E)

Monitoring framework will be developed to track the progress of adaptation activities, using indicators such as the number of households with improved water access, reduction in crop failure rates, and the number of flood-resilient infrastructure projects completed. Annual reviews of the plan's progress and adapt strategies based on emerging climate data and community feedback will be conducted.

7.5.4 Community Participation

Community-driven development approaches will be implemented to ensure that interventions are context-specific and inclusive. Climate Adaptation Committees will be formed at the village level, empowering local communities to take ownership of adaptation projects.

7.5.5 Sustainability and Scaling Up

Adaptation measures will be institutionalized by integrating them into the broader district

development plans and local or district governance frameworks. Knowledge-sharing platforms to scale up successful adaptation practices to other regions of Chitral and similar areas in Pakistan will be promoted.

7.6 Conclusion

This Climate Change Adaptation Action Plan provides a strategic framework to enhance the resilience of both Upper and Lower districts of Chitral against the impacts of climate change. Through a combination of practical measures, community empowerment, and institutional coordination, this plan aims to protect vulnerable populations, safeguard natural resources, and promote sustainable development in Chitral. By implementing the actions outlined in this plan, Chitral can enhance its resilience to climate change, safeguard its natural resources, and ensure the long-term sustainability of local communities and ecosystems. Collaboration between local governments, NGOs, research institutions, and the private sector will be crucial for the successful implementation of this plan.

Prioritizing climate adaptation actions in Chitral should focus on both immediate and long-term resilience. Early warning systems, water management, GLOF mitigation, and infrastructure resilience are urgent priorities that can help mitigate the immediate impacts of climate change. Meanwhile, sustainable agriculture, reforestation, and capacity building will lay the foundation for long-term adaptation and community empowerment.

This Climate Change Adaptation Action Plan will become successful with a combination of top-down and bottom-up approaches, integrating local knowledge and involving communities in decision-making processes. The implementation of this plan requires collective action, sustained commitment, and continuous adaptation to evolving climate challenges and is flexible, inclusive, and responsive to evolving climate challenges.

Annex-1

SCOPE OF WORK AND TERMS OF REFERENCE

The scope and deliverables of the Consultant include but not limited to:

i. Collect secondary data from Govt. line departments for Chitral Districts (Lower & Upper) for each economic sector such as agriculture and livestock, forestry, biodiversity, water resources, land covers, pastures, rangelands, mountain areas, semi-arid areas, cold deserts, wetlands, floods, droughts, gender issues, poverty, wastes, glacial lakes etc for the last ten years at least and based on the same data devise adaptation plan in the wake of Climate Change more specific to the Chitral Districts (Upper & Lower) needs.

ii. Review climate-related strategies, plans, reports and actions inclusive of but not limited to: Pakistan National Climate Change Policy (2012); National Climate Change Act (2017), National DRR policy (2012); Khyber Pakhtunkhwa Climate Change Policy 2022, Khyber Pakhtunkhwa Climate Change Action Plan, National Adaptation Plan and other relevant documentation at National and Provincial level or even international level.

iii. Review existing national legal and regulatory frameworks to ensure the Climate Change Action Plan for Chitral districts (Upper & Lower) is in accordance with the existing laws, and is aligned with the Provincial Govt. development policy directions, SDG's and relevant sectoral policies and also to incorporate strategies in the Action Plan for the Glacial Lake Outburst flood (GLOF) for Chitral Districts.

iv. To update geo-data of the glacial lakes outbursts floods (GLOF) for Chitral Districts

v. Review recent national, Provincial, regional and international developments in Climate Change negotiations;

vi. Carry out consultations with the public and private sectors, non-governmental organizations (NGOs), and key stakeholders to identify Provincial priorities for addressing Climate Change in the proposed Climate Change Adaptation Action Plan for Chitral Districts (Lower & Upper).

vii. Ensure field results are incorporated in the Climate Change Adaptation Action Plan for Chitral districts.

viii. Hold focus group discussions with the Climate Change vulnerable communities in targeted valleys in Chitral Districts, roles and responsibilities during times of disasters and derive policy actions to accommodate the different needs and roles of women and men with the aim of building resilience and awareness of Climate

Change adaptation.

ix. Present the draft and Final versions of Adaptation Action Plan with reports /pictures from time to time in the workshops (at least 03) with the participants of at least 30 per workshop in Lower and Upper Chitral to take comments/suggestions from stakeholders including the Govt. Line Departments, Academia and field local experts. The workshops will be held in the presence of EPA staff (minimum 05 members whose transportation, boarding and lodging shall be the responsibility of consultant)

x. The work done would be the property of EPA Khyber Pakhtunkhwa and would not be reproduced without prior permission from the Competent Authority.

xi. An MoU be written between the DG EPA and the winner contractor on a stamp paper of Rs 500/-

xii. Submission of finalized Climate Change Adaptation Action Plan for Chitral Districts with English Proofing in hard and soft (100 copies)**.**

Annex-2

STATION - CHITRAL

RRR = MONTHLY TOTAL RAIN (MM)[-1=TRACE] [-100 Means data not available]

YEARS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	total rain
1964	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	1.5	0.0	3.0	19.0	16.0	70.9	110.4
1965	74.2	75.9	142.0	208.3	117.9	0.0	18.5	7.1	7.9	1.5	34.0	71.1	758.4
1966	1.3	56.1	281.4	102.4	1.0	0.0	36.6	0.0	18.5	6.6	0.0	1.8	505.7
1967	10.4	107.7	106.9	146.8	46.2	17.3	0.0	0.0	11.7	32.5	12.4	58.2	550.1
1968	23.9	46.5	125.7	204.2	58.4	0.0	0.0	7.6	0.5	22.9	35.1	111.3	636.1
1969	45.2	72.4	86.9	146.8	36.1	17.8	7.9	0.0	5.3	17.5	21.1	7.4	464.4
1970	33.5	12.4	84.1	58.9	21.3	6.6	4.6	1.8	15.0	23.4	0.5	25.4	287.5
1971	0.5	82.5	44.5	66.5	0.3	0.0	4.3	0.0	1.5	6.6	0.0	19.0	225.7
1972	75.7	123.2	137.4	82.3	176.8	8.9	7.6	17.5	67.8	13.2	17.3	51.3	779.0
1973	36.1	103.9	148.8	99.1	16.3	0.8	0.0	1.8	9.7	56.4	24.4	15.2	512.5
1974	57.9	80.2	7.4	75.3	52.2	0.5	6.5	0.3	20.2	4.7	0.0	29.1	334.3
1975	19.3	54.5	102.3	193.3	85.5	0.0	0.0	22.2	4.9	27.6	1.5	24.4	535.5
1976	33.7	94.9	67.0	76.1	8.0	0.0	0.0	0.6	2.9	5.5	11.4	10.4	310.5
1977	94.3	10.0	37.0	46.1	7.6	0.0	0.2	0.4	1.6	1.5	14.2	21.1	234.0
1978	35.6	9.3	138.2	37.7	37.6	2.1	20.6	0.0	0.3	7.1	23.7	4.6	316.8
1979	17.6	87.5	90.6	150.6	66.3	2.1	0.2	11.3	0.0	0.8	25.1	13.9	466.0
1980	39.7	75.3	92.6	14.2	49.4	0.7	0.0	2.3	6.1	12.2	28.5	39.9	360.9
1981	51.7	88.2	111.6	105.6	39.2	3.8	12.6	1.9	2.1	15.2	21.5	9.3	462.7
1982	14.9	62.6	41.4	8.4	44.2	0.3	1.3	11.6	2.2	0.3	83.1	60.7	331.0
1983	32.5	19.2	151.0	19.5	21.8	1.8	0.0	9.5	2.6	19.5	7.6	16.6	301.6
1984	17.9	65.5	122.8	65.0	80.0	0.0	0.3	4.3	0.5	26.7	48.5	22.1	453.6
1985	26.7	10.7	27.7	42.8	34.5	0.0	0.0	21.3	0.5	15.6	7.5	98.4	285.7
1986	12.2	60.1	151.2	106.0	18.3	4.1	9.8	17.2	16.0	2.8	63.6	62.6	523.9
1987	0.0	68.2	139.1	102.4	36.0	64.5	5.2	1.8	0.3	62.5	0.0	9.9	489.9
1988	83.9	38.0	225.0	56.9	38.1	2.1	4.6	28.7	0.0	10.8	0.0	79.1	567.2
1989	47.0	64.7	69.8	52.5	61.1	-1.0	24.7	0.3	6.3	2.4	27.9	63.5	420.2
1990	71.1	77.8	41.6	33.6	5.1	10.4	0.0	6.3	-1.0	19.8	2.0	119.3	387.0
1991	96.5	92.5	159.7	71.1	123.5	20.6	18.3	2.6	113.7	4.6	2.4	23.4	728.9
1992	131.1	80.0	126.8	127.9	82.6	4.3	2.1	10.9	16.3	46.8	13.0	74.9	716.7
1993	22.7	31.9	228.8	49.7	32.6	12.1	13.9	1.1	0.0	25.9	61.6	5.1	485.4
1994	76.1	35.5	65.8	138.7	57.9	-1.0	4.1	10.2	27.2	46.2	13.3	52.0	527.0
1995	0.0	52.8	106.3	101.7	67.9	42.7	-1.0	-1.0	18.4	53.5	17.1	13.2	473.6
1996	8.0	55.8	185.1	78.7	50.0	37.8	16.5	1.0	1.3	52.8	38.1	4.9	530.0
1997	20.3	11.6	187.6	138.8	42.3	14.0	1.2	1.3	4.8	5.6	3.1	15.5	446.1
1998	58.2	134.0	85.6	80.9	58.7	36.1	2.4	8.9	4.6	5.3	0.4	0.0	475.1
1999	32.2	109.6	115.9	109.3	17.6	2.0	3.8	2.0	31.3	3.4	67.1	0.0	494.2
2000	51.4	34.8	111.2	18.3	0.5	11.5	5.1	0.8	38.2	22.7	119.1	51.5	465.1
2001	20.2	33.9	73.3	15.1	1.0	-1.0	8.7	2.7	19.2	2.0	26.0	12.3	214.4
2002	13.9	52.6	120.5	118.4	13.3	3.3	-1.0	11.0	1.6	0.0	15.7	39.5	388.8
2003	7.3	103.2	103.0	91.9	42.0	9.5	0.0	1.0	25.2	16.9	43.2	9.2	452.4
2004	42.1	33.5	20.0	66.4	26.7	7.4	6.6	1.1	20.7	230.2	0.0	83.5	538.2
2005	51.6	124.9	84.0	86.6	100.0	9.9	0.0	2.7	0.0	35.5	34.2	2.0	531.4
2006	98.3	56.4	37.2	71.7	3.0	0.0	0.0	1.1	11.2	3.5	57.2	109.5	449.1
2007	11.1	30.8	262.1	94.4	47.7	11.6	1.9	4.7	0.0	0.2	0.0	28.8	493.3
2008	119.1	26.0	25.6	122.7	11.9	0.0	1.0	0.0	0.0	5.0	59.2	88.6	459.1
2009	119.2	148.8	97.4	110.3	36.4	26.8	6.0	0.0	3.0	10.6	74.7	39.6	672.8
2010	94.2	0.0	48.7	76.9	78.8	31.2	63.2	33.0	28.2	3.5	0.0	0.6	458.3
2011	16.5	201.3	60.6	69.0	20.1	15.0	0.0	2.0	6.2	20.3	7.0	0.0	418.0
2012	38.6	61.0	84.3	26.9	31.4	2.0	0.0	0.0	44.6	3.8	10.2	31.9	334.7
2013	21.0	116.6	99.8	74.9	25.9	7.4	1.0	30.2	1.0	9.0	27.0	8.1	421.9
2014	1.4	55.0	174.5	43.3	42.2	6.3	0.5	23.7	1.0	18.2	51.4	0.0	417.5
2015	35.8	132.6	89.2	31.8	48.7	0.0	24.8	41.2	3.1	31.8	64.4	17.8	521.2
2016	34.5	15.7	121.8	149.8	34.8	0.0	7.1	5.0	1.0	0.0	8.3	20.2	398.2
2017	104.7	161.7	43.2	12.9	10.0	0.3	0.0	2.0	4.4	Tr	2.6	18.7	358.2
2018	10.6	35.4	60.2	47.6	55.5	Tr	0.4	1.0	4.8	15.8	26.3	3.5	261.1
2019	59.1	99.2	47.2	99.4	24.2	8.7	0.3	4.9	0.0	24.8	81.1	3.3	438.6
2020	66.8	26.6	67.3	123.4	36.1	1.1	0.3	1.3	35.0	8.3	75.4	16.5	458.1
2021	8.2	7.9	147.3	40.2	9.5	0.0	1.4	1.0	0.0	13.5	2.8	4.0	235.8
2022	36.7	12.3	41.2	62.7	43.3	16.1	15.4	110.0	0.0	8.4	28.8	0.0	374.9
2023	79.4	77.1	9.4	55.7	22.5	7.5	20.9	2.2	1.5	5.4	7.2	2.6	291.4

Data Source: Pakistan Meteorological Department

Bibliography

- [1]Post Disaster Damages and Need Assessment (PDNA) Report, SIF Pakistan. (https://www.preventionweb.net/media/89652/download?startDownload=20241126)
- [2]Pakistan Bureau of Statistics (https://www.pbs.gov.pk/sites/default/files/population/2023/KP.pdf)
- [3]Baig, Shams & Mahmood, Qaisar & Bahadar, Nawab & Hussain, Altaf & Mohammad, Nafees. (2010). Assessment of Seasonal Variations in Surface Water Quality of Chitral River, North West Frontier Province (NWFP), Pakistan. World Applied Sciences Journal. 674-680.)
- [4]Hussain, Syed & Hussain, Shabir & Hanif, Muhammad. (2013). Climate Change Scenarios and Possible Adaptation Measures, Chitral and DIK districts of KPK, Pakistan. 10.13140/RG.2.1.3123.7849.
- [5]Hussain, Syed & Hussain, Shabir & Hanif, Muhammad. (2013). Climate Change Scenarios and Possible Adaptation Measures, Chitral and DIK districts of KPK, Pakistan. 10.13140/RG.2.1.3123.7849.
- [6]Post Disaster Damages and Need Assessment (PDNA) Report, SIF Pakistan. (https://www.preventionweb.net/media/89652/download?startDownload=20241126)
- [7]ACF-HEADS Rapid Needs Analysis Report 2024 (https://reliefweb.int/report/pakistan/floods-rapid-needs-analysis-report- 2024-chitral-pakistan)
- [8]Quantitative Summary of Damages in Chitral from the SIF Report (July 2023 Floods) (https://www.preventionweb.net/media/89652/download?startDownload=20241127)