



**MINISTRY OF CLIMATE CHANGE &
ENVIRONMENTAL COORDINATION
GOVERNMENT OF PAKISTAN**

**YEAR BOOK
2021-22**

CONTENTS

1. MESSAGE	3
2. FOREWORD	4
3. FUNCTIONS OF THE MINISTRY	1
4. ORGANIZATIONAL SETUP	2
4.1 ADMINISTRATION WING	0
4.2 DEVELOPMENT WING	2
4.3 ENVIRONMENT & CLIMATE CHANGE WING	7
4.3 FORESTRY WING	15
4.5 INTERNATIONAL COOPERATION WING	20
5. ATTACHED DEPARTMENTS AND AUTONOMOUS BODIES	23
5.1 PAKISTAN ENVIRONMENTAL PROTECTION AGENCY (PAK-EPA)	24
5.2 ZOOLOGICAL SURVEY OF PAKISTAN (ZSP)	30
5.3 GLOBAL CHANGE IMPACT STUDIES CENTRE (GCISC)	35
5.4 ISLAMABAD WILDLIFE MANAGEMENT BOARD (IWMB).....	53

1. MESSAGE

We are living in an era where human beings are at risk of calamities due to unprecedented shifts in weather patterns. The unsustainable approach to living has paved the way for climate change, and it has become an unequivocal reality. Harsh climatic conditions are wreaking havoc all across the globe, but Pakistan is suffering greatly due to its topography, geography, fragile economy and low technical capacity. The recent floods in Pakistan have warned us all that if this menace is not tackled properly, it will become a matter of survival.



The Ministry of Climate Change and Environmental Coordination is committed to the government's commitment of building climate change resilience and a sustainable future through formulation and implementation of sound environmental policies. The Ministry is also focusing on improvement and better implementation of environmental policies through effective communication and mutual cooperation.

The Year Book provides information about the work and achievements of the Ministry, its attached departments and autonomous organizations during the year 2021-22. The humble efforts merit recognition. I congratulate my team members for their efforts and ensure my continued support for building together a safe and sustainable future.

I hope you find the information given in the Year Book useful, and let us know your suggestions for further improvement. Your feedback is invaluable.

(Ahmad Irfan Aslam)
Federal Minister for Climate Change
& Environmental Coordination

2. FOREWORD

Ministry of Climate Change and Environmental Coordination is mandated to frame National Climate Policies, Plans, Strategies, and Programs related to climate change, ecology, forestry, disaster management, desertification, wildlife, biodiversity, and environmental protection and preservation. The Ministry also coordinates and executes bilateral and multilateral climate change agreements. Reporting of human settlements, urban water supply, sewerage and drainage also fall in the domain of the Ministry.



In pursuance of Rule 25 (2) of the Rules of Business, 1973, I present this Year Book which provides relevant information on policy initiatives, reform, achievements, and gives overview of the major activities of the ministry and its supporting organizations during the year 2021-22. These successful initiatives and reforms are ameliorating the overall environmental condition of the country. This is just the beginning as MoCC&EC envisions an everlasting commitment to combat climate change challenges.

Finally, I appreciate the efforts of all team members who have worked dedicatedly to shape this Year Book. This Year Book demonstrates vision, initiatives and key achievements of the Ministry of Climate Change and Environmental Coordination to make it useful for government officials, academia, and other interested readers.

Feedback in the form of comments and suggestions for improvement is welcome.

(Asif Hyder Shah)
Secretary
Ministry of Climate Change
& Environmental Coordination

3. FUNCTIONS OF THE MINISTRY (UNDER RULES OF BUSINESS, 1973)

Under the Rules of Business, 1973, the Ministry of Climate Change and is assigned the following functions:

1. National policies, plans, strategies and programs with regard to disaster management including environmental protection, preservation, pollution, ecology, forestry, wildlife, biodiversity, climate change, and desertification
2. Coordination, monitoring, and implementation of environmental agreements with other countries, international agencies and forums
3. Policy formulation, coordination, and reporting of human settlements including urban water supply, sewerage, and drainage
4. Pakistan Climate Change Council (PCCC)
5. Pakistan Environmental Protection Agency (PAK-EPA)
6. Global Change Impact Study Centre, Islamabad (GCISC)
7. Islamabad Wildlife Management Board (IWMB)

4. ORGANIZATIONAL SETUP

Business allocated to the Ministry of Climate Change has been distributed amongst the following Wings:-

1. Administration Wing
2. Development Wing
3. Environment & Climate Change Wing
4. Forestry Wing
5. International Cooperation Wing

4.1 ADMINISTRATION WING

The Administration Wing (Admn Wing) headed by Sr. Joint Secretary deals with administrative and financial matters of the Ministry and its attached departments.

4.1.1 HUMAN RESOURCE

The total strength of the Ministry of Climate Change (MoCC) during the year 2021-22 was 193, out of which 52 are officers and 141 are staff members.

4.1.2. RESPONSIBILITIES

- a. Personnel and General Administration of the officers/officials of the Ministry
- b. Personnel administration of officers of the attached departments/organizations/projects
- c. Budgetary (non-development) and financial matters of the Division and its attached departments/autonomous organizations
- d. Coordination between wings/ attached departments/organizations/projects of this Ministry, and with other Ministries/Divisions
- e. Matters relating to hiring of residential accommodation
- f. Reimbursement of medical charges to the serving / retired officers/officials
- g. Maintenance of Performance Evaluation Reports (PERs), Annual Confidential Reports (ACRs), the record of all employees of this Ministry, and maintenance of annual declaration of assets possessed by the officers/officials of this Ministry
- h. Processing promotion, pay and pension cases of the officers/officials of the Ministry
- i. All the legal matters pertaining to the Ministry and its attached departments
- j. Departmental Accounts Committees (DACs) and Public Accounts Committees (PACs) matters pertaining to this Ministry and its attached departments
- k. Media and communication and awareness campaigns
- l. Trainings, conferences, seminars, and visits abroad

Promotions of officers/ officials:

Promotion of officers/officials is a regular feature of admin wing. One officer has been promoted as Conservator (Wildlife) (BS-19,) moreover four (04) officers and twenty-one (21) officials have been granted One Time Higher Scale in the light of the Finance Division's instructions.

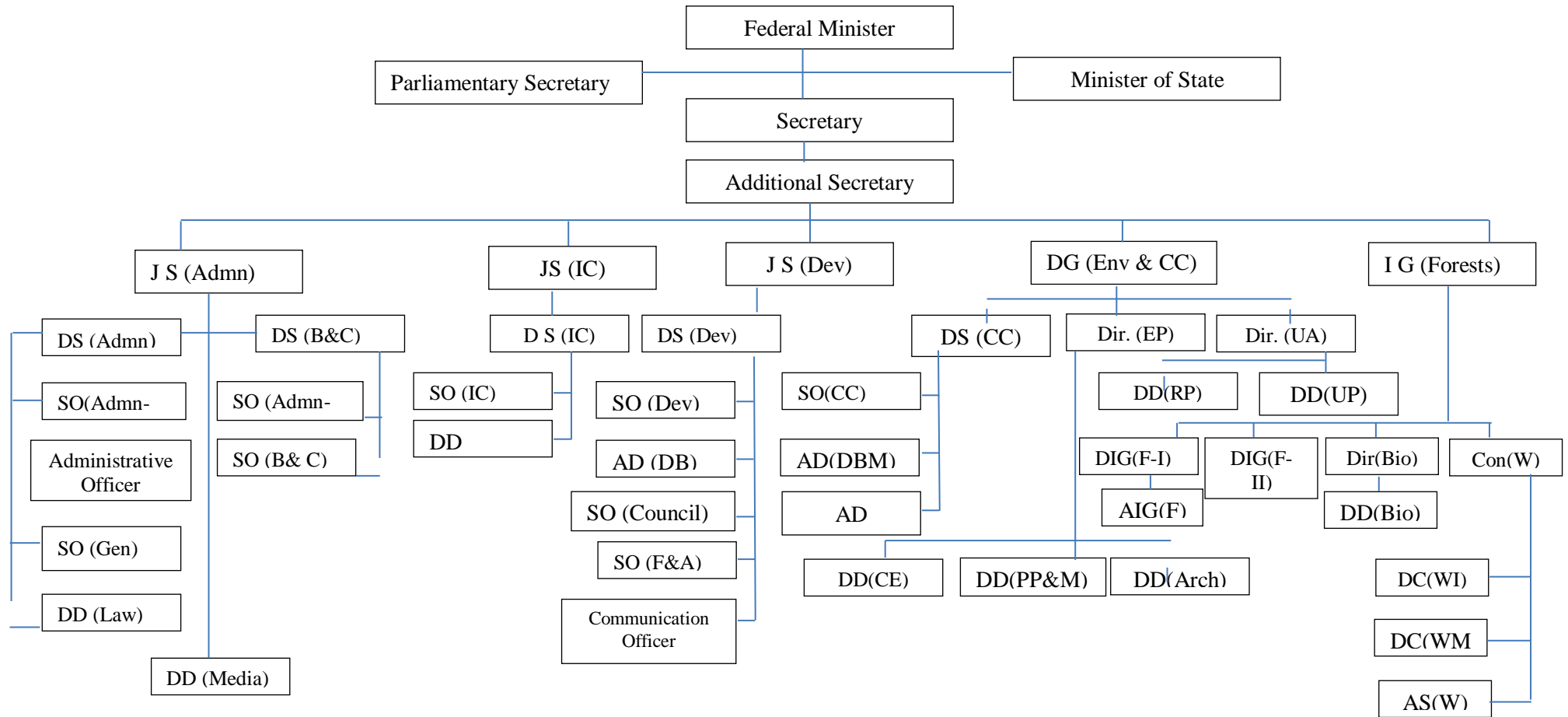
Recruitment on vacant positions:

Recruitment on the vacant position of Inspector General of Forests (BS-21) was made by the Ministry through the Federal Public Service Commission (FPSC).

Reforms:

As introduced by the Government of Pakistan the E-Office is an effective communication tool for quick disposal of official business and aimed at developing a paperless working environment. Following the footsteps, the Ministry of Climate Change is effectively implementing E-Office application in the main Ministry with the support of M/o IT. Networking infrastructure has been deployed and all wings of the Ministry are using E-Office to bring efficiency, effectiveness, and transparency in official business.

ORGANOGRAM OF MINISTRY OF CLIMATE CHANGE (2021-22)



4.2 DEVELOPMENT WING

The Development Wing is responsible for all policy, administrative and budgetary matters of Public Sector Development Projects (PSDP), their monitoring and execution.

The following projects are currently under execution:

4.2.1 CLIMATE RESILIENT URBAN HUMAN SETTLEMENTS UNIT

The Public Sector Development Projects (PSDP) funded project was initiated with the aim to ensure harmonized urban development at national level and to fulfil relevant international commitments of Federal Government, a Unit has been established in Ministry of Climate Change with the cost of rupees 90.158 million as a dedicated mechanism to coordinate provincial urban settlements policies. It will facilitate in translating and linking the provincial & local urban interventions with national scenarios after the 18th amendment; and accordingly, to synthesize efforts being made to counter the hard impact of unplanned and messy urbanization in the context of demography, economic, socio cultural and political arena. The initiative therefore aims to coordinate the Government of Pakistan's efforts regarding environmentally sustainable urban development and human settlements at federal level; and establish a ministerial-level mechanism to regularly report the sectoral progress & accomplishments.

Objectives of the Scheme:

1. To plan and implement the harmonized Action Plans for developing “Climate Resilient Safe & Sustainable Cities” in collaboration with the Pakistan Urban Planning & Policy center at the Ministry of Planning, Development and Special Initiatives (MoPD&SI) along with the UN-Habitat Pakistan, all provincial urban units, and the Line Departments of Planning and Development (P&D), local governments, Housing & Urban Development of the Governments of Gilgit Baltistan (GB) and the Azad Jammu and Kashmir (AJ&K).
2. To facilitate provincial urban units in launching community-motivated urbanization initiatives and in implementing urban projects; to facilitate their access to external funding from development partners like the Adaptation Fund, Global Environment Facility, and Green Climate Fund, in addition to increased government's budgetary allocation, and setting aside international funds for adopting actions in developing Climate Resilient cities.
3. To assist the Pakistan Urban Planning and Policy Centre in the Ministry of Planning, Development and Special Initiatives (MoPD&SI) in implementing the Pakistan Vision 2025 strategic initiatives for transforming all urban human settlements into economic growth hubs and eco-friendly sustainable cities through improved governance, effective urban planning, efficient mobility infrastructure, better security & community participation in collaboration with city governments.
4. To develop and strengthen the capacity of city administrations to assess the emission targets and adopt low-carbon energy-efficient comprehensive Action Plans to convert their urban-heat islands into “Climate Resilient Cities” while fulfilling international commitments of the federal government.
5. To strengthen the city governments' capacity in engaging the line departments and agencies and also the non-state actors to effectively meet the urban development challenges throughout Pakistan as per international obligations of Federal Government vis-à-vis United Nation Environment Program (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), and UN-Habitat targets under the Rio+20 Declaration, New Urban Agenda, and Sustainable Development Goals (SDGs).

6. To strengthen institutional capacity of provincial urban units, GB & AJK by augmenting their technical- knowledge and integrating their working mechanism to streamline future urbanization throughout Pakistan, enabling them to develop people-centered “Cities for Life” through efficient service-delivery based on information from an integrated Web-Net Databank of all human settlements scenario including the SDGs (i.e., rural-urban migration and demographics, urban poverty & land-use, GHG emissions & temperatures, informal slums, etc.).

Major Activities executed during FY 2021-22:

1. “Pakistan Resilient Urban Policy Framework” has been formulated in consultation with all relevant federal and provincial stakeholders.
2. Green Building Guidelines for the ‘Prime Minister's Five Million Naya Pakistan Housing Program’ have been formulated under this project and shared with the Naya Pakistan Housing Authority.
3. Streamlined SDG-11 (Sustainable cities & communities) to make cities inclusive, safe, resilient, and sustainable in collaboration with stakeholders. The information has been gathered and shared accordingly with the SDG Unit established in M/o PD&SI.
4. Ministry of Climate Change has been supporting UN-Habitat in preparation of ADAPTATION FUND PROJECT titled “Enhanced Community Local and National-Level Urban Climate Change Resilience to Scarcity, Caused by floods and droughts in Rawalpindi and Nowshehra.” The total cost of the project is USD 6M from 2021-2024. The project was secured from the Adaptation Fund Board, Washington DC in 2020, and is being implemented in Nowshehra and Rawalpindi.
5. Another project conceived under this Project is “Climate Resilience of the fisher folk of Rehrei Goth, Karachi”. This project will provide interventions to protect the coastal community from sea intrusion through the construction of a retention wall of 6 Kilometers at the coastal belt of Karachi. The second component of the project is the development of policy guidelines regarding “Climate Resilient Coastal Community and Marine Ecosystem Restoration” which will be submitted to the Adaptation Fund Board. The total cost of the project is 10 million US \$.
6. Development of the template and user interface of the web portal and data uploading on the web portal initiated against identified indicators.
7. 1st Training session on ‘Assessment of GHG Emissions’ was conducted in Lahore on 29th & 30th June 2022 for the development of climate-resilient sustainable cities.
8. One Day National Seminar on the ‘Promotion of Rainwater/Floodwater Harvesting in Urban Areas of Pakistan’ was conducted with relevant stakeholders (federal & provincial) to raise awareness about water harvesting and in futuristic utilization.
9. The Land Use Land Cover (LULC) and Land Surface Temperature (LST) Maps of major cities i.e., Islamabad has been completed to assess the Climate Change vulnerability.

4.2.2 CAPACITY BUILDING ON WATER QUALITY MONITORING AND SDG 6(6.1) REPORTING

The safely managed water under Sustainable Development Goals (SDGs) comprises of water accessible at premises, available when needed, and free from contamination. About 89% population in Pakistan has access to improved water sources. This largely comprises of motorized pumps, hand pumps, piped

water, and closed wells. Only 1/4Th of population in Pakistan has access to piped water (26%). High reliance on drinking water drawn from underground through hand pumps or motor pumps shows that ground water extraction is unregulated. Self-provision is leading primarily in Punjab and Sindh provinces as compared to Balochistan and Khyber Pakhtunkhwa province where high reliance is on piped or surface water.

In Pakistan, due to huge urbanization and environmental changes, there is a dire need to focus on drinking water quality in the country. Moreover, growing population further increases the demand for safe drinking water—an issue that needs to be addressed on urgent basis. In addition to this, a proper platform was required to play a vital role in reporting and tracking the progress on SDG 6 (6.1). Further, to provide support to fill in the gaps in implementation of interventions around access to safe drinking water, a separate PC-1 titled as “**Capacity Building on Water Quality Monitoring and SDG 6 (6.1) Reporting**” under the Korea International Cooperation Agency (KOICA) grant is being developed in alignment with the PC-1 of Water, Sanitation And Hygiene (WASH) Strategic Unit to strengthen the capacities for reporting, monitoring and surveillance of drinking water both at federal and provincial level.

All the interventions and activities designed for the project were conceived in consultation with the provincial stakeholders over a period of two years. An extensive process of consultations and review of data was undertaken by the Ministry of Climate Change (MoCC) and KOICA experts to ensure that there is no duplication of activities. The project will aid and facilitate the process, preparation, implementation, and monitoring of KOICA grant funds. This will also facilitate the provincial departments and governments to receive the next phase of the KOICA grant to support equipment and uplift infrastructure for water quality testing labs/systems.

Roles and Functions:

1. To develop and establish a national/ provincial drinking water quality monitoring and surveillance management system, and strengthen the capacity of WASH Cell and Public Health Engineering Department (PHEDs) to track the progress of SDG-6.1
2. To strengthen the coordination capacity of WASH Cell on drinking water issues with provincial governments
3. To build capacity of human resources on water quality testing, monitoring, and provision of necessary equipment

Goals and Targets:

1. Putting in place an effective water quality monitoring, surveillance, and management system
2. Institutional and policy arrangements for water quality monitoring
3. Establishment of a periodic IT-based reporting mechanism on water quality monitoring
4. Development of capacity for water quality monitoring and testing for the identified stakeholders

Activities:

1. Development of national and provincial water quality monitoring & management framework
2. Review of drinking water policy, and development of a national guideline on drinking water that covers the water quality monitoring and management system

3. Finalization of Water Quality Reporting Indicators
4. Organization of quarterly coordination meetings
5. Organization of one national workshop (Joint Sector Review) for the annual review of water quality component
6. Establishment of Management information systems (MIS) for water quality monitoring and surveillance
7. Development of MIS System (water quality) and interfacing it with Clean Green Pakistan Index Dashboard
8. Development of annual report on drinking water quality statistics and analysis of data on water quality twice a year
9. Capacity building (trainings) for water policy, master trainer and water quality lab operation
10. International courses/ training sessions to be organized in Korea
11. National trainings in Pakistan
12. Strengthening of water quality testing labs by providing the water quality testing equipment and necessary infrastructure uplift
13. Project implementation at national and provincial level
14. Development of Standard operating procedure (SOPs) and operating guidelines for water quality testing, labs, and staff

Achievements:

1. Baseline for water quality laboratories under Khyber Pakhtunkhwa, Punjab, and Federal (Environmental Protection Agencies) EPAs has been developed
2. The initial scoping exercise for MIS development for Khyber Pakhtunkhwa was conducted in Jan 2022
3. Training capacity building, and need assessment on water quality are under process
4. A stakeholder consultation meeting on the water quality management framework has been conducted
5. 1st steering committee meeting was conducted on 14th Dec 2021

4.2.3 UP-SCALING OF THE GREEN PAKISTAN PROGRAM (GPP)

The implementation of the Green Pakistan Program (GPP) was initiated in 2019 with a total cost of Rs. 125.1843 billion on cost-sharing basis for four years (2019-2023) to plant/regenerate 3.29 billion plants in the provinces / territories. An amount of Rs. 12949.217 million was utilized during 2021-22. As reported by the provinces/territories a total of 794.415 million plants were planted/regenerated/distributed during 2021-22. However, a cumulative total of 1838.504 million plants were planted/regenerated / distributed to increase tree cover on 0.656 million hectares over the past three years (see Table No. 1). During the extraordinary circumstances created by the COVID-19, the

provincial Forest and Wildlife Departments, AJK and GB provided about 237,860 green jobs during 2021-22.

An independent third-party consortium of the International Union for Conservation of Nature (IUCN), World Wide Funds for Nature (WWF), and the Food and Agriculture Organization (FAO) conducted a preliminary assessment of the achievements of this program. It was concluded that the success of the plantation/regeneration ranged between 75-95%. This initiative of the government has also been registered under the Bonn Challenge.

Table No.1 Details of plants planted/regenerated under TBTP

(Figures in Millions)

S. No	Province / Territory	Year wise Physical Progress				Area (Hectare)
		2019-20	2020-21	2021-22	Total	
1.	Punjab	58	74.25	151.75	284	45,591
2.	Sindh	180.23	223.04	319.9	723.17	167,426
3.	KP	168.54	218.73	260.16	647.43	352,306
4.	Balochistan	2.9	2.75	6.514	12.164	3,964
5.	AJK	69.09	35.45	37.48	142.02	60,011
6.	GB	4.69	6.9	8.13	19.72	27,506
Total		483.45	561.12	783.934	1,828.504	656,804

Digital Progress Reporting System for GPP

Ministry of Climate Change developed a robust digital reporting system to ensure transparency of project activities. The system was developed by in-house development team of GPP within a period of six months. This system is capable to capture all the activities including block plantation, linear plantation, assisted natural regeneration, and nursery management system, performed under forest component of GPP. Ministry of Climate Change has successfully organized workshops to provide training on digital reporting system to all the DFOs across Pakistan GPP is currently developing a monitoring platform to ensure transparency of the programme. In this regard, the GIS team of GPP developed a web-GIS monitoring portal that is capable of visualizing the plantation sites geographically with detailed information on the site and process satellite imagery of pre- & post plantation status. The reporting system for the wildlife component is under preparation.

4.3 ENVIRONMENT & CLIMATE CHANGE WING

The Environment and Climate Change Wing of the Ministry is mandated to perform the following functions: -

- Implementation of National Climate Change Policy (NCCP) and Implementation Framework;
- Implementation of Environment Policy;
- Sustainable and Climate resilient Urbanization;
- Water Sanitation and Hygiene (WASH)

It also deals with the United Nations Framework Convention on Climate Change (UNFCCC), Inter-Governmental Panel on Climate Change (IPCC), the United Nation Environment (UNE), UNICEF, South Asia Cooperative Environment Programme (SACEP), and Environmental Protection Component of Shanghai Cooperation Organization (SCO).

Pakistan is considered one of the low global greenhouse gases (GHG) emitter. Presently, Pakistan's GHG emissions account for less than one percent. However, the country is considered extremely vulnerable to the impacts of climate change. Being a responsible member of the global community, Pakistan has responded with a well-articulated climate change agenda, consisting of the following initiatives: -

4.3.1 CLIMATE CHANGE SECTION

4.3.1.1 Prime Minister's Taskforce on Heat Wave and Global Warming:

Given the high intensity of heat waves this year in Pakistan, a task force on Global Warming wave Heat wave was constituted by the Prime Minister with Federal Minister for Climate Change as the chair. The taskforce has membership from the ministries of Information and Broadcasting, National Health Services, National Food Security, Water Resources, all Chief Secretaries, the National Disaster Management Authority, Pakistan Meteorological Department, Pakistan Environment Protection Agency, Provincial Environment Protection Agencies, and Provincial Disaster Management Authorities. The task force has so far held four meetings to tackle issues of heat wave, forest- fires, marine pollution, and monsoon rains, as well as introducing climate-related policies/initiatives (introduction of hazardous waste management policy, and Living Indus Initiative) with the members of the task force

4.3.1.2 Living Indus Initiative:

The Initiative for the restoration of the River Indus for climate resilient future was launched by the Government of Pakistan. The initiative was proposed by the United Nations to improve water quality and quantity, while also restoring the health of the Indus Basin. The Living Indus initiative aims to restore and repair the natural resources and ecosystems of the basin to ensure that they are resilient to climate change. In this regard, the proposed draft initiative has been shared with the federal and provincial entities for consultation and input. Ministry of Climate Change is now aiming to present this initiative before the Federal Cabinet in the form of a consolidated presentation.

4.3.1.3 Pakistan's Commitment towards NDCs under the Paris Agreement:

The Government of Pakistan (GOP) as a Party to the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) has performed its role to support the global efforts in

combating climate change. GOP had submitted an inclusive updated Nationally Determined Contributions (NDC) which represents national consensus to accelerating the transition towards a climate-resilient economy. The current submission showcases GOP's progress in climate action that ranges from policy and programs on Nature-based Solutions (NBS) to technology-based interventions. Pakistan, recognizing the role of nature in climate adaptation and mitigation, has developed robust natural capital restoration efforts including the Ten Billion Tree Tsunami Program (TBTTP), Protected Areas Initiative (PAI) etc. These programs also serve as a way to enhance livelihood opportunities for the most vulnerable, including women and youth. In addition, Pakistan has introduced a number of policy actions focused on mitigating greenhouse gas emissions from high emission sectors like energy and industry.

During the decade ahead is decided by the current climate-induced vulnerabilities, aimed at achieving reduced poverty and ensuring a stable economy.

The updated NDC is informed by recent policy development in the country in the NDC sectors, and some ambitious decisions taken by the pro-climate leadership to enhance Pakistan's resilience and to decarbonize the economy. In addition, for enhanced contributions, new sectors and new gases have also been added to the updated document. Hence, Pakistan intends to set a cumulative ambitious conditional target of overall 50% reduction of its projected emissions by 2030, with 15% from the country's own resources and 35% subject to provision of international grant finance that would require USD 101 billion just for energy transition. To reach the target, Pakistan aims to shift to 60% renewable energy, 30% electric vehicles by 2030, and completely ban imported coal. Moreover, Pakistan seeks to expand NBS by implementation of TBTTP, Recharge Pakistan, and PAI. Pakistan's emissions as per 2018 are 489.87 MtCO_{2e}. Billion Trees Afforestation Project (BTAP) and TBTTP will sequester CO₂ around 500 Mt CO_{2e} by 2040, if implemented fully.

4.3.1.4 Biennial Updated Report (BUR):

Ministry of Climate Change has finalized its First Biennial Update Report (BUR1) and submitted to UNFCCC Secretariat in April 2022. The scope of the BURs is to provide an update of the most recently submitted National Communication and to provide additional information in relation to mitigation actions taken or envisaged to undertake and their effects as well as support needed and received. Pakistan's BUR1 has been developed using the expertise from nodal technical institutions working on the respective themes of climate change. This arrangement has been put in place to strengthen the national reporting process under UNFCCC, which was established under the previously executed project for the preparation of Pakistan's Second National Communication (SNC).

4.3.1.5 National Adaptation Plan (NAP):

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

4.3.1.6 International Organization for Migration (IOM's) project "Human Mobility in the Context of Climate Change"

The International Organization for Migration (IOM) approached the Ministry of Climate Change with a project proposal titled "Human Mobility in the Context of Climate Change" aiming at enhancing research, building institutional capacity, and increasing technical assistance in the context of climate-

induced migrations. In this regard, IOM requested a Letter of Support to initiate project activities. MoCC circulated the draft project proposal with all relevant stakeholders. In this regard, responses have been received and consolidated. A draft support letter has been approved by the Federal Minister for Climate Change and has been signed jointly by IOM and the Ministry of Climate Change.

4.3.1.7 Clean and Green Pakistan Movement (CGPM):

The Prime Minister of Pakistan launched the “Clean Green Pakistan Movement” with a vision to drive a nationwide movement by the people of Pakistan for a clean and green Pakistan. Clean and Green Cities Index (CGPI) is a city/ tehsil level index that aims to rank cities/tehsils according to the indicators on cleanliness and greenery. Its pillars are water, sanitation, hygiene, solid waste, cleanliness of streets, usability of parks, and number of trees. Each pillar has multiple sub-indicators.

This initiative empowers the local councils and district administration to monitor and review their cities on set performance indicators and create a healthy competitive environment. This project addresses the livelihood issue by creating green jobs in environment-specific fields like waste recycling and management, horticultural, and nurseries development for plant saplings, etc.

4.3.1.8 Introduction of Carbon Pricing Instrument in Pakistan:

Intending to strengthen the institutional capacity for developing “carbon trading” and for participation in the international carbon market, the Ministry of Climate Change in collaboration with UNFCCC has conducted in-depth study on the “Introduction of Carbon Pricing Instrument in Pakistan”. As per the study, the carbon pricing system will be introduced in Pakistan in three phases: awareness, preparedness, and pilot activities. The Government of Pakistan is committed to control carbon footprint by increasing the cost of carbon-emitting technologies. The National Committee on the Establishment of Carbon Market (NCEC) got approval of the Prime Minister of Pakistan in November 2019. NCEC has conducted an introductory meeting with relevant stakeholders, and there is an agreement to introduce this change in a steady manner.

4.3.1.9 Promotion of Rainwater Harvesting in Cities:

Pakistan is among the 36 most water-stressed countries in the world, consuming more than 70 percent of total renewable water sources with inadequate quantities of surface water (228 billion cubic meters BCM) and groundwater (approximately 62 BCM). Pakistan's population is estimated to be 207.78 million people with 63.6 percent as the rural population, further reducing the per capita availability from 5273 m³/year in 1962 to 1188 m³/year, which makes this equation even more complex. The country's water scarcity is influenced by the uncontrolled population dependence on a single river system (Indus basin), and the growing effects of climate change. The total extraction of fresh water in Pakistan is 74.4 percent of total renewable water resources. Pakistan draws about 65 billion cubic meters of groundwater in the freshwater zone at a faster rate than it recharges.

With rapid population growth and urbanization, the country cannot deal with unstable conditions due to its in-house resource and management limitations. The water crisis has become a severe issue faced by the residents of the country in various places. Pakistan storage capacity is 10 percent of the average annual flow of its rivers, which is well below the world's average 40 percent storage capacity. Pakistan was rich in water in the past (almost 6000 cubic meters per capita in 1960); but now it has become a water-scarce country with 1017 cubic meters per capita. The country's water needs are estimated to increase by 10% annually and are expected to reach 338 billion cubic meters in 2025. However, the per capita availability of water in the country fell from 1700 m³ in 1992 to 1090 m³ in 2012. Due to the enormous extraction from the groundwater source, the groundwater level is falling day by day.

The water crisis is a looming threat for Pakistan. In various parts of the country, even safe drinking

water is not available to people. Surface waters are under constant risk of industrial and anthropogenic pollution. Swiftly growing water demand due to population explosion is leading to groundwater being withdrawn faster than it is being replenished through replenishment.

Rainwater storage, long-held traditional wisdom, could be a solution to the problem. Rainwater harvesting means the right use of rainwater by storing it for domestic use and recharging the water table. Over the years, the water crisis has become a serious problem for Pakistan, and the crisis has developed twofold. One of them is an acute water shortage in summer with a lack of groundwater, and the other is urban flooding in monsoons due to water logging. Water scarcities have forced people to use contaminated water sources, causing colossal diarrhea every summer that mainly affects children. The country's groundwater resources depend mainly on the number of groundwater reservoirs and the annual recharge volume.

Rainwater harvesting is the attitude and way of collecting precipitation from a catchment area and using it. The term is taken from a more general meaning of water extraction, which refers to the storage and use of water primarily for irrigation purposes. Today the term generally encompasses the collection of drains based on micro-catchment principles, i.e., roofs.

In 2021 under the PSDP Project titled Climate Resilient Urban Human Settlements Unit, a Seminar Workshop was held for the promotion of rainwater harvesting in urban areas of the country. Wherein, the relevant stakeholders from federal and provincial institutions were sensitized. Therefore, it is proposed to hold such proceedings of awareness and capacity building in all the provinces for the promotion of rainwater harvesting and address the water scarcity by storing rainwater.

The Ministry of Climate Change is in the process of devising a strategy paper for the promotion of Rainwater Harvesting in the country, and the document will be shared with relevant stakeholders for implementation with the techniques of averting the urban flooding into the opportunity by storing of rainwater. Stored rainwater can be used for gardening, car washing, and recharge of the underground aquifer.

4.3.1.10 Asia Pacific Week 2021-2022 (Host – Pakistan):

Since its inception in 2017, regional climate weeks have gained much traction as overarching platforms for stakeholders to meet, share experiences and best practices, as well as to identify mutually beneficial climate action and policy- interventions related to the implementation of Nationally Determined Contributions NDCs and National Adaptation Plan under the Paris Agreement. The Asia Pacific Climate Week is also one of the annual activities that is hosted under UNFCCC.

After consistent deliberation and lobbying, Pakistan was able to secure a chance to host this year's Asia Pacific Climate Week (APCW). This will be a global event with huge participation as evident from the APCW event of 2021 where 152 countries and 500 organizations participated. Pakistan has provided an initial response in favor of hosting the event.

Ministry of Climate Change organized a brainstorming session with stakeholders including development sector partners, UN agencies, and development banks to discuss the opportunity and resources needed to host such an event. The session was successful given that all of the attending parties congratulated Pakistan and showed positive commitment to park resources for the APCW.

4.3.1.11 Pakistan Clean Air Programme (PCAP):

Ministry of Climate Change in partnership with Clean Air Asia (CAA) and Stockholm Environment Institute (SEI) initiated Integrating Short-Lived Climate Pollutants (SLCPs) reduction in Pakistan's Air Quality Plans and Program 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). In addition, Pakistan recently signed joined Global Methane Pledge initiated by the European Union (EU) and US governments on October 11, 2021, to slash methane emissions 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 the best available inventory methodologies to quantify methane emissions, with a particular focus on high-emission sources.

4.3.1.12 Formulation of Pakistan's Updated Nationally Determined Contributions (NDC's):

The Climate Change section of Ministry of Climate Change has successfully organized meeting of the steering committee for formulation of NDC's 2021 document. Climate Change section has made its efforts for making NDCs' comprehensive document which is a statement of climate vision and the direction of our national policies and actions. The updated NDCs document of Pakistan is much more comprehensive as compared to the 2016 NDCs document, and focuses on the Prime Minister's Vision for Climate Change. Pakistan is ambitious to further reduce its emissions.

4.3.1.13 Natural Capital Accounting:

The Prime Minister Imran Khan's aide Malik Amin Aslam and the British High Commissioner in Pakistan Dr. Christian Turner mutually signed an agreement on natural capital accounting. Natural capital is often undervalued or neglected in decision-making, which contributes to more biodiversity loss and ultimately impacts human well-being. For example, infrastructure and road development projects have historically been carried out with little to no attention to the short or long-term impact of these activities on natural ecosystems and biodiversity. While sustainable use of the natural capital provides the foundation for sustainability of life on earth and overall socioeconomic development of current and future generations, and is vital to its sustainability for generating ecosystem services for lasting human well-being.

The support on Natural Capital Accounting (NCA) between the British High Commission Islamabad, UK Statistics Authority and the Ministry of Climate Change will help make the planet livable for humans, and include carbon sequestration of forests and the moderation of extreme events, such as the role of mangroves in flood and storm surge mitigation.

4.3.2 URBAN AFFAIRS DIRECTORATE

4.3.2.1 Electric Vehicle Policy (EV):

Transportation accounts for 43% of the airborne emissions in the country. The Government of Pakistan is committed to curb emissions. Therefore, Government of Pakistan has introduced Electric Vehicle Policy targeting 30% shift to Electric Vehicles (EVs) by 2030. EVs will be introduced in the country in a phased manner. The implementation of the EV policy is spearheaded by the Ministry of Climate Change. In this regard two meetings of EVs Oversight Implementation have been conducted by the Ministry, wherein the decisions were taken to expedite the actions of implementation of EV policy. All stakeholders were directed to play their role as assigned under the EV policy i.e., installation of charging station, exemption of registration fees, and compliance regarding ensuring income and sales tax on the import of Completely Built Up (CBU). Third meeting of Oversight Committee of EVs will be convened in due course of time.

4.3.2.2 National Climate Change Policy (NCCP):

The National Climate Change Policy (NCCP) is a landmark in the Climate Change response in Pakistan, which was approved in 2012. The National Climate Change Policy comprehensively

addresses all possible challenges of Climate Change adaptation and mitigation; and ensures to provide rock solid foundational framework for ensuing Climate Change Action Plans, programs and projects. In developing countries such as Pakistan, climate change poses a serious challenge to social, environmental and economic development, and leads to migration within and across national borders of the country. The effects of global climate change in Pakistan are already evident in the form of growing frequency of droughts, flooding, increasingly erratic weather behavior, and changes in agricultural patterns, reduction in fresh water supply, and the loss of biodiversity.

Mitigating and adapting actions are considered to be the two key ways of combating climate change. The more immediate and pressing task for the country is to prepare itself for adaptation to climate change. These policy measures are addressing issues in various sectors such as water, agriculture, forestry, coastal areas, biodiversity, and other vulnerable ecosystems. Notwithstanding the fact that Pakistan's contribution to global greenhouse gas (GHG) emissions is small, yet dedicated to play its role as a responsible member of the global community in combating climate change, the country is giving due importance to mitigation efforts in sectors such as energy, transport, forestry and agriculture.

Moreover, the Policy mentions its updating after every five years span. Accordingly, it has been updated in collaboration with UNDP, relevant federal ministries/divisions, and provincial departments. The implementation of National Climate Change Policy has been assessed, which shows landmark achievements gained through adaptation and mitigation measures carried out by Ministry of Climate Change and provincial line departments in various development sectors such as agriculture, transport, energy, industries, forestry and biodiversity. Hundreds of projects have been initiated by the federal government and provincial departments. Ten Billion Tree Tsunami, Clean Green Pakistan Index, Ecosystem Restoration, WASH, Climate Resilient Urban Development and Green Building Code are some of the major initiatives in addressing climate change in the country. Furthermore, the updated policy document has been designed in accordance to the requirements of Paris Agreement on climate change, Sustainable Development Goals, 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.

Pakistan's stance at the 'UN Climate Ambition Summit' in December 2020 has set the direction of Pakistan's pathway to decarbonizing the country's economy. Government of Pakistan declared that 60 percent of all energy produced in the country by 2030 will be clean and through renewable resources, thirty percent of all the country's passenger and heavy-duty vehicles will be electric vehicles, and that Pakistan will no longer pursue imported coal power plants. These broad pronouncements in addition to "Ten Billion Tree Tsunami Forestation Initiative" can provide the country's roadmap for the achievement of NDCs emission reduction goals. The updated National Climate Change Policy- 2021's goal is to steer Pakistan towards climate resilience and low carbon development.

4.3.2.3 Adaptation Fund:

Ministry of Climate Change under its PSDP Project titled 'Climate Resilient Urban Human Settlements Unit' has supported UN-Habitat in preparation of Adaptation Fund Project titled "Enhanced Community, Local and National- Level Urban Climate Change Resilience to Scarcity, caused by floods and droughts in Rawalpindi and Nowshera." Total cost of the project is USD 6M from 2021-2024. The said project was secured from Adaptation Fund Board, Washington DC in 2020 and is being implemented in Nowshera and Rawalpindi.

4.3.3 DIRECTORATE OF ENVIRONMENT POLICY

4.3.3.1 South Asia Co-Operative Environment Programme (SACEP) Strategy:

Ministry of Climate Change, Government of Pakistan being a member state of SACEP has been supporting the SACEP Strategy for 2020-2030. The strategy was formulated in response to the decision made in the SACEP Governing Council meeting. The main objectives of the strategy is to promote regional cooperation in South Asia in the field of environment, both natural and human, and on issues of economic and social development which also impinge on the environment and vice versa; to support conservation and management of natural resources of the region; and to work closely with all regional, national and international institutions, governmental and nongovernmental, as well as experts and groups engaged in such co-operation and conservation efforts.

During the 2020–2030 period, SACEP is pursuing the following strategic goals in the region. Together, these goals define the core priorities and focus of SACEP:

- i. Enhance resilience to the impacts of climate change through mitigation and adaptation measures
- ii. Conservation of ecosystem and biodiversity
- iii. Ensure effective waste management at all levels
- iv. Ensure better air quality to safeguard health and well-being
- v. Strengthen low-emission development, improve resource efficiency for transition to an inclusive greeneconomy, and fostered sustainable and healthy lifestyles
- vi. Strengthen environmental governance for evidence-based decision-making

4.3.3.2 Collaboration with Shanghai Cooperation Organization (SCO):

Shanghai Cooperation Organization (SCO) is a political, economic, and security alliance created on 15th June 2001 in Shanghai (China). The SCO comprises of eight Member States – China, India, Kazakhstan, Kyrgyzstan, Russia, Pakistan, Tajikistan, and Uzbekistan. Afghanistan, Belarus, Iran, and Mongolia are interested in acceding full membership as observer states. It has also six Dialogue Partners. Armenia, Azerbaijan, Cambodia, Nepal, Sri Lanka, India, and Pakistan officially joined the SCO as full-fledged members in June 2017. SCO aims to:-

- Strengthen relations among member states;
- Promote cooperation in political affairs, economy and trade, scientific-technical, cultural, and educational spheres as well as in energy, transportation, tourism, and environmental protection;
- Safeguarding regional peace, security, and stability

The Ministry has been participating in the Heads of the Ministries and Agencies and Expert Group meetings of SCO Member States responsible for environmental protection. The main objective of these meetings is to discuss practical cooperation and ensure environmental sustainability and climate resilience in the SCO region. Discussion on the Greening of Belt and Road Initiative (BRT) and China-Pakistan Economic Corridor (CPEC), being part of BRT, and the Ecological well-being of the Cites in SCO region is part of these events which is a potential opportunity for Pakistan in the field of regional environmental protection and climate change.

4.3.3.3 Conversion of Brick kilns in Zig-Zag Technology:

There are around 10,000 brick kilns in Pakistan. These kilns have been operated on conventional obsolete technologies and have been contributing to air pollution and SMOG issues in winter, in and around major cities of Punjab and Khyber Pakhtunkhwa while affecting the health and well-being of the general masses.

Ministry of Climate Change in collaboration with federal and provincial EPAs, Clean Air Coalition of UN Environment, and International Centre for Integrated Mountain Development (ICIMOD), National Energy Efficiency and Conservation Authority (NEECA), Pakistan Engineering Council, Pakistan Brick Kiln Owners Association, academia, and other stakeholders has initiated the process of converting conventional brick kilns to Zig-Zag technology. The conversion of brick kilns on Zig-Zag technology is under process and has resulted in reduced emissions and fuel savings. The conversion initiative comprises the following components:

1. Sensitizing the brick kiln owners through the Pakistan Brick Kiln Owners Association
2. On-site training of brick kiln workers
3. Exposure visits to regional countries
4. Arranging soft loans from banks

The Ministry has been facilitating on-site trainings for the Brick Kiln Owners Association of Pakistan through the International Center for Integrated Mountain Development (ICIMOD) Nepal NEECA, Ministry of Energy

4.3.3.4 Collaboration with Global Green Growth Institute (GGGI), South Korea:

Ministry of Climate Change is a policy formulation body with regard to Climate Change including environmental protection. The Ministry has processed an agreement for Pakistan to become a participating member of the Global Green Growth Institute (GGGI), South Korea. The Federal Cabinet has approved the proposal, and it is under the process of final approval by the Ministry of Foreign Affairs.

GGGI is a treaty-based international organization. It aims to promote a green growth paradigm characterized by a balance of economic growth and environmental sustainability. The institute would provide support for green economic growth, simultaneously addressing poverty reduction, job creation, social inclusion, and environmental sustainability, and works across four priority areas considered to be essential for transforming national economies i.e., energy, water, land use, and green cities. The agreement aims to formalize a framework of cooperation to promote green growth planning and implementation in Pakistan which includes:

- a) Support in the development of Climate Resilient Growth Strategy and;
- b) Integrating green growth into public sector development strategy

Projects of Environment/ Climate Change Wing:

The wing is executing the following projects:

1. Capacity Building on Water Quality Monitoring and SDG 6 (6.1) Reporting

Climate Resilient Urban Human Settlements Unit

4.4 FORESTRY WING

Status of Forests, Biodiversity, and Wildlife Resources in Pakistan:

According to the latest National Forest Reference Emissions Level (FREL) findings, the country is maintaining a 4.786 million-hectare (5.45%) area under forest cover. By forest type, dry temperate forests have the largest proportional coverage (36 %) followed by sub-tropical broadleaved shrub (19 %), moist temperate (15 %), Chir Pine (13 %), Riverine (4 %), irrigated plantation (4 %), thorn (3 %), mangrove (3 %) and subalpine forests (2 %).

Unfortunately, climatic conditions, rural poverty, dependence on natural resources, meager forest cover, and a high rate of deforestation have rendered the country one of the most vulnerable to climate change effects. Forest, biodiversity, and wildlife resources have also suffered from the adverse effects of climate change. Besides, these resources are under tremendous pressure owing to change in land use and habitat destruction. Due to population increase, the consumption of fuel, wood, and timber extraction has increased. Such pressures have rendered most of the forests of poor and medium density in need of drastic restocking on a war footing.

The overall improvement of the sector in the country will require continuous efforts through several initiatives under long-term planning and programmes. Existing meager forest resources being crucial to environmental stability demand serious interventions and adequate financial flows to improve and enhance the overall forestry, wildlife, and biodiversity sector.

The major activities of Forest Wing during the year 2021-22 are under:

4.4.1 TEN BILLION TREE TSUNAMI PROGRAMME (TBTP)

The implementation of the TBTP was initiated in 2019 with a total cost of Rs. 125.1843 billion on cost-sharing basis for four years (2019-2023) to plant/regenerate 3.29 billion plants in the provinces/territories. An amount of 12,949.217 million was utilized during 2021-22. As reported by the provinces/territories a total of 794.415 million plants were planted/regenerated/ distributed during 2021-22. However, a cumulative total of 1,828.504 million plants were planted/regenerated / distributed to increase tree cover on 0.656 million hectares over the past three years. During the extraordinary circumstances created by COVID-19, the provincial Forest and Wildlife Departments, AJK, and provided about 237,860 green jobs during 2021-22.

An independent third-party consortium of IUCN, WWF, and FAO conducted a preliminary assessment of the achievements of this programme. It was concluded that the success of the plantation/regeneration ranged between 75- 95%. This initiative of the Government has also been registered under the Bonn Challenge (for more details see pg. 11- 12).

4.4.2 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 (REDD+) is a concept adopted by the countries under the United Nations Framework Convention on Climate Change (UNFCCC) in 2010. The concept relates to the 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. Ministry of Climate Change is implementing the REDD+ Readiness Preparation Project with a financial grant of USD 7.81 million received under the Forest Carbon Partnership Facility (FCPF) of the World Bank to complete the following four essential elements of the REDD+ in order to fulfill the requirements of accessing result-based payments under REDD+ mechanism.

The progress made by the project is as under:

1. National Forest Reference Emissions Level (FREL), based on the historical assessment of deforestation during the period 2004 to 2012, was prepared and submitted to UNFCCC on 6th January 2020. UNFCCC has endorsed the FREL prepared for Pakistan
2. Protocols have been developed for the National Forest Monitoring System (NFMS) and Monitoring, Reporting and Verification (MRV) system
3. Framework has been developed for Safeguards Information System (SIS) for REDD+ together with Strategic Environmental and Social Assessment, Environmental and Social Management, and Feedback Grievance Redressal Mechanism
4. A draft National REDD+ Strategy has been prepared
5. The design of Payment for Ecosystem Services (PES) has been completed for two ecosystems i.e. Mangroves and temperate forests

4.4.3 REVERSING DEFORESTATION AND FOREST DEGRADATION IN HIGH CHILGHOZA PINE FORESTS PAKISTAN BALOCHISTAN' PROGRESS

The major achievements of the project during 2021-22 are as under:

- Distributed 48,500 forest and 3,700 fruit plants, while 120,000 plants are under distribution
- 50 Acers Block Plantation raised in Adil Abad
- 250 Fuel Efficient Stoves and 50 Gasifiers procured and distributed
- 6 Cone Crushers procured and will be provided before the start of the Chilghoza harvesting season

4.4.4 DECLARATION OF MARINE PROTECTED AREAS (MPA)

Consultative process is undergoing on management and planning of Astola Island with the involvement of all stakeholders. Active consultation is in process with the Ministries of Defense, Maritime Affairs, and the provincial governments to increase the coverage of MPAs. Two new MPAs are under consideration: Off Pasni and Ras Milan. The declaration of Marine PAs remains a challenge due to the diversity of stakeholders involved. Furthermore, efforts are underway to notify all mangrove forests along Balochistan Coast as protected forests and implement activities for the protection and reforestation of degraded mangrove forests. It is anticipated that more than 14000 acres of coastal areas will come under this category of protected mangrove forests along the Balochistan coast. The following areas are significant in this regard: Miani Hor, Kalamat Khor, Shadi Khor, Sawar Khor, Shabi & Ankra Creeks, and Jiwani.

4.4.5 MEMBERSHIP OF THE INTERNATIONAL NETWORK ON BAMBOO AND RATTAN (INBAR)

INBAR is an Inter-Governmental Organization established in 1997 to promote environmentally sustainable use of Bamboo and Rattan. The President of Pakistan signed the Letter of Accession to become a member of INBAR. The network will support Pakistan in the propagation and value chain development of Bamboo in the country. On the request of Pakistan, the INBAR Secretariat is conducting a study on Bamboo Sector Development in Pakistan, mainly focusing on the following:

- 4.4.6 Bamboo resource monitoring system
- 4.4.7 Bamboo market and value chain development
- 4.4.8 Enabling policies and regulations that support the use of bamboo for socio-economic and environmental development.

4.4.6 MEMORANDUM OF UNDERSTANDING (MOU) WITH ELION RESOURCES GROUP CO. OF CHINA

The Prime Minister of Pakistan witnessed the signing of a MoU with Elion Resources Group to establish a China- Pakistan Ecological demonstration zone in Pakistan with an approximate cost of USD 5 million. The zone will be developed to demonstrate desertification control based on the Kabuqi model successfully implemented in China.

4.4.7 SAUDI GREEN INITIATIVE (SGI) AND MIDDLE EAST GREEN INITIATIVE (MGI)

An MOU has been signed with Kingdom of Saudi Arabia (KSA) to increase cooperation in the field of environment. Under the MoU, the two sides have agreed to continue cooperation in the field of environment. The Islamic Republic of Pakistan has welcomed the Kingdom's launch of the "Saudi Green" and "Middle East Green" initiatives by KSA. A meeting of the Joint Working Group was held under the Economic pillar of the Saudi Pakistan Supreme Coordination (SPSCC). Both sides have agreed to *cooperate in the field of environment, vegetation development, and afforestation.*

4.4.8 HIGH AMBITION COALITION

Pakistan joined the high-ambition coalition for nature. It supports efforts being made globally to protect biodiversity resources. The coalition reiterates commitment towards achieving the post-2020 target of 30 X 30. Pakistan remained in communication regarding the Kunming declaration and the incorporation of relevant elements.

4.4.9 DAY FOR BIOLOGICAL DIVERSITY

The International Day for Biological Diversity was observed on 22 May 2022 by the Biodiversity Directorate of the Ministry of Climate Change and other stakeholders. The message was delivered mainly using social media and other communication means.

4.4.10 IMPLEMENTING CARTAGENA PROTOCOL AND BIOSAFETY CLEARING HOUSEPROJECT

National level consultative and capacity building project on Biosafety Clearing House was approved by UNEP. This UNEP led process could not be initiated due to Covid-19 outbreak. Activities were carried out in Feb-March 2022 when first national level workshop was conducted to enhance the capacity of partner organization in GMO reporting process. The initiative involved capacity building and awareness of 90 experts and practitioners from all around the country. The project will continue in year 2022-2023. For effective implementation of Cartagena Protocol, inter- ministerial meetings were held, and a legal expert is assisting the Ministry to establish an independent entity to implement biosafety regimen.

4.4.11 MAN AND BIOSPHERE RESERVES (MAB)

National MAB Committee meeting was arranged and a decision to include more MAB areas was made. The decisions of Apex body (5th National MAB Committee meeting held in Dec. 2020) triggered follow-up actions and initiation of dossiers preparation for declaration of two new MAB areas in Khyber-Pakhtunkhwa.

4.4.12 CAPACITY BUILDING FOR MEAS REPORTING DATA REPORTING TOOL (DART)

With the technical and financial support of UNEP a capacity building workshop was arranged focusing on diverse areas covered by biodiversity related MEAs specifically CBD, CITES, CMS and Ramsar Convention. About 25 experts attended the workshop held from 23-25 May, 2022. The impact remained significant and will contribute towards the national reporting process.

4.4.13 PAKISTAN SNOW LEOPARD AND ECOSYSTEM PROTECTION PROGRAM (PSLEP)

Pakistan is a member to the Global Snow Leopard and Ecosystem Protection Program (GSLEP). GSLEP is alliance of 12 snow leopard range countries with an aim to address high-mountain environmental issues using the conservation of the charismatic snow leopard as a flagship. Under GSLEP, 23 priority snow leopard landscapes have been identified in 12 snow leopard range states which are to be conserved under GSLEP. In Pakistan following three priority snow leopard landscapes are identified under GSLEP:

1. Karakoram-Pamir Landscape (25,498 Sq. km)
2. Hindu Kush Landscape (10,541 Sq. km)
3. Himalayan Landscape (4659 Sq. km)

To achieve national goal of GSLEP, a GEF-funded five years project (2018–2023), Pakistan Snow Leopard and Ecosystem Protection Program (PSLEP) was launched with total cost of USD 4.64 million. The project was aimed to promote landscape approach for survival of snow leopard & its prey species by reducing threats and applying sustainable land & forest management in critical habitats in northern Pakistan. The project is being implemented by Snow Leopard Foundation Pakistan in collaboration with the Ministry of Climate Change and Provincial/Territorial Wildlife Departments of Khyber Pakhtunkhwa, Gilgit-Baltistan and Azad Jammu & Kashmir. The key achievements under PSLEP include:

- i. Improved management of snow leopard landscapes
- ii. Increased representation of priority landscapes in protected areas network
- iii. Participatory conservation in the targeted landscapes enhanced to reduce human snow leopard conflicts and improve livelihoods of communities
- iv. Monitoring, upscaling, and replication of project approaches supported by effective knowledge, management and gender mainstreaming

4.4.14 RECHARGE PAKISTAN PROJECT

Learning from Chinese experiences in flood plains management, the Ministry of Climate Change in collaboration with WWF Pakistan has developed a proposal ‘Recharge Pakistan’ which has been submitted for funding to Green Climate Fund. The initiative has been designed in consultation with Federal Flood Commission and relevant provincial agencies. It aims at integrated flood risk management and resilience building through Ecosystem Based Adaptations. The total budget is estimated to be USD 115. The targeted areas under the project include, DI Khan Watershed, Ramak Watershed, Taunsa/Lala Creek, Kaha Watershed, Chakar Lehri Watershed, and Manchar Watershed. The main interventions under the project include:

- Restoration of wetlands and hill torrents management for flood risk reduction

- Wise use of floods for ecosystem and wetlands restoration and ground water recharge
- Wise use of floods through ecological solutions, instead of just traditional hard infrastructure

4.5 INTERNATIONAL COOPERATION WING

The International Cooperation Wing of the Ministry of Climate Change consists of three sections/units which are mandated and responsible for performing functions as follows:

1. The chemical section is mandated to set the ground for the implementation of various chemical and waste-related conventions namely Basel, Stockholm, Minamata, and Rotterdam Conventions, etc.
2. The International Cooperation section is responsible for coordination with international environmental agencies on environmental issues, signing and implementation of MOUs, and handling of matters related to GSP+. Moreover, it also represents Pakistan at international forum with respect to the signed conventions and protocols
3. National Ozone Unit was established in 1996 after the signing and ratification of Vienna Convention and Montreal Protocol on substances that deplete the Ozone Layer in Pakistan. The main objectives of the NOU are to control the consumption of Ozone Depleting Substances (ODS) and assist the local industry for phasing out the use of ODS through financial and technical support of the Multilateral Fund Secretariat (MLFS)

During the financial year 2021-22, all the aforementioned sections performed a number of tasks/activities, while keeping in view their mandated official tasks. Details of the activities and achievements of the IC Wing have been enumerated below:

4.5.1 CHEMICAL SECTION

Achievements of Chemical Section:

One of the landmark achievements of the IC Wing during the last financial year i.e. 2021-2022 was the formulation of the **National Hazardous Waste Management Policy, 2022**. The policy document was approved by the Federal Cabinet on 28th June 2022. The main objectives of this policy are as under:

- a. To facilitate the implementation of the relevant provisions of the Basel Convention, the Stockholm Convention, and the Minamata Convention at the national level.
- b. To prevent, minimize, and control hazardous waste being generated in the country
- c. To control the trans-boundary movements of hazardous waste
- d. To create an enforcement mechanism through an effective regulatory framework, monitoring, inspect, and verification system
- e. To build capacity of all relevant stakeholders for Environmentally Sound Management of Hazardous Waste in Pakistan

4.5.2 INTERNATIONAL COOPERATION (IC) SECTION

- i. The updated compliance status of various International Conventions/Protocols under the GSP Plus scheme was shared with the European Union's Monitoring Mission during their visit to the Ministry of Climate Change on **29th June 2022**. One of the major achievements shared by the MoCC in the priority areas under the GSP Plus scheme was approval of the National Hazardous Waste Management Policy, 2022 from the Federal Cabinet on 28th June 2022

- ii. Three new MOUs were signed with the governments of the Kingdom of Saudi Arabia (KSA), United Arab Emirates (UAE), and Uzbekistan for cooperation in the field of environment and climate change
- iii. Two months Internship was offered to 5x interns of the Department of Environmental Sciences of the International Islamic University, Islamabad. The Interns were sensitized with the working and mandate of the International Cooperation Wing of the Ministry of Climate Change
- iv. An annual report on the “**Observance and Implementation of Principles of Policy**” was prepared and submitted under the Article 29(3) of the Constitution of Islamic Republic of Pakistan, 1973
- v. As per Rules of Business, 1973, IC Wing consistently coordinated with M/o Economic Affairs and M/o Foreign Affairs, and provided technical input for Bilateral Political Consultations, Inter-Ministerial Consultations (IMM), Joint Commissions (JCs) etc.

4.5.3 NATIONAL OZONE UNIT

Major activities and achievements during the year 2021-22 were as follows: -

A. **IMPLEMENTATION OF THE OZONE DEPLETING SUBSTANCES (ODS) PHASE OUT PROJECTS**

- i. An awareness Workshop was organized on Montreal Protocol on July 15, 2021 at NED University, Karachi
- ii. A Seminar on **International Ozone Day** was organized on 16th September, 2021 at Karachi with participation of more than 300 participants from public and private sector, including government functionaries, industries & industrial associations, R&D institutions, and academia
- iii. A video message of Minister of State for Climate Change was released and widely shared on social media on **World Ozone Day – 2021**. Special ozone awareness messages were also aired on electronic and social media on 16th September, 2021
- iv. NOU prepared and disseminated calendars for the year 2021. The calendar was a compilation of paintings of students on themes of "**Ozone for Life**" and "**Clean Green Pakistan**"
- v. For smooth implementation of the Hydro chlorofluorocarbons (HCFC) phase out programme, the industrial / commercial importers data for HCFCs import was monitored on monthly basis during the reporting period. National Ozone Unit updates the HCFCs importers regarding latest requirements of the ODSs storage and maintenance
- vi. Draft legal document including the rules for implementation of Montreal Protocol in Pakistan has been framed and is under initial review
- vii. Country Assessment Report was drafted for ratification of Kigali Amendment. The report was shared with relevant stakeholders for seeking views and comments
- viii. Process was initiated for engaging academia to undertake research/studies to introduce

the best practices to phase out ODS from Pakistan. In this context, Memorandum of Understanding (MOU) has been signed between the National Ozone Unit, Ministry of Climate Change and the National University of Science and Technology (NUST)

- ix. Effective compliance of ODS phase out ensured, reduction targets of the HCFC phase out on 1st January 2021 has been met and accordingly indicated in HCFC quota 2022
- x. Training programme was organized for Refrigeration and Air Conditioning (RAC) technicians in collaboration with Technical & Vocational Training (TEVTA), and 426 technicians were trained from July 01, 2021 to June 30, 2022

B. ENFORCEMENT OF POLICY/REGULATORY MEASURES

- i. In order to phase out the ODSs from the thermo-ware, PU sandwich panel, XPS and air conditioning industries, NOU along with relevant implementing agencies is implementing HPMP Stage-II. Subsequently, the remaining industries in Air Conditioning and spray foam would be phased out, for which funding request has been approved by MLFS to prepare and submit the HPMP (HCFCs Phase-out Management Plan) stage III for Pakistan for the period **2021-2030**
- ii. National Ozone Unit (NOU), in collaboration with relevant implementing agencies, developed the project proposal for stage-III of the HPMP to phase out HCFCs from remaining industries. The proposal was submitted to the 90th Executive Committee (Ex. Com) meeting of the Multilateral Fund for the implementation of Montreal Protocol
- iii. Number of online meetings were held with UNIDO and UNEP offices at Vienna and Bangkok respectively on following issues regarding policy and phasing out of the ODSS:
 - a. Preparation and submission of HPMP stage-III
 - b. Implementation of HPMP-II remaining projects and corresponding challenges
 - c. Working of the PMU for HPMP-II

5. ATTACHED DEPARTMENTS AND AUTONOMOUS BODIES

5.1 PAKISTAN ENVIRONMENTAL PROTECTION AGENCY (PAK-EPA)

The Pakistan Environmental Protection Agency (PAK-EPA), is an executive agency of the Government of Pakistan administered by the Ministry of Climate Change. The agency is charged with protecting human health and the environment by writing and enforcing regulation based on laws passed by Parliament.

LAB/ NEQS DIRECTORATE

The Lab/NEQS Directorate of Pak-EPA is responsible for the development, review, and compliance-monitoring of National Environmental Quality Standard (NEQS) that has been notified for ambient air, water, noise, and liquid/gaseous emissions. The Lab/NEQS also issues certifications to environmental labs and authorizations to manufacturers/distributors for exempted Polythene bags. Monitoring and field inspections are conducted for the resolution of public complaints. It also provides technical support to Pak-EPA's Legal/Admin and EIA/Monitoring Directorates and manages public complaint resolution. Lastly, it provides technical input in public policies, plans, documents, and legislative frameworks.

Activities/Achievements (July 2021 –June 2022):

a) Air Quality:

Pak-EPA through its fixed monitoring station located in H-8/2 monitors ambient air quality of Islamabad, the results of which are shared via official website and social media. Pak-EPA has also established a data surveillance room for 24-hour monitoring of emissions by steel industries to ensure NEQS compliance. Additionally, major industries in Islamabad submit their monthly/quarterly stack emission reports to Pak-EPA in compliance of NEQS.

Table No.2 Air quality parameters monthly average from June 2021 to 2022

Monthly average	Temperature	Humidity	NO2	SO2	PM2.5
NEQS value			80 µg/m3	120 µg/m3	35 µg/m3
Jun-21	31.4	36.8	9.4	16.54	20.33
Jul-21	32.7	52.3	6.94	15	17.35
Aug-21	27.05	64.82	7.93	13.68	23.81
Sep-21	27.45	65.9	9.65	15.68	23.76
Oct-21	24.2	57.67	9.07	12.73	20.98
Nov-21	16.44	42.45	13.7	21.35	53.3
Dec-21	11.03	56.9	25.93	24.1	104.77
Jan-22	8.42	71.4	10.32	19.37	75.72

Feb-22	12.32	59.64	10.18	20.66	51.24
Mar-22	21.41	50.03	12.37	25.32	39.2
Apr-22	28.2	35.82	9.3	21.16	24.03
May-22	32.62	35.37	5.95	17.96	22.31
Jun-22	33.6	38.4	4.55	17.89	25.15
Annual Mean	23.6	51.34	10.4	18.57	38.61
PM	Particulate Matter				
NEQS	National Environmental Quality Standards				

b) Water Quality:

Pak EPA Lab/NEQS directorate from July 2021 to June 2022 collected, tested, and analyzed:

- i. 137 water samples in EPA laboratory which included surface-water samples from natural waterbodies (Rawal Lake, Simly Dam, Soan River, Korang River, etc.); Natural streams and rivers' water samples, and monitored via Integrated Surveillance System wastewater samples from industries, nullah and sewerage system of ICT.
- ii. **Forty eight (48) drinking** water samples of CDA's and various filtration plants
- iii. **Eight (8)** bore water samples from Barakahu, Satra mail and naval farms etc.
- iv. **Thirty three (33)** water samples from nullahs (ups and down streams), villages and industrial sites and developmental project site. Twenty (20) water samples collected from ETP and STPs.

c) Noise Quality:

Pak EPA Lab/NEQS Directorate inspected a number of sites for compliance of NEQS for noise. In total, 20 inspections were carried out from July 2021 to June 2022 in commercial, industrial, and residential areas of Islamabad Capital Territory for noise levels.

d) Technical Training, Research Facilities, Internships:

Lab/NEQS Directorate has provided technical training, research facilities, and summer internships to about **400** Students from various universities from July 2021 –June 2022, which included:

- i. Research on water and air quality by MS and Ph.D. students
- ii. Summer internship for BS and BE students
- iii. A detailed survey of Islamabad Capital Territory's surface water quality, which

included sampling and analysis of **30** water samples collected from nullahs (ups and down streams) in rural Islamabad and from industrial sites of ICT.

- i. Air quality monitoring of Peshawar city on request of Khyber Pakhtunkhwa Environment Protection Agency (Khyber Pakhtunkhwa-EPA)

e) Environmental Laboratory Certification:

As per the Certification of Environmental Laboratories Regulations, 2,000, five (05) environmental laboratories in ICT were certified.

f) Ban on Polythene Plastic Bags in Islamabad Capital Territory:

For compliance and enforcement of regulations regarding ban on polythene bags in ICT, three (03) authorizations were granted to manufacturers and importers for the manufacture/distribution of polythene bags of exempted use in ICT.

g) Public Complaints and Field Monitoring:

More than 200 public complaints received through Pakistan Citizen Portal were processed through a vigilant complaint resolution system, which entailed:

- i. 12 environmental industrial site visits to check Environmental Management Plan status
- ii. Inspection of housing societies' Sewage Treatment Plants to check STP/ETP efficiency
- iii. 19 inspections (EIA, plastic bag authorization, and general complaints)
- iv. 28 inspections from July 2021 to June 2022

h) Public Awareness Raising Campaigns

- i. In commemoration of World Environment Day, Pak- EPA and Anthro-Insight organized the "OnlyOne Earth" webinar on 5th June, 2022 to raise awareness about the environment.
- ii. Pak-EPA also hosted COP26 walk rally activity in F-9 Park on 11th November, 2021 in collaboration with partners.

i) Rules and Regulations

- i. Pakistan Environmental Protection Agency Ban on (Manufacturing, Import, Sale, Purchase, Storage, and Usage) Polythene Bags Regulations, 2019
- ii. NEQS for Ambient Air, Drinking Water and Noise vide No. (S.R.O. 1062(I)/2010 & S.R.O. 1063(I)/2010 & S.R.O. 1064(I)/2010)
- iii. NEQS for Motor Vehicle Exhaust and Noise Vide No. (S.R.O 72(KE)/2009)
- iv. National Environmental Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2001
- v. Environmental Samples Rules, 2001
- vi. Revised NEQS for Municipal and Liquid Effluents (mg/l, Unless Otherwise

Defined) & NEQS for Gaseous Emissions (mg/Nm³ Unless Otherwise Defined)
Vide No. S.R.O. 549 (I)/2000

- vii. National Environmental Quality Standards Relating to Municipal and Liquid Industrial Effluents vide S.R.O. 742 (I)/93 & S.R.O. 1023 (I)/95 National Environmental Quality Standards (Environmental Laboratories Certification) Regulations, 2000

DIRECTORATE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA/IEE)

Environmental Impact Assessment (EIA) / Initial Environmental Examination (IEE) Directorate plays a major role in implementing the Pakistan Environment Protection Act (PEPA) -1997 specifically Section-12 and Review of IEE/EIA.

Regulations 2000. This Directorate comprises of two sections namely EIA/Monitoring and Environment Engineering and Technology Transfer.

Role & Function:

All developmental projects from public and private sectors that fall under any of the Schedules of Regulations have to obtain environmental approval in respect of their projects. In addition to evaluation of reports and issuance of environmental approvals or otherwise, the EIA/Monitoring Section also conducts post environmental approval monitoring to ascertain the compliance status of the Environment Management Plan (EMP).

Goals and Targets:

During year 2021-2022, EIA/IEE directorate evaluated and processed maximum number of IEE/EIA reports. The environmental monitoring team which carries out the field activities, submits its report after ascertaining the ground situation, and non-compliance by the proponents is liable to invite legal action by the Legal section.

Activities:

During the period 2021-22, ten (10) Initial Environmental Examination (IEE) Reports were received for review at the Agency, two (04) approval of EMP were granted, five (05) cases are under process, and one case was rejected.

During the period 2021-22, twenty three (23) Environmental Impact Assessment (EIA) Reports were received for review at the Agency, twelve (12) Approval of EMP were issued, ten (10) cases are under process, and one (01) case was rejected.

Achievements:

During the year twenty five (25) public hearings of various projects were conducted, in which relevant stakeholders, public, academia, and students participated.

DIRECTORATE OF LEGAL/ ENFORCEMENT

Pakistan Environmental Protection Agency (Pak-EPA) is a statutory body established under Section 5 of the Pakistan Environmental Protection Act, 1997 for enforcement of environmental laws, rules and regulations made under the Act.

Activities, Role and Functions:

According to PEP Act, 1997 the activities/roles & functions of Legal/Enforcement Directorate of Pak-EPA are following: -

- a) Draft and prepare reports and para wise comments, and defend the cases before Hon'ble Supreme Court of Pakistan;
- b) Prepare appeals, reports and para wise comments, and represent the Agency before Hon'ble High Courts;
- c) Prepare cases/complaints for Environmental Tribunal/Environmental Magistrate, and appear, act, and plead as prosecutor in environmental cases before Environmental Tribunal and Environmental Magistrate;
- d) Appear and defend the Agency before Hon'ble Wafaqi Mohtasib;
- e) Appear and represent the Agency before Human Rights Commission of Pakistan;
- f) Appear and plead the cases of the Agency before lower courts.

Moreover, the Legal/Enforcement Directorate of Pakistan Environmental Protection Agency defends, prosecutes and represents cases of criminal as well civil nature before different courts of law and forums.

Goals and Targets:

- a) Prepared draft Rules on "Ban on (Manufacturing, Import, Sale, Purchase, Storage and Usage) Single- use Plastic Commodity Rules, 2022".
- b) Prepared draft Regulation on "Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2022" and forwarded to Ministry of Climate Change for further process.
- c) Initiated draft Rules on "Ban on Handling, Storage, Sale, Purchase, Import, Export of Hazardous Substance Rules, 2022".

Achievements:

- a) Approximately 100 field visits conducted by the Enforcement Team(s) of Pak-EPA for the implementation of the provisions of PEP Act, 1997, rules and regulations
- b) Approximately three-hundred sixty five thousand rupees (3,65,000/-) fine imposed upon accused persons on contravention of Pak-EPA Ban on Polythene Bags Regulations, 2019
- c) 105 notices of personal hearing/notices of compliance served to brick kilns, hospitals, food / steel / pipe / marble / pharmaceutical industries, housing societies, asphalt plants, tyre units, and against the complaints received on Pakistan Citizen Portal under Pakistan Environmental Protection Act, 1997
- d) 32 Environmental Protection Orders issued to brick kilns, hospitals, good / steel / pipe / marble / pharmaceutical industries, housing societies, asphalt plants and tyre units
- e) 08 brick kilns were sealed for non-compliance of PEP Act, 1997, NEQS, and Environmental Protection Orders
- f) 10 Cases/Complaints filed in Environmental Protection Tribunal on violation of

Environmental Laws

- g) Five Million (5,000,000/-) administrative penalty imposed by Pak-EPA upon violators
- h) Penalty of Five Hundred Thousand rupees (500,000/-) was imposed by Environmental Protection Tribunal upon the complaint of Pak-EPA
- i) Seventeen (17) replies, para wise comments and reports filed before Hon'ble High Courts in different Writ Petitions/Appeals relating to environmental issues

5.2 ZOOLOGICAL SURVEY OF PAKISTAN (ZSP)

Zoological Survey of Pakistan (ZSP) is one of the key Federal Agency involved in policy making for wildlife conservation in the country. The mandate of ZSP is to monitor the current status and distribution of wildlife in Pakistan. Besides, ZSP is also mandated to maintain standard zoological collections for reference from different parts of the country, and impart education and raise awareness among masses for biodiversity conservation.

Role & Functions:

The specific objectives of Zoological Survey of Pakistan are as follows:

- i. To obtain information on distribution, population dynamics, and status of animal life in the country
- ii. To undertake research on the ecology and biology of wildlife populations of Pakistan
- iii. To set up and maintain standard zoological collections for reference
- iv. To advise the government on all zoological matters, including conservation, management, and trade in wildlife
- v. To impart training and create public awareness about wildlife conservation

Targets, Activities & Achievements:

The detail of targets, activities & achievements during the current FY 2021-22 is given below:

1. Target: Baseline Ornithological (Birds) Studies of Thar Desert

Some of the important areas of the country having rare and threatened species of wildlife have been declared protected areas as National Park, wildlife sanctuaries, or game reserve. Baseline surveys of the protected areas are essential to assess the biodiversity of the sites. During the FY 2021-22, baseline study of Thar Desert was carried out. Thar Desert includes the Great Runn of Kuch (Ramsar Site) and Thar Wildlife Sanctuary, located in District Tharparker Sindh. The studies were carried out in collaboration with IUCN-Pakistan with aim of recording the status and distribution of avian species of the area, along with identification of threats to the species and their habitat, and for preparation of avifaunal inventory of Thar Desert.

Activities:

The field visits were carried out for one year in autumn, spring and winter seasons i.e., October 24th to 31st 2020, January 20th to 27th, 2021, March 14th to 24th, 2021 and October 20th to 28th, 2021 respectively. At least eight days were spent in the field in each survey. Line transect method and point count method was applied to study the avifauna of the area. The scientific reports, papers, and other literature were also reviewed.

Achievements

During the current study, 172 species of birds were observed in the District Tharparker. Out of 172 species, 108 birds were resident and 63 were migratory species. According to IUCN Red Data List (2015), out of 172 species recorded during the current study from district Tharparker, 17 species of birds are globally threatened.

2. Target: Survey for Baseline Faunal Studies of Merged Areas:

Survey for Baseline faunal studies of merged areas (Ex- Fata agencies, i.e., Bajaur, Kurram, Mohmand, Orakzai, Khyber, and South & North Waziristan) of Khyber Pakhtunkhwa was carried out in collaboration with Ten Billion Tree Tsunami Project during 2021-2022. The objective of these studies was to develop database of important fauna of the area. Mainly the ornithological studies at all newly merged areas has been carried and reported by ZSP.

Activities:

The field visits were carried out from the month of October 2021 to December 2021. At least five days were spent in the field in each district during the study period. Line transect method and point count method was applied to study the avifauna of the area. The scientific reports, papers and other literature was also reviewed. The secondary information regarding presence or absence of species was also collected from locals through community meetings.

Achievements:

2.1 Status and Distribution of Avifauna of District Bajaur, Khyber Pakhtunkhwa.

The present census was conducted from 10th to 16th October, 2021 to collect information regarding the avian diversity of District Bajaur, Khyber Pakhtunkhwa, Pakistan. During the survey, a total of 95 bird species belonging to 37 families were recorded from different areas of district Bajaur. In the present study, highest numbers of the order Passeriformes (perching birds) were recorded followed by Galliformes (Pheasants and Partridges).

2.2 Ecological Baseline Study of District Mohmand, Khyber Pakhtunkhwa with reference to Avifauna

A total of 77 species of birds belonging to 16 orders and 36 families were recorded from Mohmand district with Passeriformes (perching birds) as the most dominant group with 30 species followed by 7 species of order Accipitriformes (birds of prey). 62 species of terrestrial and 15 species of aquatic birds were recorded. Among recorded 77 avian species, four species are globally threatened on IUCN Red Data List of species.

2.3 Ecological Baseline Study of District Orakzai, Khyber Pakhtunkhwa with reference to Avifauna

A total of 79 avian species belonging to 16 orders and 36 families were recorded. Passeriformes (perching birds) were the most dominant group with 29 species followed by 8 species of order Accipitriformes. 67 species of terrestrial and 12 species of aquatic birds were recorded. As per IUCN Red Data list, out of 79 recorded bird species from district Orakzai, only 3 species are globally threatened.

2.4 Ecological Baseline Study of District Kurram, Khyber Pakhtunkhwa with reference to Avifauna

A total of 91 species of birds belonging to 16 orders and 39 families were recorded from district Kurram. Passeriformes (perching birds) were the most dominant group followed by Galliformes (Pheasants and Partridges). Out of 91 recorded species of birds, 4 species were found globally threatened on IUCN Red Data List of species.

2.5 Environmental Baseline Study of North Waziristan District, Khyber Pakhtunkhwa With

Reference to Avifauna

A total of 71 species of birds belonging to 10 orders and 28 families were recorded from North Waziristan. Passeriformes (perching birds) were the most dominant group with 38 species followed by 6 species of order Accipitriformes (birds of prey). Among recorded species, Saker Falcon (*Falco cherrug*) is enlisted as Endangered (EN) while the rest of the species are Least Concerned (LC) on IUCN Red Data List of species.

2.6 Ecological Baseline Study of District South Waziristan, Khyber Pakhtunkhwa with reference to Avifauna

A total of 82 species of birds belonging to 12 orders and 33 families were recorded from South Waziristan. Passeriformes (perching birds) were the most dominant group with 37 species followed by 9 species of order Accipitriformes (birds of prey). According to IUCN Red Data List of Species, out of recorded 82 species of birds, 6 species were observed globally threatened while rest of the species are Least Concerned (LC).

2.7 Ecological Baseline Study of District Khyber, Khyber Pakhtunkhwa with reference to Avifauna

A total of 73 species of birds belonging to 12 orders and 33 families were recorded from district Khyber. The Passeriformes (perching birds) were the most dominant group with 29 species followed by 5 species of order Falconiformes (birds of prey) and 5 species of Galliformes (Pheasants and Partridges). Among 73 avian species recorded from District Khyber, 47 species were resident, 26 species were migratory—either winter migrants or summer visitors. According to IUCN Red Data List of Species, out of recorded 73 species of birds, 3 species were observed globally threatened while rest of the species are Least Concerned (LC).

3 Target: Annual Mid-winter Waterfowl Census

Mid-winter waterfowl census is an annual activity of the department since 1982 and is carried-out in the second week of January. The basic and essential motive of conducting these surveys is to estimate and monitor migratory waterfowl population annually, and also study the trends of their population at various wetlands during migratory season i.e., winter (non-breeding). In addition, these surveys are crucial for promoting waterfowl conservation by raising awareness and interest among local communities about migratory water birds and wetlands. The collected data also provides substantial insights on population declines, causes of decline in time, as well as trigger adequate management actions—both at site and at flyway level.

Activities:

Field surveys of globally protected Ramsar sites and important wetlands of country were conducted for population estimates of water birds, especially migratory waterfowl. The point count method was applied at each wetland. Community meetings were also held for awareness among local people regarding the importance of migratory water birds and wetlands. During the current FY (2021-22), following wetlands of Punjab and Sindh were visited for waterfowl census:

3.1 Punjab Province

Kalarkahar Lake, Namal Lake, Chashma and Jinnah Barrages, Uchali Wetlands Complex, lake, Head Marrala, Head Qadirabad, and Rasool Barrage. From the eleven important wetlands, 58 species of water birds were recorded with 60025 in number. Among these 58 birds' species, 14 belongs to Family Anatidae. Highest number of birds were recorded at Chashma barrage 30489 (51%), second highest

number was recorded at Uchali lake 9985 (17%), third highest number was recorded at Head Maralla 5121 (9%) followed by Namal lake 5048(8%), Rasool barrage 3245(5%), Kallar Kahar lake 2932(5%), Ahmadabad lake 797(1%), Jinnah barrage 749 (1%), Head Qadirabad 700(1%), Jahler Lake 548(1%), and khabeki Lake 411(1%).

3.2 Sindh Province

Runn of Kuch, Dam, Ranpur Dam, Sindhuri Dam , Sakkar Dam, Bodesar Lake , Nurri Lake, Phoosana Lake, Hudero and Haleji Lake, Manchar Lake, Lugh Lake, Drigh Lake, Hammal Lake. During the current waterfowl census at the wetlands of Sindh province, total of 162427 water birds belonging to 73 species of both migratory and resident birds were recorded. The Nurri Lake was observed to be most populated with water birds numbering (53307), followed by Hammal lake with (46709) birds, and Haleji Lake with (22176) birds. The Common Coot (*Fulica atra*) was observed most abundant migratory bird with total number of (75802) individual birds followed by Common Teal (*Anas crecca*) with number of (26737) birds, while Garganey and Lesser Whistling teal were observed to be less abundant or rare migratory Duck species.

4 Target: Studies on Threatened Species of Wildlife

Rut season study of Kashmir Markhor in Chitral Gol National Park and Chitral wildlife division, Khyber Pakhtunkhwa.

During the current financial year 2021-2022, the Rut season study of Kashmir Markhor was carried out along with the teams from IUCN, WWF, PFI, PMNH and Khyber Pakhtunkhwa Wildlife department in Chitral Gol National Park and Chitral wildlife division, Khyber Pakhtunkhwa.

Objectives:

The aim of the studies was:

- i. Recording the distribution and status of the concerned species.
- ii. Identification of the threats to the species and its habitat.
- iii. Preparation of conservation strategy for protection, conservation and management of the species and its habitat.

Activities:

Markhor Rut Season Survey was conducted using vantage point count method. To observe the maximum numbers of animals, confirm the movements, record the occurrence, number, population dynamics (age and sex data) on prescribed data sheet developed for the purpose, all the survey parties ensured early morning sighting at about 7am and early evening sighting around 4pm at the vantage points. The local field watchers also helped identifying the sex and age of Markhor.

Achievements:

4.1 Population Estimates and Dynamics of Kashmir Markhor during rut season at Chitral Wildlife Division, Khyber Pakhtunkhwa.

The surveys were conducted from 30th December 2021 to 4th January 2022 in Chitral Wildlife Division especially in its two conservancies i.e., Toshi Shasha and Ghairat Goleen. The current counts revealed about 2405 number of Markhors of different age that were recorded from the two conservancies. The results of current survey show that the population of Kashmir Markhor is stable in

the Chitral Wildlife Division. It is recommended that the livestock grazing needs to be controlled and properly monitored to eliminate any kind of source conflict and spread of disease in wild herds of the livestock. Further, the fuel wood collection by local people during rutting season should be monitored.

4.2 Population Estimates of Kashmir Markhor during Rut season at Chitral Gol National Park (CGNP), Khyber Pakhtunkhwa

The current surveys were conducted from 26th December 2021 to 29th December 2021 in CGNP and in its buffer zones. The current counts revealed about 2278 number of Markhor of different age groups distributed within 28 different sites of CGNP. The population of Kashmir Markhor is stable and increasing in Chitral Gol National Park. It is recommended that the livestock grazing needs to be controlled and properly monitored to eliminate any kind of source conflict and spread of disease in wild herds of the livestock. Further, the feral dogs should be eliminated from Park area and its surroundings.

Publications:

ZSP annually publishes the results of surveys and research in its Journal “RECORDS” Zoological Survey of Pakistan to create awareness regarding important groups of animals. During the current financial year, research articles, writing and formatting for upcoming volume-25 of Records Zoological Survey of Pakistan is in pipeline.

5.3 GLOBAL CHANGE IMPACT STUDIES CENTRE (GCISC) (A Body Corporate established under the GCISC Act 2013)

Global Change Impact Studies Centre (GCISC) was first established as a development project in April 2002 with the mandate to undertake research on climate change and its impacts and potential remedies. Subsequently, GCISC's status was formalized through the passage of the GCISC Act 2013 by the Parliament (notified vide Gazette of Pakistan on 26 March 2013 as Act No. XVII of 2013). The Act defines GCISC as a body corporate governed by Board of Governors (BoG), which is chaired by the Federal Minister in-charge of the concerned Ministry dealing with the subject of climate change.

Mission Statement:

To undertake scientific investigations of the phenomenon of climate change at regional and sub-regional level, and study its impact on various sectors of socio-economic development in order to prepare the country to counter threats to its water resources, agriculture, ecology, energy, health, biodiversity etc.

Main Functions:

Under the GCISC Act, the Centre is tasked with the following three functions, namely research, capacity building, and outreach and awareness:

- a. **Research:** The research program is driven by national policy goals, namely protecting people against the impacts of climate change, promoting economic growth and sustainable development in a climate-constrained future, and honoring Pakistan's international commitments. To these ends, research is organized in three groups:
 - ***Climatology and Environment:*** using climate system models to predict future climate behavior in Pakistan, including monsoons, temperature, precipitation, and climate extremes
 - ***Water Resources and Glaciology:*** using glacio-hydrological and water models to assess future behavior of glaciers, aggregate and seasonal flows in the Indus River System, and changes in the hydrological extremes across the country
 - ***Agriculture, Forestry & Land Use:*** using crop simulation models to predict the impact of projected changes in temperature, precipitation, and water availability on agriculture and food security of the country, and to assess the impacts on Forestry and Land Use
- b. **Capacity building:** imparting technical and communication skills to GCISC staff as well as students and climate scientists at other national research organizations and universities
- c. **Outreach and Awareness:** dissemination of research findings to the scientific community, planners, policymakers, and to the public at large, to raise awareness of climate change among policymakers as well as the citizenry

Ongoing Research Activities:

I. Climatology & Environment Section

The key research activities of the Climatology & Environment section revolve around the following themes:

- Assessment of past climatic changes;
- Development of future climate projections for Pakistan by employing state-of-the-art high resolution Climate Models;
- Scientific investigation and prediction of climatic extremes by using modeling as well as statistical techniques;
- Simulation modeling to study monsoon dynamics and its associated impacts;
- Intra-seasonal to inter-decadal climate predictions;
- Development and updating of the GHG Inventory of Pakistan for energy and industrial process sectors

II. Water Resources & Glaciology Section

- Application of Machine Learning and Artificial Intelligence (AI) techniques to model Indus River System flow;
- Climate change analysis for the high-elevation Karakoram region;
- Drought prediction in the Indus Basin as a climate adaptation strategy;
- Spatio-temporal assessment of climate change impacts on the UIB-cryosphere and variability of flows;
- Analysis of climate impact on the frequency and intensity of hydrological extreme events;
- Plausible Adaptation strategies in line with national climate change, and water policies to ensure the country's water security;
- Research dissemination (international and national science journals and books, newspaper articles, policy briefs, etc.);
- Capacity building and awareness raising.

III. Agriculture, Forestry, and Land Use Section

- Assess the impact of projected climate change on productivity of key agricultural crops in different climatic zones using crop models;
- Assess the impact on related areas, including the productivity of forestry, grasslands, rangelands, and fragile ecosystems (i.e., mountains, wetlands, coasts, and arid areas), livestock, land degradation, deforestation, and insect-pest infestation dynamics;
- Assess food security in the face of future climate changes, especially under reduced availability of irrigation water;
- Devise adaptation measures including climate-smart agriculture;
- Studies on water, food, energy, and climate change nexus;
- Updating GHG emissions from agriculture, forestry, and land use and waste sectors

Achievements (Summary):

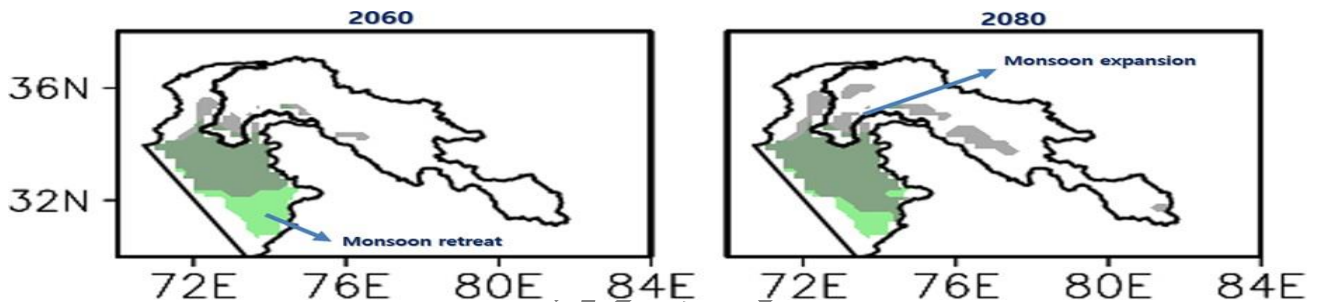
During the year, GCISC made significant contribution to the international scientific literature in the field of climate change and its associated impacts, and provided tangible inputs in a number of research projects. It also organized workshops/seminars for information dissemination and awareness. A summary of the accomplishments in 2021-22 is as follows:

- Publication of key research findings in scientific journals = 17
- Contribution towards technical reports = 03
- Contributions in research projects = 05
- Organization of scientific activities/workshops/seminars for information dissemination and awareness =12
- Effort on capacity building of GCISC young scientists through academic and specialized trainings and participation in conferences, workshops etc. at the international level (Nos.) = 22
- Effort on capacity building of GCISC young scientists through academic and specialized trainings and participation in conferences, workshops, etc. at national level (Nos.) = 80
- Provision of training to university students across Pakistan in the field of climate change through summer internship programs = 40
- GCISC experts delivered lectures as resource persons and imparted trainings to the researchers of various organizations.
- Muhammad Arif Goheer, Principal Scientific Officer/ Head- Agriculture and Coordination contributed to UNFCCC's Consultative Group of Experts (CGE) activities.
- Contributions to Pakistan's 1st Biennial Update Report submitted to UNFCCC in April 2022.
- Two scientists from GCISC are contributing as Lead Author for IPCC 6th Assessment Report.
- One GCISC scientist contributed as a "Reviewer" to the GEO report on Cities.
- GCISC provided technical inputs in the preparation of Nationally Determined Contributions (NDCs) submitted to UNFCCC in October 2021.
- GCISC has been awarded a contract by the Ministry of Climate Change (MoCC) to contribute in various chapters of Third National Communication (TNC).
- Development of MRV platform for GHG Inventories and MRE platform for Adaptation tracking in agriculture (Pilot basis).

Salient Research Findings:

a) 21st century precipitation and monsoonal shift over Pakistan and Upper Indus Basin (UIB) using high-resolution climate projections

The study investigates probable shift in the monsoon over Pakistan and Upper Indus Basin (UIB) by employing high resolution future projected data of climate models. The results indicate that June July August (JJA) precipitation over the Upper Indus Basin (UIB) which also includes northern parts of Pakistan is projected to increase more under RCP8.5 as compared to RCP2.6. The results also show a projected expansion in the monsoon area in UIB and the northward shift of monsoon currents which corresponds with future precipitation changes in the area and hence indicates the penetration of the



monsoon system over UIB under a higher warming scenario. The changes in monsoon precipitation and domain are related to the changes in wind circulation patterns at 850 hPa and 200 hPa atmospheric levels.

Fig. 1: Future Projections of monsoon over Pakistan for near (2041-2070) and far (2071-2100) future periods under RCP2.6 and RCP8.5

b) Projections of wind power density in Pakistan and adjacent regions

This study focuses on the evaluation of wind power density over Pakistan and its provinces for four seasons defined as December January February (DJF), March April May (MAM), June July August (JJA), and September October November (SON). The results for the whole Pakistan indicate that wind intensity was higher in JJA due to the influence of the active phase of the monsoon. In terms of subdomains, higher intense winds were reported in the provinces of Baluchistan and Sindh. For the same regions and seasons, the wind intensity is projected to increase (by $\sim 1-1.5 \text{ m s}^{-1}$), which leads to an increase in WPD of $>20\%$ in Baluchistan and 40% in Sindh under RCP8.5. We also project an increase in WPD in the eastern part of the country, but it will not be enough for wind energy generation.

c) Climate change and spatio-temporal trend analysis of climate extremes in the homogeneous climatic zones of Pakistan

An analysis has been performed to evaluate the precipitation and temperature trends in the Karakoram region in the recent past. The analysis showed a decrease in precipitation during 1991–2019 and an increase in temperature (maximum and minimum) during 2010–2019, which is consistent with the recently observed slight mass loss of glaciers related to the Karakoram Anomaly.

Variable	Season	Stations						
		Astore	Bunji	Chilas	Darosh	Gilgit	Gupis	Skardu
Difference of Average Temperature between 1991–2019 and 1962–1990	DJF	0.5082***	0.5404***	-0.5618***	0.7148***	0.8567***	-0.1942***	0.9677***
	MAM	0.6780***	0.5298***	-0.1238	0.6121***	0.7384***	-0.0823	0.7679***
	JJA	-0.2891***	-0.9248***	-0.1220**	-0.0137	-0.4890***	-1.4199***	-0.2753***
	SON	0.3906***	-0.3328***	-0.2666**	0.5326***	0.1510	-0.0157	0.0041
	Overall	0.3208**	-0.0489	-0.2671**	0.4600***	0.3121**	-0.4303***	0.3642**
Precipitation	DJF	0.2720***	0.1299***	0.1980***	0.1877**	-0.2388***	0.1456***	0.2984***
	MAM	-0.1176	-0.0347	0.0705	-0.3605***	-0.1836***	0.5083***	0.0513
	JJA	0.1502***	0.1719***	-0.2282**	0.03797	-0.3112**	0.3367***	0.0850***
	SON	-0.0786	0.0604***	0.0024	0.1001	-0.0727*	0.1046**	-0.3861**
	Overall	0.0558	0.0817**	0.0098	-0.0099	-0.2017**	0.2749***	0.0119

Note: Where “***”, “**” and “*” indicate significance of the test at 1%, 5% and 10% level of significance.

DJF = December, January, February; MAM = March, April, May; JJA = June, July, August; SON = September, October, November.

<https://doi.org/10.1371/journal.pone.0271626.t004>

Fig.3: Precipitation and temperature change trends in selected stations in the Gilgit Baltistan region.

d) An overview of groundwater monitoring through point-to satellite-based techniques

Groundwater supplies approximately half of the total global domestic water demand. It also complements the seasonal and annual variabilities of surface water. Monitoring of groundwater fluctuations is mandatory to envisage the composition of terrestrial water storage. This research provides an overview of traditional techniques and a detailed discussion on the modern tools and methods to monitor groundwater fluctuations along with advanced applications. The groundwater monitoring can broadly be classified into three groups. The first one is characterized by the point measurement to measure the groundwater levels using classical instruments, and electronic and physical investigation techniques. The second category involves the extensive use of satellite data to ensure robust and cost-effective real-time monitoring to assess the groundwater storage variations. Many satellite data are in use to find groundwater indirectly. However, GRACE satellite data supported with other satellite products, computational tools, GIS techniques, and hydro-climate models have proven most effective for groundwater resources management. The third category is groundwater numerical modeling, which is a very useful tool to evaluate and project groundwater resources in future. Groundwater numerical modeling also depends upon point-based groundwater monitoring, and more research to improve point-based detection methods using latest technologies is required, as these still play the baseline role. GRACE and numerical groundwater modeling is suggested to be used conjunctively to assess the groundwater resources more efficiently.

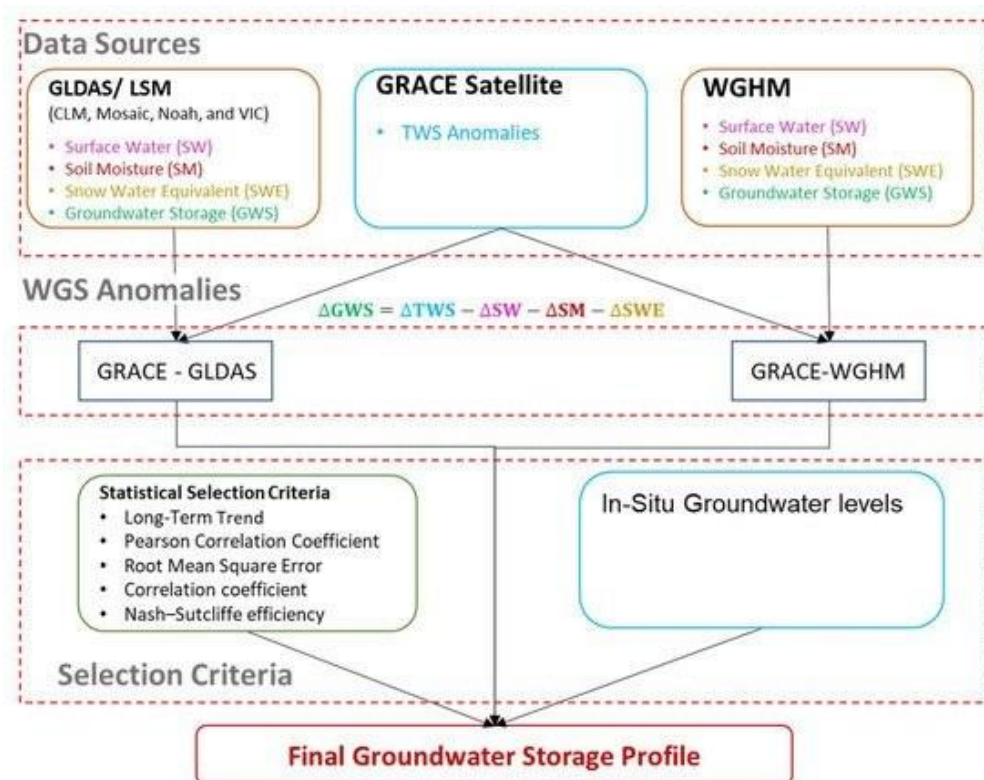


Fig. 4: GRACE–GLDAS and GRACE–WGHM processing to get Groundwater storage from GRACE satellite data

e) Hydrological interpretation of Machine Learning Models for 10-daily stream flow simulation in climate sensitive Upper Indus catchments

Machine learning for hydrologic modeling has seen significant development, and has been suggested as a valuable augmentation to physical hydrological modeling, especially in data scarce catchments. In Pakistan, surface waterflows predominantly originate from the trans boundary Upper Indus sub-catchments of Chenab, Jhelum, Indus and Kabul rivers. These are high elevation data scarce catchments, and generated stream flows are highly seasonal and prone to climate change. Given the catchment characteristics, there is utmost need to develop machine learning models that are hydrologically robust. Thus, the current study besides evaluating the potential of three machine learning models for stream flow simulation also focused on the hydrologic interpretation of machine learning models using SHapley Additive exPlanations (SHAP). XGBOOST, Random Forest and Classification and Regression Trees (CART). All of these models performed well, and range of R^2 and Nash Efficiency for all three models lies between 0.65 to 0.90. Our study's most crucial contribution is SHapley Additive exPlanations (SHAP) method which gives extensive insights into the influence of each variable on simulated stream flow. SHAP analysis highlighted the significance of minimum temperature in high elevation zones for both Indus and Chenab catchment where stream

flows are dominated by snow and glacier melt. The findings of the study will promote the use of SHAP analysis for stream flow forecasting in data scarce and high elevation catchments in Pakistan.

Fig. 5: Simulated and observed hydrographs of XGBoost model at outlets of Upper Indus catchments of Pakistan: a) Indus at Tarbela b) Jhelum at Mangla c) Chenab at Marala and d) Kabul at Nowshera

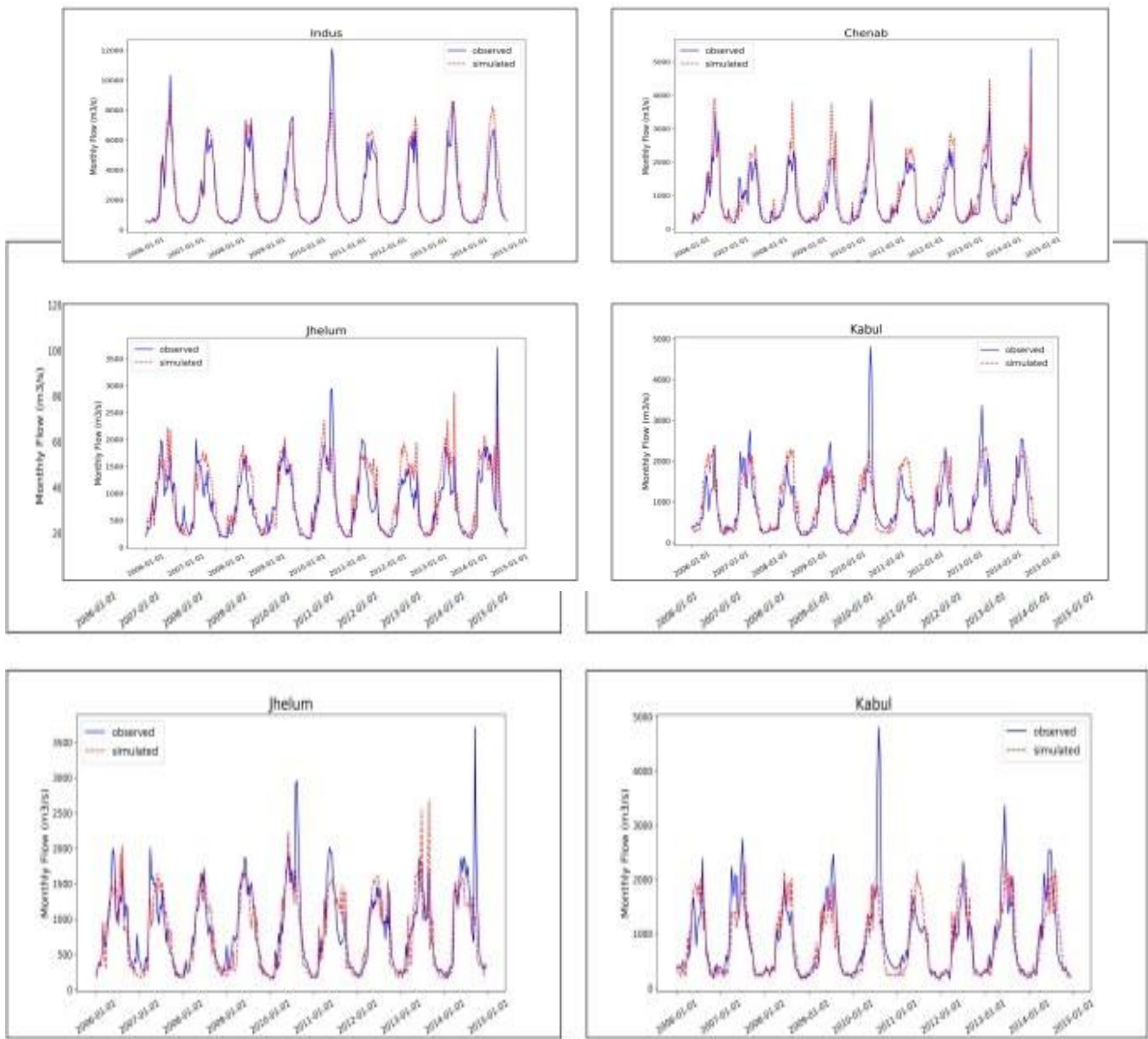


Fig. 6: Simulated and observed hydrographs of Random Forest model at outlets of Upper Indus catchments of Pakistan: a) Indus at Tarbela b) Jhelum at Mangla c) Chenab at Marala and d) Kabul at Nowshera

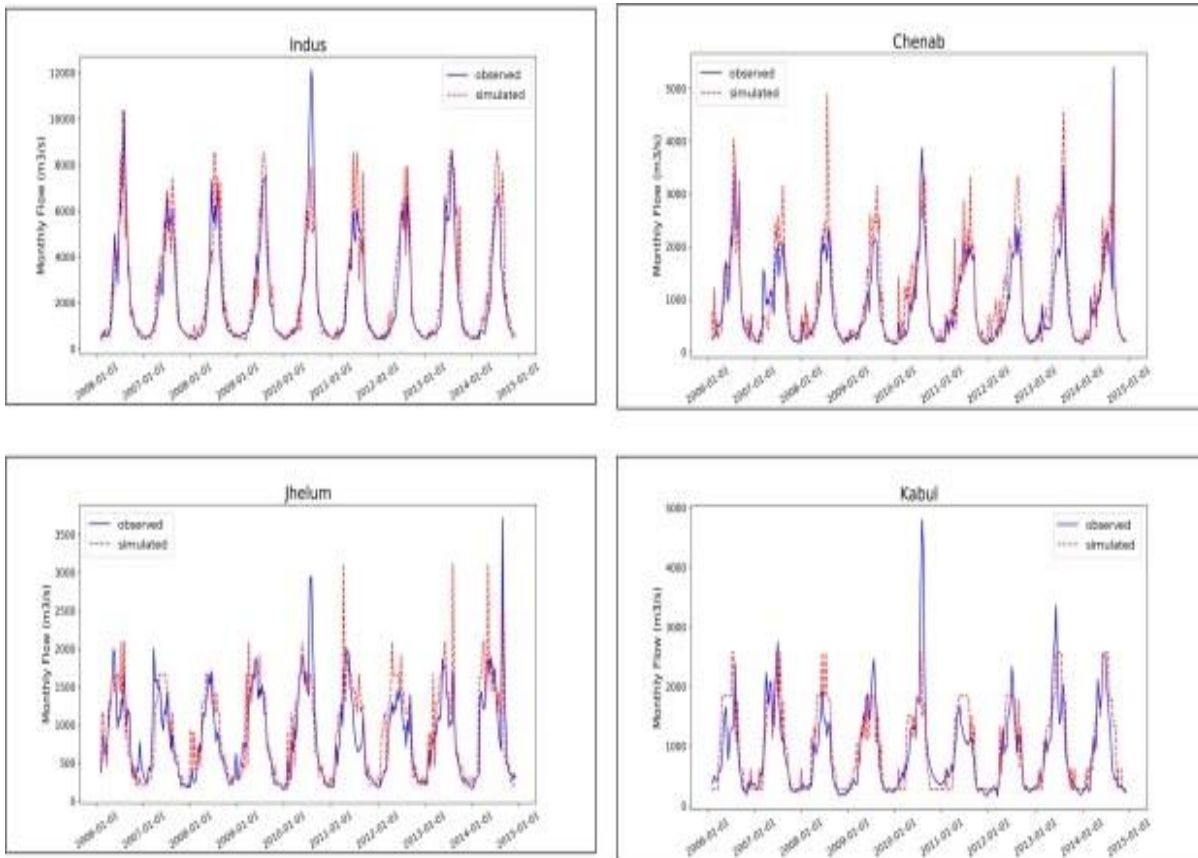


Fig. 7: Simulated and observed hydrographs of CART model at outlets of Upper Indus catchments of Pakistan:

- a) Indus at Tarbela b) Jhelum at Mangla c)Chenab at Marala d)Kabul at Nowshehra

f) Climate-induced shifts in irrigation water demand and supply during sensitive crop growth phases in South Asia

This study investigated climate-induced shifts in irrigation water demand and supply of the major staple and water-intensive crops (wheat and rice) in the Indus, Ganges and Brahmaputra (IGB) river basins of South Asia. It explored the usage of irrigation water during climate-sensitive crop growth phases (i.e., vegetative and reproductive which required ~ 60% of the total crop water demand), supposed to be crucial for long-term integrated crop water management. A hydrology vegetation model LPJmL was forced with an ensemble of eight downscaled (5 arc-min) GCMs using a mix of two emission scenarios i.e., RCP4.5-SSP1 and RCP8.5-SSP3. To investigate phase-specific shifts in crop water use during the period 1981-2100, trend analysis was performed. It shows a significant ($p < 0.001$) increase in irrigation water demand during the vegetative phase of wheat (6 mm) and reproductive phase of rice (26 mm) and a decrease during the reproductive phase of wheat (13 mm) and vegetative phase of rice (11 mm) in selected study sites. The large decrease in projected irrigation demand of wheat can be explained by a shortening of the growing season length as a result of rising temperatures and increased precipitation. Whereas, an increase in irrigation demand for rice is a combined effect of higher temperatures and less precipitation during the reproductive phase in the region. At the same time, irrigation supply by surface water and groundwater is likely to change in future as a result of warmer and drier growing period, causing a significant increase in groundwater irrigation, mainly for rice. Major research findings show the importance of crop water assessments during the sensitive crop growth phases of wheat and rice which varies in space and time. Including

crop phase-specific climate impact assessments of regional and global projection will help to improve the existing crop-water management strategies and adaptation practices in the region.

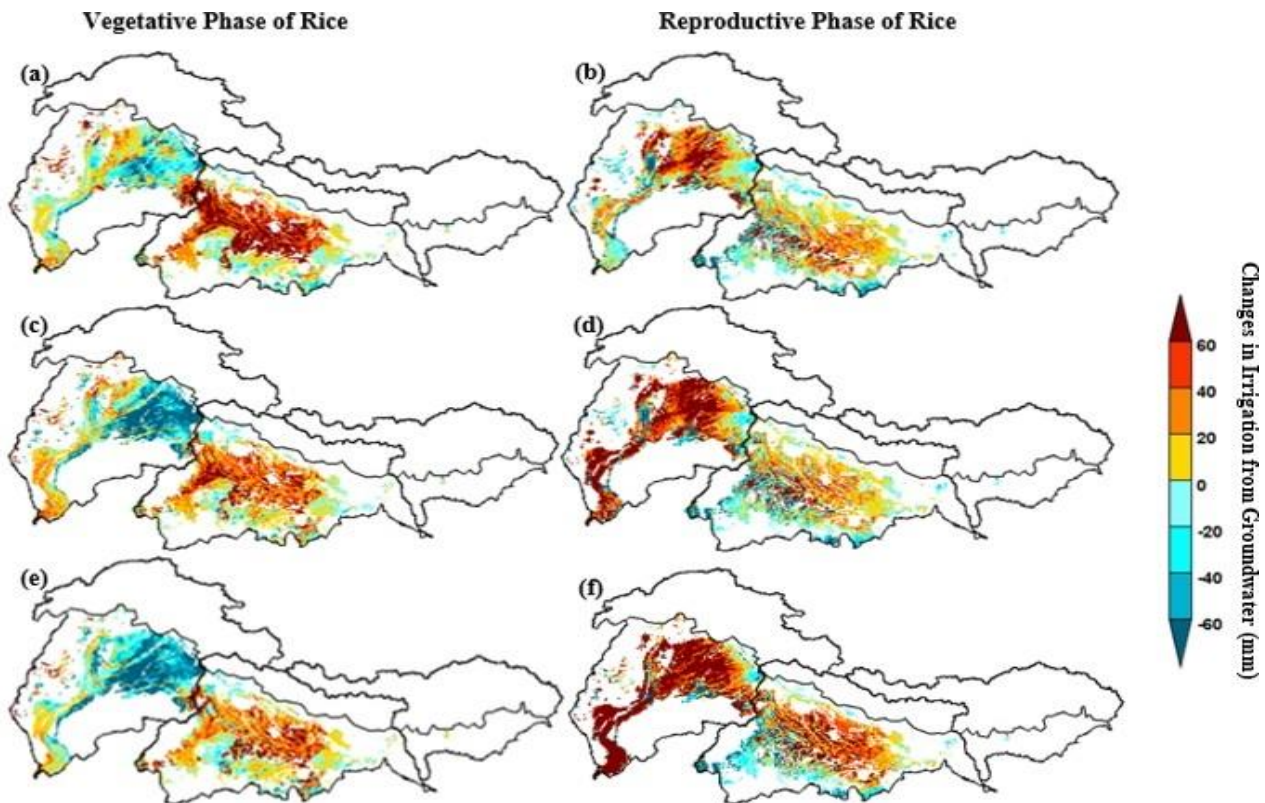
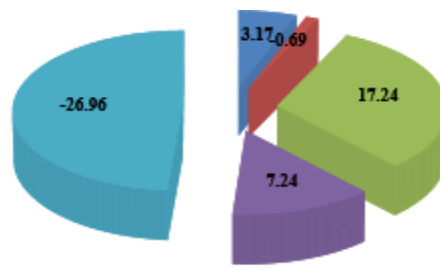


Fig. 8: Projected changes in irrigation from groundwater (mm) during the vegetative (a, c, e) and reproductive (b, d, f) phases of rice over the whole IGB river basins for three reference periods i.e., 2011-2040 (a-b), 2041-2070 (c-d), and 2071-2100 (e-f). Changes are relative to the 30 years mean groundwater supply for the control period 1981-2010 (Fig. S1b). Positive values indicate the groundwater supply is increasing relative to the control period.

g) GIS-based spatio-temporal assessment of forest cover change and carbon sequestrations of Abbottabad district, Pakistan

This study was conducted to analyze Land Use Land Cover (LULC) changes and Carbon stock assessment over Abbottabad district, Pakistan. The result shows an overall increase of 3.17%, 17.24%, and 7.24% in the forest, vegetation, and build-up areas, respectively; whereas water-bodies and others (barren land) have decreased significantly by 0.69% and 26.96% respectively (**Figure 9**). Results revealed that carbon sequestration increase as the year passes due to afforestation in the study area. From 1986 to 2004 carbon sequestration decreased by 12.93%, while in 2002 – 2014 carbon sequestration increased by 19.54% between 2014 – 2019 (**Figure 10**).



■ Forest ■ Water Bodies ■ Vegetation ■ Builtup ■ Others

Fig. 9: Net percentage Change in Land Use Land Cover (1986 – 2019)

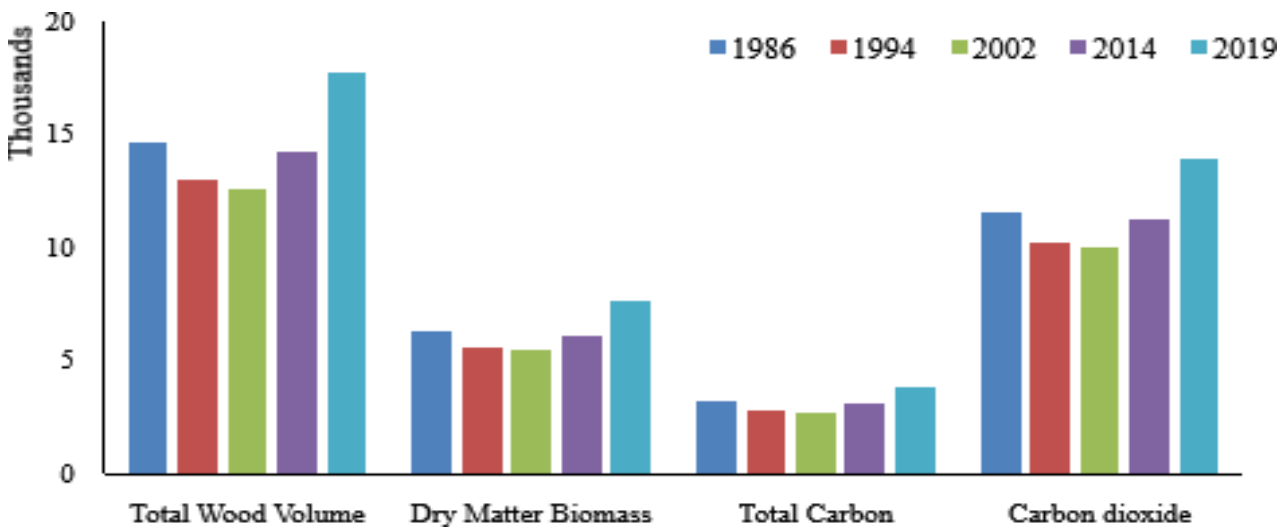


Fig. 10: Trend of total wood volume, Dry matter biomass, total carbon, carbon dioxide during 1986 – 2019

h) Implication of Remote Sensing Data under GIS Environment for appraisal of irrigation system performance

The substantial contribution of agriculture sector in Pakistan’s economy is presently under threat due to water shortage, unequal distribution, and access to water resources. Efficient and integrated use of water by improving irrigation management and delivery can reduce this menace. An appraisal of system performance helps in managing the system. This needs real-time data which is usually expensive and difficult to collect for longer periods. Remotely sensing and Geographic Information System have the potential to overcome it. This manuscript presents a methodology to assess irrigation system performance by determining commonly used indicators and successfully applied on main canal system. Remotely sensed and conventional data were used to derive crop water requirement, availability and its spatial distribution. The potential water requirement of the area was found 401.66 million cubic meters (MCM) and the available canal water supply was 247.14 MCM, thus having shortage of 38%. Water consumption of wheat was estimated by remote sensing to be 243.41 MCM which was comparable to the available canal water supply confirming accuracy of the proposed method. *Adequacy* of the system was found to be 74% while its reliability varied from 35-73% throughout the wheat season. The coefficient of variance (Cv) showed that the irrigation system under this study was unreliable during the wheat season. Performance in *equity* terms revealed that head areas of irrigation channels were receiving more water supplies than the tail areas. Strong correlation

was found between crop yields and water supplies i.e., crop yield was strongly dependent on water supplied ($R^2=0.80$).

i) Effect of zero and minimum tillage on cotton productivity and soil characteristics under different nitrogen application rates

Long-term conservation tillage and straw incorporation are reported to improve the soil health, growth, and yield traits of crops; however, little is known regarding the optimal nitrogen (N) supply under conservation tillage with straw incorporation. The present study evaluated the effects of conservation tillage practices (ZTsas: zero tillage plus wheat straw on the soil surface as such, and MTsi: minimum tillage plus wheat straw incorporated) and different N application rates (50, 100, 150, and 200 kg ha⁻¹) on the yield and quality traits of cotton and soil characteristics in a five-year field experiment. The results showed that ZTsas produced a higher number of bolls per plant, boll weight, seed cotton yield, 100-seed weight, ginning out-turn (GOT), fiber length, and strength than MTsi. Among different N application rates, the maximum number of bolls per plant, boll weight, seed cotton yield, GOT, 100-seed weight, fiber length, strength, and micronaire were recorded at 150 kg N ha⁻¹. Averaged over the years, tillage × N revealed that ZTsas had a higher boll number plant⁻¹, boll weight, 100-seed weight, GOT, fiber length, and strength with N application at 150 kg ha⁻¹, as compared to other tillage systems. Based on statistical results, there is no significant difference in total soil N and soil organic matter among different N rates. Further, compared to MTsi, ZTsas recorded higher soil organic matter (SOM, 8%), total soil N (TSN, 29%), water-stable aggregates (WSA, 8%), and mean weight diameter (MWD, 28.5%), particularly when the N application of 150 kg ha⁻¹. The fiber fineness showed that ZTsas had no adverse impact on fiber fineness compared with MTsi. These results indicate that ZTsas with 150 kg N ha⁻¹ may be the optimum and most sustainable approach to improve cotton yield and soil quality in the wheat–cotton system.

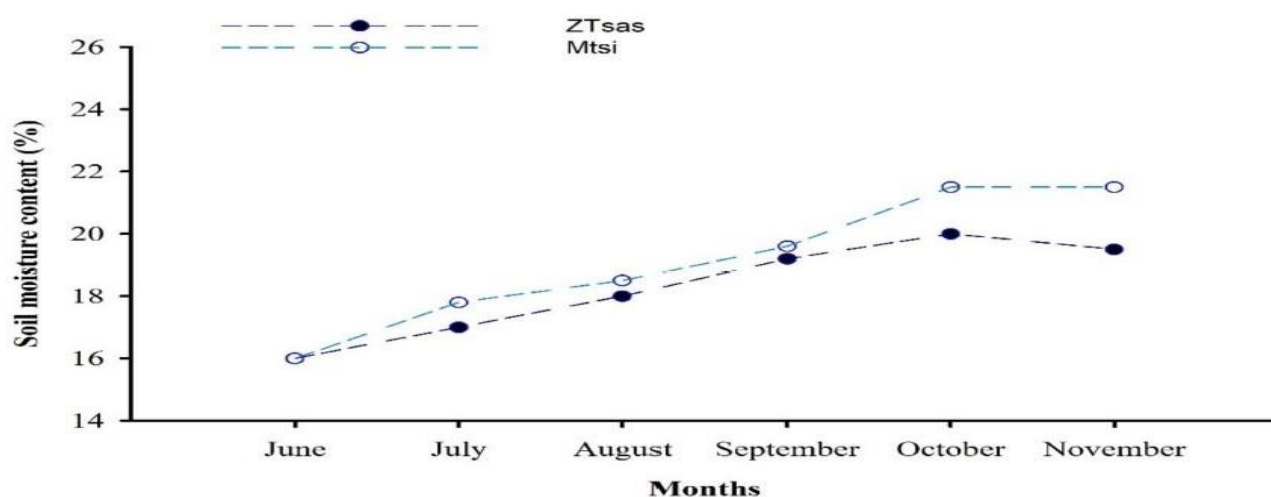


Fig. 11: Effect of tillage treatments (ZTsas, zero tillage with straw retention; MTsi, minimum tillage with straw incorporation) on soil moisture content during the last year of experiment (2015-2016).

j) The implication of remotely sensed vs. climate data in assessing crop water ingestion using machine learning

Pakistan possesses an agriculture-based economy, and in general, its agricultural production is relatively increased during the last decade. Pakistan’s agricultural industry is a major contributor to its GDP. It fulfills almost all of the 90% food and fiber requirements. Still, there is a big gap when

compared with many countries of the world due to its poor resource management. Irrigated agriculture in Pakistan consumes 93 percent of the available water resources, whereas more than 60 percent of irrigation water is lost during the conveyance and application in the field. The major reason for application losses is lack of knowledge about irrigation scheduling. Other factors are the ever-growing population, urbanization, industrialization, and inadequate storage. Estimation of Crop Water Requirement (CWR) is a basic tool in water resources management which is based on crop evapotranspiration (ET) estimation. Several methods for estimation of crop ET are being used by various researchers, which have their own deficiencies. Under this study, two well known and most reliable methods i.e., SEBAL and CROPWAT, which use satellite data and climatic data respectively, were tested. Both methods were applied to the estimation of wheat crop ET on the entire district of Peshawar and results were compared to provide a sound basis for ET estimation. It has been observed that both results were comparable with minor deviations. CROPWAT requires a lot of climatic parameters that are difficult to collect due to the involvement of huge labor and instrumentations. To avoid the collection of this data, satellite-based estimation of crop ET through energy balance equation is easy and it gives an actual on-ground estimation of crop ET. The study testifies that satellite base ET estimation is cost-effective, easy to apply, and gives more reliable results.

k) Assessing drought and its impacts on wheat yield using remotely sensed observations in rainfed Potohar region of Pakistan

This study aims to assist the decision-making process for drought monitoring and yield predictions, as it informs drought assessment and its impacts on crop yield using drought and vegetation indices along with climate and crop yield data. The research quantifies recurrent drought events for Rubi (wheat crop) season (November-April) from 2000 to 2018 in the Potohar region using indices such as Standardized Precipitation Index (SPI), Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), and Soil Adjusted Vegetation Index (SAVI) along with climatic parameters i.e., mean temperature, rainfall and soil moisture. Results identify three moderate (2000-01, 2001-02, 2009-10) and two weak (2011-12, 2017-18) drought events using SPI, whereas two more drought events (2007-08 and 2016-17) are noticed when vegetation indices are used. Artificial Neural Network (ANN), a multilayer perception (MLP) model is applied afterwards to see the individual impact of each study parameter on wheat yield. Soil moisture is found to impact yield by 100 %, temperature by 74 %, rainfall by 61 %, and then rest of the indices.

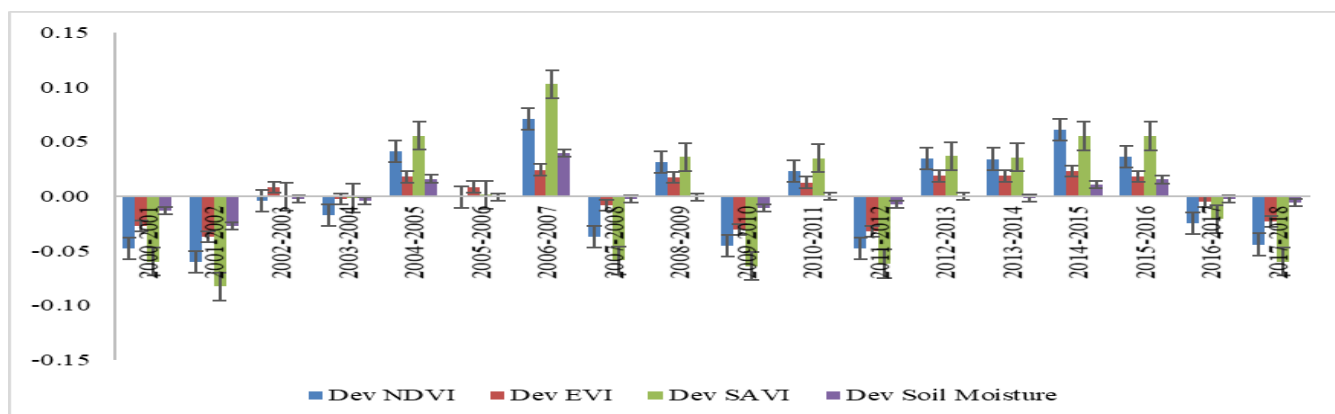
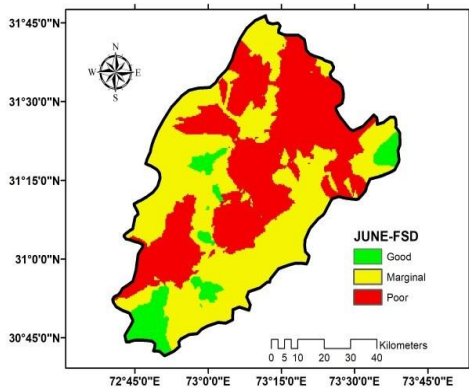


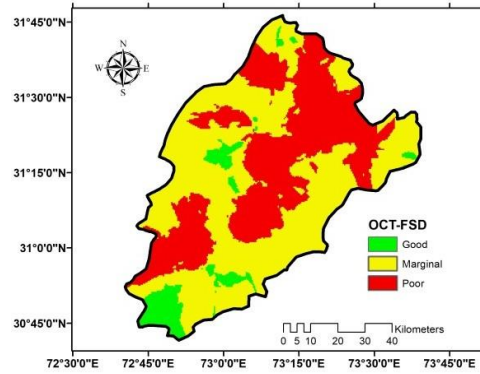
Fig. 12: Deviation of NDVI, EVI, SAVI, and soil moisture in the Potohar region during Rubi season from 2000-2018

l) Geostatistical investigation of groundwater quality zones for its application in irrigated agriculture areas of Punjab (Pakistan)

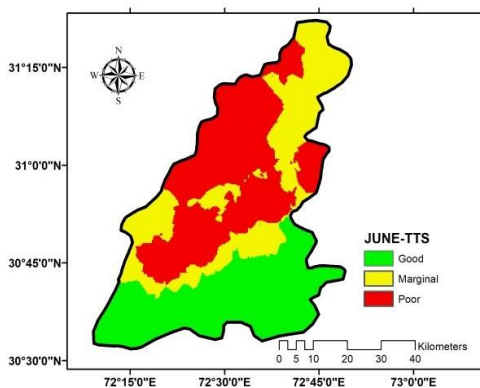
This study was carried out in Faisalabad (FSD) and Toba-Tek Singh (TTS) districts of Punjab, Pakistan to check its suitability for irrigation with three major parameters (i.e., EC, SAR, and RSC). Geo-statistical water quality analysis was carried out using the GS+ and ArcGIS which includes three basic components, normalized histograms, semivariograph, and Kriging. A hydro-economic model was applied to observe the impact of groundwater quality on crop yield and farmers' income. It was found that the percent area under a good groundwater quality zone in FSD was about 25% fewer than TTS. In FSD, the majority area of the aquifer was under marginal (50-55%) to poor (39-44%) quality groundwater zones, and salinity and sodicity are major threats depicted by EC and RSC respectively. In TTS district, salinity was the only major risk to groundwater quality as about 45% area was under poor quality zone. The overall aquifer's area was under about good (~33%), marginal (~29%) and poor (~38%) quality groundwater zone. Comparing the economic models in two districts using the different quality water, it was found that the BCR (Benefit Cost Ratio) was recorded 2.31, 2.13, and 1.73 in FSD district, while in TTS district the BCR was 2.35, 2.09, and 1.58 for good, marginal, and poor quality zone respectively.



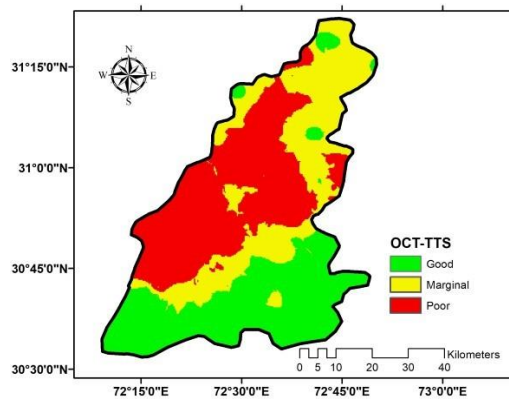
(a) Faisalabad district (Pre-monsoon)



(b) Faisalabad district (Post-monsoon)



(c) Toba Tek Singh district (Pre-monsoon)



(d) Toba Tek Singh district (Post-monsoon)

Fig. 13: Spatial variation of overall water quality for irrigation

m) Projections of wind power density (WPD) in Pakistan and adjacent regions

This work focuses on the wind energy in Pakistan projected by 3 regional climate models (RCMs), namely COSMO-CLM, REMO, and RegCM4 nested in different global climate models from the Coupled Model Intercomparison Project 5. Five time-slices (1995-2014, 2020-2039, 2040-2059, 2060-2079, and 2080-2099) and two scenarios (RCP2.6 and RCP8.5) were analyzed. Wind energy studies are based on two variables: wind intensity and wind power density (WPD). WPD is a measure of the wind energy produced by turbines installed above the surface, currently at 100 m height. Before computing WPD, a simple bias correction was applied to the model data. Considering all of Pakistan, wind intensity was higher in June, July and August due to the influence of the active phase of the monsoon. In terms of subdomains, higher intense winds were reported in the provinces of Balochistan and Sindh. For the same regions and season, the wind intensity is projected to increase (by $\sim 1-1.5 \text{ m s}^{-1}$), which leads to an increase in WPD of $>20\%$ in Balochistan and 40% in Sindh under RCP8.5. An increase in WPD in the eastern part of the country is projected, but it will not be enough for wind energy generation. The research findings can be useful for entrepreneur investors in wind energy.

Workshops Organized:

1. Online Workshop on F-Gases jointly organized by GCISC, GIZ, and CITEPA - 1 July 2021
2. Training workshop on GHG Emissions / Carbon Accounting in Forestry sector

- organized jointly by MoCC / IUCN / GCISC / REDD+ at Hotel Margala Islamabad- 31 Aug - 1 Sep 2021
3. Workshop on Development of MRV System for Greenhouse Gas Inventories in Punjab, Pakistan jointly organized by GCISC / MoCC / CITEPA / GIZ at Serena Hotel, Islamabad on 20 September 2021
 4. WORKSHOP on “Development of M & E System for Adaptation Tracking (Agriculture) in Pakistan” jointly organized by GCISC / MoCC, CITEPA, and GIZ-Pakistan at Serena hotel, Islamabad on 21 September 2021
 5. Workshop on "Monsoon Variability and Extremes in Changing Climate" organized by GCISC at Islamabad from 12-14 October 2021
 6. RISQ Platform Training Workshop on “Official Launch and Training of Monitoring and Evaluation (M&E) System for Adaptation Tracking (Agriculture Sector) in Pakistan” jointly organized by GCISC and CITEPA at Islamabad Hotel on 23 November 2021
 7. RISQ Platform Training Workshop on “Official Launch & Training of Monitoring and Evaluation (M&E) System for Adaptation Tracking (Agriculture Sector) in Pakistan” jointly organized by GCISC and CITEPA at Islamabad Hotel on 24 November 2021
 8. Provincial Training Workshop on "The RISQ Climate Change Adaptation M&E Tracking Tool (Agriculture Sector)" jointly organized by GCISC and CITEPA at Luxus Grand Hotel, Lahore from 29-30 November 2021
 9. Provincial Training Workshop on "The RISQ Climate Change Adaptation M&E Tracking Tool (Agriculture Sector)" jointly organized by GCISC and CITEPA at PC Hotel, Karachi from 02-03 December 2021
 10. National Stakeholder’s Consultation Workshop on Mainstreaming Climate Smart Agriculture under Workshop organized on "Pathways to Strengthening Capabilities for Climate Smart Agriculture in Pakistan" - 22 December, 2021 at Islamabad Hotel
 11. Workshop on “Responding to Climate Change: Adaptation and Mitigation in Agriculture” in Training program on “Climate and resilient and water smart agriculture” organized by PARC-NARC/GCISC at NARC Islamabad from 29-30 December 2021
 12. Workshop on Climate Change and development of IT based Digital Monitoring, Reporting and Verification System for Climate Smart Rice to the Ministry of Climate Change, Islamabad jointly organized by GCISC & Helvitas at Hotel Margala Islamabad on 23 June 2022

Dissemination of R&D Findings:

Research Papers in National/ International Journals and Reports

1. GIS-based spatio-temporal assessment of forest cover change and carbon sequestrations of District Abbottabad, Pakistan. Journal of Water and Climate Change, 13(8), 2962-2971. Goheer, M. A., Hassan, S. S., Gul, K., Waqar, M., & Parveen, N. (2022)
2. Effect of Zero and Minimum Tillage on Cotton Productivity and Soil Characteristics under Different Nitrogen Application Rates. Niamat Ullah Khan, Aftab Ahmad Khan, Muhammad Arif Goheer

3. The implication of remotely sensed vs climate data in assessing crop water ingestion using machine learning. Aftab Ahmad Khan, Muhammad Arif Goheer, Mubashir Ali, Dr. Sultan Ahmad Rizvi
4. An Overview of Groundwater Monitoring through Point-to-Satellite-Based Techniques by Amjad Masood, Muhammad Atiq Ur Rahman Tariq, ORCID, Muhammad Zia Ur Rahman Hashmi, Muhammad Waseem, Muhammad Kaleem Sarwar, Wasif Ali, Rashid Farooq ORCID, Mansour Almazroui, ORCID and Anne W.M. Ng (Feb 2022)
5. Hydrologic Interpretation of Machine Learning Models for 10-daily streamflow simulation in Climate sensitive Upper Indus Catchments, Haris Mushtaq, Taimoor Akhtar, Muhammad Zia-ur-Rahman Hashmi, and Amjad Masood (2022)
6. Geostatistical investigation of groundwater quality zones for its applications in irrigated agriculture areas of Punjab (Pakistan), *Environmental Earth Sciences* (2022) 81:91
7. Implication of Remote Sensing Data under GIS Environment for Appraisal of Irrigation System Performance. Sultan Ahmad Rizvi, Afeef Ahmad, Muhammad Latif, Abdul Sattar Shakir, Aftab Ahmad Khan, Waqas Naseem & Muhammad Riaz Gondal
8. Assessing drought and its impacts on wheat yield using remotely sensed observations in rainfed Potohar region of Pakistan. Muhammad Ijaz, Qudsia Zafar, Aftab Ahmad Khan, Sher Shah Hassan. *Environment, Development and Sustainability* (2022)
9. "Shifts in Irrigation Water Demand and Supply Pattern During Sensitive Crop Growth Phases in South Asia". Qurat-ul-Ain Ahmad, Eddy Moors, Hester Biemans, Nuzba Shaheen, Ilyas Masih, Muhammad Zia ur Rahman Hashmi. (under review)
10. Variability in runoff and responses to land and oceanic parameters in the source region of the Indus River. *Ecological Indicators*, 140, 109014. Hussain, A., Cao, J., Shaukat Ali., Ullah, W., Muhammad, S., Hussain, I., & Zhou, J. (2022)
11. Climate change and spatio-temporal trend analysis of climate extremes in the homogeneous climatic zones of Pakistan during 1962-2019. *PloS one*, 17(7), e0271626. Khan, F., Shaukat Ali., Mayer, C., Ullah, H., & Muhammad, S. (2022)
12. Observed trends and variability of seasonal and annual precipitation in Pakistan during 1960–2016. *International Journal of Climatology*. Hussain, A., Cao, J., Shaukat Ali., Muhammad, S., Ullah, W., Hussain, I., ... & Zhou, J.
13. Early summer surface air temperature variability over Pakistan and the role of El Niño–Southern Oscillation teleconnections. *International Journal of Climatology*. Rashid, I. U., Abid, M. A., Almazroui, M., Kucharski, F., Hanif, M., Shaukat Ali., & Ismail, M. (2022)
14. Non-uniform changes in different daily precipitation events in the contiguous United States. *Weather and Climate Extremes*, 100417. Li, M., Sun, Q., Lovino, M. A., Shaukat Ali., Islam, M., Li, T., ... & Jiang, Z. (2022)
15. Projections of wind power density in Pakistan and adjacent regions. *Climate Research*, 85, 177-192. Reboita, M. S., Kiani, R. S., Shaukat Ali., & Khan, T. (2021)
16. 21st century precipitation and monsoonal shift over Pakistan and Upper Indus Basin

- (UIB) using high- resolution projections. *Science of The Total Environment*, 797, 149139. Shaukat Ali., Reboita, M. S., & Kiani, R. S. (2021)
17. Wavelet coherence of monsoon and large-scale climate variabilities with precipitation in Pakistan. A Hussain, J Cao, S Ali, W Ullah, S Muhammad, I Hussain, H Abbas, ... *International Journal of Climatology*
 18. Preparation of GHG Inventory 2017-18
 19. Contribution to the preparation of Pakistan updated NDC's submitted to UNFCCC in November, 2021
 20. Contribution to the preparation of Biennial Update Report (BUR1) submitted to UNFCCC by MoCC in April 2022

A. Capacity Building:

Capacity building is an important component of GCISC's activities. Climate change still is an evolving science. The new concepts, tools, and methodologies for impact assessment emerge quite frequently, making it necessary to capacitate the Centre's researchers as well as other institutions with upcoming technologies and skills for quality research and action.

During 2021-22, the Centre's scientists participated in several national/ international training workshops and acquired new skills ranging from climate science, climate modeling, seasonal forecasting, early warning systems, drought monitoring and assessments, hydrological, crop simulation, and water management modeling, water surface runoff analysis, water-food-energy nexus, to earth observation systems, space technology, and RS/GIS tools. The acquired skills are being used for the ongoing and planned research activities at the Centre. GCISC's scientists also contributed as resource persons in workshops and seminars organized by various organizations.

Forty (40) students from the National University of Science and Technology (NUST), Islamabad, Bahria University, Islamabad, PMAS-Arid Agriculture University Rawalpindi, University of Agriculture, Faisalabad and University of Engineering & Technology (UET) Peshawar attended GCISC as Interns for a period of 2-3 months. The Centre's researchers provided them with orientation lectures on climate science, modeling, and other analytical skills, and supervised them for various studies assigned to them by their university teachers and GCISC researchers.

The Centre is also organizing a series of lectures called as 'Friday Seminar' in which GCISC's own as well as researchers from other institutions deliver lectures on the latest ongoing research and present studies on the aspects of climate sciences, sectoral impacts, and response strategies.

B. Mass Awareness / Media Appearance:

The Centre's scientists published several news articles in the leading national newspapers on various aspects of climate science and its associated impacts on water, agriculture, and forestry. Scientists also provided interviews and responses on the ongoing issues of heat waves, glacier melting, monsoon havoc, food insecurity, wheat crisis, effective irrigation water management, and other allied issues pertaining to climate change. A detail of activities is as follows:

Newspaper Articles:

- Article on Climate Hotspots and Policy- The News on 13 Jul 2021;
- Article on Spatial Shift in Monsoon- The News on 9 Oct 2021;

- Article on COP26 - Glass half-full or half-empty- The News on 23 Nov 21;
- Article on How to deal with heat waves- The News on 16 Jun 22.

Climate Change Awareness on Electronic Media:

- GCISC Message on Climate Change awareness broadcasted live on SUCH TV-31 Dec 2021;
- GCISC Scientist Live broadcast on Pakistan Television News (PTV News) and FM98 Radio DostiChannel - 16 May 2022;
- SAMMA TV broadcasted GCISC's paper's findings during the May 2022 heat wave. The study has been published in The International Journal of Climatology

Briefings to Institutions:

- Medical Doctors of Aga Khan Medical University, Karachi were briefed on the aspects of Climate Change on health - 07 March 2022;
- Participants of the Akhtar Hameed Khan Niazi National Commission for Rural Development (NCRD) visited GCISC and were briefed on Climate Change – 11 May 2022

C. Inputs for Parliamentary Business

GCISC, being the research arm of the Ministry of Climate Change, frequently provides technical input on climate change, impacts, and response strategies for parliamentary business. In this regard, GCISC provided responses to National Assembly and Senate question and also contributed to the proceedings of the standing committees on the concerns of climate change.

5.4 ISLAMABAD WILDLIFE MANAGEMENT BOARD (IWMB)

The Islamabad Wildlife Management Board was constituted under the “Protection, Preservation, Conservation and Management” (PPC&M) Ordinance, 1979. The purpose of this Board is to implement the PPC&M Ordinance 1979 and its Rules 1983, ensuring to protect the wildlife and environment of Islamabad Capital Territory (ICT). Accordingly, Margallah Hills National Park (MHNP) was notified as the National Park of Pakistan in 1980. The covered area of this National Park is 67 square miles. In addition, the Rawal Lake and Shakarparian areas were also declared as National Parks of Islamabad.

In 1981, the Federal Government notified a Wildlife Management Board. This Board was chaired by the Chairman of the Capital Development Authority (CDA), and included officials from CDA and the Federal Government. The Board remained dysfunctional, and MHNP was managed through Environment Directorate of CDA without involving the notified Board.

On September 30, 2014, Prof. Z. B Mirza, a prominent Zoologist and field expert, filed a petition in the Islamabad High Court (IHC) maintaining that the MHNP was facing severe degradation due to lack of attention from CDA.

The Cabinet Division held a meeting with the petitioner, members of the Committee, and the CDA to solicit their views on the constitution of the Board, and forwarded its recommendations to the Federal Government. The Board was finally re-notified by the Federal Government on July 7, 2015. Thereafter, via a Cabinet Division notification No. 6/9/2015-CDA-II dated August 10, 2015, Dr. Anis-ur-Rahman was appointed Chairman of the Board with immediate effect till 23rd October 2020. In pursuance of approval of the Prime Minister, conveyed vide Prime Minister's Office F. No.6(9)/020-Admn-UU-IWMB dated 23.11.2020, Rina Saeed Khan was appointed as the chairperson of the Islamabad Wildlife Management Board, and in exercise of the powers conferred by section 4 of the Islamabad Wildlife (Protection, Preservation, Conservation, and Management) Ordinance, 1979 (LXX of 1979) read with sub-rule:

- (a) Of rule 2A of Islamabad Wildlife (Protection, Conservation and Management) Rules, 1983, the Federal Government reconstituted a Board of Wildlife Management on October 23rd 2020.

After its declaration as a protected area in 1980, the Margallah Hills National Park was managed by the Capital Development Authority (CDA). However, in 2015, the Islamabad Wildlife Management Board (IWMB) was set up under Section 4 of the Islamabad Wildlife (Protection, Preservation, Conservation and Management Ordinance 1979, Government of Pakistan). The IWMB is the legal custodian of the National Parks in ICT and is involved in the protection, conservation, and management of the Margalla Hills National park. The aim is to minimize anthropogenic impacts on the ecological resources of the national park through a park protection programme from threats such as illegal extraction of park wood, exploitation of wildlife species, forest fires, illegal construction and encroachment. In addition, the IWMB is working with the local communities of the Park to raise their environmental awareness, educate them, and improve their living conditions.

The Islamabad Wildlife Management Board is in the process of building capacity to fulfill its mandate for the management of wildlife in the Islamabad Capital Territory.

Objectives:

The IWMB has the following objectives:

- To protect and manage Islamabad’s unique and outstanding natural beauty for

generations to come, by international standards while engaging local communities.

- To preserve, protect, and enhance the indigenous flora and fauna (biodiversity) in Islamabad and create open space to enrich the quality of life for present and future generations in a safe and secure environment.
- Manage and control the illegal trade of wildlife species in ICT. Development and maintenance of physical infrastructure inside the MHNP such as roads and buildings.
- Consistent with legislation, all plans related to roads and buildings need to be shared and approved by the IWMB before implementation.

MARGALLAH HILLS NATIONAL PARK (MHNP):

Margallah Hills National Park lies adjacent to the capital city of Islamabad. To the northwest is the incipient industrial center of Taxila. Encroachments from these urban areas pose serious threats to the integrity of the wilderness of the Park. However, the foremost and most serious threat to the Park is from the communities living inside the Park which have increased in population over the years. These local communities allow their livestock to graze freely, and thus destroy the vegetation cover and trample young seedlings. In addition, the locals cut trees for fuel, gather fodder for their animals, and divert natural water streams to cultivated plots near their homes. Some residents even hunt native animals such as hares and birds for food and sport. Solid and liquid waste is not disposed of adequately with consequent negative impacts for the environmental and ecological resources.

There are a number of rock mining quarries in the Park where the habitat is severely degraded. Quarries operate on lease arrangements made by the Planning Directorate of the CDA. Some leases were granted after the park was established, but public pressure brought mainly by a citizens' group "*The Margallah Hills Society*" forced the termination of such leases. The CDA ordered the closure of all mines on 31 July 1991. Most of the quarries have discontinued operations, and others are expected to be closed in the near future. The Fecto Cement company's 30-year lease for mining limestone, granted in 1983, is however not included in this order.

Fires have fairly common occurrence in the Margallah Hills, and require significant expenditure and manpower to extinguish. Eighty-five per cent (85%) of these fires occur during the dry May-June period preceding the monsoon rains. The number of fires averaged 49 per year from 1986 to 2022. Most of the fires occur on the upper slope, or ridge top sites on southern aspects, and tend to be manmade.

Alien invasive vegetation species competing native species are growing at an alarming rate, negatively impacting the delicate balance of the park ecosystem. Invasion of exotic vegetation like Paper Mulberry, *Parthenium Spp.* and *Lantana Spp.* has not only impacted the vegetation balance, but also led to an increase in incidence of allergies.

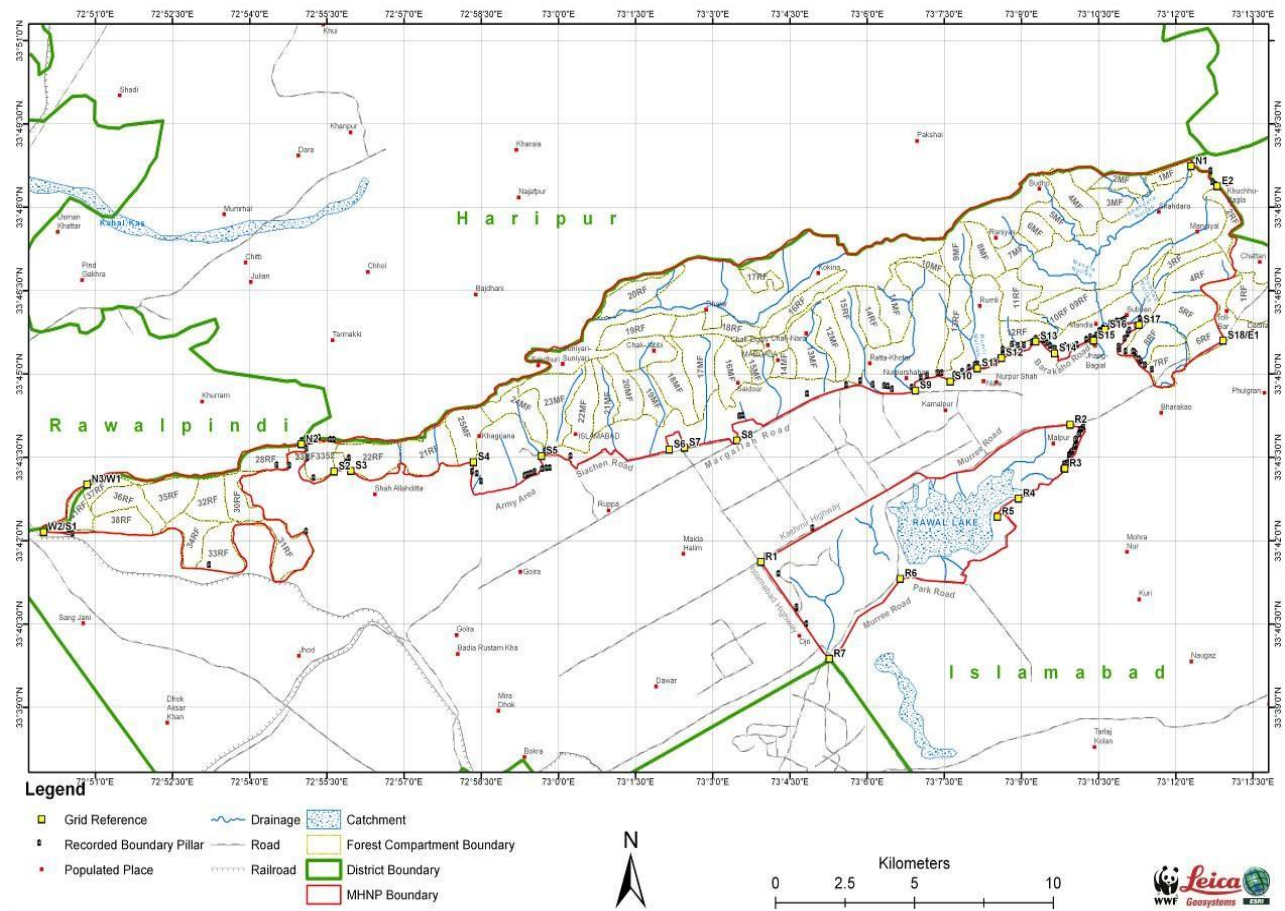
Area:

The Margallah Hills ranges between 456 m and 1,580 m in altitude. The topography is rugged, with numerous valleys and steep slopes. Rocks have been observed to date back to the Jurassic and Triassic ages, limestone being characteristic of the region (though shale, clay, and sandstone are also present). Soils are dark, with a high mineral content, and are capable of supporting good tree growth despite being shallow. The hills are an extension of the Himalayan range, and form the northern boundary of the Potohar plateau. The area is drained by the River Kurang and its tributaries, which flow into the Soan River.

The climate is subtropical semi-arid. The region lies in the monsoon belt and experiences two rainy seasons. Winter rains last from January until March and summer rains from July to September. Temperatures ranges from 1-15 °C in winter and 20-40 °C during the summer. Annual average rainfall is 1,000 mm. There have been occasional incidents of light snowfall in severe winters.

There are at least 38 species of mammals, 350 species of birds reported from the Margallah Hills within the MHNP. There are 32 species of reptiles and 9 species of amphibians reported.

Map of Margallah Hills National Park



Proposed Notification Map of Margallah Hills National Park

Governing Body:

In pursuance of approval of the Prime Minister, conveyed vide Prime Minister's Office F. No.6(9)/020-Admn-UU- IWMB dated 23.11.2020, Rina Saeed Khan, was appointed as the chairperson of the Islamabad Wildlife Management Board, and in exercise of the powers conferred by section 4 of the Islamabad Wildlife (Protection, Preservation, Conservation and Management) Ordinance, 1979 (LXX of 1979) read with sub rule (a) of rule 2A of Islamabad Wildlife (Protection, Conservation and Management) Rules, 1983, Federal Government reconstituted a Board of Wildlife Management on October 23rd, 2020 consisting of the following members, namely;

Ex.Official Members:

01.	Sr. Joint Secretary or Joint Secretary, Ministry of Climate Change	Member
-----	--	--------

02.	Inspector General of Forests, Ministry of Climate Change	Member
03.	Deputy Commissioner, ICT or nominee	Member
04.	Director (Environment) Metropolitan Corporation, Islamabad	Member
05.	Director (Regional Planning), Capital Development Authority	Member

Non-Official Members:

06.	Mr. Zahid Baig Mirza, Biodiversity Expert	Member
07.	Ms.Imrana Tiwana, Environmental and Natural Resource Expert	Member
08.	Ms. Rina Saeed Khan, Outreach and Visibility Expert	Member
09.	Mr. Vaqar Zakria, Member Civil Society	Member

Organizational Strength:

The IWMB has a team of 45 members that are working for the conservation and protection of wildlife species and National Park in Islamabad. The detail of strength is given below:

Sr.#	Designation & Scale	Sanctioned	Working	Vacant
01.	Director (Wildlife) (BPS-19)	01	01	0
02.	Secretary (Board) (BPS-18)	01	01	0
03.	Deputy Director (Research & Planning) (BPS-18)	01	01	0
04.	Deputy Director (Admin & Accounts) (BPS-18)	01	01	0
05.	Deputy Director (Wildlife) (BPS-18)	01	01	0
06.	Assistant Director (Wildlife) (BPS-17)	01	01	0
07.	Assistant Director (Research & Planning-Wildlife) (BPS-17)	01	01	0
08.	Assistant Director (Research & Planning-GIS) (BPS-17)	01	0	01
09.	Assistant Director (Information & Outreach) (BPS-17)	02	01	01
10.	Assistant Director (Community Relations) (BPS-17)	02	02	0
11.	Assistant Director (Accounts & Finance) (BPS-17)	01	01	0

12.	Assistant Director (Legal) (BPS-17)	01	01	0
13.	Admin Officer (BPS-16)	01	01	0
14.	Admin Assistant (BPS-15)	01	01	0
15.	Account Assistant (BPS-15)	01	01	0
16.	Wildlife Guard (BPS-07)	26	24	02
17.	Peon (BPS-02)	02	02	0
Total		45	41	04

Committees in IWMB:

The IWMB has 5 Committees: Protection Committee, Scientific Committee, Legal Committee, HR Committee, Accounts and Finance Committee. Each committee has a chairman and three members who look after their respective tasks.

i. Protection Committee:

Chaired by Syed Mujtaba Hussain (Sr. Joint Secretary), Ministry of Climate Change is involved in making policies and plans for the protection of the wildlife and Margalla Hills National Park in Islamabad. Protection committee of IWMB stopped the illegal activities in the park. The field staff of IWMB is involved in the routine patrolling from Margalla road to the top of the Monal. They look for the encroachment, illegal hunting, illegal trading, poaching, wildlife rescue, wildlife monitoring, and wood cutting etc.

ii. Scientific Committee:

Scientific Committee chaired by Professor Zahid Baig Mirza (Biodiversity Specialist) is involved in drawing plans and policies for carrying out the research and scientific studies in the MHNP.

iii. Legal Committee:

Legal committee chaired by Mr. Vaqar Zakaria (Member Civil Society) looks after the legal issues of the board.

iv. HR Committee:

HR committee of IWMB chaired by Mr. Vaqar Zakaria (Member Civil Society) looks after the recruitment, service of current employees, and legal issue of the board.

v. Accounts and Finance Committee:

Chaired by Mr. Vaqar Zakaria (Member Civil Society) makes the budget, and does accounts related tasks of the IWMB in addition to looking after the legal issues of the Board.

Role and Function of IWMB:

The role and function of Islamabad Wildlife Management Board is given below:

- i. The Islamabad Wildlife Management Board (IWMB) has been constituted by the Federal Government in terms of section 4 of The Islamabad Wildlife (Protection, Preservation, Conservation and Management) Ordinance, 1979 (“the Ordinance”)
- ii. Exercising powers under section 21 of the Ordinance, the Federal Government has issued S.R.O 433(I)/80 dated 28th April, 1980 wherein certain areas have been declared to form the Margalla Hills National Park (MHNP)
- iii. The Ordinance envisages IWMB to be the custodian of MHNP since no other body has been tasked to look after or manage the affairs of MHNP in the Ordinance, nor has the Federal Government declared any other body as the custodian of MHNP
- iv. The Federal Government, exercising powers under 41 of the Ordinance, has framed The Islamabad Wildlife (Protection, Preservation, Conservation and Management) Rules, 1983 (“the Rules”), which lay down the functions and powers of IWMB in rules 3 and 4 respectively
- v. One of the functions of IWMB as per rule 3 of the Rules is to “*take all policy decisions, draw plans, programmes, and execute them with regard to protection, preservation, conservation and management of wildlife, including the zoos in the Islamabad Capital Territory,*” which means that all matters pertaining to management and preservation of MHNP is the domain of IWMB
- vi. The landmark judgment of the Honorable Islamabad High Court in the case titled ‘Islamabad Wildlife Management Board vs. MCI and others’ reported as 2021 PLD Islamabad 6 (“the judgment”) lays down in detail the mandate of IWMB with regards to protection of wildlife in Islamabad as well as management of MHNP. Relevant portions of the judgment are reproduced below:
 - *“The Wildlife Ordinance of 1979 is a special law which was explicitly promulgated with the object to provide for the protection, preservation, conservation and management of wildlife, and setting up of a National Park in the Islamabad Capital Territory”*
 - *“It is declared, therefore, that the Zoo, its management and all other matters relating thereto fall within the jurisdiction and competence of the Board of management constituted under the Wildlife Ordinance of 1979”*
- vii. The judgment further directs that “the Board will be assisted by the Chief Commissioner, Islamabad Capital Territory and the Inspector General Police in order to enforce the provisions of the Wildlife Ordinance 1979”

Therefore, any hindrance caused to carrying out of the Board’s mandate and functions may amount to contempt of court

Goals and Targets:

Islamabad Wildlife Management Board is working for the conservation of wildlife in Margallah Hills, National Park and ICT with following main targets:

- To protect and manage Islamabad’s unique and outstanding natural beauty for generations to come, by international standards while engaging local communities
- To preserve, protect and enhance the indigenous flora and fauna (biodiversity) in

Islamabad, and create open space to enrich the quality of life for present and future generations in a safe and secure environment

- Management and Control of illegal trade of wildlife species in ICT

Development and maintenance of physical infrastructure inside the MHNP such as roads and buildings

- Consistent with legislation, all plans related to roads and buildings need to be shared and approved by the IWMB before implementation
- Rescue the wild animals in Islamabad Capital Territory that need treatment and further rehabilitation
- Control the illegal collection of natural resources from Margallah Hills National Park
- Create awareness and education among the citizens to protect the wildlife and their habitat for future generations
- Conduct community engagement programs to empower the custodian communities to protect the Margallah Hills National Park resources in sustainable way
- Scientific research on the Margallah Hills National Park resources to protect these assets scientifically
- Promotion of Eco-Tourism and responsible tourism which lead to “Plastic Free National Park” following the principal of “My Waste My Responsibility”

Activities and Achievements:

➤ Protection:

Protection of MHNP and wildlife is core responsibility of IWMB. Staff is deputed to different valleys of Margalla Hills National Park to protect the natural resources and wildlife. There are 38 species of mammals, 350 species of birds, 32 reptiles, 09 species of amphibians, and 650 species of plants in Margallah Hills National Park.

The protection staff controls the following:

i. Control Wood Cutting in MHNP

Plants are vital to life on earth and for humans. Life as we know it would not be possible without plants. They are the main source of food for all animals. They are source of oxygen, medicine, fuel, furniture etc. for humans, but the current percentage of plants in MHNP is decreasing due to deforestation and illegal wood cutting. It creates severe loss of young trees, and also leads to destruction of wild habitat.

ii. Protection of Wildlife from Forest Fires

The fire season starts every year from April to August in Margallah hills National Park. The fires in the Margalla can erupt due to several reasons such as rising temperatures, burning of garbage or dried leaves, or even due to the discarding of burnt cigarettes in the forest area.

➤ Islamabad Wildlife Management Board Fire Protection Plan:

Islamabad Wildlife Management Board (IWMB) has formulated a 'Fire Protection Plan' to protect the most valuable and visible forested part of the MHNP. Shortage of supervisory staff does not permit more area to be protected by IWMB staff. IWMB protects the wildlife species in its natural habitat through existing IWMB staff. However, forest fires from April to June 30th in the MHNP every year during dry season cause immense loss of forest, undergrowth cover, damage to wildlife habitat, impact on wildlife, and greatly disturb the citizens of Islamabad. The major impact of forest fires is on ground nesting birds, reptiles, amphibians, soil biodiversity, and seeds of flora in National Park.

IWMB protects the habitat of wildlife in MHNP, especially ground nesting birds, reptiles and amphibians by developing SOPs which define expectations and responsibilities of all team members. Additional fire staff is hired each fire season from local communities (end April to June 30th).

Impacts of Forest Fires on Soil Biodiversity

Forest fires cause severe impacts on biodiversity of soil. Forest fires affect vegetation by suppressing certain species and promoting other species causing changes in vegetation structure, and altering succession pattern. Fire causes reduction in soil micro-organism diversity and change soil bacterial composition.

Equipment Provided to Staff to Control Forest Fires

The equipment provided to staff to control forest fires is:

- Fire Beaters
- Leave scrappers
- Fire extinguishers (Fire ball)

Fire incident reports/damage reports are also prepared. For effective coordination among all stakeholders, a group is created on whatsapp. This group is headed by the Minister of Climate Change and other members as under:

- Secretary MoCC
- Chairperson-IWMB
- IWMB Protection Committee Chairman
- Chief Secretary Khyber Pakhtunkhwa
- Secretary (Environment) Khyber Pakhtunkhwa
- DC-Haripur (Khyber Pakhtunkhwa)
- Director-IWMB
- Provincial NDMA Directors
- DFO-Haripur (Khyber Pakhtunkhwa)

Fire Control by IWMB Staff

A total 27 fire incidents were reported in Margallah Hills National Park in the year 2022 till end of

June. There were five major fire incidents which affected forested landscape, natural ecosystem, and its wildlife. Due to fires following losses occurred as per observation in the field:

1. Loss of habitat
2. Loss of nesting & breeding sites
3. Loss of reptilian fauna
4. Loss of young saplings
5. Loss of regeneration process

Damage details of forest fires in Margallah Hills National Park, Islamabad in 2022 recorded by IWMB staff

SR. NO.	DATE	AREA	DAMAGE AREA IN(ACRE)
April 2022			
1	16/4/2022	Shahdara West (33°46'35.9"N 73°10'25.9"E)	3.75
2	17/04/2022	Pir Sohawa Road near Talhar More	0.625
3	20/04/2022	Damn-e- Koh Road	0.125
4	20/04/2022	RF-21 Shah Allah Dita	2.5
5	25/04/2022	M-F Jungle No 13 Rumli	0.625
6	25/04/2022	Damn-e- Koh Road Near M-F Jungle No 15 Bodal Ban	0.75
7	27/04/2022	Saidpur Valley	2.5
May 2022			
8	05/01/2022	Leopard Zone	0.0812502
9	05/07/2022	Talhar West	0.125
10	15/05/2022	RF-19	5
11	15/05/2022	RF-16	1.25
12	20/05/2022	Trail 3 Top	0.875
13	21/05/2022	RF-19	0.5
14	22/05/2022	KP Moza Nartopa	0.25

15	29/05/2022	RF-18 Talhar	0.5
16	30/05/2022	RF-12 Bari Imam	0.0937502
June 2022			
17	01/06/2022	RF-16 (33°45'54.4"N 73°04'18.7"E)	1.25
18	03/01/2022	RF-16 (33°45'54.4"N 73°04'18.7"E)	1.125
19	05/06/2022	Trail 3&5 Chiran Di Gali	11
20	06/06/2022	MF-9&10 near Pir Sohawa	1.875
21	07/06/2022	RF-13 (Ratta Hottar)	5
22	07/06/2022	Saidpur Valley	0.625
23	07/06/2022	RF-17 and 18	5
24	8/6/2022	RF-18 near Talhar (33°45'37.6"N 73°03'55.8"E)	15
25	9/6/2022	MF-14 near LAMONTANA (33°45'38.5"N 73°04'01.3"E)	2
26	14/6/2022	MF-15 Saidpur Dara	5
27	29/06/2022	RF-19 Near Talhaar (33°45'12"N 73°03'0321"E)	0.375
Total Damaged Area			67.8 Acre

➤ **Control On Illegal Trade & Hunting Of Wildlife:**

There are (29) animals in Rescue Center.

List of Existing animals

Black Bears	04
Monkeys	08
Kites	10
Steppe Eagle	01
Booted Eagle	01
Rose Ringed Parakeet	04
Rock Python	01

List of animals released in their natural habitat

Chukar	05
--------	----

Grey Partridge	01
IWMB has moved against monkey "dancing" and the selling of birds in ICT by confiscating the wild animals found onstreets, and then Monkey	02
Freshwater Turtles	05
Kites	06
Hedgehog	02
Spiny Tailed Lizard	01

Releasing them back in the wild. Zero tolerance is being shown for those indulging in animal cruelty and wildlife trafficking in ICT.

➤ **Control on Encroachments in MHNP:**

IWMB has made SOPS to report encroachments in MHNP. Encroachment is reported on regular basis by the fieldstaff to the field supervisor. After confirmation, supervisor reports to protection in-charge and then it is reported to the Assistant Director. A report is compiled and sent to Deputy Commission Islamabad and Environment DirectorateCDA with the approval of Director IWMB.

Standard Operating Procedures (SOPs) for reporting Encroachments in MHNP

Policy	Reporting Encroachments in MHNP
Purpose	It is the duty of IWMB to protect MHNP and restrain the people from performing illegal activities like encroachment here.
Procedure	<p>IWMB field staff patrols regularly in MHNP, and if they suspect encroachment, they take pictures and the GPS coordinates.</p> <p>After that, incidence is reported to the protection In charge. A report is prepared and finalized, that is signed by the field staff and protection In charge.</p> <p>Protection Incharge gives this report to the Assistant Director (Wildlife). On the report of Protection Incharge, after checking GPS coordinates and pictures shared by the field staff, an encroachment report is prepared and sentto the Environment directorate CDA and Deputy Commissioner with the signatures of Director IWMB.</p>

➤ **Habitat Improvement and Soil Establishment:**

For conservation of natural habitat and preservation of national park, it is of ultimate importance to remove alien invasive species and replace them with indigenous plants of MHNP. In MHNP the numbers of indigenous species of plants are under competition with the invasive plant species. These invasive plant species release hormones under soil that deteriorate the hyphae present in the roots of these indigenous plant species. These hormones also effect the regeneration of new saplings that naturally grow in the MHNP. The following was done for habitat improvement and soil establishment:

- Compiled progress report on invasive removal
- Formulated teams for the removal of invasive plant species like Parthenium /Lantana.
- Invasive plants uprooted and tracks cleared up to 5 feet each side.
- Removed invasive plants are collected at side of every trail

Report on Invasive Removal

In the light of directions of director of IWMB, a meeting was held on 28th July, 2022 in which three teams were formulated for habitat improvement (removal of invasive plants) from different sites of MHNP.

1- TEAM A

In phase one, on 30th July, team A started their work from trail 6 to Chanta Di Gali, and from both right and left side (5.5ft) Lantana and Parthenium were removed along with the maintenance of trail. Similarly, team A cleared upto 5km from Chanta Di Gali to Jabi di Gali.

In phase 2, team A cleared trail 4, and in phase 3 Lantana and Parthenium were removed from the Dhok Jeevan trail.

- Team A cleared 5km on chanta Di Gali trail
- 4km from trail 4 to jabi Di Gali
- 5km from Dhok Jeevan to Chanta Di Gali Total area covered 14km

2- TEAM B

Team B initiated its work from the starting point of trail 6, and from Noran Di Gali to Chakjabi, all kind of exotic herbs and shrubs were cleared up to distance of 5km along with the maintenance of trail.

- Team B covered 5km from trail 6 to Chanta Di Gali.
- 2km at trail 3b Total area covered 7km

3- TEAM C

In phase one, team C cleared Lantana and Parthenium from both right and left sides of Talhar mor to Chak jabi, along with the maintenance of trail.

In phase 2, team C cleared the whole area from Lantana which had blocked the whole way from the area of Jabi di galito Chak jabi.

- It covered 3km from Talhar morr to Jabi Di Gali

- Jabi DI Gali to Chak jabi
- 1km trail-5

Total area covered: 4km

Total distance covered: 25KM

Need to improve removal techniques:

- Scientific study is required to control the invasive plants in MHNP.
- Latest technology required to remove the alien invasive plant species

➤ **Mass Awareness and Community Trainings:**

Environmental Education (EE) refers to organized efforts to teach how natural environments function, and particularly, how human beings can manage behavior and ecosystems to live sustainably. IWMB conducts awareness sessions at trail-5. In these sessions, following mainly participate:

- Local schools located in MHNP
- Universities
- Departments; NGOs
- General public/ Visitors of MHNP.

IWMB Volunteer Policy

A ‘Volunteer’ is anyone who, without compensation or expectation beyond reimbursement of expenses incurred in the course of his or her volunteer duties, performs a task at the direction of and on behalf of the Islamabad Wildlife Management Board.

Applications for volunteer work are received throughout the year. Applicants are required to fill the **Statement of Interest Form**. All volunteers engaged must fill the **Personal Details Form**.

Volunteers shall not be provided Group Medical & Life Insurance. However, IWMB shall arrange any work-related travel, and cover the costs in full.

Volunteers must not disclose to any third party information pertaining to IWMB projects/policies, plans, or any other aspects of business without approval from the concerned supervisor.

Volunteers may be provided with necessary office equipment like computers, stationery, and other things in this category essential for the accomplishment of tasks as assigned by the supervisor. Volunteers shall return all such material or equipment to the concerned supervisor at the end of the assignment/contract. Willful or accidental damage to any equipment must be reported to the concerned supervisor immediately.

Volunteers are required to follow IWMB guidelines and policy on behavior. Any deviations may result in the contract being terminated.

Human Resource Department maintains record of each volunteer. Records are accorded the same confidentiality as staff personal records.

Volunteer Work Certificate

- A certificate is given to volunteers that complete the assignment as per contract and guidelines and to the satisfaction of the supervisor
- The Admin Department issues the certificates
- Shahan and Bani Gala were engaged for participation on World Environment Day
- Clean up drive at Brothi Lake with Volunteers
- **Guided tours are conducted on Trial-6** by IWMB staff as it is declared as leopard preservation area. These tours are arranged on specific days and time for better management. These tours are in form of groups. Sometime individuals are also entertained

➤ **Visitor Management & Cleanliness of MHNP**

Visitor management on trails of Margallah Hills National Park is most important component of wildlife conservation. The tourist pressure on trail increases day by day, which is managed by the IWMB team working in this wing. Responsible tourism is promoted in Margallah Hills National Park to conserve and preserve the natural beauty. The staff deputed on the trails cleans the trail from time to time and controls plastic pollution in the national park.

Visitors and tourist were engaged to protect the park from plastic pollution as littering in MHNP was increasing day by day. IWMB Visitors' Management Team worked on the awareness & education—IWMB team worked hard to raise awareness amongst visitors and tourists of Margalla Hills National Park to control plastic pollution. Nobody is allowed to take plastic bags and edibles in plastic packing inside the trails.

THE END