PUNJAB CLIMATE CHANGE POLICY

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LIST OF ACRONYMS

ADP	Annual Development Plan
ARE	Alternate and Renewable Energy
BC	Black Carbon
CBOs	Community-Based Organizations
CCGAP	Climate Change Gender Action Plan
CFU	Climate Finance Unit
CMIPs	Climate Model Inter-comparison Projects
CSA	Climate – Smart Agriculture
EPCCD	Environment Protection and Climate Change Department
EPR	Extended Producer Responsibility
FAO	Food and Agriculture Organization
GCM	Global Climate Models
GHG	Green House Gas
GIS	Geographical Information System
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
MHVRA	Multi-Hazard, Vulnerability and Risk Assessment
NAP	National Adaptation Plan
NbS	Nature – based Solutions
NCCP	National Climate Change Policy
NDCs	Nationally Determined Contributions
NEPRA	National Electric Power Regulatory Authority
NGOs	Non-Profit Organizations
PCCPIC	Provincial Climate Change Policy Implementation Committee
PDMA	Provincial Disaster Management Authority
PMD	Pakistan Meteorological Department
PKR	Pakistani Rupees
PSS	Punjab Spatial Strategy
R&D	Research and Development

RCP	Representative Concentration Pathways
RE	Renewable Energy
RF	Radiative Forcing
RECP	Resource Efficiency and Cleaner Production
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
SUPARCO	Space and Upper Atmosphere Research Commission
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-OCHA	United Nations Office for the Coordination of Humanitarian Affairs
WMO	World Metrological Organization

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1. Situational Analysis

Climate change is evident around the globe. Scientific research and reports have established that the world is in a state of climate emergency. There is more carbon dioxide in atmosphere than at any time in the human history[1]. Developing countries, particularly the South Asian states are among the most vulnerable nations to the impacts of changing climate. During past two decades, above 750 million residents of South Asian countries have been affected by climate-induced disasters[2].

Pakistan, located in the northwest of Indian subcontinent in South Asia, is the world's 8th most vulnerable country to long-term climate risk.[3] Although Pakistan's contribution in global GHG footprint is negligible, past decades have seen a rising trend in the per capita GHG emission of the country, with an absolute increase of 0.97 tons from 1946 to 2021.[4] Agriculture, forestry & land use sector is the largest source of GHG emissions, accounting for nearly 46% of these emissions, followed by the energy sector (45%), industrial processes (5%), emissions and waste (4%)[5]. However, the vulnerability, adaptation, institutional capacity and resilience remains at the top policy and strategy priority in context of climate action in the country.

The annual mean temperature in Pakistan during the last fifty years has increased roughly by 0.5°C and it is likely that it will rise further by two degrees (3°C to 5°C) till 2100, with the highest surge in warming observed in the Baluchistan province followed by Punjab.[6]

1.1 Punjab's Climate Change Paradigm

Spanning across 205,345 sq. km, Punjab stands as Pakistan's most populous province, home to over 127.6 million inhabitants[7]. Its unique geographic positioning, diverse agro-climatic zones, and intersecting rivers render it particularly susceptible to the impacts of climate change, including hydro-meteorological events, heatwaves, and drought[8] **(Figure 1)**.

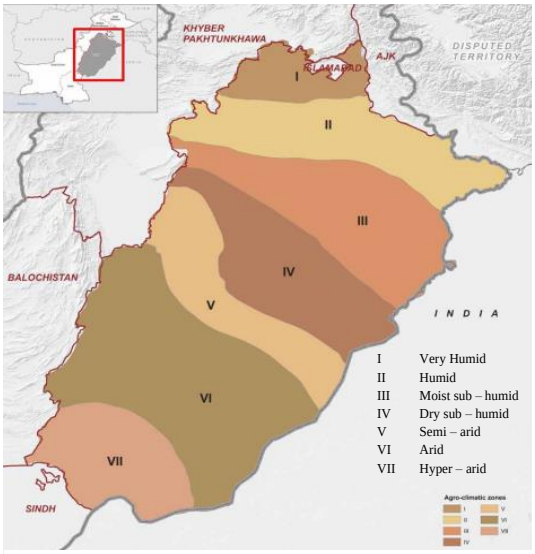


Figure 1 Agrco-climatic zones of Punjab

Temperature

Punjab experiences a wide temperature range, from -2°C in winter to 50°C in summer. The province typically sees mean maximum and minimum annual temperatures fluctuating between 28°C-32°C and 15°C-19°C, respectively[9]. Over the past 30 years (1975-2005), a noticeable uptick in

[1] Mauna Loa Observatory, 2020

[2] Climate Change Action Plan (2021-2025), South Asia Roadmap, The World Bank group, 2021

[3] Eckstein, D., Künzel, V., and Schäfer, L. 2021. Global Climate Risk Index 2021: Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000-2019. Germanwatch, Bonn.

[4] Global Carbon Project, Our World in Data, 2022

[5] GHG Inventory of Pakistan 2017-18 and NCCP

[6] Zaman, Q. 2017.Climate Change Profile of Pakistan. Asian Development Bank. Manila, Philippines.

[7] Population Census of Pakistan, 2023.

[8] UNFAO, 2019

[9] Multi-hazard vulnerability and risk assessment reports (2019), Provincial Disaster Management Authority, Punjab

temperatures has been observed, with 57% of the province experiencing an average rise of 0.97°C and 1.14°C in minimum and maximum temperatures, respectively. This warming trend has been particularly pronounced in Southern Punjab, accompanied by an increase of 20 days in annual summer days.

Despite global warming trends, the summer of 2023 witnessed unexpectedly cooler temperatures in the Indian Subcontinent and eastern Pakistan (the Punjab region), a deviation from the preceding year's surface air temperatures[10]. These regional variations are influenced by a myriad of factors, including atmospheric pressures, wind patterns, cloud density, solar radiation, and geographical features[11].

In 2022, an anomaly of +0.88°C in the annual area-averaged mean temperature has been reported in Punjab, making it the sixth warmest year for the province, whereas the temperature anomaly of 0.18°C was reported in 2023[12].The summer temperatures in Punjab during 2023 were noted to be comparatively cooler than the climatic averages, attributed to the overall cooler conditions prevailing across the Indian subcontinent.

Precipitation

Like other regions in Pakistan, Punjab receives the bulk of its precipitation during the monsoon season (July to September). In recent decades, the province has observed an upward trend in precipitation levels. According to the PMD's State of Pakistan's Climate Report (2022), Punjab received an area-weighted rainfall of 560.9 mm, marking a 45% increase from normal levels. This surge in rainfall has been attributed to various factors, including persistent La Niña conditions, intensified heatwaves leading to low-pressure systems, and the overarching impacts of climate change.

Similarly, 2023 saw above-normal precipitation records across Pakistan, with Punjab experiencing a notable 30% increase in rainfall compared to typical levels.

1.2 Punjab's Climate Drivers: Unveiling the sectors

Punjab stands as one of South Asia's most urbanized regions, with approximately 40.70% of its populace dwelling in bustling metropolises[13]. Contributing a substantial 60% to the national GDP, it holds the mantle as Pakistan's most industrialized province[14]. However, this rapid urbanization and economic growth have ushered in climate change stresses, environmental degradation, and resource depletion.

Air pollution emerges as a significant environmental challenge in Punjab, exacerbated by seasonal smog episodes (October to February) each year. These occurrences, intensified by climatic disturbances, such as variations in wind velocity and temperature inversions, are compounded by Short-lived Climate Pollutants (SLCPs), notably Black Carbon (BC) found in Particulate Matter (PM2.5) and smog.

Hence the province of Punjab encounters the impacts arising from reciprocal relationship of smog and climate.

There is dearth of data on sectoral – release of GHGs. Following sectors are the potential sources for both

[10] Copernicus Climate Change Service (https://climate.copernicus.eu/global-climate-highlights-2023)
[11] NOAA (2020) (https://www.climate.gov/news-features/climate-qa/does-global-warming-mean-it%E2%80%99s-warming-everywhere)
[12] State of Pakistan Climate in 2022. Pakistan Meteorological Department
[13] Pakistan population Cnesus 2023

[14] The World Bank Group, Sustainable Industrial Development in Punjab (2019).

the CO_2 - and non - CO_2 factors contributing to the climate change:

- **Energy:** Punjab's significant contribution to Pakistan's total electricity consumption, housing 62% of the nation's power plants, positions it as a key contributor to CO_2 emissions. Fossil fuels dominate the province's energy mix, further amplifying greenhouse gas (GHG) emissions and Black Carbon levels. Recent Emission Inventory of Punjab indicates 13% contribution of the energy sector over temporal range of 1990-2020, whereas the time series analysis shows significant increase in the air emissions from this sector.[15]
- **Industry:** With over 48,000 industrial units, employing around 78% of Punjab's non-agricultural workforce[16], Punjab's industrial landscape spans various sectors, including chemicals, textiles, pharmaceuticals, and metals. Many production industries, particularly those utilizing furnaces and kilns, emit substantial carbon emissions, compounding air quality and climate concerns.
- **Transport**: Punjab boasts 19.7 million registered motor vehicles[17], with the majority being two-wheelers. Inefficient fuel burning in transportation sectors contributes significantly to carbon oxides and nitrogen oxides emissions.
- **Agriculture**: According to Pakistan's national GHG inventory (2018), agriculture sector accounts for 46% of its GHG emissions. The agricultural practices, including livestock rearing, stockpiling the animal dung, manure management, fertilizers, paddy fields, diesel-fueled irrigation sources, slash burning are main sources of GHGs to the atmosphere. Agriculture is also a water-intensive sector, utilizing about 94% of country's water, mainly in Punjab.
- **Waste Sector:** Punjab generates 47,300 tons of municipal solid waste daily[18], with improper disposal practices releasing methane and carbon dioxide, potent GHGs with significant global warming potential.
- **Land-use Change and Forestry:** The loss of forest cover arising from different factors is not only deteriorating the Punjab's carbon sinks, but is also increasing the subsequent risks of land sliding and floods[19]

1.3 Past and Projected Climatic Stresses in Punjab

In Punjab, climate change has its manifestations in the form of accelerated frequency and intensity of riverine, flash & urban flooding, droughts and heatwaves, with multiplex secondary impacts on all sensitive sectors, including, but not limited to the water resources, agriculture, health and ecosystems. Southern Punjab has faced the catastrophic floods in 2010 (causing the damages of 219 billion PKR[20]), 2014 (affecting more than 10 million acres of agricultural land in Districts Jhang and Muzaffargarh[21]) and 2022

[15] SUPARCO and The Urban unit. 2023. Air Pollution Emission Inventory of Punjab (1990-2020). Lahore, Pakistan. Pp. 1-59.

[16] Punjab Growth Strategy 2018

[17] Punjab Bureau of Statistics (2021)

[18] Punjab State of the Environment Report (2022), Environmental Protection Agency, Punjab

[19] Government of the Punjab, European Union and Civil Society Coalition for Climate Change (CSCCC). Stakeholder Recommendations for Climate Change Implementation Framework, Punjab

[20] Pakistan Flood Impact Assessment, Economic Survey, 2010-11

[21] Ghani, R. *et al* (2017), Socio-economic Damages caused by the 2014 Flood in Punjab Province, Pakistan Academy of Sciences

(damaging over 438,000 acres of crops/orchards, 733,000 livestock and up to 50% of water systems[22]).

Most recently, Punjab has faced flooding along Sutlej River in August, 2023. The water levels on the Sutlej at the Ganda Singh Wala village gauging station, 7 km west of Ferozepur, were recorded to be highest in 35 years[23]. According to PDMA, flood season was observed from 17th of August, 2023 to 30th September, 2023, during which Districts Bahawalnagar, Bahawalpur, Lodhran, Kasur, Vehari, Okara, Pakpattan and Multan were affected by urban flooding. The floods affected the 467 villages/basti/mozas, more than 24000 houses and 545,270 acres of cultivated land in the affected districts. Around 300000 livestock was transported for rescue purposes, whereas around 11 persons were reported injured and 10 were reported dead as a result of these floods[24].

On the other side, the record heatwaves, especially during year 2022, have also left grim impacts on vegetation, livestock and water resources, especially in the Southern Punjab (Cholistan region). During the heatwave 2022, a steep and persistent rise in temperatures (5°C -11.5°C above normal) was recorded in Cholistan region for more than 40 days[25]. In the main urban centers[26] of Central and Southern Punjab, extreme heat events are more pronounced in the last few years and have reportedly increased heat related illnesses and morbidities in extreme heat episodes and during the advent of droughts.

Pakistan's district level climate risk and hazard assessment classification indicates that risks of droughts are more pertinent for Central and Southern Punjab (Table 1)

Table 1: District Level Climate Risk Assessment Classification

[22] Situation Report No. 4, 2022 (UN-OCHA)

[23] Pakistan Meteorological Department

[24] Flood Situation Report (17th Aug 2023 To 30th Sep 2023), PDMA, Punjab

[25] Technical Report on catastrophe due to heatwave instead of drought in the Cholistan, Punjab (PMD), 2022

[26] The Urban Unit. 2020. Punjab Spatial Strategy 2047. Policy Statement 6.3. World Bank. Punjab. Pakistan

#	Districts	Floods	Cyclone	Droughts	#	Districts	Floods	Cyclone	Droughts
1.	Rawalpindi	4	2	3	2.	Toba Tek Singh	3	2	4
3.	Sheikhupura	5	2	4	4.	Sialkot	5	2	1
5.	RY Khan	5	2	5	6.	Sahiwal	3	2	4
7.	Multan	4	2	5	8.	Narowal	5	2	1
9.	Gujranwala	5	2	2	10.	Jhang	5	2	3
11.	Okara	3	2	4	12.	DG Khan	5	2	3
13.	Nankana Sahib	3	2	4	14.	Sargodha	4	2	2
15.	Muzaffargarh	5	2	4	16.	Rajan Pur	5	2	3
17.	Mianwali	4	2	2	18.	Lodhran	3	2	4
19.	Gujrat	5	2	1	20.	Layyah	5	2	3
21.	Faisalabad	3	2	4	22.	Khushab	4	2	2
23.	Chiniot	3	2	3	24.	Khanewal	3	2	4
25.	Vehari	3	2	3	26.	Kasur	3	2	3
27.	Pakpattan	3	2	3	28.	Jhelum	3	2	2
29.	M. Bahaudin	3	2	2	30.	Lahore	3	2	2
31.	Bahawalnagar	3	2	3	32.	Hafizabad	3	2	2
33.	Bahawalpur	2	2	3	34.	Attock	2	1	1
35.	Chakwal	2	1	2	36.	Bhakkar	3	1	1

Scoring Key

Very High	High	Medium	Low	Very Low
5	4	3	2	1

Various studies by multiple international and native organizations have been conducted on climate projections for Pakistan, both at national and sub-national/provincial level, using different projection models. However, a regular, homogenized and updated system for climate change projections at Punjab level is still a major gap in climate study and research at present.

The Climate Change Modelling of the whole province using CMIPs Global Climate Models (GCMs)[27] for

[27] The Urban Unit. 2020. Strategic Environmental Assessment – Punjab Spatial Strategy 2047.

maximum and minimum temperature as well as for the precipitation exhibits that, under the RCP4.5 scenario, the northern region of Punjab is projected to experience the highest increase in temperature, with an estimated rise of 1.70°C by 2050; and 2.16°C with RCP 8.5 **(Figure 2)**.

Similar to temperature, precipitation also shows projected increase in both emission scenarios. The western edge of North and central regions experiences the highest increase is in precipitation while South region showed relatively dry conditions in observed precipitation.

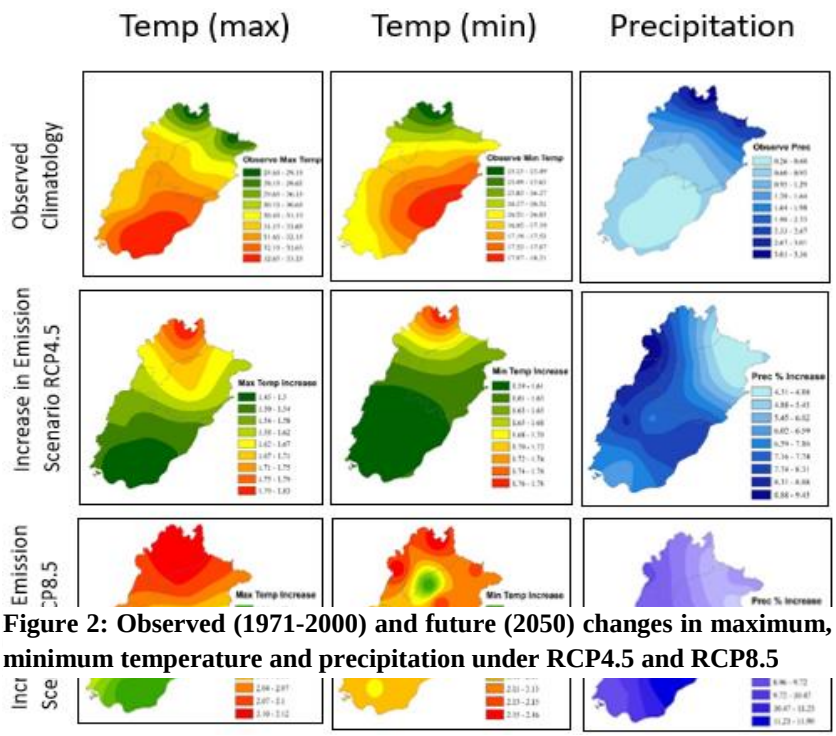


Figure 2: Observed (1971-2000) and future (2050) changes in maximum, minimum temperature and precipitation under RCP4.5 and RCP8.5

1.4 Sectoral Vulnerability to Climate Change

Punjab province is largely dependent on climate sensitive economies that make it very weak in terms of adaptive capability and resilience against the devastating impacts of climatic variations. The vulnerabilities to climate change across different key sectors are tabulated below **(Table 2)**:

Table 2: Sectoral Vulnerability to Climate Change in Punjab

Key Sectors	Vulnerability	Key Sectors	Vulnerability
Water Resources	Punjab is irrigated with five river tributaries, comprising 10 inter river link canals and 24 main canal system, with a number of distributaries and minors[28]. The climate induced rains and flooding pose serious threats to the water infrastructure of the province. The over-abstraction of groundwater, poorly managed water infrastructure and water quality degradation make the water resources of Punjab even more vulnerable to the threats of climate change. More frequent and intense rains in the catchment areas lead to increased siltation of major dams and subsequent floods.	**Land and Ecosystems**	Punjab has a variety of ecosystems including the protected wetlands, deserts, forests and mountain ranges. However, the climate-driven extreme events and unprecedented weather patterns are serious threats to ecosystems' survival, ultimately endangering the poor communities dwelling on these ecosystem resources. Cholistan, is the prime example, which is reportedly highly vulnerable to climate induced droughts due to arid or hyper arid meteorological trends, elevated temperatures and high evapotranspiration rates. Climate

[28] Groundwater in Pakistan's Indus Basin (World Bank Report), 2021

			change is also affecting wetlands by altering the precipitation patterns, causing more extreme weather events, which in turn affects the ecological processes and biodiversity of wetlands, subsequently affecting the livelihoods based on this ecosystem.
Human Health	Punjab faces an increased risk of vector- and water - borne diseases, heat related mortalities, deaths and injuries due to climatic extremes and anomalies. Recent floods in Pakistan (2022&2023) were a big challenge, causing multiple cases of, dengue, gastrointestinal diseases, severe dehydration, and skin infections, in addition to the peaking of casualties all over the country[29].	**Agriculture**	This sector is highly vulnerable to climate change in context of disturbed rainfall patterns, elevated temperatures, dry spells, unexpected typhoons and floods. In the past decades, Southern Punjab has experienced severe droughts, followed by devastating floods in 2010, 2011, 2014 and in 2022. Whereas, in 2020, less rainfall during the wheat sowing and growing periods, and moderate precipitation during the harvesting season, declined the wheat yield in Punjab by 25.5 million tons, in 2022[30].
Forests & Biodiversity	Despite its total forest cover amounting to only 2.8%, Punjab boasts diverse dry forests, primarily located in districts Attock, Rawalpindi, Jhelum, and Gujrat, spanning temperate and sub-tropical sub-Himalayan regions. According to the Punjab Bureau of Statistics, 48.2% of the province's compact forest area comprises reserved forests. While limited data exists on climate change impacts, it's evident that climatic variations and extreme weather events pose threats to forests and wildlife, including soil instability, heat stress, land degradation, habitat loss, and disease outbreaks.	**Urban Infrastructure**	The population density of the province has raised from 183 persons/km^2 in 1972 to 622 persons/km^2 in 2023. Punjab has the highest population growth trend among all other provinces[32]. The interplay between urbanization and climate change yields complex and reciprocal effects. Urban expansion amplifies both a region's contribution to and vulnerability to climate change. Urban infrastructure, encompassing buildings, roads, bridges, and utilities, becomes highly susceptible to extreme weather events. Climate change further impacts resource availability, energy supply, and consumption patterns, notably affecting power plant

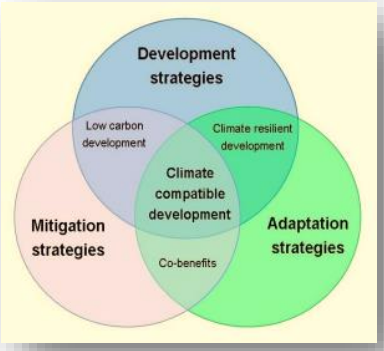
[29] Irfan, H. *et al.* 2023. http://dx.doi.org/10.1097/GH9.0000000000000097

[30] Waseem M, Jaffry AH, Azam M, Ahmad I, Abbas A, Lee J-E. Spatiotemporal Analysis of Drought and Agriculture Standardized Residual Yield Series Nexuses across Punjab, Pakistan. Water. 2022; 14(3):496. https://doi.org/10.3390/w14030496

[32] Statistical Pocket Book of the Punjab (2022), Punjab Bureau of Statistics

	Factors such as forest conversion for agriculture, overgrazing, soil erosion, unsustainable agricultural practices, hunting, commercial forestry, and environmental degradation exacerbate these threats. Climate-induced forest fires are also significant contributors to forest cover loss, with 88ha lost between 2001 and 2021 due to fires and 347ha from other drivers of tree cover loss[31].		operations and transmission systems[33].

2. Goal



To ensure climate-compatible development in Punjab through mainstreaming the climate change mitigation, and adaptation strategies in its development planning.

3. Policy Objectives

The specific objectives of the policy are to:

- Integrate climate change adaptation and mitigation in development planning, sectorial policies, strategies and plans.
- Account for the impacts of climate projections in infrastructural-, water-, agriculture-, energy- and town-planning, for climate change adaptation and development of a climate resilient and climate smart infrastructure.
- Catalyze Punjab's swift transition towards cleaner, greener, and lower-emission development pathways.
- Mainstream gender equality and ensure a just transition in climate actions province-wide, recognizing the disproportionate impacts on women and girls through gender-responsive planning and development strategies.
- Mobilize youth, women, and civil society to heighten awareness, education, and community-level actions for climate resilience.
- Promote comprehensive empirical data collection for research and development initiatives addressing climate change challenges.
- Strengthen Punjab's adaptive capacity through robust climate governance, institutional fortification, and capacity-building efforts.

[31] Environmental Protection Agency, Punjab (2023), Punjab State of the Environment Report 2022. Strategic Planning and Implementation Unit, Punjab Green Development Program, Environment Protection Department, Government of the Punjab

[33] Food and Agriculture Organization of the United Nations Programme. Living Indus. 2022. National Agricultural Research Center (NARC), Islamabad. Pakistan. p. 9. https://pakistan.un.org/en/196036-living-indus.

- Uphold climate justice across the province, particularly in climate-change-affected and vulnerable regions.
- Foster enhanced inter- and intra-departmental, provincial, national, and regional coordination and cooperation to bolster effective climate action.
- Harness financial, technological, and governance opportunities available at national and international levels, including avenues like the Green Climate Fund (GCF) and Global Environment Facility (GEF).

4. Policy Principles

The Policy is guided by the following principles:

- **Climate Leadership and Inclusiveness:** Strong political and institutional will and climate leadership at all tiers of governance.
- **National and International Commitments:** Policy considers the targets stipulated in Pakistan's national and international commitments and obligations towards climate change.
- **Concerted Response:** Adopting a holistic, multi-sectoral approach to initiate a unified climate action in the province leading to tangible results.
- **Sectoral Climate Mainstreaming:** Mainstreaming climate change in sectoral policy making, employing maximum Nature-based Solutions and adhering to the concept of low carbon Development.
- **Climate Justice:** A resilient province, well – adapted to the impacts of climate change is a common right, without any discrimination and marginalization on the basis of sex, poverty, disabilities and racial or religious differences.

5. Policy Areas:

Three specific areas have been delineated to formulate policy measures aimed at achieving the overarching policy goal. These policy domains encompass tangible actions for both mitigation and adaptation across various sectors. Importantly, they align not only with the targets outlined in the UN Sustainable Development Goals, Pakistan's Nationally Determined Contributions (NDCs) for 2021, the National Climate Change Policy (NCCP) of 2021, and the National Adaptation Plan (NAP) of 2023 (refer to Appendix A), but also with other pertinent national and provincial policies (refer to Appendix B). The identified policy areas for the Punjab Climate Change Policy are as follows:

1. Climate change adaptation and resilience
2. Climate change mitigation and low carbon development
3. Cross-cutting areas (adaptation and mitigation)

5.1 Climate Change Adaptation and Resilience

Government of Punjab visualizes to take all the necessary measures to make the most populous province of the country climate resilient and well-adapted to inevitable impacts of climate change. Sector-wise adaptive measures are as follows:

5.1.1 Water Resources

a) Water Storage and Infrastructure

- Assess and address the needs for additional water storages and infrastructures for sustainable water resources management.
- Accelerate the projects on building the climate resilient water - infrastructures.
- Develop and conserve water resources especially in hyper arid and arid areas of Punjab.
- Protect and preserve water catchment areas, reservoirs and water resources against degradation, silting and subsequent contamination.

b) Integrated Water Resource Management

- Coordinate & implement multi sector water resources planning & management, recognizing the wider social, economic and development goals.
- Promote & ensure active participation of farmers and irrigation workers, with fair representation of women, in the integrated water resources management.
- Promote water efficient farming techniques especially in low rainfall areas.
- Ensure measurement and monitoring of irrigation water delivery at various points of the supply system for effective planning and management.
- Strengthen the capacity of the relevant agencies engaged in watershed, hill torrent, and desert area management.
- Devise & strengthen coordination mechanism among inter provincial water sector institutions.
- Adopt and strengthen water accounting and budgeting system in the province
- Promote and leverage the measures for the restoration and sustainability of Indus River Basin which is major irrigation resource for Punjab.

c) Water Security Measures

- Ensure the treatment of wastewater from agricultural and municipal sectors before disposal into water bodies through implementation of nature - based solution at large scale as well as other traditional techniques.
- Improve & implement surface and groundwater water quality management through strengthening the monitoring system and enforcing drinking water and sanitation standards.

- Promote recycling of industrial wastewater.
- Carryout the zonation and ranking of sustainable water availability, quality and usages at reasonable spatial scale.
- Explore technological solutions for groundwater quality management in addition to regulatory measures.
- Explore avenues for multilateral negotiations for redressal of water quality degradation through untreated water entering Punjab from cross borders

d) Gender responsive planning and management of water resources

- Ensure active participation of women in the planning and designing of water conservation projects, realizing their key role in water management at household level.

e) Awareness

- Sensitize general public, including women, about water resources limitations, water quality, droughts, floods, water scarcity and water resource depletion due to climate change.

5.1.2 Land and Vulnerable Ecosystems

a) General Measures

- Conduct comprehensive, gender-inclusive studies to identify both fragile and resilient ecosystems across all ecological zones in Punjab.
- Integrate ecosystem conservation into development policies and planning initiatives.
- Expand current protected area coverage and implement proper ecological management plans to ensure the sustainability of threatened vulnerable ecosystems.
- Preserve natural habitats to support the survival of species within all vulnerable ecosystems in the province.
- Maintain and enhance vulnerable ecosystems while promoting eco-tourism.
- Advocate for integrated land-use management and discourage unlawful land-use alterations.
- Build resilience among communities, particularly vulnerable groups like women, children, the elderly, and disabled individuals, who rely on ecosystem services for their livelihoods.
- Establish women's focus groups to gather insights into their specific vulnerabilities and contributions to ecosystem sustainability.

b) Mountain Ranges

- Restrict commercial activities, such as illegal timber trade, detrimental to mountain ecology with community involvement.
- Engage local communities, with equitable representation of women, in the conservation of mountain biodiversity.
- Empower local communities, especially women, through sustainable land-use practices and wetland management to enhance ecosystem resilience and livelihoods.
- Promote terrace farming and establish botanical gardens in Punjab's mountainous regions to leverage ecological services for local communities, particularly vulnerable groups.

d***) Rangelands and Pastures***

- Implement measures to prevent topsoil erosion in rangelands and pastures, particularly in the Potohar region.
- Advocate for soil conservation practices in rangelands to combat desertification.
- Encourage rotational grazing in pastures and rangelands to facilitate vegetation regeneration.
- Designate alternative pastures and passages for grazing livestock in response to unusual weather changes.
- Expand rangelands by planting indigenous and climate-adapted vegetation species.
- Encourage and promote rangeland management, reclamation, and restoration practices.

c) Wetlands

- Preserve naturally existing wetlands located in the vicinity of major cities.
- Control and minimize the conversion of wetlands and surrounding areas for agriculture and grazing.
- Ensure adequate water flows to rivers, streams, and wetlands for ecological balance.

- Investigate the feasibility of creating artificial wetlands in suitable locations.
- Acknowledge and enhance the role of wetlands in natural disaster protection and climate change mitigation.
- Implement balanced harvesting of wetland resources.
- Engage local communities, with fair representation of women, to participate in wetland conservation efforts and sustainable land-use practices.
- Develop conservation plans for fragile wetlands in consultation with communities reliant on their ecological services.

d) Deserts (Arid and Hyper – Arid Areas)

- Research technological solutions for irrigation systems to increase vegetation cover in harsh arid zone areas.
- Implement measures to maintain vegetative cover in arid and semi-arid lands to prevent desertification.
- Discourage planting water-intensive trees in arid areas, except in waterlogged regions.
- Promote the use of local and hybrid livestock species adapted to arid and desert ecosystems.
- Encourage sand dune stabilization and soil moisture conservation techniques in desert areas.
- Establish and maintain protected areas in desert regions of the province.
- Advocate for water conservation practices in arid and hyper-arid zones.
- Conserve the arid and hyper-arid areas of Southern Punjab to support vulnerable communities dependent on desert ecosystems.

e) Protected areas

- Establish additional protected areas within the province focusing on ecological criteria and climate considerations.
- Enhance the resilience of existing protected areas through effective ecological management plans.
- Seek funding opportunities and engage in national-level initiatives such as the Protected Areas Initiative 2020.
- Develop mechanisms to incentivize land use for protection and involve local communities, including women, in conservation efforts.

5.1.3 Disaster Preparedness, Management, Emergency Response

- Develop climate and Multi-Hazard, Vulnerability and Risk Assessment (MHVRA) profiles to inform the formulation of gender-responsive, risk management action plans for all districts of Punjab.
- Strengthen the disaster risk management through latest and more efficient forecasting and early warning systems as well as the dense observational hydro-meteorological networks, with special attention to the geographically vulnerable population.
- Build institutional capacities to carry out district-wise climate modeling periodically to get updated climate change projections, enabling timely upgradation and implementation of disaster management plans.
- Ensure the coherence of provincial and district level multi-hazard climatic risk management and contingency plans.

- Maintain accurate records of seasonal patterns, temperature and precipitation for each agro-ecological zone and ensure public disclosure of information and cross-sectoral data sharing.
- Enhance flood preparedness by building the flood-resilient infrastructure, strengthening and enhancement of barrage capacity, retarding basins and providing escape channels, etc.
- Develop and regularly update the district-wise heatwave management and emergency response plans, based on hotspot identification and climate models
- Strengthen interdepartmental coordination for disaster management by defining clear roles and responsibilities.
- Strengthen the enforcement regime to avoid encroachments in floodplains.
- Prevent climate-induced migration and displacements through effective disaster preparedness, management and response.
- Seek private-sector as well as the foreign funding and investments to strengthen the disaster management regime in province.
- Ensure integration of disaster risk management development planning and implementation.
- Analyze how floods, droughts, and heatwaves impact women, men, and children differently due to social roles, access to resources, and mobility. Develop action plans addressing their specific needs.
- Ensure effective outreach of women in communication, considering their cultural sensitivities, and addressing safety concerns like Gender Based Violence (GBV) risk in shelters.
- Train household women in first aid, disaster preparedness, and livelihood restoration to enhance community resilience for climate-induced disasters.

5.1.4 Human Health

- Conduct comprehensive needs assessments within the healthcare sector to identify infrastructure, human resource, and financial requirements necessary for effective management and response to climate-induced disasters and diseases.
- Ensure the integration of measures addressing climate change-related health issues into provincial health strategies and plans.
- Strengthen forecasting and monitoring systems for climate-related diseases to anticipate potential health impacts of climate change, facilitating proactive planning.
- Enhance systematic data collection, analysis, and dissemination of health advisories on climate-related diseases across all levels of service delivery.
- Ensure access to essential resources such as clean drinking water during climate-related extreme events.
- Prioritize the assessment of climate risks to Water, Sanitation, and Hygiene (WASH) infrastructure, seeking sustainable and climate-resilient solutions.
- Foster climate change resilience in the health sector through public-private partnerships.
- Improve the distribution of health facilities to ensure equitable access for women in both urban and rural areas.
- Address gender-specific health needs, including maternal healthcare and reproductive services, in disaster preparedness and resource allocation.
- Train women as community health workers to strengthen community-based surveillance, response systems, and health-related information dissemination.

- Disseminate easily understandable health advisories on climate-related diseases tailored to women and vulnerable populations, considering literacy levels and language preferences.
- Conduct media and awareness campaigns to educate healthcare professionals and the public about the health impacts of climate change.

5.1.5 Biodiversity

Ecosystem based Adaptation is a key to adopt climate change measures for conservation, sustainable management and restoration of ecosystems.

- Draft Biodiversity Action Plans (BAPs) for cities/districts, aligning with the National Conservation Strategy and relevant Multilateral Environmental Agreements.
- Establish nature reserves, botanical gardens, and gene banks across all districts for recreational and educational purposes, while enhancing awareness and capacity-building among relevant institutions, NGOs, CSOs, communities, and conservationists.
- Monitor and enhance understanding of climate change impacts on biodiversity using modeling techniques to assess vulnerability of priority species. Develop an updated flora and fauna inventory for Punjab with IUCN classifications for improved planning and management.
- Strengthen biodiversity conservation efforts amidst urban expansion and housing developments.
- Integrate biodiversity conservation across various disciplines and sectors for more efficient management.
- Provide training and engage local communities, including men, women, and children, in biodiversity conservation and sustainable practices.
- Empower women through income-generating activities linked to women-led community gardens within green belts, promoting sustainable urban agriculture.
- Establish botanical gardens specifically for women, offering training and educational opportunities.
- Manage and mitigate invasive species proliferating due to climate change, employing integrated pest management techniques for pest control, such as locusts.
- Monitor trends in climate-induced local and trans-boundary migrations and extinctions of native species, taking measures to create favorable environments for threatened species.

5.1.6 Socio-economic Issues

a) Poverty

- Integrate the poverty-climate change connection into provincial social protection policies and growth strategies, ensuring sustainable development that meets the needs of the poor.
- Target poverty alleviation policies and programs, specifically towards the vulnerable groups, enabling them to survive in the changing climate
- Expand and implement provincial population planning initiatives.
- Diversify livelihood options for vulnerable rural communities, promoting socio-economic stability and reducing climate-induced migrations through access to suitable agricultural technologies and credit facilities.
- Strengthen community-level climate change adaptation measures for enhanced natural resources management.
- Provide incentives to rural communities contributing to natural resource management.

b) Gender:

- Mainstream gender perspectives into provincial climate action.
- Establish women's focus groups to assess their vulnerabilities and contributions to ecosystem sustainability.
- Recognize and value women's contributions to natural resource usage and management.
- Study gender-specific impacts of climate change, focusing on provincial adaptation and mitigation strategies.
- Develop gender-sensitive criteria and indicators for adaptation and vulnerability.
- Ensure women's adequate participation in decision-making processes regarding climate change initiatives.
- Implement actions outlined in Pakistan's Climate Change Gender Action Plan and Punjab Women Development Policy.
- Encourage and educate women on household resource conservation.
- Promote equitable resilience for women and men through gender-responsive disaster risk reduction plans.
- Introduce green skills development programs for women in formal and informal sectors.
- Ensure equal opportunities for women in climate resilience, adaptation, and mitigation job markets.

c) Climate Justice:

- Adopt a participatory, transparent, and accountable approach to climate change decision-making and policies.
- Initiate special programs for disabled individuals, especially women, providing education, job creation, and skills development opportunities.
- Educate vulnerable communities about green lifestyles and climate risks, empowering them to take climate action.
- Advocate for equitable distribution of climate-related burdens and benefits.
- Provide employment opportunities and compensation for workers displaced by climate-related projects.
- Seek international cooperation and foreign funding for climate justice programs in the province.

5.2 Climate Change Mitigation and Low Carbon Development

Pakistan, in its revised Nationally Determined Contributions (NDCs), has pledged to cut its greenhouse gas (GHG) emissions by 50% by 2030. This ambitious goal includes generating 60% of the nation's energy from renewable sources, transitioning 30% of its vehicles to electric, and phasing out imported coal for power generation. Punjab is fully committed to supporting the nation's endeavors by implementing targeted policies across various sectors, including energy, industry, transportation, and waste management, among others.

5.2.1 Energy

- Formulate a provincial energy policy aligning with the measurse outlined in the Alternate & Renewable Energy Policy (ARE 2019), tailored to provincial and local contexts.
- Cultivate a supportive political, regulatory, and financial landscape to bolster the integration of Alternate and Renewable Energy (ARE) resources into Punjab's energy portfolio, expediting the transition to renewable energy sources.

- Explore cleaner power generation technologies to diminish reliance on coal-based electricity production, ensuring coal-fired power plants operate at peak efficiency and are adaptable for CO2 capture and storage retrofitting.
- Evaluate potential greenhouse gas emissions stemming from proposed and existing provincial energy policies, strategies, and plans, incorporating this data into future energy planning initiatives.
- Harness opportunities for renewable and solar energy generation by fostering partnerships with the private sector.
- Stimulate renewable energy markets through incentivization and supportive frameworks. Subsidize projects promoting energy efficiency and conservation.
- Attract investments to facilitate off-grid renewable energy expansion in rural and remote agricultural and irrigation regions.
- Promote efficient energy management systems and interventions, such as net metering, household solar installations, and smart grids, to encourage the adoption and development of renewable energy sources. Advocate for the deployment of energy-efficient appliances across households, governmental, and private establishments, as well as irrigation, agricultural zones, and industries.
- Introduce the concept of green taxation or eco-taxation to incentivize sustainable energy practices.
- Facilitate the establishment of carbon crediting mechanisms within the energy sector.
- Encourage a behavioral shift towards energy efficiency and conservation among stakeholders.
- Implement energy efficiency audits, standards, and labeling regimes to enhance energy performance.
- Switch to off-grid renewable energy sources for cooking and lighting applications.

5.2.2 Industry

- Revise the Punjab Industrial Policy 2018 to incorporate climate change and greenhouse gas emission considerations, fostering climate-resilient industrial growth in the province.
- Strengthen and raise awareness among industrial sectors regarding the adoption of environmentally friendly technologies and green practices. Encourage regular Energy and Resource Efficiency Audits to promote sustainable resource management.
- Advocate for the implementation of cap-and-trade systems, carbon crediting mechanisms, polluter pays principles, and greenhouse gas emission standards through regulatory reforms.
- Conduct comprehensive assessments to establish greenhouse gas emissions profiles for all manufacturing industries and SMEs in the province.
- Provide support to industries for the adoption of Resource Efficiency and Cleaner Production (RECP) technologies, particularly focusing on reducing greenhouse gas emissions and smog-forming pollutants.
- Promote the transition towards a circular economy model and the adoption of Extended Producer Responsibility (EPR) principles. Stimulate market demand for recycled products to encourage sustainable consumption patterns.
- Harness the potential of local labor forces to minimize fuel consumption and enhance energy efficiency within industrial operations.

5.2.3 Transport

- Integrate climate risk planning into provincial transportation policies, strategies, and plans to promote a clean energy mix and embrace low-carbon transportation technologies, including non-motorized modes.
- Develop a comprehensive GHG emissions inventory for the transport sector across all districts of

Punjab and devise specific action plans to address emissions reduction targets.

- Establish and enforce stringent vehicle emission standards, emphasizing the use of energy-efficient transportation options. Implement vehicle fitness testing to ensure compliance.
- Implement demand management measures to discourage private vehicle usage through pricing and non-pricing controls. Simultaneously, invest in upgrading and expanding public transport and railway networks.
- Deploy technological solutions to reduce GHG and other emissions from motorized vehicles, securing necessary financing for their implementation.
- Transition to less carbon-intensive and cleaner fuels while ensuring the fuel efficiency of public transport systems across the province.
- Promote the adoption of electric vehicles in alignment with Pakistan's Nationally Determined Contributions (NDCs) and the National Electric Vehicle Policy 2019.
- Raise awareness and promote a behavioral shift among commuters to consider climate change impacts across all dimensions of travel, including demand management, vehicle maintenance, and fuel efficiency. Encourage the use of non-motorized vehicles wherever feasible.
- Facilitate the use of mass transport systems, ensuring accessibility for women, children, and persons with disabilities.

5.2.4 Waste

- Implement integrated waste management, treatment, and disposal systems for all types of waste.
- Promote the 5Rs concept (Rethink, Refuse, Reduce, Reuse, Recycle) in waste management, emphasizing its climate co-benefits.
- Encourage the development and adoption of waste-to-energy technologies to convert waste into renewable energy sources, further reducing the sector's impact on climate change.
- Strengthen regulatory frameworks and enforcement mechanisms to ensure compliance with waste management standards and guidelines, with penalties for non-compliance.
- Foster public-private partnerships to innovate waste management solutions and infrastructure, including recycling facilities and waste processing plants.
- Advocate for environmentally sound solid waste management facilities, such as scientific landfills equipped with methane control systems.
- Provide capacity building and training for waste management personnel to enhance their skills and knowledge of best practices, improving the sector's performance in addressing climate change.
- Empower women through training in waste management, recognizing their crucial role at the household level.
- Launch public awareness campaigns on waste management, with active involvement of women in dissemination efforts.

5.3 Cross-cutting Areas

5.3.1. Agriculture and Livestock

a) Agriculture

<u>Adaptation</u>

Climate Smart Agriculture:

- Advocate for the adoption of Climate Smart Agricultural practices across all focus areas identified

in the Punjab Growth Strategy 2023.

- Develop new high-yielding, heat-resistant, drought-tolerant crop varieties with increased resistance to precipitation changes and insect/pest attacks.

Climate Vulnerability Mapping:

- Map the geographical distribution of climate change vulnerabilities in the agriculture sector and regularly update agro-ecological and agro-climatic zones accordingly.
- Establish a robust risk management system to mitigate crop failures resulting from climate-induced extreme events.

Extension System Enhancement:

- Enhance the extension system and utilize ICT for effective and timely communication of climatic predictions and corresponding advice to farming communities.
- Encourage diversification of crops, particularly in rain-fed areas, to mitigate crop failure risks associated with monoculture farming.

Drought Management and Soil Quality:

- Promote agricultural drought management practices that acknowledge drought as a component of highly variable climate conditions.
- Enhance soil quality through adoption of best soil management practices, addressing potential degradation caused by hydrological implications of climate change.

Technological Advancements:

- Adopt advanced seed germination and management practices.
- Implement technological advancements to enhance irrigation efficiency and farm practices.

Pest and Weed Control:

- Promote integrated pest management practices while reducing reliance on pesticides.
- Improve weed control practices to enhance harvest efficiency, crop quality, and yield.

Capacity Building and Gender Inclusion:

- Build the capacity of farmers, including women, in climate smart agriculture through climate-oriented agricultural extension services.
- Incorporate knowledge and experiences of both male and female farmers in agricultural research and planning to facilitate adaptation to changing climate conditions.

Market Access and Indigenous Knowledge:

- Improve physical access to markets and market information, especially for small and landless farmers.
- Document and promote appropriate indigenous knowledge and best practices in agriculture.

Mitigation

- Explore methods to reduce nitrous oxide release from agricultural soils.
- Promote the use of green manure and improve manure storage and management practices.
- Encourage the development of biogas and manure digesters for methane reduction and energy production.
- Manage water in rice paddies to control methane releases and introduce low water-dependent rice varieties.
- Promote the cultivation of crops for biofuel production and advocate for zero-tillage farming to mitigate methane emissions.
- Build the capacities of relevant institutions, ensuring fair representation of women, to undertake

appropriate mitigation actions to reduce GHG emissions from the agriculture sector.

b) Livestock

Adaptation

- Strengthen livestock extension services to provide farmers with up-to-date information and guidance on climate-resilient practices.
- Develop systems for reporting livestock productivity and disease outbreaks, capable of forecasting trends and identifying climate change-related vulnerabilities.
- Implement adequate food and fodder management practices to ensure the sustainability of livestock in changing climatic conditions.
- Design water and heat management plans tailored to farms in hyper-arid areas of the province to mitigate the impact of extreme heat on livestock.
- Develop climate-resilient livestock breeds that are adapted to heat, diseases, and other climate-related challenges, leveraging indigenous knowledge.

Mitigation

- Advocate for climate-smart livestock development strategies, including improved husbandry practices, breed selection, and feed quality enhancement.
- Encourage farmers to use suitable feed mixes and additives to reduce methane production from enteric fermentation in cattle, thereby mitigating greenhouse gas emissions.
- Enhance manure and compost management practices to minimize methane emissions and maximize nutrient recycling.
- Incorporate indigenous knowledge, including insights from women, in the designation of alternative pastures, considering their understanding of local weather patterns and grazing needs.

5.3.2. Forestry

a) Adaptation

- Conduct regular forest cover assessments using advanced techniques such as GIS and remote sensing to inform evidence-based decision-making.
- Implement afforestation and reforestation programs to enhance forest cover and biodiversity, promoting ecosystem resilience.
- Enhance land use planning and zoning to conserve and expand tree cover, aligning with sustainable development objectives.
- Promote farm forestry and agro-forestry practices, integrating multipurpose tree species to enhance land productivity and support local livelihoods.
- Initiate pilot projects to address adaptation challenges in the forestry sector, fostering innovation and knowledge sharing.
- Establish criteria for sustainable forest management in protected areas and public spaces, ensuring biodiversity conservation and ecosystem integrity.
- Develop area-specific adaptive forest management strategies, engaging local communities and stakeholders to enhance ownership and effectiveness.
- Encourage sustainable forest management practices in protected areas and public spaces, emphasizing ecosystem services and climate resilience.
- Implement water and soil management strategies to support forest conservation efforts, safeguarding natural resources and mitigating climate risks.

- Strengthen regulatory measures to combat illegal timber trade and deforestation, promoting governance and accountability.
- Launch projects and initiatives to promote sustainable utilization of non-timber forest products, enhancing economic opportunities and forest conservation.
- Discourage unsustainable use of forests for fuel and firewood, promoting clean energy alternatives and reducing pressure on forest resources.
- Establish effective mechanisms to protect the rights and interests of vulnerable forest-dependent communities, ensuring inclusivity and social equity.
- Improve forest health through comprehensive research programs on forest pathology, entomology, water management, flood risk management, soil conservation, etc., fostering scientific innovation and adaptive management practices.
- Expand protected areas to safeguard biodiversity and ecosystem services, promoting landscape-scale conservation.
- Engage in multilateral initiatives such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation) to leverage international support for forest protection and sustainable management efforts.

b) Mitigation

- Develop a robust forest carbon accounting system to accurately assess changes in carbon stocks in forest areas to promote carbon crediting mechanisms, facilitating financial incentives for forest conservation and management.
- Maximize the potential of carbon sequestration by implementing reforestation and afforestation programs, restoring degraded forest ecosystems, and protecting existing natural carbon sinks. Prioritize the preservation of old-growth forests and intact ecosystems to optimize carbon storage capacity.
- Utilize cultivable wasteland as a carbon sink by implementing agroforestry and reforestation initiatives. Foster the accumulation of organic soil matter through sustainable land management practices, such as conservation agriculture and agroecology, to enhance soil carbon sequestration.

5.3.3. Urban Planning

a) Adaptation

- Advocate for Decision Support Systems to guide climate adaptation and sustainable urban development across all development schemes.
- Develop climate-resilient master plans for major metropolises to enhance urban resilience to climate change impacts.
- Prioritize the development of climate-resilient infrastructure in smaller agro-based towns and peripheral urban areas.
- Promote climate-resistant urban infrastructure, including roads and water supply systems, capable of withstanding and recovering from climate-related disruptions.
- Enhance transport safety and resilience to natural disasters, ensuring safe travel for all users and surroundings through preventive and adaptive measures.
- Foster women-friendly transport modes to address gender-specific travel needs and promote sustainable urban mobility.
- Implement integrated waste management systems in urban planning to address waste disposal challenges sustainably.

- Promote sustainable water management strategies and stormwater drainage, particularly in urban areas prone to climate-related hazards.
- Encourage housing development in areas less susceptible to floods and other climatic extremes or natural hazards.
- Invest in cost-effective Nature-based Solutions to mitigate vulnerabilities to climate events, focusing on heat waves, floods, and droughts.
- Upgrade storm drainage capacity in major cities to accommodate intensifying precipitation patterns driven by climate change.
- Engage women in the development of green urban infrastructure, such as parks and community gardens, to mitigate heat island effects and enhance groundwater recharge.

b) Mitigation

- Promote community participation in urban afforestation initiatives to enhance green cover and biodiversity.
- Ensure the inclusion of wastewater treatment plants in all urban sewerage schemes to mitigate pollution and protect water resources.
- Mandate the installation of solar water heaters in commercial and public buildings to promote renewable energy use and reduce carbon emissions.
- Implement urban planning and transport schemes aimed at reducing cities' carbon and air pollution footprint.
- Enforce the measures outlined in Punjab's clean air policy and action plan to improve air quality in urban areas.
- Encourage urban densification and green development to optimize land use and enhance environmental sustainability.
- Expand green belts and urban forestry to create carbon sinks and improve urban ecosystems.
- Incentivize the private sector to design zero-emission buildings using renewable energy technologies to promote sustainable development.

6. Climate Change Communication, Education and Awareness

Effective climate communication, awareness, education, and outreach are essential to foster behavioral change in response to climate challenges. It is crucial to instill a sense of ownership among the public to encourage their active participation in climate action. To achieve this goal, the government will undertake the following measures in the realm of climate change communication, awareness, and education:

6.1. Climate-Communication and Outreach

- Design and implement climate communication and outreach programs, oriented around both the mitigation and adaptation perspectives, targeting audiences at all levels of the society, utilizing the media and different communication tools.
- Mobilize the district-level, gender-responsive communication groups (individuals, communities, interest groups, non-profit organizations and NGOs) for climate-communication and outreach within their social circles and community networks.
- Develop two-way communication forums, enabling the public to coordinate with the government regarding climate-induced issues

6.2. Climate Awareness

- Engage print, electronic and social media in disseminating important and timely information to public regarding the current climate change situation and impacts in the province.
- Publish an environmental calendar and adopt “Climate Day”.
- Develop learning sessions for peer-to-peer exchange of knowledge and information on climate related activities for each sector at international, national and provincial levels.
- Identify, engage and support Non-Government Organizations (NGOs), Community-Based Organizations (CBOs) and Climate Activists in their efforts to raise awareness in different community groups.
- Launch awareness raising campaigns on climate awareness with active participation of women
- Provide climate change related information to general public, especially the women, with a target of behavior change in switching to low-carbon lifestyles.

6.3. Climate Education

- Children - Learning from lap to be able to educate next generations
- Introduce well-designed climate change educational programs throughout the province by integrating climate change science, research and information into curriculum and academic frameworks of different grade levels of schools, colleges and universities.
- Promote the expansion of activity – based learning on climate change at school and higher education levels which may inter alia include the learning through story books, board games, quiz games, puzzles, guides, videos and mobile applications.

7. Research and Development

Research and development play an undeniable role in both adapting to and mitigating climate change. Given the complex and diverse nature of climate change and its impacts, targeted and continuous research across various disciplines is imperative. The government has identified the following measures to advance research and development in the context of climate change:

- Conduct empirical and applied research to understand Punjab's sectoral and regional contributions to and vulnerabilities from climate change.
- Undertake research and development, including demonstration projects, to promote climate-friendly technologies for both mitigation and adaptation.
- Utilize prediction models and advanced technologies to assess regional vulnerabilities to climate change.
- Foster collaboration with international scientific organizations to enhance research on climate change-related issues.
- Employ gender-sensitive vulnerability assessment tools and methodologies to evaluate the impact of climate change on economically vulnerable sectors in Punjab.
- Assess the specific impacts of climate change on women, including their contributions to sectors, infrastructure, employment, demographics, resource utilization, and socioeconomic well-being.

8. Capacity Building

Capacity building is essential to empower stakeholders with the knowledge, skills, and resources needed to effectively address climate challenges. It enables individuals, communities, and institutions to understand and respond to climate impacts, fostering resilience and adaptation. By strengthening capacity, governments

and organizations can implement climate actions more efficiently, promote sustainable development, and achieve long-term climate goals. The government envisions following measures for capacity building in climate change context:

- Build provincial capacity to gauge the quantum and nature of climate change in Punjab for reliable climate change vulnerability assessments in various sectors, particularly water and agriculture.
- Promote mechanisms for strengthening and raising the institutional, systemic and individual capacity- building to implement the actions to achieve SDG – 13.
- Cultivate a cadre of climate change professionals by facilitating the enrollment of young scientists and students in esteemed international institutions for advanced studies.
- Foster a culture of knowledge-based management and collaboration with leading climate change research organizations globally, ensuring our nation benefits from cutting-edge scientific advancements.
- Enhance the expertise of emerging professionals in climate services, equipping them to provide essential research and technical support to policymakers.
- Conduct comprehensive assessments of capacity and competency needs related to climate change across all sectors at both provincial and district levels.
- Forge strategic partnerships with provincial and national entities dedicated to climate change, pooling human, technological, and financial resources for maximum impact.
- Develop inclusive capacity-building initiatives, integrating gender perspectives into existing training programs offered by academic and technical institutes.
- Facilitate multi-stakeholder engagement, involving gender experts, researchers, policymakers, and community representatives, to facilitate dialogue and advance gender-responsive approaches to climate change adaptation.
- Design and deliver training modules focused on the gender dimensions of climate change, fostering gender equality and empowering women to actively contribute to climate action.

9. Climate Governance

The climate governance in Pakistan finds its origin from the country's participation in the UN Conference on Sustainable Development held in Rio in 1992. As a signatory to the Rio Convention, Pakistan also signed and ratified the UNFCCC, Kyoto Protocol and Paris Agreement. Pakistan submitted its updated Nationally Determined Contributions in 2021 in line with Paris Agreement. National Climate Change Policy was adopted in 2012, recently updated in 2021. The NDCs envision formulation of provincial climate change policies, strategies and action plans by 2024.

In Punjab, there is no existing law or policy on climate change. The Punjab Government Rules of Business (1974) do not list the climate change governance among the responsibilities of any department. Government agencies, particularly at the provincial level, lack conceptual clarity on climate change. There is evidence that climate change is not a priority concern for the executive. Action on climate change is generated by judicial interventions or donor-led projects[34].

- Enact legislation addressing the urgent issue of climate change, updating pertinent laws across relevant sectors to effectively mitigate its impacts, and instituting mechanisms for legislative

[34] Environmental and Climate Governance Assessment Report (2021) by Sub-National Governance (SNG)

accountability to ensure robust implementation.

- Amend the rules of business governing all provincial departments to explicitly include responsibilities pertaining to climate action, thereby integrating climate considerations into governmental operations.
- Advocate for the establishment of accessible and tailored Performance Standards applicable to all sectors contributing to greenhouse gas emissions, promoting measurable progress towards emission reduction targets.
- Foster an enabling environment for the growth of green jobs, creating pathways for employment in sectors that support sustainable practices and contribute to climate resilience.
- Establish a dedicated Cabinet Task Force on climate change, housed within the Environment Protection and Climate Change Department (EPCCD), to provide essential support and coordination on climate-related matters across government departments.
- Promote gender-inclusive decision-making processes at every level, from policy formulation to implementation, ensuring meaningful participation of women in climate governance for more effective and equitable outcomes

10. Institutional Strengthening

Institutional strengthening through uplifting the existing institutions with relevant resources and establishing new ones is inevitable to derive tangible outcomes from climate change policies and plans. Following measure will be taken in this regard:

- Establish dedicated institutional framework and support centers for conducting regular situational analyses, vulnerability assessments, climate modeling, and GHG emissions monitoring at the government level.
- Secure technical and legislative support to establish climate change research institutes at the district or provincial level in Punjab.
- Implement the Punjab Fair Representation of Women Act, 2014 while bolstering the public institutions engaged in climate action.
- Provide training and support to officials and experts at provincial, national, and international levels to enhance their capacity on climate change issues and in developing climate change related projects, schemes, and programs.
- Strengthen institutional capacities for disaster mitigation and preparedness at provincial and district levels, including assessing economic implications of climate change impacts.
- Enhance institutional capacities in using GIS and Remote Sensing tools for monitoring temperature variations, precipitation trends, flood forecasting, and topographical changes over time.
- Develop robust coordination mechanisms with government departments and stakeholders for integrated climate change management efforts.
- Forge partnerships with MOCC's Climate Finance Unit (CFU) for training on climate financing.

11. Technology Transfer

The government shall take following measures for climate adaptation and mitigation in terms of technology development and transfer.

- Conduct empirical and applied research to assess both sectoral and regional contributions to and vulnerabilities from climate change in Punjab.

- Engage in research and development to demonstrate climate-friendly technologies for both mitigation and adaptation purposes.
- Utilize prediction models and technologies to identify regional vulnerabilities to climate change.
- Foster collaboration with international scientific organizations to expand research on forest-related adaptation in Punjab.
- Invest in cutting-edge technologies to support sustainable development, enhance climate resilience, and promote environmental conservation.
- Harness the potential of IoT technology and artificial intelligence for climate modeling, monitoring, and evidence-based decision-making.
- Establish and manage a centralized digital climate change database at the provincial level.
- Validate the results from simulation modeling experiments for inter- annual and decadal climatic projections, seasonal forecasts, and predictions of climate extremes in the province.
- Promote the adoption of city-specific climate and air quality monitoring systems by public and private sectors, including government offices, educational institutions, and healthcare facilities.
- Promote gender mainstreaming by ensuring equitable access to technology and providing training on the use of various technologies for climate change mitigation and adaptation

12. . Finance

The Government of Punjab shall adopt a coordinated climate-finance approach to reinforce existing climate-oriented development and access new avenues for climate-innovations through the following policy measures:

- Collaborate closely with the Ministry of Climate Change's Climate Finance Unit to effectively tap into national and international climate finance opportunities.
- Spearhead efforts to mobilize ample resources from both public and private sectors, with a focused emphasis on private sector engagement, to bolster climate actions across within the province.
- Uphold the equity, justice, and fairness as paramount principles for decision-making in climate finance, particularly in the allocation and distribution of resources, with a deliberate focus on the unique needs of vulnerable communities.
- Implement gender-responsive climate budgeting within Punjab's fiscal policies.
- Strengthen institutional capacity within the public sector to proficiently plan, administer, and monitor climate finance, ensuring optimal utilization of resources for climate action.
- Embed climate change considerations into all levels of operational and developmental planning throughout the province, ensuring alignment between climate action and broader developmental objectives at national and international levels.
- Embrace climate change-focused interventions outlined in the Punjab Green Financing Strategy, including fiscal measures, to drive impactful climate action.
- Foster transparency and accountability in climate finance endeavors to uphold their effectiveness and earn public trust.
- Create a climate fund to support research in sustainable technology and solutions, leveraging investments to promote technology transfer and stimulate innovation for resilience and adaptation.
- Develop a robust carbon pricing framework within the province and establish a provincial emissions trading system clearinghouse to effectively manage carbon emissions.
- Cultivate strong public-private partnerships and engage with international development

organizations to maximize the impact of climate actions across various sectors.

- Allocate a specific percentage of funds for women's participation in projects or initiatives wherever possible to ensure their inclusion and empowerment in climate action efforts.

13. Coordination and partnerships

Coordination and partnerships are vital for effective climate action as they enable the pooling of resources, expertise, and efforts from diverse stakeholders. By coordinating actions across government departments, agencies, and sectors, and forming partnerships with civil society, private sector, federal government and international organizations, the impact can be amplified, efficiency maximized, and innovation fostered in tackling climate change. Government of Punjab is committed to taking proactive measures to ensure coordination and bolster partnerships for effective climate action.

- Seek assistance from the Federal Government in localizing the climate change projections and targets for meeting with national and international obligations related to climate change.
- Coordinate Punjab's stance on financial and technical needs and priorities with the Federal Government for onward representation of the province in international climate forums.
- Conduct regular coordination meetings among provincial bodies, local authorities, and communities to share information and prioritize climate actions.
- Encourage joint planning and implementation of climate projects to maximize impact and avoid duplication of efforts.
- Foster partnerships with civil society and private sector entities to leverage expertise and resources in advancing climate resilience initiatives.
- Strengthen coordination mechanisms between the provincial government and federal authorities to align climate initiatives and policies across different administrative levels.
- Establish a provincial climate action coordination unit tasked with overseeing and streamlining climate-related efforts across government agencies and stakeholders.
- Foster collaboration with indigenous communities and traditional knowledge holders to integrate local perspectives and practices into climate adaptation and mitigation strategies.

14. International and Regional Cooperation

In order to achieve international and regional cooperation in climate change context, the Government of Punjab shall take the following measures:

- Foster regional partnerships for climate action, enhancing institutional linkages with key international organizations like UNFCCC, UNEP, and IPCC, ensuring gender-balanced representation.
- Accelerate innovation in climate-friendly technologies and practices through joint research projects, while exploring diverse funding sources to ensure gender-inclusive responses.
- Develop cross-border adaptation plans for climate-vulnerable regions and promote female student participation in international university exchange programs, especially in climate change studies.
- Harmonize climate policies with neighboring countries, promoting gender equality in climate initiatives and cooperation with international organizations.
- Support capacity building and technology transfer in developing regions, emphasizing women's leadership in climate action.

- Coordinate diplomatic efforts to advance ambitious climate goals, advocating for gender-inclusive responses and educational opportunities for female students.
- Implement collaborative approaches for transboundary natural resource management, integrating gender considerations into conservation efforts.
- Establish regional climate funds to mobilize resources for climate projects, prioritizing gender-inclusive initiatives and opportunities for female students in the climate change discipline.

15. Policy Implementation Mechanism

15.1 Environmental Protection and Climate Change Department (EPCCD)

The Environmental Protection and Climate Change Department will serve as the institutional focal point for managing climate change at the provincial scale. It will develop a comprehensive provincial Climate Change Action Plan aligned with the overarching policy, delineating clear and time-bound roles and responsibilities for both public and private sectors within the province, along with a structured financial framework. EPCCD will assume the role of coordinator for implementing the policy and action plan in Punjab.

15.2 Provincial Climate Change Policy Implementation Committee (PCCPIC)

The Provincial Climate Change Policy Implementation Committee (PCCPIC) (refer to Table 3) will oversee the smooth execution of the policy and action plan, in addition to supervising the development of a climate database aimed at establishing quantifiable targets. The PCCPIC will meet biannually, ideally prior to finalizing the annual development program and at the conclusion of the financial year, to monitor policy implementation progress and recommend any necessary corrective measures to achieve the policy's goals and objectives. Moreover, the committee will maintain communication with the National Climate Change Policy Implementation Committee established under the National Climate Change Policy as and when necessary.

Table 3: Composition of Punjab Climate Change Policy Implementation Committee

Minister for Environment, Government of the Punjab	Chair
Chairman, Planning and Development Board, Government of the Punjab	Co- Chair /Member
Representative from the Ministry of Climate Change, Pakistan	Member
The Secretaries to the Government of the Punjab, Environment Protection and Climate Change Department Agriculture Department Forest, Wildlife and Fisheries Irrigation Department Local Government and Community Development HUD and PHE Department Energy Department Higher Education Department School Education Department Information and Culture Department Social Welfare and Bait-ul-Maal Department Women Development Department	Members

Industries, Commerce, and Investment Department Finance Department Department of Emergency Services	
Chief Executive Officer (CEO), The Urban Unit, P&D Board, Punjab	Member
Chairman, Punjab Information Technology Board	Member
Director General, Provincial Disaster Management Authority, Punjab	Member
Three representatives from corporate sector/Chambers of Commerce and Industries	Member
Three representatives from Civil Society Organizations/NGOs/Public Interest Groups	Member
Three eminent environment & climate experts from the private sector	Member
Three representatives from Academia	Member
Chief Meteorologist, Pakistan Meteorological Department	Member
General Manager, SUPARCO	Member
Director General, EPA Punjab	Member/ Secretary

Note: The committee shall have fair representation of women

15.3 Monitoring and Evaluation

EPCCD will serve as the focal point for monitoring and evaluating the implementation of the policy and action plan. A comprehensive monitoring data portal will be established by EPCCD to collect data on sectoral initiatives, targets, achievements, budget allocations, expenditures, and planned activities related to climate change adaptation and mitigation, as outlined in the policy and action plan. This data will be compiled into annual Climate Reports, which will be evaluated by the PCCPIC.

15.4 Reporting, Review and Updation

Provincial departments and attached departments responsible for the identified sectors will regularly report on the progress of policy implementation to the Provincial Climate Change Policy Implementation Committee through EPCCD. This policy document is considered a 'living' document and will undergo review and updating every three years or as necessary by the Government to address emerging concepts and issues in the continually evolving science of climate change.

16. GLOSSARY[2]

1. **Adaptation**: Strategies and measures implemented to reduce the vulnerability of communities, ecosystems, and infrastructure to the impacts of climate change.
2. **Biodiversity**: The variety of life (flora and fauna), including species diversity.
3. **Black Carbon**: Black carbon, often referred to as soot, constitutes a segment of fine particulate matter in air pollution, known as PM2.5. It originates from the incomplete combustion of wood and fossil fuels, a process that generates carbon dioxide (CO_2), carbon monoxide, and volatile organic compounds.

4. **Carbon Pricing**: A policy instrument that assigns a cost to carbon emissions, either through taxes, emissions trading systems (such as cap-and-trade), or other mechanisms. Carbon pricing aims to internalize the external costs of greenhouse gas emissions and incentivize emission reductions.
5. **Climate Change**: Refers to long-term shifts in temperature, precipitation patterns, and other aspects of Earth's climate, largely resulting from human activities such as the burning of fossil fuels and deforestation.
6. **Climate Finance**: Financial resources provided by governments, international organizations, and private entities to support climate change mitigation and adaptation activities. Climate finance may include grants, loans, and investments in renewable energy projects, adaptation measures, and capacity-building initiatives.
7. **Climate Justice**: The principle that the impacts of climate change and efforts to address it should be equitable and fair, particularly considering the disproportionate burden borne by vulnerable populations and future generations. Climate justice advocates for the rights of marginalized communities and the recognition of historical responsibilities for greenhouse gas emissions.
8. **Energy Efficiency**: The practice of reducing energy consumption while maintaining or improving the same level of output or service.
9. **Greenhouse Gases (GHGs)**: Gases that trap heat in the Earth's atmosphere, contributing to the greenhouse effect and global warming. Common greenhouse gases include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
10. **Mitigation**: Actions taken to reduce or prevent the emission of greenhouse gases and their effects on the climate system.
11. **Renewable Energy**: Energy derived from sources that are naturally replenished, such as sunlight, wind, and biomass. In Punjab’s context, renewable energy technologies include solar photovoltaic panels, and hydropower systems.
12. **Resilience**: The ability of individuals, communities, ecosystems, and infrastructure to withstand and recover from the impacts of climate change, natural disasters, and other shocks or stresses.
13. **Vulnerable Groups**: Populations that are disproportionately susceptible to the impacts of climate change due to factors such as socioeconomic status, geographic location, age, gender, disability, or indigenous and minority status. Vulnerable groups may face heightened risks from extreme weather events, food and water insecurity, displacement, and other climate-related hazards. Examples of vulnerable groups include low-income communities, women, children, the elderly, people with disabilities, and indigenous peoples.