

Climate Change

Climate change is caused by an increase of carbon dioxide and other greenhouse gases in earth's atmosphere mostly from fossil fuel emissions. In Pakistan, the environmental degradation and climate change are adversely affecting the economy, livelihood of the poor and sustainable development. On the one hand, growing population, unplanned urban expansion and dependence on natural resources puts immense pressure on environment that triggered climate change. Moreover, lack of public awareness regarding environmental issues and mismanagement of water and solid waste has aggravated the situation. Consequently, Pakistan continues to suffer from a plethora of natural and human induced hazards that threaten the lives and livelihood of its citizens – natural disasters including floods, earthquakes, landslides, cyclones and drought.

The Government of Pakistan has evolved policy frameworks backed by strategy to address various aspects of the climate change including major policy and climate related interventions. In this context, the Ministry of Climate Change (MoCC) has taken different initiatives to mitigate the effects of environment and climate.

Forests, Wildlife & Biodiversity Resources in Pakistan

According to the National Forest Reference Emissions Level (FREL) findings, the country is maintaining 4.786 million-hectare (5.45 percent) area under forest cover. Within the forest cover area, dry temperate forests hold the largest share (36 percent), followed by sub-tropical broadleaved shrub (19 percent), moist temperate (15 percent), Chir Pine (13 percent), Riverine (4 percent), irrigated plantation (4 percent), thorn (3 percent), mangrove (3 percent) and subalpine forests (2 percent). The meager forest cover area due to growing population, and dependence on the natural resources coupled with deforestation have rendered the country one of the most vulnerable to climate change effects. As a result, natural resources are under tremendous pressure owing to change of land use and habitat destruction and consumption of fuel wood and timber extraction. Such pressures have rendered most of the forests of poor and medium density in need of drastic restocking on war footing.

Ten Billion Tree Tsunami Programme (TBTTP)

The implementation of the TBTTP was initiated in 2019 with a total cost of Rs 125.1843 billion for four years (2019-2023) to plant / regenerate 3.296 billion plants across the country. The programme is being implemented by the provincial forest and wildlife departments through MoCC on 50 percent cost sharing basis except AJ&K and GB which

are 100 percent funded by the Federal Government through PSDP. The programme has achieved 579.093 million plants during July-March FY2022 and cumulatively has attained 1586.18 million plants till March 2022. Through this programme 327,877 man months have been employed upto March 2022.

Digital Progress Reporting System for TBTP

MoCC developed a robust digital reporting system to ensure the transparency of TBTP activities. The system captures all activities including block plantation, linear plantation, assisted natural regeneration and nursery management system performed under forest component of TBTP. In addition, Geographic Information Centre (GIS) team of TBTP developed a web-GIS monitoring portal which is capable to visualize the plantation sites geographically with detailed information of the site and processed satellite imagery of pre & post plantation status. Table 1 shows the details of Plants, planted or regenerated under TBTP.

S.No.	Province/Territory	Plantation / Regeneration / Distribution Progress and Targets				Anticipated Progress Till 30 th June 2022
		2019-20	2020-21	Monsoon 2021 Progress	Spring 2022 Target Presented	
1	Khyber Pakhtunkhwa	167.880	223.060	107.230	194.000	692.170
2	Punjab	58.000	10.675	46.242	74.000	188.917
3	Sindh	177.030	231.360	206.980	140.000	755.370
4	Balochistan	2.900	3.202	2.334	13.500	21.936
5	AJK	69.087	41.503	13.217	98.757	222.564
6	GB	4.690	17.700	11.060	20.642	54.092
Total		479.587	527.500	387.063	540.899	1935.049

Source: MoCC

Protected Areas Initiative

The initiative was launched to improve management and governance of 23 protected areas with a total estimated cost of Rs 3.89 billion. The initiative will result in preserving rare fauna / flora and promote eco-tourism. The potential gain of this programme will be reaped with 5,500 new green jobs. Nanga Parbat National Park and Himalayan National Park in GB was inaugurated to achieve the targets envisaged under this initiative. Besides, Tilla Joggian Park and Salt Range National Park are in progress in the Punjab province, whereas the Khyber Pakhtunkhwa has notified new protected areas to support implementation of this initiatives.

Billion Tree Honey Initiative

This initiative is launched as a coherent effort of different Ministries/ Agencies to promote apiculture in the country. It is estimated that the existing forest resource will increase to about 5.5 million hectares after addition of new areas being planted/regenerated under TBTP by FY2022-23. It was estimated that about 10,000 bee keepers were using 300,000 colonies for producing 7,500 metric tons of honey annually. The potential can be enhanced to produce 70,000 metric tons of honey from the same harvest by using modern bee keeping gears, training on latest techniques, standardization/ certification of the product and intensive marketing. It is anticipated that marketing of 70,000 metric tons of honey will generate an income of about Rs 20-25 billion in the national economy and provide about 87,000 green jobs.

The available forest resource shall be used by the bee keepers to produce honey specific to particular flora and shall be branded accordingly. The NAVTTC will provide training to the selected beekeepers along with technical support, follow-up of on-ground activities and product extraction. The certified bee keepers will be provided financial support. The Ministry of Science and Technology shall be responsible for certifying the honey produced under the programme, whereas the Ministry of Commerce shall patent the market brand of ‘Ten Billion Tree Honey’.

REDD+ Readiness and Preparation Project

Reducing Emissions from Deforestation and forest Degradation, conservation of existing forest carbon stocks, sustainable forest management and enhancement of forest carbon stocks is a concept adopted by the countries under United Nations Framework convention on climate change (UNFCCC) in 2010. The concept relates to absorption of atmospheric carbon through forest resource. Due to accumulation of carbon in standing trees their financial value increases. Carbon stocked in forests is traded in carbon markets.

M/o CC is implementing REDD+ Readiness Preparation Project with financial grant of US\$7.81 million received under the Forest Carbon Partnership Facility (FCPF) of the World Bank to complete following four essential elements of the REDD+ in order to fulfill the requirements of accessing result-based payments under REDD+ mechanism. The progress made under the project is as under:

- i. National Forest Reference Emissions Level (FREL) of deforestation was prepared with the technical assessment of the panel of UNFCCC over the period 2004 to 2012, which endorsed by UNFCCC.
- ii. Protocols have been developed for National Forest Monitoring System (NFMS) and Monitoring, Reporting and Verification (MRV) system.
- iii. Framework has been developed for Safeguards Information System (SIS) for REDD+ along with Strategic Environmental and Social Assessment, Environmental and Social Management and Feedback Grievance Redressal Mechanism.
- iv. Draft National REDD+ Strategy has been prepared.
- v. Design of Payment for Ecosystem Services (PES) has been completed for two ecosystems i.e., Mangroves and temperate forests.

Reversing Deforestation and Forest Degradation in High Chilgoza Pine Forests Pakistan - Balochistan Progress

Some of the major achievements of the project over the last two years are given below:

- ⊙ 8,443 households (includes 6,679 men and 1,764 women) have directly benefited from the project out of the total 25,000 households targeted in the project.
- ⊙ Assisted Natural Regeneration on 2153 ha in 14 valleys through 48 enclosures (4 million seedlings) achieved out of the 3,600 ha targeted in the project.
- ⊙ Four Chilgoza Processing units provided to different communities.
- ⊙ Total of 600 sets of Chilgoza cone collection and storage tools procured against the target of 100 sets.

- ⦿ Gasifiers and 2,100 fuel efficient stoves are distributed.
- ⦿ Different communities have planted fruit and forest seedlings on 653 ha (653,000 plants).
- ⦿ Management plans for Chilgoza forests over 26,000 ha have been prepared.

Declaration of Marine Protected Areas

Astola Island was declared as first marine protected area of the Pakistan. In this context, consultative process continued on management planning of Astola Island with the involvement of all stakeholders. Moreover, active consultation is in process with other Ministries like Defense, Maritime Affairs and the Provincial Governments to increase Marine Protected Areas in the country.

Membership of International Network on Bamboo and Rattan

INBAR is an Inter-Governmental Organization established in 1997 to promote environmentally sustainable use of Bamboo and Rattan. President of Pakistan signed the Letter of Accession to become 48th state member of INBAR in 2021. The network will support Pakistan in propagation and value chain development of Bamboo in the country with effect from 1st July, 2021. In this association, a cross sectoral working group has been constituted to steer activities of INBAR in Pakistan.

Bio-safety Clearing House Project

National level consultative and capacity building project on Biosafety Clearing House is already in progress. However, the UNEP led process could not be initiated due to COVID-19 outbreak. The first National Capacity Building Workshop was held on 28th Feb to March 2nd, 2022.

**Box: Living Indus Initiative–Ecological Restoration of the
Indus Basin for a Climate Resilient Future**

More than 80% of Pakistan's population living on the Indus Basin, it has served as the core of the region's socio-cultural and economic life for over a documented 5,000 years. However, the question needs to be addressed; does it be able to do so even for another 100 years? Indus Basin is facing multiple threats ranging from Climate Change due to poor resource management, environmental hazards and unsustainable use of this valuable resource. Unaddressed, the economic cost to Pakistan of poor water resource management is estimated to be USD \$12 billion per annum (4% of GDP). In addition, the Indus Basin faces an existential threat in the wake of Climate Change, which is the biggest longer-term and currently unmitigated external risk to Pakistan's water endowment. Climate change is expected to bring about an increase in the frequency and intensity of extreme weather events, coupled with the increased variability in South Asian Summer Monsoon (SASM) rains causing frequent and intense floods and droughts in the country (IPCC 2013).

United Nations in Pakistan is assisting the Ministry of Climate Change, Government of Pakistan in developing a vision and agenda which aspires to an Indus Basin that can sustain a thriving civilization from its sources to the ocean whose natural resources and ecosystems have been repaired and restored, and are resilient in the face of climate change. Through this initiative, it is intended to establish the health of the Indus Basin at a higher level of urgency and ambition, both through the implementation of a series of new and innovative interventions in the short term and through the identification and deployment of as-yet-untried approaches drawn from and adapting approaches tried in other parts of the world.

Source: Food and Agriculture Organization of the United Nations, Pakistan

Water, Sanitation and Hygiene (WASH)

M/o CC revised the National Climate Change Policy in 2021 that included alignment of WASH related interventions. The National Water Policy 2018 also underpins drinking water and sanitation as key priority over all other usages, that emphasized on the provinces to develop their guideline and strategies for drinking water and sanitation. In this connection, the Government of Punjab developed Water Policy 2018 that includes WASH for an alignment with SDGs and developed as WASH strategy 2021. Similarly, the Government of Khyber Pakhtunkhwa has prepared new drafts of the revised drinking water and sanitation policies 2020 in accordance with SDGs 6.

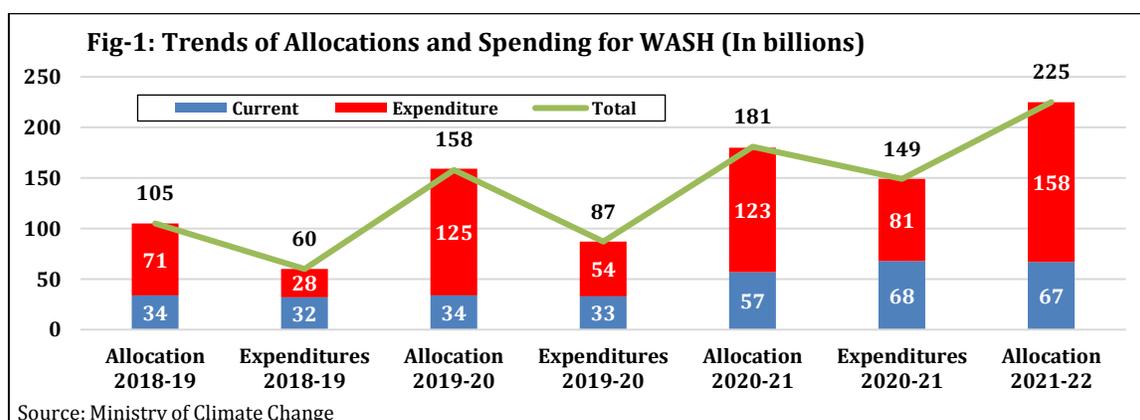
Besides, the provincial governments have developed their WASH Sector Development Plans and these are being periodically reviewed. Further, MoCC supported all provinces through UNICEF to organize WASH Joint Sector Reviews (JSRs) to determine the key challenges and identify consensus for a way forward through consultative meetings and workshops. This culminated with a national WASH JSR in February 2022 by MoCC.

Planning, Monitoring and Review and SDG Reporting

Pakistan Bureau of Statistics (PBS) is the national custodian of tracking and reporting the progress on sustainable development goals in the country. The MoCC and PBS brought different stakeholders together in order to streamline all federal and provincial surveys for consistency and timeframe against the indicators. However, at present there is a need for a single monitoring body or institution in Pakistan for carrying out M&E and reporting on drinking water, sanitation and hygiene. Hence, the MoCC developed online web portal that includes Clean Green Pakistan Index (CGPI) dashboard to track and record the progress of performance indicators.

Financing for Water Sanitation and Hygiene

The Government has allocated Rs 225 billion for 2021-22 for WASH services in provincial and federal budgets of Pakistan. A review of the budget documents showed an upward trend of WASH allocations from FY2019 to FY2022. There is an increase of 114 percent budgetary allocations for WASH in 2021-2022 as compared to 2018-2019. Similarly, as compared to 2018-19, during 2020-21 WASH expenditure increased by more than 100 percent. Trends of allocation and spending for WASH (FY 19-FY 22) depicted in the Fig-1.



In 2020-2021, overall utilization was recorded 83 percent compare to 55 percent and 57 percent in 2019-20 and 2018-19, respectively. For last three years, the utilization of current budget is more than 93 percent.

A review of the 2020-21 budgetary allocations and expenditures shown in Table-16.2 reveal that highest level of spending was reported by Sindh province (88 percent), followed by Punjab (86 percent), Balochistan (84 percent), and KP (69 percent), respectively.

Provinces/ Region	Budget 2020-2021			Expenditures 2020-2021			Spending (%)
	Current	Development	Total	Current	Development	Total	
Balochistan	5,759	16,596	22,355	5,706	12,982	18,688	84
Sindh	15,304	40,504	55,808	24,415	24,643	49,058	88
Punjab	24,700	38,189	62,889	24,561	29,390	53,951	86
Khyber Pakhtunkhwa	11,688	24,188	35,876	13,390	11,295	24,685	69
Federal	0	3,739.84	3,740	0	2,672.87	2,673	71
Total	57,450	123,217	180,667	68,071	80,982	149,054	83

Source: M/o CC

The budgetary allocations for Water, Sanitation and Hygiene in 2021-2022 (including federal and provincial budgets) are Rs 225.159 billion includes Rs 126.897 billion under development expenditures and Rs 67.133 billion under current expenditures. The provincial and federal budget breakup of WASH programme for 2021-2022 is given in Table-16.3.

Province	Current	Development	PSDP	Total	Rs Per Capita
Balochistan	7,409	19,330	1,500	28,239	2,139
Sindh	17,995	36,822	22,532	77,349	1541
Punjab	28,063	54,329	500	82,892	723
Khyber Pakhtunkhwa (Including NMDs)	13,666	16,416	730	30,812	822
Federal	0	0	5,867	5,867	
Pakistan	67,133	126,897	31,129	225,159	1,034

Source: M/o CC

The per capita WASH allocation in Pakistan is Rs 1,034. The Table 16.3 shows the highest per capita WASH allocation is in Balochistan with Rs 2,139, whereas Punjab holds the lowest per capita WASH allocation of Rs 723.

Pakistan WASH Strategic Planning and Coordination Cell

Establishment of Pakistan WASH Strategic Planning and Coordination Cell was a PSDP project with total cost Rs 41.136 million executed and sponsored by MoCC. The project was completed on 31st December 2021 with the following achievements:

- ⊙ Establishment of coordination mechanism as National Coordination Committee.
- ⊙ Establishment of research caucus for WASH.

- ⦿ Regular reporting on SDG-6 that includes reporting on WASH in health care facility, GLAAS survey, JMP reports in close coordination with PBS.
- ⦿ Development of policy guidelines for drinking water and sanitation.
- ⦿ Behavior Change Communication (BCC) strategy for WASH addressing all the thematic area of clean green Pakistan has been developed.

Capacity Building on Water Quality Monitoring and SDG 6 (6.1) Reporting under the KOICA Grant

The project will provide support in water quality infrastructure and equipment uplift in the 36 labs of Punjab and 8 divisional labs of KP. The complete staff of water quality labs will be trained on water quality monitoring and compliances frameworks in Punjab, KP, Sindh and Baluchistan. The total cost of the project is Rs 1289.206 million with Rs 102.006 and Rs 1187.2 share of federal and KOICA, respectively.

COVID Response for Hygiene and WASH

Hand washing with soap appeared the most cost-effective approach for COVID-19 response. The Ministry of Climate Change developed and launched a national roadmap for Hand Hygiene for All (HH4A). The provinces have been supported to develop detailed action plans for HH4A.

Climate Resilient WASH

The Ministry of Climate Change has conducted a national study to determine the impact of climate change on children that covers the vulnerability of climate change for different regions of Pakistan along with overall impact of key climate hazards in Pakistan. Findings of the study indicated that the total economic cost of climate change in Pakistan ranges from US\$1.3 to US\$1.9 billion which is equivalent to 0.5 to 0.7 percent of GDP of Pakistan. Air pollution has the highest share in economic costs (30-34 percent), followed by water-related costs (26-27 percent), malnutrition (15-17 percent), temperature related diarrhea (9-17 percent), agricultural productivity (5-7 percent), deaths due to excess heat (2.8-3.2 percent), decrease in exports (1.6-2.3 percent), sanitation-related diarrhea (1.2-1.9 percent), and maternal mortality (0.3-0.4 percent). Based on this work the WASH Strategic unit has worked with sector partners to bring climate resilient WASH services. In this regard, a climate risk and vulnerability assessment of WASH has been conducted in 2021.

International Cooperation

Ministry of Climate Change is responsible for coordination with international environmental agencies on environmental issues, signing & implementation of MOUs. Moreover, it also represents Pakistan at international forums with respect to the signed Conventions and Protocols. In this regard, the MoCC has taken the following initiative during the 2021-22:

- ⦿ Pakistan Green Diplomacy Initiative (PGDI) document, as policy tool was developed in consultation with Ministry of Foreign Affairs.

- ⊙ Study on plastic waste in Pakistan conducted and disseminated findings of the same to all federal and provincial stakeholders.
- ⊙ Integration of Mobile App on “Ban on Polythene Bags” into the city of Islamabad application initiated and launched.
- ⊙ Organized First National Dialogue and Stakeholder Convening at Islamabad with the Collect and Recycle (CoRe) Alliance on the topic “Collective action approach to deal with Packaging waste in Pakistan”.
- ⊙ Signed MOUs with TEVTA Punjab, Sindh, KPK, Balochistan and Punjab Vocational Training Council for transfer to tools and equipment related to Refrigeration and Air Conditioning (RAC) trade. All the TEVTAs nominated 56 institutes for receiving RAC tools and equipment.
- ⊙ Ratification process for Kigali Amendment is underway and the hired consultancy firm has submitted the initial draft Country Assessment Report (CAR).
- ⊙ Funds were approved for Pakistan amounting US\$ 287,318/- for Phase-XI of the Institutional Strengthening Project for the Implementation of Montreal Protocol preparation in 87th Executive Committee Meeting of the Ozone Secretariat held in July, 2021.
- ⊙ Working on developing PCT codes for import of HFCs in Pakistan in collaboration with FBR and Ministry of Commerce for consideration in upcoming IPO Amendment 2022.
- ⊙ Draft legal document including the rules for implementation of Montreal Protocol in Pakistan has been drafted and are under initial review.
- ⊙ MoU signed with the Government of the Uzbekistan on Cooperation in the field of Environment and Climate Change
- ⊙ Developed draft National Hazardous Waste Management Policy in Pakistan.
- ⊙ Issued HCFCs import licenses for 2022. It will enable Pakistan to keep the imports under the scale target of Ozone Secretariat

Policies and Strategies

Updated National Climate Change Policy (2021)

M/o CC updated National Climate Change Policy of Pakistan. The goal of this policy is to steer Pakistan towards climate resilient and low carbon development. Thus, it would provide a comprehensive framework in order to address the issues that Pakistan faces and will face in future due to changing climate. This policy document will be reviewed and updated regularly to address emerging concepts and issues in the ever-evolving science of climate change.

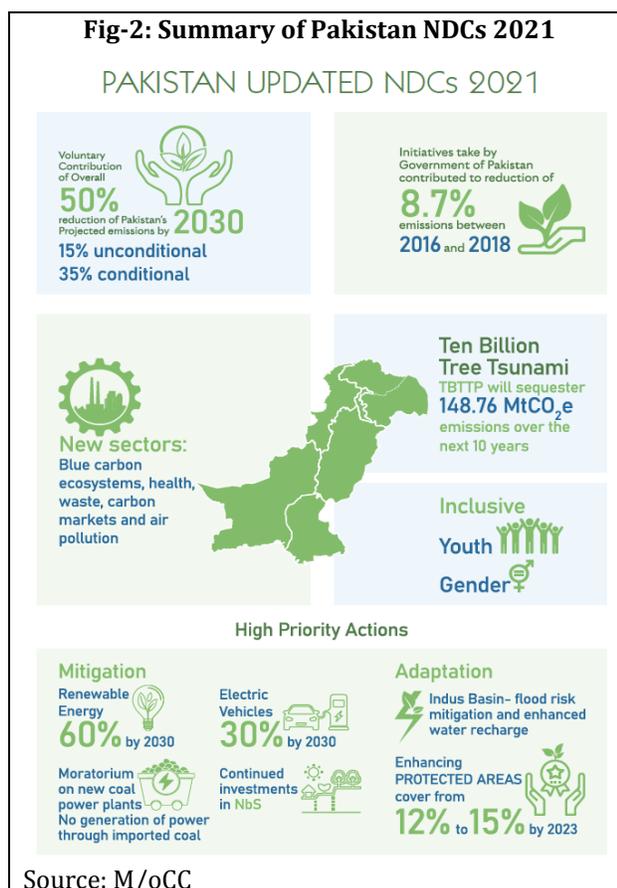
Keeping in view national and international requirements, the updated policy document has been designed in accordance with the requirements of Paris Agreement on climate change, SDGs and Sendai Framework for Disaster Risk Reduction. Hence, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer and international cooperation have also been incorporated as important components of the policy.

The implementation of National Climate Change Policy has been assessed, which shows landmark achievements gained by MoCC, Provincial line Departments in various development sectors i.e., agriculture, transport, energy, industries, forestry and biodiversity through adaptation and mitigation measures. Number of projects has been initiated by the Federal Government and Provincial departments i.e., Ten Billion Tree Tsunami, Clean Green Pakistan Index, Ecosystem Restoration, WASH, Climate resilient Urban Development and Green Building Code are the major initiatives in addressing climate change in the country.

Pakistan Nationally Determined Contributions (NDC) revised 2021

Aimed at achieving reduced poverty and ensuring stable economy, the updated NDCs commit to abate overall 50 percent of Pakistan's projected GHG emissions by 2030. This commitment will be contributed by the shift to 60 percent renewable energy for electricity generation, and 30 percent to electric vehicles by 2030 and complete ban on the use of imported coal. The success of restoring the forest cover and conservation efforts was corroborated when the latest GHG inventory of 2018 reported an 8.7 percent decline in projected GHG emissions for 2018 (sequestration of 8.4 Mt CO₂e). Encouraged by these analytics, Pakistan commits to enhance its reliance on Nature-based Solutions (NbS) underpinned by the fact that TBTP will alone sequester 148.76 MtCO₂e if fully implemented.

To achieve these commitments, it is estimated that transition to renewable energy will cost Pakistan US\$ 101 billion by 2030 plus additional US\$ 65 billion by 2040 given costs involved in completing in-progress renewable energy projects, building additional hydropower (US\$50 billion by 2030 and US\$80 billion by 2040) and transmission lines (US\$ 20 billion), and phasing out coal (US\$ 18 billion to buy out Pakistan's coal power plants and US\$ 13 billion to replace the energy production capacity of coal power plants with solar). Pakistan's adaptation cost ranges of between US\$ 7–14 billion per annum to 2050. Financing these initiatives is considered a challenge in NDCs and Pakistan in the NDCs commits to employing the instruments on enhanced ambition provided in Article 6 of the Paris Agreement, public-private partnerships and international climate finance opportunities including Green Climate Fund (GCF) and Global Environment Fund (GEF). A summary of Pakistan NDCs 2021 is shown in Fig-2.



National Adaptation Plan

Pakistan is in the process of developing National Adaptation Plan (NAP) for building resilience to climate change. NAP is widely seen as one of the most important mechanisms to cope with the challenges of climate change. The core objective is to reduce vulnerabilities to climate impacts by creating comprehensive medium and long-term plans including the integration of adaptation measures into the national policy. Pakistan will use the NAP process and its outcomes to enhance the adaptation elements of the Nationally Determined Contributions (NDCs), which is the central aspect of the Paris Agreement. The NAP Process will be in place by June 2023.

First Biennial Update Report (BUR)

M/o CC has finalized its First Biennial Update Report (BUR) which will be submitted to UNFCCC Secretariat. The scope of the BURs is to provide an update of the most recently submitted National Communication and to provide additional information. This initiative proves beneficial for mitigation actions taken or envisaged to undertake as well as support needed and received. Pakistan's BUR1 has been developed using the expertise from renowned technical institutions working on the respective themes of climate change. This arrangement has been put in place for strengthening the national reporting process under United Nations Framework Convention on Climate Change (UNFCCC), which was established under previously executed project for preparation of Pakistan's Second National Communication (SNC).

Gender dimension in Climate action

Pakistan acknowledges that advancing gender-sensitive commitments in climate adaptation and mitigation are synonymous with enhancing adaptive capacity of women, families, and communities, eventually building and achieving the country's resilience to climate change. Hence, the updated Pakistan's NDC have a separate chapter on gender reflecting how the harnessing of knowledge and capacity of women is an important tool to design and implement effective solutions. The role of women in decision-making and implementation is proposed to deliver results across various policy sectors.

In addition, Canadian Embassy is supporting MoCC in developing a report for mainstreaming gender into revised policies and also develops gender reporting mechanism within MoCC. The Government with support from International Union for Conservation of Nature (IUCN) will build capacities and innovative approaches through development of a national Climate Change Gender Action Plan (CCGAP). The project will finalize and validate a national CCGAP, anchored around the country's priority sectors.

Green Jobs

In a green economy, development of green jobs becomes the basis of sustainable economic development. Green jobs are central to sustainable development and respond to the global challenges of environmental protection, economic development, and social inclusion. The ILO defines green jobs as "being decent jobs, either in traditional sectors or in the new green ones, which contribute to preserving or restoring a sustainable environment". In the context of Pakistan, the following interventions can be termed as green jobs:

- ⦿ Protection of ecosystems and biodiversity
- ⦿ Minimization of waste pollution and enactment of stringent waste management practices
- ⦿ Reduced consumption of energy and raw materials
- ⦿ Minimized GHG emissions

Pakistan, through the MoCC, has increased its reliance on nature-based solutions in recent years, such as the TBTTP, which has also shown an increase in 'Green Jobs.' Following the pandemic, the MoCC also launched a 'Green Stimulus' to assist daily wage earners, particularly women and youth, in earning a living through green jobs in a dignified manner. MoCC has also launched a number of interventions to promote green occupations such as protected area management and eco-tourism through the Protected Areas Initiative, Clean Green Pakistan Champions through the Clean Green Pakistan Movement, and so on. MoCC with the support from development sector partners is also developing green jobs roadmap for priority sectors.

In line with the Government's commitment for socio-economic and gender responsive green economy, UNDP Pakistan is supporting MoCC to promote green jobs in Pakistan. The support includes baseline assessment of green jobs future in Pakistan based on existing legislative environment, gaps and challenges to leveraging the potential benefits of green economy and opportunities (like public-private partnerships) to catalyze national green jobs efforts. In addition, the gender analysis is also included in the efforts to create a gender responsive green job strategy for future. The ultimate goal is to formulate green jobs roadmap focusing on guiding relevant stakeholders on creating and promoting green jobs and green skills especially suitable for women, youth and excluded groups.

Climate and Clean Air Initiatives

With rapid population growth and urbanization, Pakistan is facing the worst air quality for many years. Air pollution and climate change result from same sources i.e., fossil fuel burning, industrial processes, transport and agriculture activities. However, anthropogenically induced climate change further increases the threat of exposures to air pollutants by changing the concentrations, transport process and lifetime of local and regional pollutants. These pollutants also include a major category of Short-Lived Climate Pollutants (SLCP) including black carbon and methane. Another significant problem that has emerged in recent years is smog. There is no doubt that urgent and collective action is required in order to tackle the issue of air quality and greenhouse gas emissions. In this connection, following measures have been initiated under the umbrella of the MoCC.

Pakistan Clean Air Programme (PCAP)

Revision was initiated by MoCC that is endeavored to develop the targets for improving air quality as realistic as possible so that they are specific, measurable, achievable, realistic, and time-bound. The revision process highlighted the need for an inventory that will not only help in the development of a roadmap for short, medium, and long-

term action plan but also to track the implementation of PCAP targets. Therefore, MoCC in partnership with Clean Air Asia (CAA) and Stockholm Environment Institute (SEI) initiated Integrating Short-Lived Climate Pollutants (SLCPs) reduction in the Pakistan's Air Quality Plans and Programme to substantially reduce SLCPs in Pakistan by strengthening the capacity of national partners through training on the use of Low Emissions Analysis Platform system including the Integrated Benefits Calculator (LEAP-IBC¹), supporting national partners in the development of the Pakistan LEAP-IBC analysis, and through the development of the LEAP-IBC analysis, identifying and evaluating those mitigation actions, at national and provincial scale, which are most effective at simultaneously improving air quality and mitigating climate change.

In addition, Pakistan recently signed joined Global Methane Pledge initiated by EU and US governments in October 11th, 2021 to slash methane emission and initiate focused intervention. The parties joining the pledge are committing to a goal of reducing global methane emissions by at least 30 percent from 2020 levels by 2030 and moving towards using best available inventory methodologies to quantify methane emissions, with a particular focus on high emission sources.

Pakistan Environmental Protection Agency

Pakistan Environment Protection Agency (Pak-EPA) is mandated to enforce the Pakistan Environmental Protection Act 1997 in the Islamabad Capital Territory. The following major activities have been undertaken:

Water Quality

Pak-EPA constituted an Inspection Committee and sampling team collected 15 up and down stream nullah water samples with nullah flows of KachiAbadis and analyzed in EPA water lab. As EPA mandated for reservoir water quality surveillance and regularly monitored the Islamabad's natural streams, Simli dam, Rawal lake catchment area and river sides, 13 water samples were collected and analyzed, along with, Margallah hills. Four water samples collected from industrial effluent treatment, slaughter and housing society's sewage treatment plant. Six water samples collected from CDA filtration plants along with microbial testing. Two Bore water samples received from public Gulberg green and I-8. From July-December 2021, Lab/NEQS Directorate collected 88 water samples and tested in EPA laboratory. From January-March 2022, Lab/NEQS Directorate has also tested 40 water samples in EPA water quality laboratory.

Air quality

Lab/NEQS Directorate reported daily air quality data, for the year 2021-22 and air quality monitoring reports are available on the Pak-EPA website. Pak-EPA has established an active and reliable monitoring system to routinely monitor air emissions of tyre burning units, asphalt plants, steel, aluminum, food industries, brick kilns and construction sites.

At the end of December 2021 to January 2022, Director General EPA-KPK requested

¹ LEAP-IBC tool is an integrated modelling and scenario planning tool to help governments jointly assess the emission reduction potential of greenhouse gases, short-lived climate pollutants and other air pollutants emissions in their country.

Federal Environmental Protection Agency (Islamabad) to mobilize the Mobile Air Quality Monitoring Station (AQMS) along with EPA team to Peshawar. EPA AQMS system deployed at six different locations for four days and monitored smog and air pollution in Peshawar city.

Pak-EPA Islamabad gathered data on air quality and analyzed on 24-hourly basis and disseminated to the public through Pak-EPA website (www.environment.gov.pk), official social and print media accounts. Highest concentrations of PM_{2.5} were recorded in January. During January-March, especially in winter months, air quality is badly deteriorated and unhealthy due to smog season, agriculture waste burning and Transboundary air pollution.

Hospital Waste Management of ICT

Hospital wastes include different kinds of wastes such as infectious, radioactive, chemical, heavy metals and regular municipal wastes. Pak EPA implemented the HWM Rules 2005 in the ICT and proper management of hospital wastes through an appropriate method of separation from the source, transportation and disposal can prevent environmental pollution. Total 120+ health facilities are under observation within ICT and more than 78 health facilities submitting their monthly waste-management reports to Pak-EPA. Environmental monitoring team visited more than 10 hospital/health facilities during January- March 2022.

National Bio-safety Centre (Cartagena Protocol)

Pakistan ratified Cartagena Protocol on March 02, 2009 under which it is obligatory to devise implementation mechanism for regulating Genetically Modified Organisms (GMOs) and their products. The National Bio-safety Centre (NBC) is working under Pak-EPA. The two committees i.e., Technical Advisory Committee (TAC) and National Bio-safety Committee (NBC) functions for the purpose of granting licenses to the extent of Cartagena Protocol on Bio-safety.

Global Change Impact Studies Centre

The Global Change Impact Studies Centre (GCISC) is governed by the Board of Governors, with the mandate of conducting research on climate change and its impacts and possible remedies. The Centre undertakes and commissions scientific investigations on climate change at regional and sub-regional levels. Specific research themes include the climate change profiles of Pakistan, impacts on critical socio-economic sectors and identification of appropriate adaptation/mitigation strategies. In addition, it arranges capacity building opportunities for young scientists in climate related subjects and engages in outreach and dissemination of research outputs.

Impacts of Climate Change on Water Resources

Globally the incidences of hydrological extreme events are rising. In Pakistan, it is in many different forms, especially flash flooding in mountainous streams in the north. Analysis of the available long-term record (1969-2014) of annual total flow volumes and annual maximum flows of the Indus River at Besham Qila (a flow gauging station upstream of Tarbela Dam), shows no statistical evidence of a significant and sustained

change in the aggregate average annual flows in the Upper Indus Basin (UIB) upstream of Tarbela Dam. However, there is a significant increase in the annual maximum flows. This has specially been found in the water availability analysis of the Kabul River Basin, a snow melt-fed basin, where there is a sharper peak with a clear shift in the annual peak flow by a month. Other modelling work focused on the Gilgit River Basin, a glacier-fed basin, revealed that faster melting of glaciers under increased temperatures would bring more flow a month earlier but with a flattened peak.

Another highly damaging event is a drought. Climate change has increased its likelihood and spread in Pakistan. The analysis is in progress to devise a computational framework for efficiently monitoring and predicting the future drought events so that appropriate steps are taken in advance so as to minimize loss of human lives and economy.

Impacts of Climate Change on Agriculture

Agriculture is one of the major sectors which is being adversely affected by climate change. Climate change can disrupt food availability, reduce access to food and affect food quality. Projected increases in temperatures, changes in precipitation patterns and reductions in water availability may reduce agricultural productivity. Crop simulation models-based studies depict significant reductions in wheat, rice and maize yields in the arid, semi-arid and rainfed areas of Pakistan under various IPCC climate change scenarios by the mid and end of the century.

Recent findings of GCISC study reveals an increasing trend in the average maximum temperature for the future projections for both RCPs, with 1-2.0 °C for RCP 4.5 & 5-6 °C for RCP 8.5 during Rabi and kharif seasons. Temperature in the South Eastern part of Pakistan exceeds the thresholds at the times of flowering and ripening thereby causing wheat yield losses. Further, increase in temperature is projected to have serious implications for these growing areas. Due to rise in temperature, an increase of 1000 Growing Degree Days (GDDs) between historical and late century extreme scenarios have been observed in case of wheat, implying that South Eastern side of Pakistan are likely to become unsuitable for wheat production.

APSIM Crop Simulation Model, disclosed that wheat production in the arid areas of Pakistan is likely to suffer to the tune of 17 percent in 2020s in case of RCP 4.5, whereas 21 percent and 40 percent in case of RCP 8.5 for 2020s and 2080s, respectively. Aqua Crop Model projected 34 percent and 41 percent decline in Maize yields in case of scenario RCP8.5 by the end of the century in the KPK province, respectively. The results suggest that the aggregate impact of climatic parameters i.e., changes in temperature and rainfall exerted negative impact on cereal crop yields, given that the management practices and use of technology remain unchanged. Studies suggest an imminent need of adaptation interventions to cope with the negative impacts of climate change.

Another study reported that agriculture is the second largest sector contributing to GHG emissions (174 out of 406 Mt CO₂ Eq). Baseline emission (of 2015) projections till 2030 under future scenarios of agricultural growth are expected to increase up to 271.9 (56 percent) Mt, 314.3(80 percent) Mt and 362.9 (108 percent) Mt of CO₂-equivalent under Business As Usual (BAU), Food Security (FS) and Enhanced Consumption Pattern (ECP)

scenarios, respectively. Besides the fact that agricultural emissions are expected to increase in future, it is also true that presently Pakistan has yet to produce more to meet the future needs and preferences of the masses which will lead to emissions at faster rates. Till now, Pakistan has not devoted much of its efforts in curtailing the emissions from agriculture due to limited awareness and low confidence in monitoring/estimation of these emissions. Since agriculture sector offers a lot of opportunities in GHG reduction, the present estimates will aid in designing the future agriculture policy, especially for emission reductions from livestock sector and soils.

Pakistan Biennial Update Report (BUR1)

GCISC has contributed to the preparation of national GHGs inventory and chapters on National Circumstances and Development of Measurement Reporting Verification (MRV) framework for climate change reporting.

Monitoring, Reporting and Verification (MRV) System Development

As a signatory to the Paris Agreement, Pakistan is deeply committed to its implementation. Under Enhanced Transparency Framework (ETF) the countries are required to regularly track the progress on contributions and put in place methodological tools necessary to account for GHG emissions. Further, under the ETF, parties are expected to submit their first Biennial Transparency Reports (BTRs) and National Inventory Reports till 31st December 2024.

In this context, a broader GHG MRV system (RISQ – a web platform for the compilation of the national MRV System database) has been developed by GCISC to establish historical baselines, validate data quality, analysis of mitigation policies implementation and reporting compliance. Efforts are underway to develop the national adaptation M&E system by developing a roadmap for its future setup based on pilot experimentation in the agriculture sector.

Adaptation is a critical concern for developing countries and in particular for Pakistan owing to the fragility of its ecosystems and its vulnerability to the impacts of climate change. Reducing the vulnerability of counties and communities to climate change by increasing their ability to absorb impacts and remain resilient – is a key pillar of the Paris Agreement. The Agreement requires all of its signatories to plan and implement adaptation measures through national adaptation plans, studies, monitoring of climate change effects and investment in a green future. Building resilience to climate change is a key focus of NCCP. Given this, GCISC has taken a step in developing an adaptation tracking mechanism which will not only aid in the national climate change adaptation planning process but also will support in preparing the Adaptation Communication (ADCOM) to the UNFCCC. The platform (on pilot basis) is ready for Agriculture Sector, whereas the platform is being extended for other sectors viz. water and health.

Third National Communication

In accordance with the provision of UNFCCC, each party has an obligation to submit its National Communication which includes the national greenhouse inventory measures taken and to be taken for the implementation of the convention as well as other

information that the party considers relevant. In this context, Pakistan submitted its Initial National Communication in 2003, and the second National Communication (SNC) in 2019. Pakistan also prepared its First Biennial Update Report which is at its final stage of approval and expected to be submitted in the second quarter of 2022. The work on the 3rd National Communication has just been started to update the Greenhouse Gas Inventory (for 2020-21) coupled with specified outcomes that will be prepared over the course of next 28 months.

Research Activities underway

- ⊙ Drought is a highly damaging but slow on-set extreme event and climate change has increased its likelihood and spread in Pakistan. For this reason, an analysis is in progress to devise a computational framework to cope challenges and consequences of drought in the future.
- ⊙ In the Transboundary Indus Basin (TIB) data support process-based hydrological models are limited. Hence, research study is being carried out to use Machine-Learning methods for hydrological modeling a useful complement to physical hydrologic models in the TIB, to make streamflow forecast at 10-day lead time at four sub-catchments; Indus, Jhelum, Chenab and Kabul watersheds in the Indus Basin.
- ⊙ Assessment of the impact of future growing degree days as simulated by CMIP6 models over major wheat growing areas of Pakistan.

Conclusion

Pakistan is facing growing environmental challenges, which have an obvious socio-economic consequence. Heat waves, impacting crop cycles, floods, drought and degradation of water and air quality posing negative impact quality of life. To cope with the challenge of climate change matters should be addressed on both mitigations and remedies front. In this context, the Government has taken multiple measures. Plantation is the most appealing strategy to expand forest cover area in the country. Forestation will increase the absorption capacity of greenhouse gases, regulate water flows and protect coastal communities from extreme events and sea level rise. In addition, they provide migrating plant and animal species routes to resilient habitats. In Pakistan, the existing meager forest resources being crucial to environmental stability, which appeal for serious interventions supported with commitment for adequate financial flows to improve and enhance the overall forestry, wildlife and biodiversity sector. However, the TBTP is helping to restore the ailing ecosystems and it will improve natural capital as well.