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LASOONA
Relief and Development Organization

LOCAL ADAPTATION PLAN
of Action for Village Council

BADWAN BALA AND BADWAN PAEEN

District Lower Dir

Changing Minds for Climate Resilience through Awareness Raising and Local Capacity Measures

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This project “Changing Minds for Climate Resilience through Awareness Raising and Local Capacity Measures” is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

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Context

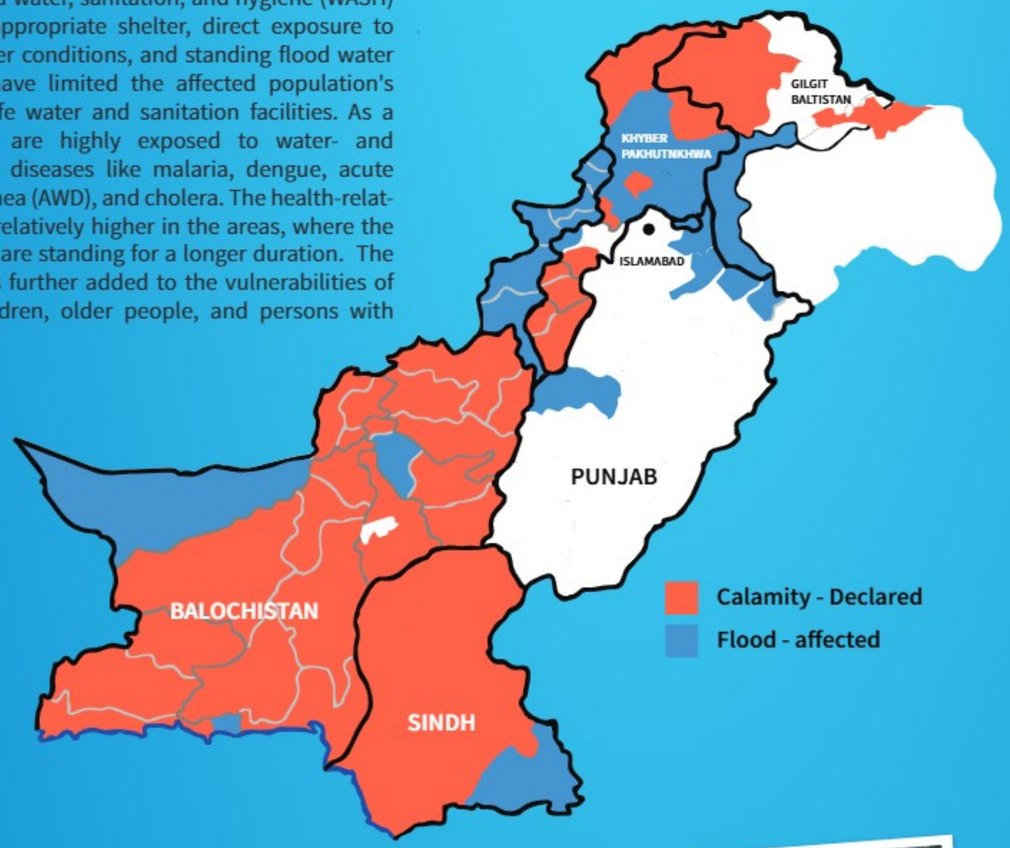
According to the Global Climate Risk Index (CRI) 2021 developed by German Watch, Pakistan is ranked as the 8th most impacted country by the effects of climate change from 2000 to 2019. The index evaluates the influence of extreme weather events on both human fatalities and their economic consequences. It is noteworthy that Pakistan contributes only 0.43% of the world's total greenhouse gas emissions and is ranked 135th globally in terms of emissions. This information highlights the disproportionate impact of climate change on Pakistan despite its relatively low contribution to global emissions.

CRI 2000-2019 (1999-2018)	Country	CRI Score	Fatalities	Fatalities per 1000 000 inhabitants	Losses in million US$ PPP	Losses per unit GDP in %	Number of events (2000 - 2019)
1	Puerto Rico	7.17	149.85	4.12	4149.98	3.66	24
2	Myanmar	10.00	7056.45	14.35	1512.11	0.80	57
3	Haiti	13.67	274.05	2.78	392.54	2.30	80
4	Philippines	18.17	859.35	0.93	3179.12	0.54	317
5	Mozambique	25.83	125.40	0.52	303.03	1.33	57
6	The Bahamas	27.67	5.35	1.56	426.88	3.81	13
7	Bangladesh	28.33	572.50	0.38	1860.04	0.41	185
8	Pakistan	29.00	502.45	0.30	3771.91	0.52	173
9	Thailand	29.83	137.75	0.21	7719.15	0.82	146
10	Nepal	31.33	217.15	0.82	233.06	0.39	191

Climate change has adverse impacts on Pakistan as it continues to disrupt the water balance and the hydrological cycle, induces delayed supply chains, and results in reduced and poor food quality, among other adverse consequences. The agricultural sector is expected to be amongst the most adversely affected by climate change in Pakistan. The country is expected to experience increased variability of river flows due to increasingly erratic precipitation and the foreseen acceleration in the melting of glaciers. Hotter temperatures are likely to increase energy demand due to increased air conditioning requirements, when, on the other hand, water availability for hydropower generation may decline. Power generation may additionally be affected by increasingly warmer air and water temperatures which decrease the efficiency of nuclear and thermal power plant generation.

The most recent climate induced disaster event was flood 2022. According to the Revised Flood 2022 Response Plan Pakistan, 84 districts nationwide were notified as ‘calamity hit’ by the Government of Pakistan, mainly in Balochistan (32 districts), Sindh (23 districts), and Khyber Pakhtunkhwa (17 districts) . More than 2 million houses had been affected, comprising over 767,000 houses destroyed and nearly 1.3 million houses damaged. The floods have taken the lives of more than 1,700 people, one-third of which were children. The total damages exceed USD 14.9 billion, and total economic losses reach about USD 15.2 billion . According to Pakistan 2022 Flood Response Plan, the floods caused total or partial damage to nearly 950,000 housing units across the country. Among provinces, the housing stock in Sindh has been the most affected, with 571,699 housing units completely or partially damaged, which represents 86 percent of the total affected housing stock across the country . Flood has impacted standing crops on 38,287 square km (9.4 million acres) . Preliminary official estimates show that 1.1 million animals died due to drowning or starvation as grazing land was covered by water and feedstocks were lost .

According to the Multi-Sectoral Rapid Needs Assessment (MSRNA), 48 percent of households reported having lost their stored cereal stocks, with higher shares in Sindh and Balochistan, followed by Punjab and KP. The year-on-year food price inflation stood at 30.2 percent in rural areas and 28.8 percent in urban areas. This has made the poor flood-affected population in particular and low-income groups of the country in general, more vulnerable to purchasing the required quantity of quality food for their families. The damaged water, sanitation, and hygiene (WASH) facilities, inappropriate shelter, direct exposure to harsh weather conditions, and standing flood water largescale, have limited the affected population's access to safe water and sanitation facilities. As a result, they are highly exposed to water- and vector-borne diseases like malaria, dengue, acute watery diarrhea (AWD), and cholera. The health-related risks are relatively higher in the areas, where the flood waters are standing for a longer duration. The situation has further added to the vulnerabilities of women, children, older people, and persons with disabilities.



Pakistan Initiatives

Pakistan has made significant efforts and progress in combating climate change. The country has ratified important global conventions and protocols such as the UNFCCC (United Nations Framework Convention on Climate Change), the Kyoto Protocol, and the Paris Agreement. These international agreements demonstrate Pakistan's commitment to addressing climate change on a global scale. In addition to these global commitments, Pakistan has also taken domestic measures to tackle climate change. The National Disaster Management Act was promulgated throughout the country in 2010. This act aims to enhance disaster preparedness and response, including addressing the impacts of climate change-related disasters.

These efforts reflect Pakistan's recognition of the challenges posed by climate change and its commitment to taking action at both the national and international levels. By ratifying global agreements and implementing domestic legislation, Pakistan is working towards a more sustainable and resilient future. In July 2023, country first ever National Adaptation Plan was launched, to enhance the nation’s resilience against adverse impacts of climate change and environmental degradation. NAP is a framework for implementing large-scale environmental adaptation, building climate resilience, promoting inclusivity, and facilitating collaboration among different stakeholders, and serves as an effective tool for climate finance mobilisation.

Pakistan developed its first National Climate Change Policy (NCCP) in 2012 and in view of Pakistan’s high vulnerability to the adverse impacts of climate change, in particular extreme events, the major focus of the policy was on climate resilient development and adaptation. However, after Paris Climate Accord-2015, Pakistan accepted to contribute to the global emissions reduct ion efforts. Pakistan has updated its policy and the focus of the NCCP-2021 is equally on adaptation and mitigation it the major emphasis on nature-based solutions. In addition, Nationally Determined Contributions (NDCs) were updated 2021 which is inclusive and represents national consensus to accelerating the transition towards a climate-resilient economy. The updated NCCP-2021 now equally emphasizes adaptation and mitigation, with a major emphasis on nature-based solutions. This update reflects Pakistan's recognition of the need to address climate change through a comprehensive approach that includes both adaptation and mitigation strategies. Pakistan has also updated its Nationally Determined Contributions (NDCs) in 2021. The updated NDCs represent a national consensus and aim to accelerate the transition towards a climate-resilient economy. These contributions demonstrate Pakistan's commitment to taking action on climate change and aligning its efforts with global goals.

Moreover, the Ministry of Climate Change (MoCC) prepared a Technological Needs Assessment for Adaptation (TNA-Adaptation) to tackle recurring damage from extreme weather events, Pakistan’s TNA prioritizes climate monitoring, forecasting and early warning system technologies. To update and strengthen the current technical capacity of this type of technology, the TNA has outlined a project that aims to install two hundred automatic weather stations and five wind profilers, and automate fifty existing observatories .

Khyber Pakhtunkhwa Government initiatives

Khyber Pakhtunkhwa's Response To Climate Change:
In line with the National Climate Change Policy (2021), Khyber Pakhtunkhwa was the first province to update its Provincial Climate Change Policy in 2022. This policy focuses on adaptation and mitigation strategies, highlighting the province's vulnerability to climate change impacts like locust invasions, dengue, and other viral diseases.

Climate Change Cell Establishment:
A dedicated Climate Change Cell was established in the Planning and Development Department, a pioneering initiative in the region, to integrate climate considerations into development, planning, and budgeting. This initiative was supported by the German Federal Ministry for Economic Cooperation and Development (BMZ) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Climate Change Financing Framework (CCFF):
Introduced in 2018, the CCFF is a key component of Khyber Pakhtunkhwa's climate change response. It integrates climate change into public economic and financial management, aiding policymakers in making informed resource allocation decisions and aligning systems and policies for accessing international climate finance. The Climate Change Expenditure Tracking System is part of this framework.

LASOONA and GIZ Partnership:
In collaboration with GIZ Pakistan, LASOONA is implementing a 27-month project titled “Changing Minds for Climate Resilience through Awareness Raising and Local Capacity Measures”. This project, focusing on selected villages in District Lower Dir and Dir of Khyber Pakhtunkhwa and District Rahim Yar Khan and Rajanpur of Punjab province, aims to increase the resilience of vulnerable communities, particularly women, people with disabilities, youth, and children. Detailed information on this project can be found here.
The creation of Local Adaptation Plans of Actions (LAPAs) was a crucial step in the project's efforts to cope the effects of climate change at the local level. These plans were developed through a rapid need assessment process conducted in 8 villages of the district and consultation with the relevant district officials . They involved evaluating the risks and vulnerabilities posed by climate change, identifying necessary adaptation measures, prioritizing actions, integrating the plans with existing development processes, and implementing, monitoring, and evaluating the plans. The ultimate goal of LAPAs was to strengthen community and ecosystem resilience, decrease vulnerability, and encourage sustainable development in the districts.

Purpose and Key Objectives

The creation of Local Adaptation Plans of Action (LAPA) for two village councils encompassing eight villages was a crucial step in the project's efforts to mitigate the effects of climate change at the local level. These plans, developed through a comprehensive and collaborative process, targeted the unique needs and vulnerabilities of these specific communities due to climate change. The process of developing LAPAs involved input from a wide range of stakeholders within the two targeted VCs that oversee eight villages. This included a detailed evaluation of the risks posed by climate change, identification of necessary adaptation measures, and prioritization of actions.
A key aspect of our methodology was the involvement of a multi-disciplinary team of experts in Climate Change/Disaster Risk Reduction, Agriculture, Water, Sanitation, and Hygiene. This team conducted an extensive climate change impact assessment across the eight village councils. Their approach included engaging directly with the communities through joint focused group discussions and key informant interviews with various community segments. Additionally, the team interacted with relevant district officials from the District Disaster Management Unit (DDMU), Department of Agriculture, Forest Department, Department of Health, and Public Health Engineering. These consultations, encompassing both primary and secondary data, were integral to ensuring that the LAPAs are well-informed and tailored to the specific needs of the communities.
The aim of these plans is not only to integrate them into existing development processes but also to ensure their effective implementation, monitoring, and evaluation. Ultimately, the LAPAs are designed to strengthen community and ecosystem resilience, reduce vulnerability, and foster sustainable development within these districts.

Vision:
Build a resilient Lower Dir district where communities actively adapt to climate change. Our focus is on balancing socioeconomic growth with environmental conservation, using community-driven, sustainable practices.

Goal:
Empower vulnerable communities in
to become resilient to environmental challenges. We'll achieve this through equitable resource management and gender-sensitive, inclusive strategies.

Objectives:

This Local Adaptation Action Aims To:

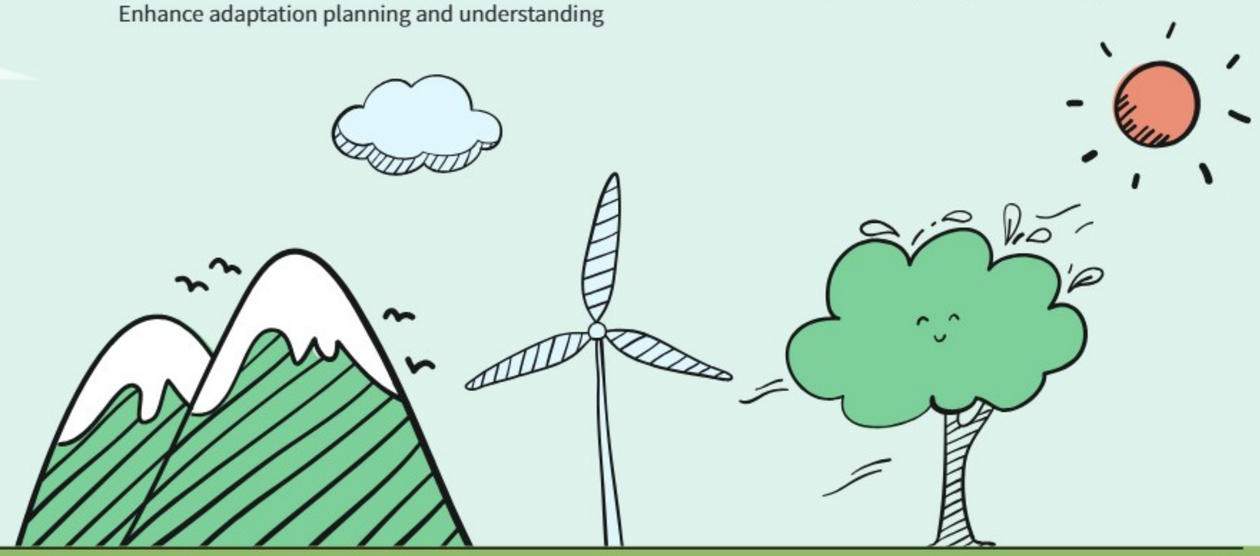
- Identify how climate change threatens local livelihoods, health, and ecosystems. Prioritize the most impacted sectors and communities.
- Develop practical measures such as improved infrastructure, land management, and disaster preparedness. Enhance community skills and awareness to tackle climate challenges.
- Ensure that our climate adaptation efforts align with existing local development plans. This will make our actions more effective and sustainable.
- Foster a network for exchanging regional and sectoral adaptation experiences. This encourages innovation and collective problem-solving.

This plan will support decision-makers in the most vulnerable communities of the district and their existing adaptation actions at local levels. They will prioritize adaptation actions and integrate indigenous adaptation actions to enhance climate resilience at the district/local level. This can also help in assessing the progress of other climate related projects to ensure effective service delivery and provide a thorough understanding of climate impacts on different social groups including gender and socially marginalized groups and to consider their needs ahead of climate-induced disasters.

Guiding Principles

The guiding principles of this plan are aligned with National Adaptation Plan (NAP), which are as under:

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



Rationale For Development of Plan

Climate change effects, including the escalating temperatures, shifts in precipitation patterns, and heightened occurrence of extreme weather events, exert profound consequences on local communities, ecosystems, and economies. The development of this plan is specifically aimed at addressing the impacts of climate change at the local level, while concurrently integrating adaptation activities into community and district-level development planning processes. The overarching objective of this plan is to foster climate-resilient development by bolstering the resilience of communities, institutions, and ecosystems.
The aim of developing LAPA for District Lower Dir is to integrate climate adaptation activities into local and national development planning processes and to create a situation for climate-resilient development. It aims to help the District Government in unifying the efforts of all partners working in various sectors across the districts, establish a clear direction, and provide a coordination platform for all the partners in bringing a paradigm shift in the district via response and recovery and adaptation and mitigation approaches. Responsiveness in LAPA will ensure immediate, efficient, and effective delivery of adaptation services to climate vulnerable communities and households; while flexibility in the implementation of LAPA will ensure immediate delivery of administrative, financial, and institutional services to implement adaptation actions effectively including but not limited to the following:

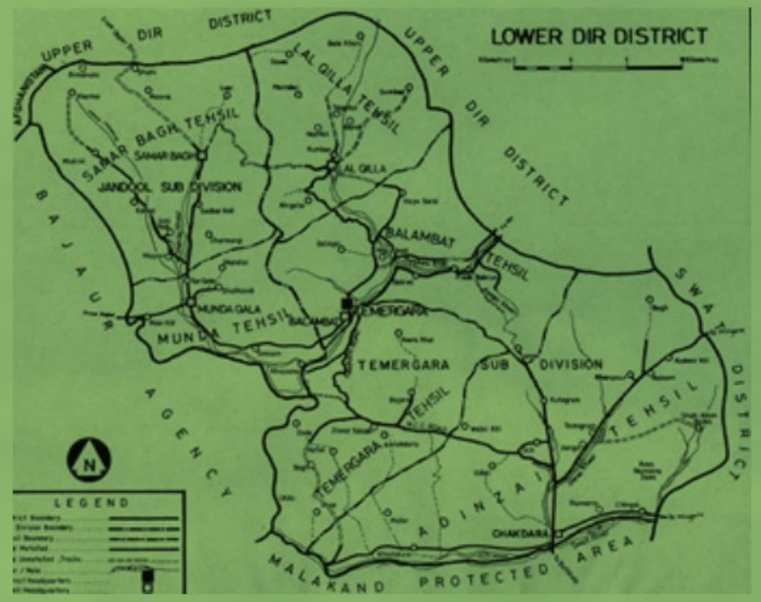
- Support activities from local to national level development planning.
- Identify the most climate-vulnerable communities and their adaptation challenges and opportunities, including possible activities.
- Identify and prioritise adaptation actions in easy ways whereby local communities make the prioritization decisions about their needs.
- Integrate LAPA into local plans.
- Identify and mobilize appropriate service delivery agents and necessary resources for the implementation of the LAPA.
- Adopt and/or implement adaptation actions sequentially by the service providers in a timely and resource-efficient manner.
- Conduct monitoring and evaluation by ensuring effective implementation of the plan of action.
- Identify cost-effective adaptation alternatives for scaling up into local and national planning.

The above-mentioned scope of the LAPA will complement the thematic areas of the National Climate Change Policy 2021 (updated), National DRR Policy 2012, and Public Sector Development Programme (PSDP). Moreover, the strategies /interventions will be aligned with the IRC Strategy 100 - Strategic Action Plan, Sendai Framework for Disaster Risk Reduction (2015-30), Sustainable Development Goals (2015-30), and the 2015 Paris Agreement on Climate Change.

To achieve this objective, the plan emphasizes the identification of vulnerabilities and risks associated with climate change. By thoroughly assessing these factors, the plan proposes a range of strategies and actions that will enhance the capacity to endure and rebound from climate-related shocks and stresses. These measures are designed to fortify resilience against the adverse effects of climate change and facilitate effective adaptation.
By seamlessly integrating adaptation activities into community and district-level development planning processes, the plan ensures that climate resilience becomes an intrinsic component of decision-making frameworks. This holistic approach prevents maladaptation and enables a comprehensive and coordinated approach to sustainable development.

Moreover, the plan serves as a catalyst for climate-resilient development by creating a conducive environment for the implementation of adaptation initiatives. It strives to align adaptation measures with broader development objectives, thereby maximizing co-benefits and optimizing resource allocation.
Additionally, the plan aims to engage and empower local communities, stakeholders, and relevant institutions in the adaptation process. This participatory approach fosters ownership, encourages collaboration, and harnesses local knowledge and expertise. By involving key actors, the plan ensures that adaptation initiatives are contextually relevant, culturally sensitive, and responsive to the specific needs and priorities of the local community. Furthermore, the plan recognizes the importance of learning and knowledge sharing. It seeks to document experiences, lessons learned, and best practices in climate change adaptation. This information exchange facilitates cross-learning between regions and communities facing similar challenges, thereby enhancing adaptive capacity, and promoting innovation in climate change resilience.

In summary, this plan is tailored to address the repercussions of climate change at the local level, by incorporating adaptation efforts into community and district-level development planning processes. Its primary objective is to promote climate-resilient development. Through the identification of vulnerabilities, the proposition of strategies and actions, and active stakeholder engagement, the plan seeks to strengthen the resilience of communities, institutions, and ecosystems. This resilience will empower them to withstand and recover from climate-induced challenges effectively, ensuring their long-term well-being and sustainability.



District Lower Dir
at a Glance

General Profile of The District

Dir was a small Princely State in Khyber Pakhtunkhwa Province. Bordering Chitral, this State was located in the valley of River Panjkora, which originates in the Hindu Kush Mountains and joins the Lower Dir River near Chakdara. It was located between 34° 22⊠ and 35° 50⊠ north latitudes and 71° 02⊠ and 72° 32⊠ east longitudes. It mainly comprised the terrain drained by Panjkora River and its effluents. The State was bordered by Lower Dir district in the east, Bajaur Agency of FATA on the west, Chitral district on the north and Malakand district (then Malakand Agency) on the south. Even after acceding to Pakistan in 1948, the State enjoyed relative independence and continued to be ruled by the Nawabs/Khans till 1969, when the State was incorporated into Pakistan. The area once occupied by the State (covering 5,282 km2 area) now forms two districts of Pakistan: Upper Dir and Lower Dir.

Dir derives its name from a Sanskrit word that means "place of worship, monastery, or convent where one can live in seclusion from others."

Lower Dir district is located in Dir Valley between 34° 37⊠ to 35° 07⊠ north latitudes and 71° 31⊠ to 72° 14⊠ east longitudes. The district is bounded on the north by Upper Dir district, on the east by Upper Dir and Lower Dir districts, on the south by Malakand Agency and on the west by Bajaur Agency and Afghanistan. .

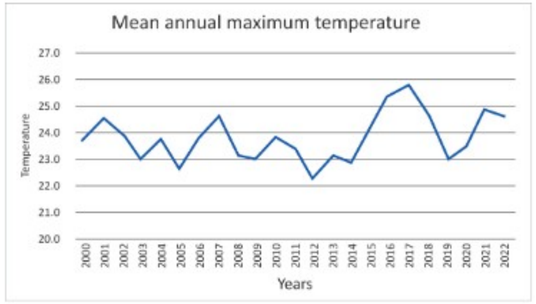
District Headquarter	**Timargara**	
Administrative Profile		
Tehsils	7	7 Tehsils: Adenzai, Samrbagh, Khaal, Munda, Lal Qilla, Samar Bagh and Timargara
Number of Village and Neighbourhood Councils[1]	198	Number of village councils=182 Number of Neighbourhood Councils= 16
Area	**1,583 km²**	
Tribes Ethnic Groups and Languages	Pushto is the main language of Dir, while Gugro, and Kohistani are the languages of Kohistanis and Gugars. A few people speak Hindko (a variant of Punjabi,Gujari and Khowar Chitrali). The majority of the population in this area belongs to Isazai and Ismailzai tribes.	
Demography		
Population	1435917	
Population Density	816.8 persons per sq. km	
Growth Rate	2.59%	
Rural Population	97%[2]	
Male Population	49%	
Female Population	51%	
Sex Ratio (males per 100 females)	102.70	
Average Household Size	9.17	
Livelihood Sources		
Total Cropped Area	71,531 Hectares	
Total Irrigated Area	21,714 Hectares	
Major Crops	Maize, Wheat, Fruits, Vegetables, Rice	
Total Livestock Population	1,659,203	
Major Minerals	The mineral resources include mainly marble, limestone, quartz and granite.	
Total area under Forest	25,263 acres.	
Fish Production	96.53 M tons	
Livestock	2%	
Education		
Literacy rate	58%	
Literacy rate (male)	79%	
Literacy rate (female)	36%	

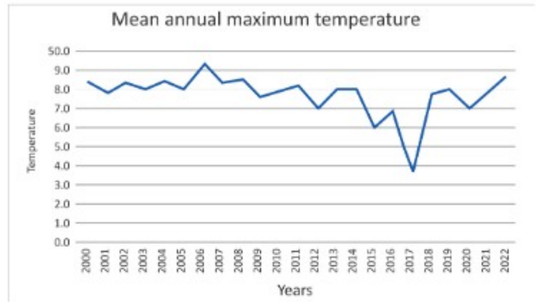
Climate Profile of District Lower Dir

The climate of District Lower Dir can be described as mild temperate with hot summers.
During the months of May to July, the region experiences warm temperatures, with the northern parts generally being cooler due to higher humidity levels. From December to March, the temperature drops significantly, resulting in colder weather throughout the district. It is during this period that rare snowfall can occur in District Lower Dir.
The climate of Lower Dir is influenced by its varying altitudes, particularly in the Kohistan region where the mountains remain snow-covered throughout the year. The higher areas of the region tend to be colder, and they frequently experience snowfall during the winter season.

Temperature

District Lower Dir exhibits a distinct climatic pattern, characterized by a mean maximum temperature of 23.9°C and a mean minimum temperature of 7.7°C over the past 22 years. June is the warmest month, with an average temperature of 32.9°C, while January is the coldest, with an average temperature of -1.9°C. Temperature variation is strongly influenced by altitude, with lower plains experiencing higher temperatures compared to high-altitude mountainous regions.
During the Focus Group Discussions (FGDs) and Key Informant Interviews conducted in the assessment phase, participants consistently reported a significant rise in temperature in the area. This observation was further supported by scientific secondary data received from Pakistan Martyrology Department, Khyber Pakhtunkhwa.
The graph 2.1 shows the mean annual maximum temperature and mean annual minimum temperature in District Lower Dir, Pakistan, over the past 22 years. It shows that the mean annual maximum temperature has been increasing over time, while the mean annual minimum temperature has remained relatively stable.



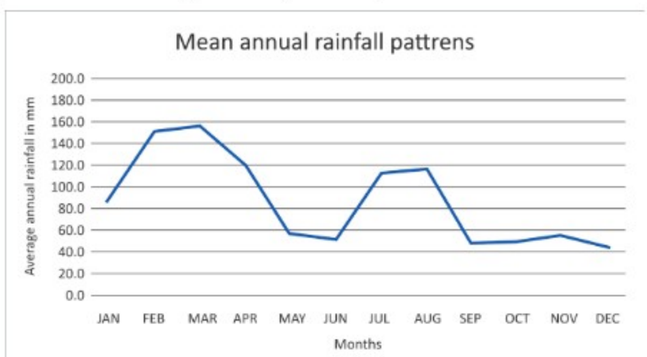


There are a few possible explanations for the increasing trend in mean annual maximum temperature. One possibility is climate change. Climate change is causing global temperatures to rise, and this is likely having an impact on District Lower Dir. Another possibility is deforestation. Deforestation has reduced the amount of tree cover, which can lead to higher temperatures.

Overall, the graph suggests that District Lower Dir is experiencing a warming trend. This trend is likely to continue in the future, with potential implications for human health, agriculture, and other sectors.

Rainfall

The following graph shows the average monthly rainfall patterns for district Lower Dir based on 22 years data.



An analysis of 22 years of rainfall data (2000-2022) from District Lower Dir revealed a significant shift in precipitation patterns. The linear trend line for mean annual precipitation indicated an upward trend of 0.85 mm per year (y = 0.85x + 68.09, R2 = 0.52). While this increase in precipitation initially provided some relief to water-stressed areas, it also brought about associated challenges. The heightened rainfall intensity led to an increased risk of flash floods and exacerbated soil erosion in the region.

An analysis of rainfall data from District Lower Dir spanning 22 years (2000-2022) revealed a noticeable shift in precipitation patterns across different seasons.

Winter Rainfall

The linear trendline for winter rainfall indicates a slight decline of 0.63 millimeters per year (y = -0.63x + 78.31). This suggests that the average winter rainfall has been gradually decreasing over the past two decades.

Pre-Monsoon Rainfall

In contrast, pre-monsoon rainfall exhibits an increasing trend of 0.48 millimeters per year (y = 0.48x + 68.68). This implies that the average pre-monsoon rainfall has been steadily rising over the same period.

Monsoon Rainfall

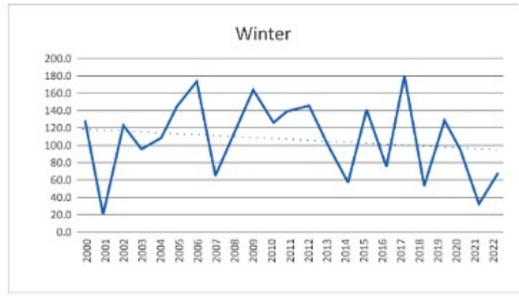
The analysis also shows a positive trend in monsoon rainfall, with an increase of 0.45 millimeters per year (y = 0.45x + 70.84). This suggests that the average monsoon rainfall has been gradually increasing over the past 22 years.

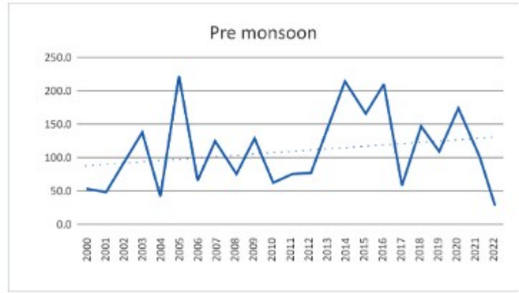
Post-Monsoon Rainfall

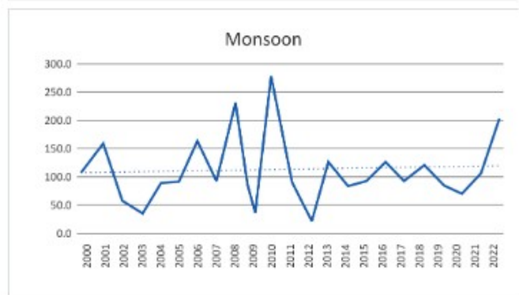
However, post-monsoon rainfall presents a contrasting pattern, with a decline of 0.68 millimeters per year (y = -0.63x + 78.31). This implies that the average post-monsoon rainfall has been gradually decreasing over the same period.

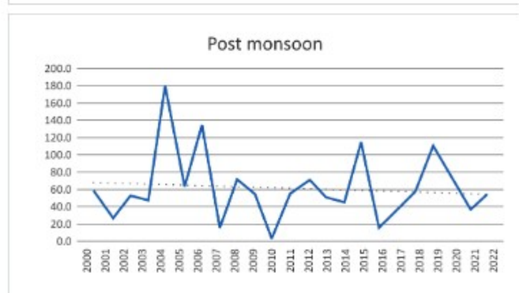
The impacts of climate change on rainfall patterns are likely to vary across different regions within District L ower Dir. The changing rainfall patterns could also impact the frequency and intensity of extreme weather events, such as droughts and floods in future.

The 22-years rainfall data shows that maximum precipitation event was recorded as 137.6 mm in 2015 (wettest year or with more rainfall) while the minimum precipitation was recorded as 75.9 mm (drought prone or driest year) in 2001. The highest monsoon precipitation (248.2) occurred in 2010 which resulted in massive flooding event.









Governance & Administration

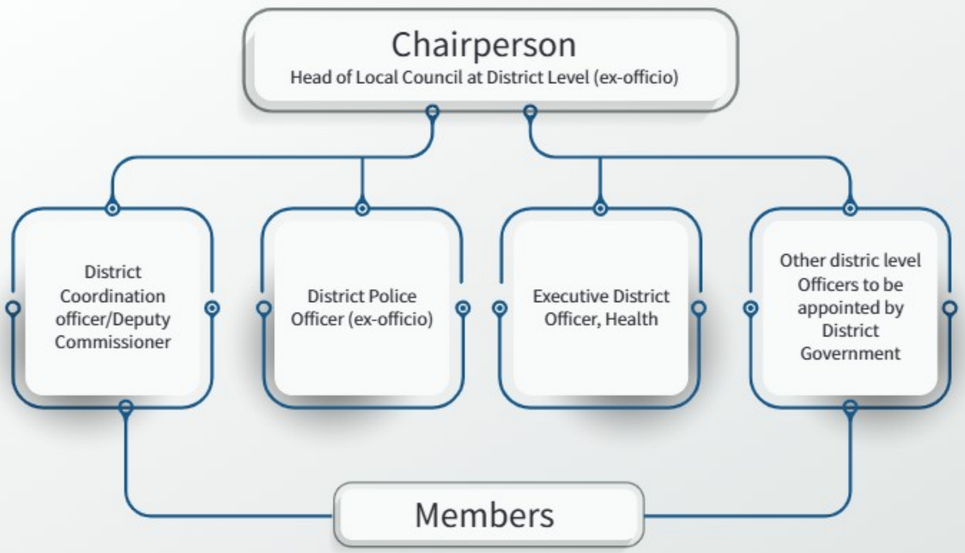
Like other Districts the Deputy Commissioner supervises the activities of all the departments at district level. Where-as at sub-divisional level, the Assistant Commissioner,& Addl: Assistant Commissioner are responsible for the smooth running of the activities of all government departments in the sub-divisional level. The major concern is the maintenance of law and order and development in the district as District Magistrate/ Administrator. Deputy Commissioner is the District Collector and incharge of district record room and treasury.

District Disaster Management Authority

Constitution & Structure of DDMA

Section 18, Chapter IV of NDM Act 2010, envisaged constitution of DDMA (KP Province named them as DDMUs) for every district by the province. AS per the Act, the district authority shall consist of such number of members, as may be prescribed by the Provincial Government. The Act has proposed the following organizational structure for all district level DMAs.

The Chairperson of the district authority have power to exercise all or any of the powers of the authority in case of emergency. However, the exercise of such powers shall be subject to ex-post facto approval of the District Authority.



LAPA Development Methodology

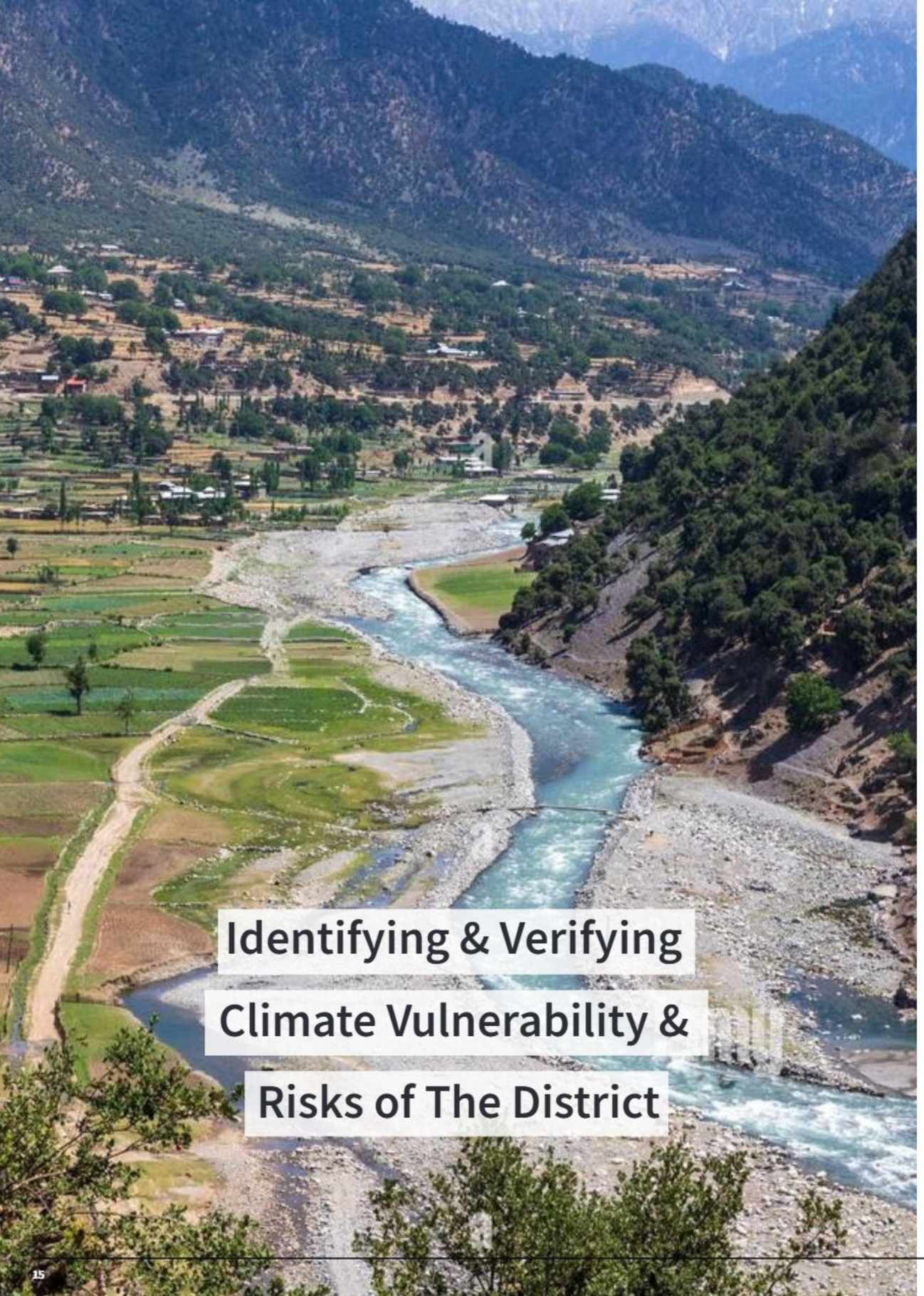
A multi-disciplinary team expert comprised of Climate change/ Disaster Risk Reduction, Agriculture and water, sanitation and Hygiene conducted climate change impact assessment in four villages of Village councils Badwan Bala and Badwan Payee of the district. The team met with the communities and conducted joint focused group discussions and key informant interviews with different segments of the community groups. In addition, the team also conducted key informant interviews with the relevant district officials from District Disaster Management Unit (DDMU), Department of Agriculture, forest Department, Department of Health and Public Health Engineering department.

The team also reviewed the secondary data for development of this adaptation plan which includes:

- National Climate Change Policy (NCCAP) 2021
- National Adaptation Plan (NAP) 2023
- Climate change Policy of Khyber Pakhtunkhwa 2022
- Local Adaptation Plan of Action, District Chaman

The Plan Development Process

Identification of Challenges



Identifying & Verifying Climate Vulnerability & Risks of The District

Climate Risk Profile of the District

Pakistan is highly susceptible to climate-induced hazards, including floods, droughts, storms, heatwaves, and extreme weather events. Flooding, in particular, poses a significant threat to the country. Over the years, Pakistan has experienced multiple devastating flood events, resulting in the loss of thousands of lives and substantial damage to infrastructure. The situation has worsened in recent decades, with an increase in the frequency and severity of floods. The massive floods of 2010, and 2022 had a profound impact on the economy, and the country is still recovering from their effects.

Geographically, Lower Dir District is situated in the valley of the Panjkora River, which originates in the Hindu Kush Mountains and joins the Lower Dir River near Chakdara. The district mainly comprises the terrain drained by the Panjkora River and its tributaries. One of the significant impacts of climate change in the Hindukush Himalaya region is the retreat of glaciers. As temperatures rise, glaciers are melting at an accelerated rate, leading to a reduction in their size and volume. This has implications for water availability downstream, as glaciers serve as natural water reservoirs.

Panjkora River:

The Panjkora river is the main river in the Panjkora River Basin which is a part of the larger Lower Dir River Basin located in the Khyber Pakhtunkhwa province in the northwest of Pakistan. The main tributaries of the Panjkora river are Rivers Dir, Barawal, Kohistan, and Usherai. The flow of water occurs year-round, during the monsoon season (June-September) the water levels drastically rise. Large amounts of water can be found during this time in the Panjkora river with greater amounts at the mouths of the tributaries. This water flow is very powerful causing floods throughout the region.

The Panjkora basin is a temperamental region that is very dependent on the season. The climate in this region of Pakistan is characterised by large downpours during the monsoon season (June- September) and relatively dry winters.[5] The monsoon seasons have caused many significant and devastating floods in the region. Most notably a flood in 2010 swept through the river resulting in loss of life and large amounts of destruction to ecosystems and infrastructure.[6] These high levels of seasonal rainfall are magnified by the topography of the land surrounding the river. Steep slopes on either side of the river allow for water to runoff into the river quickly and in large volumes. While rainfall in these higher altitudes is generally less, the combination of the huge basins tributaries makes for large volumes of water towards the mouth of the river Panjkora. With river systems floods are generally much more likely to occur in the low-lying areas towards the base of the mountains.[5] Panjkora basin has 15% of its area classified as highly prone to flooding.[5] These areas that are flood prone are also inhabited making for a deadly mix of people gambling their lives for the rich alluvial farmland. This then continues to run down the river destroying agricultural land, taking lives and causing infrastructure damage .

Furthermore, climate change has brought about changes in hydrological processes. The patterns of rainfall and snowfall have become more erratic, resulting in altered water flow patterns and increased variability in river discharge. These changes pose challenges for water resource management and have impact agriculture, hydropower generation, and overall water availability. The region has also witnessed a rise in the frequency and intensity of extreme floods. Climate change has contributed to more intense rainfall events, which can overwhelm rivers and drainage systems, leading to devastating floods. These floods not only cause immediate damage to infrastructure and livelihoods but also have long-term consequences for the affected communities.

Area of Climate Variability	Change		
	Increased	Decreased	No change
Rainfall		x	
Snowfall		X	
Temperature	X		
Floods	X		
Droughts	X		
Summar Duration	X		
Winter Duration		X	
Early Springs		X	
Water in springs		X	

Climate Induced Vulnerabilities

Climate Induced Disasters

a **Floods.** Rainfall in the district generally occurs during two different seasons: winters rainfall continues during December to March while summers rainfall which falls during June to September. Normally monsoon arrives in first or second week of June but major floods occur in late summer i.e. July to September. During recent years, it has been commonly observed that the distribution of rainfall is disturbed due to climatic changes and the district receives heavy rainfall in the form of erratic and cloud burst normally occurs especially during the monsoon season. These types of rainfall generate flash floods and witnesses of loss of life and property in the district.

During July 2010 the district was badly affected by the devastating floods that caused enormous losses to human life, collapse of social infrastructure, tourism and agriculture. Standing crops were washed away, while new crops couldn't be grown up due to sediment deposits in the field, tourism industry badly affected as most of the hotels and restaurants washed away, while all the trade activities came to a standstill. Thus the local economy badly shattered while food insecurity in the region was threatened seriously. The unprecedented rainfall led to create secondary disaster such as landslides, mudslides, riverine floods and flash flood in the upper reaches of river Panjkora and its tributaries. The flood water causes heavy damages to properties and infrastructure.

b **Hailstorm.** Lower Dir produces large number of fruits and vegetables because of the favourable climatic conditions. It produces both seasonal and off-season fruits and vegetables. July is the peak season for various fruits and vegetables in the district . Hailstorm also follow similar time pattern and badly affect quantity and quality of fruits and vegetable in almost all parts of the district though consider medium in terms of physical and ivelihood loss.

c **Snowfall.** River Panjkora has a large catchment area in the mountains with snowy heights reaching up to above 5,000 meters. These mountains receive heavy snowfall in winter.

Water and Sanitation

The study conducted in Lower Dir, found that the communities in the district face significant challenges in terms of WASH services due to the impacts of climate change. The interviews with local communities and the district health official provided valuable insights into the specific issues faced by these communities.

One of the key challenges highlighted by both the community focus group discussions (FGDs) and the interview with the district health official is the availability and quality of drinking water. The major source of drinking water in the community is natural spring water. However, there is a lack of testing to determine its safety for consumption. During the dry season, the springs in the region become dry, and during the rainy season, the water can turn murky, posing a risk of contamination and affecting the community's access to clean drinking water.

Excessive rainfall and flooding during the monsoon season also have a significant impact on the availability and accessibility of water resources. The natural springs and wells, which are the primary sources of drinking water, get contaminated due to the overflow of rainwater from sewerage lines and floods. This further exacerbates the situation, as waste gets mixed with drinking water, increasing the risk of waterborne diseases such as cholera.

Sanitation facilities also face challenges due to climate change. In rural areas, there is a lack of proper infrastructure for toilets and sewerage systems, leading to open defecation as a common practice. This lack of sanitation facilities increases the risk of water contamination and the spread of diseases. In urban areas, although individuals have access to toilets connected to sewerage systems, the absence of proper waste disposal during extreme weather events, such as floods, can lead to the mixing of waste with drinking water, further compromising sanitation.

These WASH challenges reported in the study are directly linked to the spread of diseases. Contaminated drinking water sources can lead to waterborne diseases such as cholera, diarrhea, and gastroenteritis. The lack of proper sanitation facilities and open defecation practices contribute to the spread of diseases like typhoid, intestinal worms, and skin infections.

Health

The findings from the study conducted in Lower Dir District provide detailed insights into the impact of climate change on the health of local communities. The changing weather patterns, infrastructure damage, and various diseases reported by the communities and health officials are all interconnected.

The communities in Lower Dir District reported a decline in winter rainfall and increasingly erratic and unseasonal rainfall, which are indicators of climate change. These changes in precipitation patterns have led to several health challenges. One of the major concerns raised by the communities is the increase in waterborne diseases. Contaminated water sources, including natural springs and wells, become polluted due to the overflow of rainwater from sewerage lines and floods. This contamination leads to outbreaks of diseases such as typhoid, cholera, dysentery, and gastroenteritis.

The rise in temperature and extreme weather events associated with climate change have also contributed to the spread of vector-borne diseases. The communities reported an increase in diseases like malaria and dengue fever, particularly during the monsoon season. Mosquitoes, which are carriers of these diseases, thrive in stagnant water. Excessive rainfall and flooding create breeding grounds for mosquitoes, leading to outbreaks of malaria and dengue fever.

Furthermore, the impact of climate change on infrastructure has indirect health implications. Flash floods during the rainy seasons have caused damage to houses, roads, and health facilities. This destruction disrupts access to healthcare services and increases the risk of injuries and accidents. Additionally, riverbank erosion resulting from climate change has led to the loss of fertile land, affecting agricultural productivity and food security. Malnutrition and related health issues can arise as a consequence.

Certain vulnerable groups, such as children and the elderly, are particularly susceptible to the health impacts of climate change. Children, whose immune systems are still developing, are more prone to diseases like typhoid, malaria, and respiratory infections. The elderly, who may have pre-existing health conditions, are at higher risk of heat-related illnesses and complications from infectious diseases.

In summary, climate change in Lower Dir District has led to a range of health challenges. Waterborne diseases like typhoid, cholera, dysentery, and gastroenteritis have increased due to contaminated water sources. Vector-borne diseases such as malaria and dengue fever have become more prevalent during the monsoon season. Infrastructure damage and the loss of fertile land also have indirect health implications. Vulnerable groups, including children and the elderly, are particularly affected by these health impacts.

Agriculture

Lower Dir encompasses around 41,005 hectares (which is 2% of the total cultivated land of the province) and 55% of its land is irrigated mainly from canal water and tube wells and 45% unirrigated. The area has suitable season for growing vegetables especially for tomato and okra and farmers earn income by selling fresh produce in local and national markets.

The assessment study was focused on two Village Councils; Badwan Bala and Badwan Payee in Tehsil Adenzai District Lower Dir and following is the details of current agriculture status in these two Village Councils.

Sources of Irrigation & Techniques

- Main source of irrigation in Village Councils Badwan Bala and Badwan Payee is Lower Dir River from where, water is diverted through Badwan Irrigation Canal for irrigation. The fields are irrigated through water courses which are lined, unlined and some are damaged.
- Tube wells is another main source of irrigation which are run through diesel, electricity and solar. The Tube wells running through diesel generators are common and very expensive due to high price of fuel. Tube wells owners
  are sharing water with other farmers on rent.
- Spring and streams are third source of irrigation. The people living in upland part of the areas are using this source by connecting pipe and grow vegetables and pulses etc
- Badwan Irrigation Canal is closed each year in winter (Nov to March) and farmers have alternative option of private irrigation channels from Lower Dir River.
- Flood irrigation is common in both districts. There is no water storage facility
- Water table in tube wells are going down

Crops

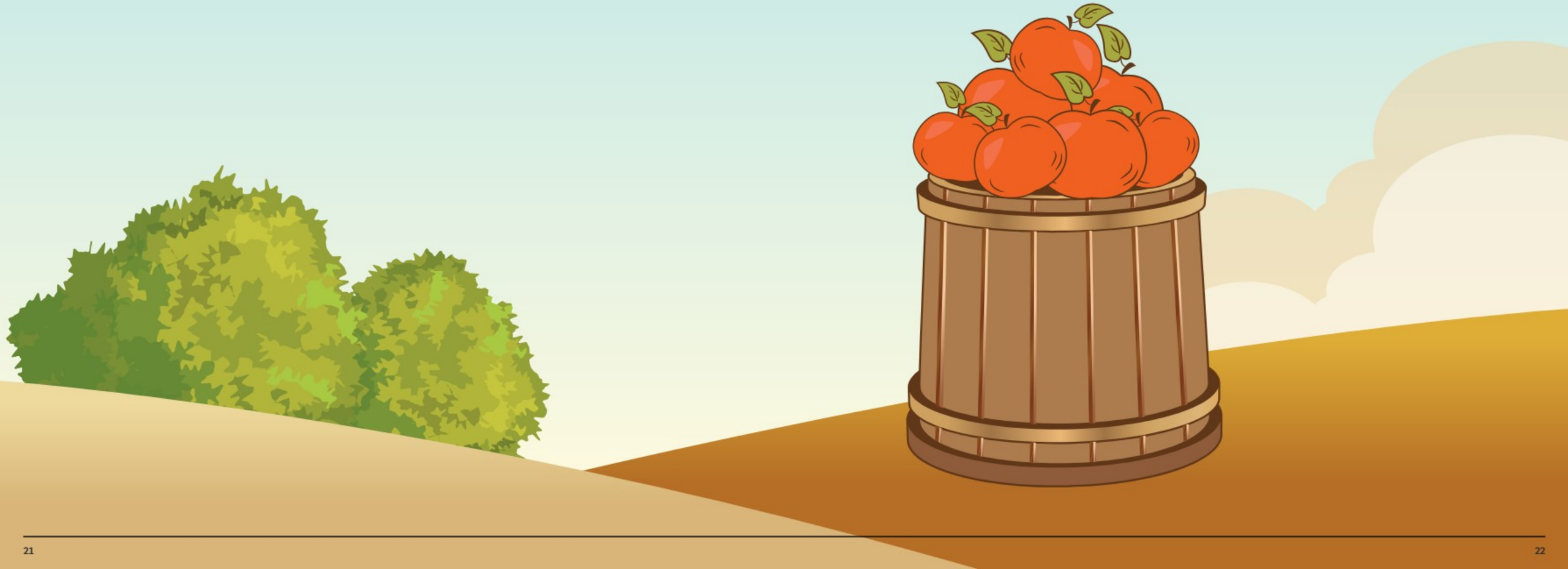
- Wheat, Rice and Maize are main crops cultivated in the area. Rice is grown on irrigated land while wheat and maize on rainfed land. Broadcast method is used for seed sowing of wheat and maize.
- Crop season for Rice (Jun to Nov), Maize (Jul to Oct) and Wheat (Nov to May/Jun)
- Cropping pattern (irrigated land): Rice – Wheat/fodder/Onion – Rice
- Cropping pattern (rainfed land): Wheat – Maize/ Vegetables - Wheat
- Maize and vegetables are intercropped with orchards of peach etc
- Wheat produced fulfil demand of household for 3 to 4 months and for the rest of period in the year, flour is purchased from market
- Growers who are growing maize and rice are self-sufficient and don't purchase from market for their consumption.

Vegetables

- Summer vegetables like tomato and okra etc are cultivated on a larger scale than winter vegetables. This is because more land is covered under wheat during the rabi season (winter season), and winter vegetables are grown on less land due to the harsh cold season and the availability of less land. Badwan Irrigation Canal is closed during winter. Summer vegetables are produced on large scale as the area is more suitable for summer vegetables.
- Main winter vegetables grown are; onion, turnip, tomato and peas
- Summer season, commercial vegetables grown are; tomato and okra.
- Tomato is the cash crop and grown in two seasons; a) Sowing in Jun and picking in Sep to Nov, b) Sowing in Feb and picking in May to Aug. The tomatoes are of high quality and production, and known for their deep red color and firm texture.
- Spring potato and peas are grown on very limited scale
- Onion is grown on irrigated land while potato and tomato on irrigated and unirrigated land dependent on rain while other vegetables are irrigated from tube wells.
- Main market for Badwan growers is Timergara market which is one hr. away.
- Vegetables are grown independent and intercropped with orchards in both districts
- Vegetables cannot thrive in irrigated rice fields because the excess water can drown the plants and cause root rot. Fruit trees and vegetables need well-drained soil to survive.

Orchards

- In VCs Badwan Bala and Badwan Payee, main fruits are; Peach, Plum, Walnut and Persimmon. Peach is the leading fruit covering more areas
- Orchards are established on rainfed land and irrigated through diesel generator tube wells or dependent on rain
- 80% farmers sell their fruit through contractors at flowering stage
- All farmers practice regular pruning of trees
- Agroforestry is common and Poplar trees are planted around the field for commercial purpose
- Fruit and forest plants are available in local nurseries at Jalawanan.
- Fruit orchards cannot thrive in irrigated fields because the excess water can drown the plants and cause root rot. Fruit trees need well-drained soil to survive.



Inputs (Fruit Plants Nursery, Seed, Fertilizer and Pesticides)

- 50% farmers recycle wheat seed for the next season. Uncertified wheat seed without seed treatment is used
- Maize and Rice seed is almost 100% purchased from market. Rice China variety is commonly used
- 100% farmers buy vegetable seed from market. About 50% farmers recycle onion seed for the next season. Those farmers who miss the onion sowing season, buy seedlings from neighbor farmers
- Weedicides is used in wheat crop for weeds (unwanted plants) control
- Excessive use of pesticides against viral and fungal diseases in vegetables
- Farmers buy fruit plants from local nurseries.
- Expertise in pruning and spray is available locally
- Farm Yard Manure on alternate year and synthetic fertilizer per crop is used
- No mechanization except tractor with thresher is used for cereal crops

Women Role in Agriculture in Lower Dir

Traditions, culture and customs are same in both districts. Women keeping in view their culture are supporting their men family members in farming like seed threshing, storing seeds, picking vegetables and cooking food for labors engaged in the field. Most of the women are growing vegetables near their house for kitchen purpose. They enjoy to cultivate, maintain their gardens and collect fresh vegetables. As part of culture, women share vegetables with other neighbor women. Male buy seed and fertilizer from market and women sow according to the season. During study women asked for quality seed and new improved cultivation practices. Poor quality of vegetable seed, incidence of diseases and low yield of vegetables and scarcity of water are common challenges. Their interaction with technical service providers is prohibited due to local traditions and don't know about climate smart agriculture technologies.

Sectors	Available sector policy	Climate change related projects in district	Implementation gaps
Environment /climate change	National climate change policy 2021 national adaptation plan 2023 Khyber Pakhtunkhwa climate chan ge policy 2022 Khyber Pakhtunkhwa climate change action plan 2022		Limited capacity of district stakeholders in climate change adaptation strategies and disaster risk reduction
Health	Khyber Pakhtunkhwa health policy (2018-2025) The Khyber Pakhtunkhwa RP idemic control and emergency relief act, 2020 The Khyber Pakhtunkhwa health foundation act, 2016	Khyber Pakhtunkhwa rural investment and institutional support project- World bank conservation and sustainable management of biodiversity in Khyber Pakhtunkhwa (BKP) - GIZ	Fast demographic growth[1] poor access to and utilization of health services[2] underfunded public health system[3] lack of comprehensive legi slation[4] transportation support[5]
Water and sanitation	The Khyber Pakhtunkhwa water act, 2020	Khyber Pakhtunkhwa rural investment and institutional support project - world bank conservation and sustainable management of biodiversity in Khyber Pakhtunkhwa (BKP) - GIZ	Lack of access to WASH services[6] quality and safety of WASH infrastructure[7] operation & maintenance[8]
Agriculture and irrigation	Khyber Pakhtunkhwa agriculture policy 2015-25	Climate resilience through horticulture interventions in Khyber Pakhtunkhwa	Limited capacity of staff of agriculture department in climate resilience

Prioritization of Adaptation Options

Solutions and its Prioritization

Action Planning is a vital component of Local Adaptation Plans of Action (LAPA) as it involves developing strategies for implementing interventions. It includes the identification and prioritization of adaptation options, taking into account climate threats. This prioritization process aids decision-makers in selecting actions that are both cost-effective and sustainable, with a focus on meeting the needs of vulnerable communities. Following consultations with the government, civil society, and communities, the following adaptation measures have been prioritized based on technical considerations. These measures have been categorized as immediate, medium-term, and long-term solutions, with the specific timeline for implementation determined by the researcher's assessment.

Climate Change and Disaster Risk Reduction

Action Planning is a vital component of Local Adaptation Plans of Action (LAPA) as it involves developing strategies for implementing interventions. It includes the identification and prioritization of adaptation options, taking into account climate threats. This prioritization process aids decision-makers in selecting actions that are both cost-effective and sustainable, with a focus on meeting the needs of vulnerable communities. Following consultations with the government, civil society, and communities, the following adaptation measures have been prioritized based on technical considerations. These measures have been categorized as immediate, medium-term, and long-term solutions, with the specific timeline for implementation determined by the researcher's assessment.

Climate Risk Assessment (CRA)

The detailed climate risk assessment of the district is recommended to be conducted for the district to identify climate induced vulnerabilities on different sectors, segments of society for development of more targeted strategies to mitigate and adapt to climate change. Community participation in CRA process. In addition, the climate risk assessment will provide scientific evidence and data that will inform decision-making processes. It will also help local authorities, policymakers, and stakeholders in Lower Dir to understand the potential risks associated with climate change and make informed decisions about land use planning, infrastructure development, disaster management, and resource allocation.

Community Sensitization and Awareness

Conduct multi strategic awareness to sensitize community about climate change risks and its adverse impacts of climate change and to improve climate change adaptation actions of the community. These actions may include information dissemination through awareness sessions, information education and communication material, behaviour change communication messages etc. appropriate communication channels should be used for awareness sessions.

Information Dissemination: Share accurate and up-to-date information about climate change risks and adaptation strategies through various channels such as websites, social media, brochures, and local media outlets. Ensure that the information is accessible and easily understandable for the community.

Capacity Building

Local Action Plans: Develop and implement local action plans that address specific climate change risks and adaptation needs of the community. These plans should involve community input and focus on practical actions that can be taken at the local level. It is recommended to conduct capacity development sessions for community and government officials.

Community Engagement

Engage with the community through various platforms such as town hall meetings, community forums, and online platforms to discuss climate change risks and adaptation strategies. Encourage community participation and involvement in decision-making processes. Use existing community structures like CBOs, village organization, village disaster management committees structures for development and implementation of community level adaptation plans.

Development of Community Adaptation Plans

The community should be mobilized to develop their community-based adaptation plan of actions (CBAPAs) in collaboration of district officials. A comprehensive advocacy plan should also be develop to incorporate community level prioritized action in village councils, tehsil and district annual development plans.

Improved Stakeholders' Coordination

Work closely with government agencies responsible for climate change policies and initiatives. Advocate for policies that support climate change adaptation and encourage the integration of community perspectives in decision-making processes.

Agriculture and irrigation

Solarization of Tube Wells

In Lower Dir farmers are using diesel or petrol generators to power their tube wells. The generator is connected to a water pump, which draws water from a well or borehole. The water is then distributed to the crops through a network of canals or pipes. This system has a number of drawbacks. First, the cost of fuel can be high, especially in remote areas where fuel prices are higher. Second, the power supply from the generator can be unreliable, especially during peak demand hours or during power outages. Third, the generator produces emissions that can pollute the air and contribute to climate change. Fourth, the generator can also produce noise pollution that can be disruptive to people and animals in the area. During field assessment the farmers shared their challenges of high cost of diesel/petrol use for the power of their tube wells and requested for support in conversion of existing system of running tubewells with diesel/petrol generators to Solar tube well system.

Water Harvesting Through Water Tank Technology

Spring and stream water is a major source of irrigation in the project areas. The region is home to many springs, which are fed by the melting snow and glaciers of the Hindu Kush mountains. The spring water is typically clean and cold, making it ideal for irrigation. Farmers are using this source through open unlined water channels for irrigation of variety of crops including vegetables and fruits. These channels are prune to damage during extreme weather events, such as heavy rains or floods. During heavy rains, the channels can overflow, causing waterlogging and damage to crops. During dry periods, the channels can dry up, leaving farmers without water for their crops. To address this problem, farmers need to use water tanks with pipes. Water tanks can store water during wet periods and release it during dry periods. The pipes can be used to transport water to the crops, even if the channels are damaged.

Vertical Farming for Vegetable Production

Climate change is having a significant impact on vegetable cultivation in target areas. The average temperature is rising, and the rainfall is becoming more erratic thus increasing the risk of pests and diseases. These pests and diseases can damage crops and reduce yields. The conventional cultivation practices are more susceptible to these climate changes. Vertical farming is a type of agriculture that uses structures to protect crops from pests, diseases, and insects. Vertical farming for vegetables is often done using nets and sticks. One common way to use nets and sticks for vegetable farming is to create a raised bed. This helps to improve drainage and aeration, and it also makes it easier to weed and harvest the crops. Vertical farming can help to increase crop yields by protecting the crops from pests, diseases, and extend the growing season.

Drip Irrigation System

Drip irrigation is a method of irrigation that delivers water directly to the roots of plants. This method is more efficient than traditional methods of irrigation, such as flooding or overhead watering, because it minimizes water loss due to evaporation and runoff. Drip irrigation can be used to irrigate newly planted orchards in Lower Dir and Lower Dir. This is important because orchards are susceptible to water stress, especially during the dry season. Drip irrigation can help to ensure that the trees have the water they need to grow and produce fruit. Drip irrigation can help to conserve water, minimizes waterlogging and erosion and can reduce labor costs by eliminating the need to water orchards manually.

Development of Community Adaptation Plans

Action Planning is a vital component of Local Adaptation Plans of Action (LAPA) as it involves developing strategies for implementing interventions. It includes the identification and prioritization of adaptation options, taking into account climate threats. This prioritization process aids decision-makers in selecting actions that are both cost-effective and sustainable, with a focus on meeting the needs of vulnerable communities. Following consultations with the government, civil society, and communities, the following adaptation measures have been prioritized based on technical considerations. These measures have been categorized as immediate, medium-term, and long-term solutions, with the specific timeline for implementation determined by the researcher's assessment.

Use of Drought & Disease Resistant Varieites

Wheat and maize are under threat from climate change in the target areas. The quantity and quality of these crops are being affected, and yields are being reduced. Climate change is causing more extreme weather events, such as droughts and erratic rain. These events are making it difficult for farmers to grow wheat and maize. In addition, climate change is causing pests and diseases to become more common which are affecting the yield and quality of wheat and maize. For example, farmers face challenges of rust and smut disease occurrence on wheat and the borer attack on maize along with lodging but do not know how to manage. Farmers have no access to drought- and disease-resistant varieties of wheat and maize and using conventional practices in sowing, harvesting, threshing, and storing. The conventional practices are not sustainable and are not effective in mitigating the impact of climate change. Drought resistant varieties of wheat are NIPA Lalma, PS 05, Shahkar 13, PS 15, Wadan 17, PS 19, PS 21, Taskeen 22 and Khyber 2023. In case of maize, the short season varieties are white varieties; Pahari and Iqbal. The mid-season white varieties are; Azam, Saad and Babar (hybrid) and full season white varieties are; Jalal, Kaptan

Drought Tolerant Fruit Orchards Establishment

Peach is the dominant and leading fruit in Lower Dir. However, climate change is affecting the yield and quality of peach. Therefore, it is important to diversify crops and plant other fruits that are more resilient to climate change. When establishing a new orchard, it is important to choose the right location. The location should be well-drained and have good soil quality. It is also important to consider the climate of the area and the pests and diseases that are common in the area. Here are some fruits that are drought tolerant or need less water are; apricots, persimmons, pomegranate, almond and olives.

Fruit Fly Control With Traps in Peach

Fruit fly is a serious problem in fruit and vegetables in district Lower Dir. In Peach fruit fly is severe. The current climate change has serious impact on peach like hail storm, erratic rain causing fruit damage and creating conducive environment for fruit fly. In addition, the climate change variables also cause fruit drop which can become host for larvae and remain till the next season ready for attack. Traps for fruit fly can be used to catch adult flies. This can help to reduce the number of flies that lay eggs on the fruit. The eggs of fruit fly are the ones that cause damage to the fruit. They burrow into the fruit and feed on the flesh, causing it to rot. Traps are baited with pheromones. Pheromones are chemicals that are released by fruit fly to attract other fruit fly. Traps can be placed in peach orchards, check regularly and any captured flies should be removed. Traps for fruit fly are a relatively safe and effective way to control this pest. They are not harmful to the environment or to human health. However, it is important to note that traps are not a complete solution to the problem of fruit fly. They can be used in conjunction with other cultural practices like removal of drop fruit and bury in soil, proper pruning and nutrition.

Tomato Nursery Raising Technology

Tomato is the cash crop in Lower Dir and farmers are extensively growing in summer season (Jun to Oct). Climate change has negative impact on tomato crop production. Erratic rain and hailstorm damage tomato nursery and standing crops and thus yield is affected. The use of plastic trays for tomato nursery raising is proposed. Plastic trays

provide a more uniform growing environment, which results in healthier and more vigorous seedlings. Plastic trays are easier to clean and disinfect than the ground, which helps to prevent the spread of diseases. Plastic trays can be easily filled with soil and planted with seeds, which saves time and effort. Plastic trays allow for better drainage and aeration, which helps to prevent waterlogging and root rot. Besides tomato nursery, the trays can also be used for nursery raising of other vegetables.

Farmer's Field School (FFS)

A Farmer Field School (FFS) is a participatory learning and action approach to agricultural extension that is designed to improve the knowledge and skills of farmers so that they can make informed decisions about their farming practices. FFSs are typically facilitated by a trained extension worker who works with a group of farmers to learn about a particular agricultural topic. The group meets regularly over a period of time to discuss the topic, share experiences, and learn from each other. Improved knowledge and skills: Farmers who participate in FFSs gain a better understanding of agricultural practices, such as crop rotation, pest management, and water management. Farmers who participate in FFSs often see an increase in their yields. This is due to the improved knowledge and skills they gain, as well as the opportunity to share experiences and learn from each other. Participants find ways to reduce their costs, such as by using less fertilizer or pesticides. They are more likely to adopt new technologies, such as improved seeds or irrigation systems.

Food gardens

During assessment it was found that women are engaged in vegetable cultivation near to their houses. They are growing both summer and winter vegetables for their home consumptions. They are using conventional methods and poor quality of seed. In some cases, they recycle seed for the next season. It is recommended to support women in improved seed of vegetables along with capacity building through female expert.

Stakeholders Identification & Analysis

Tomato Nursery Raising Technology

There are couple of Government and Non-Government Organizations/institutions working on climate change and agriculture in Khyber Pakhtunkhwa Province. Following are the details:

District Disaster Management Unit

District disaster management authorities/units established at district level and are headed by district executive whereas respective deputy commissioners, district police officers, executive district officer (Health) and any other district-level officer appointed by the District Government are its members. The organization varies from province to province depending upon the disaster situation in the respective province/region/state. The roles and functions of the DDMUs are clearly defined by National Disaster Management Act. DDMU is more relevant department to develop disaster management plans, contingency plans, coordination of different stakeholders involved in disaster risk reduction (DRR) actions.

Department of Health

The Department of Health plays a crucial role in providing healthcare services to the general public at the grassroots level. In addition to its primary function of delivering healthcare, the health department also has a vital role in preventing and treating health hazards induced by climate change. Here are some key points highlighting the relevance of the health department in climate risk mitigation and adaptation:

1. The health department is involved in developing and implementing adaptation strategies to address the anticipated, current, and future climate change impacts on public health. These strategies aim to protect communities from the health risks associated with climate change.
2. The health department actively participates in climate change policy and planning efforts. By integrating public health considerations into these initiatives, the department helps to ensure that climate change mitigation and adaptation measures prioritize the well-being of the population.
3. Investing in health systems strengthening is a crucial approach to mitigate the adverse effects of climate change and infectious disease threats on the population. The health department plays a key role in enhancing the resilience of healthcare systems to climate-related challenges.
4. Climate change has direct and indirect impacts on health, which are influenced by environmental, social, and public health determinants. The health department works to understand and communicate these impacts, collaborating with other sectors to promote climate change mitigation and protect public health.

Department of Education

The Department of Education plays a crucial role in raising awareness about climate change within general communities, recognizing the significant influence children have as key drivers of change. By actively involving students in climate change initiatives, we can empower them to become environmental advocates and contribute to a sustainable future. One effective approach is the establishment of climate clubs in schools, providing students with a platform to engage in various activities that promote climate change awareness. Establishing climate clubs within schools enables students to actively participate in climate change initiatives. These clubs can undertake a range of activities, including speech competitions, painting and art exhibitions, essay competitions, debates, and community outreach events focused on raising awareness about climate change and its local impacts.

Public Health Engineering Department (PHED)

PHED is mandated to provide potable water and sanitation facilities to the rural population and planning and construction of mega water supply and, sewerage and drainage scheme in urban areas. The risk of water and sanitation facilities is increased during climate induced hazards, which have negative impacts on health of the local population. Incorporation of mitigation measure in design of water and sanitation facilities, can provide these facilities on sustainable basis and can effective reduce health risks of the effected population.

Department of Agriculture Extension

Agriculture Extension department has offices in each district and staff are based at district, tehsil and Union Council level for advising farmers on best practices of agriculture. The department has dual mandate of regulating fertilizer and extension services for farmer. The Agriculture Extension Department is advising farmers to use drought and disease resistant varieties of wheat, maize and rice. Certified seed of wheat and maize varieties suitable for the target areas are available with Farmer Services Centers (FSCs). The department is managing Farm Services Center through which inputs like seed and fertilizers are provided to member farmers on price less than market price.
The climate change concept is new to Agriculture Extension Department and trying to integrate climate change with all agriculture interventions. The department has recently started climate resilience project through horticulture interventions. Orchards requiring less water were established on farmer's field and in second year drip irrigation system will be installed. The department has taken initiative on biological control of fruit fly in peach and supported farmers with traps to control it. The department is encouraging farmers to use line sowing method specially for wheat and maize.

Department of On Farm Water Management

On Farm Water Management (OFWM) department has offices in each district and staff are based at district level for advising farmers on best water management practices for agriculture productivity enhancement. The department has the mandate of supporting farmers water saving and increasing water efficiency through lining water courses, pipe irrigation, drip irrigation and water reservoirs etc. Though the climate change concept is new, however, OFWM believes that most of their interventions are directly linked to climate change resilience.
During study it was observed that in the selected villages the farmer's linkages with OFWM are very weak and they rely on their own resources by implanting tube wells and connecting pipe for irrigation. The OFWM Department mode of operandi is that in response to application for scheme, the sub engineer visits the site and prepare feasibility accordingly.

Department of Agricultural Research

The Agriculture Research Institute Lower Dir and Cereal Crops Institute Pirsabak Nowshera play a significant role in addressing climate change effect on Agriculture by introducing resilient varieties that may result in reduced losses due to climate change that causes abnormal rainfall, drought, storms, hailstorm, etc. The institute has introduced new varieties but there is a need to come up with new varieties in light of growing challenges due to climate change. There is no proper planning for capacity building of staff in Climate Change like conceptual clarity, hazards, adaptation and mitigation plan.

Pakistan Meteorological Department

Pakistan Met Department (PMD) is another key stakeholder for the collection of climate information and analysis. PMD has formed specialized units along with Weather Forecasting Centre, such as Flood Forecasting Division, National Drought Monitoring Centre, Climate Change Impact & Integration Cell. Despite the formation of these specialized groups, the government has been unable to address the difficulties caused by climate change due to a lack of adequate communication channels and proper systems that assist in decision-making. For example, a regional agrometeorological center established in different selected cities of the country to collect data about soil, high and low temperature, humidity, precipitation and fog. This collected data is published fortnightly and is not available to farmers and other key stakeholders on a daily basis.

Soil & Water Conservation Department, Government of KP

This department has the mandate to increase yield per unit area by conserving soil and controlling land sliding with efficient and affordable technologies. The Department takes soil samples and analyze the status of micro and macro nutrients and recommend measures for crop production. The department disseminate soil and land practices to farmers for water efficiency and water saving which cause high crop production. This department has an important role to provide technical input for mitigation and adaptation measures against climate change impact on agriculture in the province.

Plant Protection Department, Government of Pakistan

This department has regional offices in each province to check import and export of plant materials including plants and seed at the border. The department has a mandate to control incidence of insects and diseases by checking plant materials at border. This department has important role in insect and disease management in the current climate change scenario and can provide valuable technical inputs to KP Government

Small Medium Enterprise Development Authority (SMEDA)

SMEDA is a Federal Government organization under the Ministry of Industries & Production (MoIP) with Head Office at Lahore with a provincial office and technical staff in Peshawar supporting associations and group of farmers in the preparation of proposals in horticulture and other sectors. The organization prepares pre-feasibility of potential projects which are economically viable and place on their website for investors and other relevant stakeholders.

Federal Seed Certification and Registration Department (FSCRD)

It is a Federal Government Department and has offices in each province. The mandate is approval of variety registration and certification, seed and plant nursery registration and certification.

Financial Institutions

Financial Institutions have their branches almost in each district of KP for providing credit. Some of those are Bank Alfalah, Askari Commercial Bank Limited (ACBL), United Bank Limited (UBL), Zarai Taraqiati Bank Limited (ZTBL), Muslim Commercial Bank Limited (MCB), Allied Bank Limited (ABL), Meezan Bank Limited (MBL) etc.

Food and Agriculture Organization (FAO) of United Nations

FAO works to reduce hunger, food insecurity, reduce rural poverty, ensure inclusive and efficient agricultural and food systems, and protect livelihoods from disasters. FAO with the financial assistance of couple of donors like SDC, USAID etc are focusing on climate change impact and agriculture development across the country in general and KP in particular.

Local Adaptation Plan for Action

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
Lack of awareness and capacity in climate change resulting adaptation	Climate & weather	Pakistan Meteorological Department / DDMU	Weather updates should be timely issued to the community	■		
		NGOs/INGOs	Sensitize communities about the climate change risk through an intensive communication campaign	■		
		DDMU/PDMA/INGOs	Climate risk assessment study should be conducted utilizing Multi-Hazards vulnerability Capacity techniques	■		
		NGOs/INGOs	Develop knowledge products on climate change Adaptation and Disaster Risk reduction for conceptual clarity.	■		
		District Government PDMA/DDMU/NGOS NGOs	Develop protective infrastructure to protect communities from adverse impacts of riverine floods, flash floods, land sliding etc.		■	■
			Develop stakeholders' capacity on climate adaptation measure to reduce its impacts	■		
			Formation/ re-vitalization of community based organizations/groups for community based planning and implementation of community based local adaptation plans for their community	■	■	
		NGOs/ DDMU	Developing linkages and networking of community based organizations with DDMU and other line department for supporting communities in implementation of Community based adaptation Plans		■	
Adverse impacts of climate change on livelihood	**Irrigation**	Agriculture Engineering Department	Solarization of Tube well for irrigation	■		
		On Farm Water Management Department	Construction of water tank & pipe for orchards and vegetables	■		
			Rehabilitation of water channels (lining)	■		
			Use of drip irrigation system in orchards and vegetables	■		
		Soil and Water Conservation Department	Construction of check dams for control of soil erosion and decrease flood damage		■	

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
	Agriculture	Agricultural Research Institute	Development of drought and disease resistant varieties of cereal crops and vegetables			
			Research on adjusting sowing and harvesting season of cereal crops			
			Research on value addition of fruits and vegetables in the current climate change impact			
			Research on finding techniques for protection of crops, orchards and vegetables from hail storm			
		Agriculture Extension Department	Vertical Farming (Gourds, Cucumber, Chilies, Tomato)			
			Orchard establishment with drip Irrigation System (Almond, Persimmon and Pomegranate)			
			Integrated Pest and Disease Management in Peach			
			Climate Smart Technology for tomato nursery raising			
			Fruit/Forest Nursery Enterprise			
			Strawberry cultivation for runners			
			Farmer's Field School on wheat, maize, peach, onion and tomato for learning and productivity enhancement			
			Capacity building of women food production gardens			
			Awareness Campaign on Climate Change Impact on Agriculture			
			Training of farmers on insect and disease management			
			Training of farmers on vertical farming			
			Training/exposure of farmers in High Efficiency Irrigation System			

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
			Training of farmers in wheat, rice and maize seed storage			
			Awareness Campaign on effect of use of fertilizer and pesticides			
			Training of farmers in Bio pesticides, bio fertilizer			
			Training of farmers in value addition of fruits and vegetables			
	Forest	Forest department	Agroforestry (plantation of forest plants on margins of field)			
Rise in Vector Borne Diseases	Health and hygiene	Local Communities	Promote hygiene education and awareness campaigns			
			Encourage the use of water filters or purification tablets			
			Construct and maintain community water storage facilities			
			Implement rainwater harvesting systems			
			Establish community-based water quality monitoring systems			
Impacts of climate change on access to safe water and sanitation services	**Water**	Health Department	Strengthen disease surveillance and reporting systems			
			Provide training on waterborne disease prevention			
			Improve access to healthcare facilities and services			
			Conduct regular health camps in rural areas			
			Collaborate with local communities for health interventions			
	Sanitation	Department of KP	Develop and enforce regulations for water quality standards			
			Invest in infrastructure for safe drinking water			
			Support research on climate-resilient water supply systems			

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
			Allocate funds for waterborne disease prevention programs			■
Sanitatio-Impacts of climate change on access to safe water and sanitation servicesan	Water	NGOs/CSOs/CBOs	Provide access to affordable water treatment technologies Short term	■		
			Conduct capacity-building workshops for local communities	■		
			Implement community-led sanitation initiatives		■	
			Support community-based water management projects		■	
			Advocate for policies promoting water and sanitation			■
			Implement community-led sanitation initiatives		■	
		Local Communities	Rainwater harvesting systems: Promote the construction of rainwater harvesting structures to collect and store rainwater for domestic use during dry periods.	■		
			Community-led water management: Encourage the formation of community-based water management committees to monitor and maintain water sources, ensuring their sustainability and quality	■		
			Water conservation practices: Raise awareness among community members about water conservation techniques such as using water-efficient appliances, fixing leakages, and practicing responsible water use.	■		
		Government	Infrastructure development: Invest in the construction and maintenance of water supply infrastructure, including pipelines, storage tanks, and water treatment facilities, to ensure reliable access to safe water.		■	
			Climate-resilient water sources: Identify and develop alternative water sources, such as deep tube wells or protected springs, that are less vulnerable to climate change impacts like contamination and depletion.		■	

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
			Policy and regulation: Develop and enforce policies and regulations to protect water sources, promote water conservation, and ensure equitable distribution of water resources among rural communities.			■
		NGOs/CSOs/CBOs	Capacity building and training: Provide training and capacity-building programs to local communities on water management, water quality testing, and maintenance of water infrastructure.	■		
			Community-based water projects: Support the implementation of community-led water projects, including the installation of hand pumps, water filtration systems, and sanitation facilities, tailored to the cultural and financial capabilities of the rural communities	■		
	Sanitation		Climate information dissemination: Facilitate the dissemination of climate information and early warning systems to raise awareness among communities about climate change impacts on water resources and promote adaptive measures.		■	
		Local Communities Government	Promote community-led sanitation initiatives, such as building and maintaining latrines and handwashing facilities.	■		
			Raise awareness about proper sanitation practices, including safe disposal of waste and personal hygiene.	■		
			Encourage the use of low-cost and culturally acceptable sanitation technologies, such as pit latrines or composting toilets.	■		
			Establish community-based monitoring systems to ensure the functionality and cleanliness of sanitation facilities.		■	

Challenge	Sector	Stakeholders	Solutions	Implementation Phase		
				Short Term	Medium Term	Long Term
			Implement rainwater harvesting systems for water storage and reuse in sanitation facilities.		■	
			Develop and enforce regulations and policies for sanitation infrastructure in rural areas.	■		
			Provide financial incentives and subsidies for the construction and maintenance of sanitation facilities.	■		
			Strengthen the capacity of local government institutions to plan, implement, and monitor sanitation programs.	■		
			Invest in the training and education of sanitation workers to ensure proper waste management practices.		■	
			Establish partnerships with NGOs and international organizations to access funding and technical expertise.			■
		NGOs and International Organizations	Support community-led sanitation initiatives through funding and technical assistance.	■		
			Conduct hygiene promotion campaigns to raise awareness and change behavior regarding sanitation practices.	■		
			Provide training and capacity building programs for local communities and government officials on sustainable sanitation practices.		■	
			Facilitate knowledge sharing and best practices exchange among different stakeholders involved in sanitation services.		■	
			XS			■

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Relief and Development Organization

"The **"Changing Minds for Climate Resilience through Awareness Raising and Local Capacity Measures"** is a transformative initiative spanning selected districts of Khyber Pakhtunkhwa and South Punjab. **Focused on empowering vulnerable communities—particularly women, people with disabilities, youth, and children**—the project seeks to enhance climate awareness, build adaptive capacities, and equip farmers with sustainable practices. Through knowledge dissemination and community engagement, we aim to forge a resilient front against climate change, fostering a united commitment for a sustainable future."

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