

Climate Change

Erratic weather patterns and climate change have emerged as the biggest environmental challenges that are affecting almost all the sectors of economy particularly water resources, energy, health, biodiversity with a major impact on agricultural productivity. In view of Pakistan's high vulnerability to the adverse impacts of climate change, the current government is committed to meet this challenge and the Prime Minister has constituted "Prime Minister's Committee on Climate Change" to provide high level strategic guidance and platform for coordinated efforts on the issues of climate change. Federal Forestry Board (FFB) has also been revived to rehabilitate forests and forest cover in the country. Ministry of Climate Change has adopted a comprehensive approach on the disaster risk reduction and management.

The government has also introduced climate budget coding and expenditure tracking system. This initiative has become a solid conduit for the climate change finance mainstreaming and will foster transparency in public investments. The monitoring of the expenditure will also give confidence to the international development partners in tracking expenditure under different funding streams to ensure that the finances are spent on the intended objectives.

Ministry of Climate Change (MoCC) has taken various initiatives in the area of climate change adaptation and mitigation in accordance with our National Climate Change Policy which are as under:

- a) To ensure effective implementation of National Climate Change Policy and its Framework, meetings of National Climate Change Policy Implementation Committee are being held regularly.
- b) MoCC has completed the process of ratification of Doha Amendment to Kyoto Protocol.
- c) Pakistan Climate Change Council and Pakistan Climate Change Authority are being established to address the issues of climate change and meet Pakistan's obligations under international conventions relating to climate change.
- d) Climate Change Council is being established and the mandate is to:
 - i. Monitor implementation of international agreements
 - ii. Approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs & projects
 - iii. Monitor implementation of National Adaptation Plan
 - iv. Protection and conservation of renewable and non-renewable resources, species & habitats
- e) Preparation of Pakistan's Second National Communication (SNC) on Greenhouse Gases (GHG) emissions is at final stage.
- f) Biennial Update Report (BUR) is an extended report on National Communications which describes the status of GHG emissions and mitigation measures taken by the countries. MoCC has started preparatory work on Pakistan's first BUR.

All these are indicators of a shifting landscape in Pakistan under the present government towards a cleaner, greener and sustainable future aiming for lowering the emissions and ensuring climate

resilient growth.

Water, Sanitation and Hygiene (WASH) Program

Pakistan is a signatory to the Sustainable Development Goals (SDGs). SDG 6 i.e. clean water and sanitation aims to provide safe drinking water to 95 percent of the population and access to safe sanitation to 72 percent of the population by the year 2030. Currently the national base line for safe drinking water is 36 percent and for sanitation is zero percent. The indicators in national data sets for WASH: Pakistan Social and Living Standard Measurement (PSLM) and Multiple Indicator Cluster Survey (MICS) were reviewed and aligned with Sustainable Development Indicators 6.1, 6.2 and 6.3.1.

Safely Managed Water

The access to improved drinking water sources (piped, hand pump, motorized pump and closed well) is 89 percentage, available when needed (24 hours available at premises) is 77.5 percent, basic service is 53 percent (basic services but not free from contamination) contamination is 36 percent. The lowest figure of all three that is free from contamination is 36 percent, which is the baseline figure of safely managed water in Pakistan in 2018¹.

Safely Managed Sanitation

Improved sanitation is 63 percent (it is 58 percent as per JMP), hand washing with soap is 60 percent and data regarding on-site and off-site treatment is not available or is less than 1 percent. The lowest of all figure of the three is On-Site and Off-Site treatment so baseline safely managed sanitation is zero.

Inclusion and Disparities

There is significant difference between access to piped water in urban areas with coverage of 48 percent and of rural areas with 13 percent only. Furthermore, only 10 percent of the poorest have access to piped water supply compared to 39 percent of the rich and 35 percent of the richest groups. Under sanitation, less than half of the rural population in Pakistan use improved sanitation. Only 20 percent of the poorest have access to improved sanitation compared to 82 percent of the richest. Similarly, 40 percent of the poorest have no toilets compared to only 1 percent of the richest.²

Sector Policies/Strategies

The Prime Minister of Pakistan has reinforced the commitment of government for creating an enabling environment for water and sanitation through launching of Clean Green Pakistan Movement (CGPM) in October 2018, showing the highest level of political commitment. The CGPM will seek institutional strengthening for effective service delivery and behavioural change for sustenance and continuity for the accessibility and availability of safe water and sanitation to the people of Pakistan.

Institutional Arrangements

The provincial and administrative units take a lead on the identification, planning and implementation of drinking water and sanitation policy along with budgetary allocations and spending in their jurisdictions. At federal level, Ministry of Climate Change has been entrusted the role of policy formulation, standards setting, reporting and coordination for regional and international commitments. In order to strengthen the institutional arrangements at the national level, the MoCC has created a Water, Sanitation and Hygiene (WASH) Strategic Unit in 2018 based on a

¹Pakistan Country Preview Paper 2017

²PSLM 2015

capacity assessment done in 2016.

Capacity Development

The WASH Strategic Unit at the Ministry of Climate Change (MoCC) rolled out Joint Sector Reviews (JSRs) of WASH in 2016/2017 by arranging a training workshop of key provincial departments and sector partners. All four provinces organized JSRs in 2017-18, which culminated in a National JSR in December 2018 by the MoCC. The overall SDG 6.1 and 6.2 targets for WASH have been finalized along with a roadmap for next two years.

Planning, Monitoring and Review

There is no single regulatory and monitoring authority for carrying out M&E and reporting on WASH. Each province carries out WASH activities in its jurisdiction and also compiles data. Pakistan Bureau of Statistics (PBS) is the national custodian of tracking and reporting the progress on SDGs. The MoCC and PBS brought different stakeholders together in 2017 and 2018 for developing consensus on the indicators and methods of data collection for tracking and planning.

Sector Financing

The overall estimated financial layout of the sector for 2017-2018 was Rs 128,000 million. This includes:

- i. Government /public sector expenditure on water and sanitation: Rs 80,000 million
- ii. ODA and Voluntary transfers for WASH: Rs 4,200 million
- iii. Repayable Financing :Rs 8,200
- iv. Tariffs for services provided: Rs 25,100 million and Households' out of pocket expenditures: Rs 9,900 million. Currently, the contribution of private sector is not reflected in financial layout available for 2017-18.

Sustainable Development Targets for Pakistan

By using the SDG costing tools developed by SWA, Pakistan calculated annual investment needs for WASH Sector. Below calculations are based on current coverage of safely managed water i.e. 36 percent and safely managed for sanitation i.e. zero. Based on SDG costing tool, it is estimated that Pakistan needs Rs450 billion annually to meet SDG targets by 2030. Presently, Pakistan is spending PKRs 80 billion annually through public sector while overall financial layout of the sector is PKRs 130 billion. However, it is under-reported as many of the departments, providing water and sanitation services as integral component of their interventions do not report their spendings like school education, health, housing, works and communication, irrigation, etc.

Annual Financial Needs for Safely Managed WASH Services -PKRs Million

#	Description	Urban		Rural		Total
		Water	Sanitation	Water	Sanitation	Total
1	New Services: Basic Access	13,968	12,797	8,595	28,543	63,883
2	New Services: Safely Managed	62,630	48,904	113,736	123,099	348,369
3	Sustaining existing services: Basic Access	16,635	11,100	11,110	20,735	59,580
4	Sustaining existing services: Safely Managed	36,229	11,100	33,461	20,735	101,525
6	Overall Financing Needs	98,849	60,004	147,197	143,834	449,894

The current allocation for 2018-19 is Rs. 150 billion and Pakistan shall be able to make a growth of 2.1 percent annually. The country shall be able to cover 95 percent of safe water and 72 percent of safe sanitation (62 percent by investment and 10 percent with private sector).

Forests

According to the Pakistan Forestry Outlook Study total area of forests in the country is 4.34 million ha (5.01 percent), out of which 3.44 million ha forests exist on state-owned lands and remaining on communal and private lands. Annual consumption of wood (timber and fuel wood) is estimated at 44 million cubic meters whereas annual growth of natural forests is 14.4 mm³, resulting in over-exploitation of forest resources. Moreover, sole dependence of forest-owning local communities on this resource for livelihood is reported as main cause of deforestation. The contribution of forest in GDP is 0.4 percent. Under Millennium Development Goals (Goal-7), Pakistan had committed to increase forest cover to 6 percent, which could not be achieved mainly due to financial constraints of federal and provincial governments. Overseas Development Assistance (ODA) from either bilateral or multilateral sources has also declined drastically impeding government policies and plans to bring additional lands under tree cover.

Ministry of Climate Change is implementing following initiatives towards achievement of objectives of above Conventions and Protocols with the technical and financial support of Global Environment Facility(GEF), UN agencies, World Bank, multilateral donors and NGOs including International Union for Conservation of Nature(IUCN) and WWF and PSDP.

- ▶ Mangrove for the Future (MFF) regional program in collaboration with IUCN-Pakistan
- ▶ Implementation of World Bank funded REDD+ Readiness Preparation Proposal (R-PP)
- ▶ Preparation and implementation of National Biodiversity Strategy and Action Plan
- ▶ Revival of forestry and wildlife resources in Pakistan (Green Pakistan Program)
- ▶ Up-scaling of GPP into Ten Billion Tree Tsunami (new initiative)
- ▶ Scaling-up of Glacial Lake Outburst Flood (GLOF) risk reduction in Northern Pakistan
- ▶ Reversing Deforestation and degradation in high conservation value pine forests in Pakistan
- ▶ Sustainable Land Management Program to combat desertification in Pakistan (SLMP II)
- ▶ Implementation of Federal Forest Policy 2015

Measures to Increase Forest Cover

Seasonal Tree Planting Campaigns

In order to enhance tree cover in the country, seasonal tree planting campaigns held each year and government, private departments, organizations actively involved in planting activities. During 2018 inter-provincial meetings on the onset of spring 2018 and Monsoon 2018 were held whereby achievement

(Plants in Millions)			
Season	Target	Achievement	Survival Rate
Spring 2018	102.4	84.32	76%
Monsoon 2018	47.44	55.195	78%
Spring 2019	141.72		

against target fixed for tree planting are as follows:

Mangroves for the Future (MFF)

Mangroves for the Future (MFF) initiative focuses on promotion of an integrated ocean wide approach to coastal zone management. Under this initiative more than 30 projects have been completed since the inception.

Participation in Reducing Emissions from Deforestation and forest Degradation (REDD+)

Reduced Emission from deforestation and Forest Degradation (REDD+) is a concept adopted by the countries under United Nations Framework convention on climate change (UNFCCC) in 2010. The

concept relates to absorption of atmospheric carbon through forest resource. Due to accumulation of carbon in standing trees their financial value increases. Carbon stoked in forest is traded in carbon markets.

The REDD+ Readiness Preparation Proposal (R-PP)

R-PP is being implemented in Pakistan with a grant of \$ 3.8 million since July, 2015. Pakistan was awarded the grant through a competitive process by Forest Carbon Partnership Facility (FCPF) of World Bank. International and national consultants were hired to prepare documents required to complete the REDD+ readiness phase. Final documents have been prepared by the consultants and the project has been shared with the Forest Departments of provinces and territories for acceptance/concurrence in February, 2019.

Meanwhile in 2018, an additional grant of \$ 4.01 million has also been awarded by FCPF to further support the preparedness activities in Pakistan till June, 2020.

Migratory Birds and Houbara Bustard Endowment Fund

This Fund was established in 2016 and it will provide support for developing and implementing programs for conservation of valuable migratory birds with an initial endowment of Rs. 250 million.

Green Pakistan Program – Revival of Forest Resources in Pakistan

The main objective of the program is to facilitate transition towards environmentally resilient Pakistan by mainstreaming notions of adaptation and mitigation through ecologically targeted initiatives covering afforestation, biodiversity conservation and enabling policy environment. The program towards reviving forestry resources in the country is being implemented through PC-I scheme titled, Green Pakistan Program-Revival of Forestry Resources in Pakistan (2016-2021). The estimated cost of the project is Rs. 3.652 billion for a period of five years.

Ten Billion Trees Tsunami Program (TBTP) is a full-fledged organized and an elaborated approach aiming at revival of forestry and wildlife resources in light of international conventions and national and provincial legislative frameworks has been initiated. The implementation modalities for TBTP have been developed under the Chairmanship of Federal Advisor on Climate Change. Upon the consultation with provinces and federating units, it was decided to upscale the existing implementation framework of Green Pakistan Program in light of lessons learnt from KP-Billion Tree Tsunami Program under the PSDP funding mechanism. The Prime Minister of Pakistan inaugurated the Ten Billion Trees Tsunami Program on 2nd September, 2018 during “Plant for Pakistan Day” event.

Ten Billion Tree Tsunami Program, Phase-I

1. Time required for completion of Program 8-Years (2016-2024)
2. Capital cost of Program
 - i. Forestry Component Rs. 98.051 billion
 - ii. Wildlife Component Rs. 12.0316 billionTotal: Rs 110.0826 billion
3. The Ten Billion Tree Tsunami Program, Phase-I will be implemented with an overall cost of Rs. 110.0826 billion. The Federal Government would make an allocation of Rs. 69.067 Billion on cost sharing basis for five years (2019-2024) to revive the forestry and an allocation of Rs.7.30 billion for wildlife resources of Pakistan.

Specific Objectives of TBTP

The program has three components:

- a) Enhancement of Forest Cover and management of plantations, state, guzara and reserve forests
- b) Biodiversity Conservation and establishment of 725 acres of Zoo-cum Botanical Garden, Islamabad
- c) Institutional Strengthening of Zoological Survey of Pakistan

A). Enhancement of Forest Cover

This component focuses on enhancement of the forest cover by adding 4.446 billion indigenous plants through afforestation, reforestation and regeneration over next five (05) years to curb the impacts of climate change.

The priority areas for the purpose are as under:

- a. Conservation and enhancement of natural forests through assisted natural regeneration
- b. Road and canal side plantation
- c. Rehabilitation and re-stocking of historical plantations
- d. Restoration and improvement of scrub forests
- e. Increase in existing cover of mangrove forests
- f. Watershed and soil conservation in hilly and river catchment areas (reserved as well as community forests)
- g. Rehabilitation of guzara and protected forests
- h. Protection and augmentation of dry temperate forests

Biodiversity Conservation

The Ministry of Climate Change based upon extensive discussions with all stakeholders recognized that challenges to wildlife protection and preservation could be overcome through improvement and effective implementation of wildlife legislations and institutional strengthening.

- a. Enhanced management of Protected Areas (Biosphere Reserve/ National Parks) with special focus on Eco-tourism (at least one in each province/territory) on international standards including Margalla Hills, National Park, Islamabad
- b. Establishment or Up gradation of existing Zoo on international standards (at least one in each province / territory)
- c. Revival of Critically Endangered Habitats
- d. Curbing of illegal wildlife trafficking through establishment of control desks in international/national airports
- e. Rehabilitation/ Rescue Centers for Confiscated Wildlife in each province/ territory
- f. Zero plastic in protected areas (All protected areas of Pakistan)
- g. Improvements of Wildlife related Legislations and its implementation
- h. Liaison between Wildlife Departments and Universities
- i. Rehabilitation of forest cover in Man and the Biosphere (MAB) reserves and intervention for declaration of more MAB reserves, which are in pipeline

B). Institutional Strengthening

Zoological Survey of Pakistan (ZSP) is the pioneer research organization for multi-disciplinary zoological and wildlife related matters in the country. Therefore, to enhance its capacity following are the specific objectives:

- a) Strengthening and capacity building of ZSP through establishment of its regional offices in each province
- b) Inventory of Endangered Wildlife species and Habitat across Pakistan

Overall number of plants planted, sown and regenerated in plantations and enclosures and planting stock established in nurseries:

- a. Total plants planted, sown and regenerated in plantations and enclosures are 33.065 million
- b. Planting stock established in nurseries are 22.005 million

Watershed Management and Soil Conservation works

- a) Intensive planting of suitable species on 22 ha of degraded slopes in Gilgit Baltistan (66,655 plants)
- b) 30.35 ha land treated with a combination of different bio-engineering structures consisting of layering, vegetated soft gabions, live brushwood check dams etc. in AJK
- c) 2803 cubic meter of bio-engineering structures constructed in Rawalpindi North Forest Circle in Punjab
- d) 3,913 cubic meter of loose stone check dams constructed with 566 cubic meters in Juniper and Chilghoza forests of Balochistan and 3,347 cubic meters in Scrub Forests of FATA
- e) 991 cubic meter of Gabion structures constructed in Chilghoza Forests of Balochistan
- f) 61 meter of gabion flood protection spurs constructed in Gilgit Baltistan
- g) 254 meter of diversion channels constructed to divert water from streams to marginal waste lands for afforestation in Gilgit Baltistan
- h) 72 water harvesting ponds constructed with 104140 plants planted in the immediate catchments of these ponds in Rawalpindi North and Rawalpindi South Forest Circles in Punjab

Convention on Biological Diversity

The government is firmly committed to take necessary steps in fulfilling its obligations on the issues related to Conservation of Biological Diversity. National consultation on Sixth National Report has been completed and the report will be submitted to Secretariat of Convention on Biological Diversity after approval. National Biodiversity Strategy and Action Plan (NBSAP) has been approved and submitted to the Secretariat of Convention on Biological Diversity. National actions towards implementation of NBSAP are well under way:

- 1) Access and Benefit Sharing (ABS) Law is in process of consultation for wider acceptance
- 2) Astola Island was declared as first marine protected area of the Pakistan. Consultation on other potential sites like Churna Island and MianiHorr is in process

Pakistan's compliance with Montreal Protocol

Pakistan is party to the Vienna Convention for the protection of the Ozone Layer and its Montreal Protocol. A dedicated National Ozone Unit is established in the Ministry of Climate Change for effective compliance of the Convention and its Protocol. Pakistan is successfully implementing the obligations of the Montreal Protocol and has phased out 10 percent Hydrochlorofluoro carbons (HCFCs) in January 2015 as per the given time line through multi-pronged actions including ozone depleting substances (ODS) trade restrictions, awareness and capacity building campaigns, and

technology transfer. The implementation is a continuous process and at present Pakistan is successfully moving towards 35 percent reduction targets of the HCFCs till 1st January, 2020.

Persistent Organic Pollutants (POPs) management in Pakistan

Persistent Organic Pollutants (POPs) are highly toxic chemical considered as global threat to Human Health and environment. Stockholm Convention on POPs was ratified by Pakistan in 2008. The elimination of POPs pesticide stockpiles became more urgent after the 2010 floods damaged some of the storage sites of hazardous chemicals and pesticides resulting in a greater risk to human and environmental health. Pakistan is now on its way for comprehensive reduction and elimination of persistent organic pollutants aiming to reduce human health and environmental risks. The country is in process of development and implementation of a regulatory, policy and enforcement system to reduce POPs releases and to regulate POPs waste disposal; capacity building to reduce exposure and releases of POPs; and collection, transport and disposal of POPs Pesticides.

Sustainable Land Management Program(Phase-II)

On successful results from phase-I, Phase-II of SLMP is being implemented in 14 dry land districts of all four provinces since 2015. With funding support from UNDP, GEF, Federal PSDP, Provincial ADPs, SLMP-II is assisting the Government of Pakistan in implementation of United Nations Convention to Combat Desertification in order to achieve the long-term goals in Sustainable Land Management (SLM).

Pakistan Environmental Protection Agency (PAK-EPA)

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

Air and Water Quality

- ▶ Pak-EPA had fixed and mobile automatic air quality monitoring stations. Pak-EPA is capable of monitoring all the major parameters of air quality by mobilizing its mobile air quality station in Islamabad as well as any part of the country.
- ▶ Data surveillance room to monitor steel industries air pollution in I-9 and I-10 industrial areas during 2018-19. Three Steel industries installed state of art new air reverse bag houses system to reduce air pollution.
- ▶ Drinking water quality checked by chemical and microbiological analysis of 25 filtration water plants and municipal and waste water pollution monitoring of Industrial Effluent and other Environmental Related Samples in ICT.
- ▶ Pak-EPA has established an Integrated Surveillance System to monitor ESBL producing E Coli in the environment (water up streams, wet markets and sewerage system) of ICT
- ▶ Hospital Waste Management in Islamabad

Health-care facilities waste contains potentially harmful microorganisms that can infect hospital patients, health workers and the general public. Under Section 31 of PEP Act 1997, based on the Hospital Waste Management Rules, 2005, the current hospital waste management practices in both public and private health care facilities are inspected by Pak-EPA in ICT.

Geomatic Center for Climate Change and Sustainable Development Project

Climate change is a geographic problem and reducing the risks caused by climate change is an immense challenge. Presently, policy makers, developers, engineers, and many others around the

world are using geographic information system (GIS) technology to understand a complex situation and offer some tangible solutions in environment and climate change scenarios.

Through the support of Geomatic Center for Climate Change and Sustainable Development project in Pakistan, Environmental Protection Agency Islamabad is one of the ventures under Ministry Climate Change which encourages application of Satellite Remote Sensing (SRS), Geographical Information System (GIS) and Geographical Positioning System (GPS) technologies in environmental monitoring and decision-making.

Achievements

1. Digital Environmental Atlas of Islamabad

The Digital Environmental Atlas of Islamabad was launched under this project. The basic objective of this Atlas is to enable the visualization of Islamabad's environmental information through maps. The spatial distribution of environmental indicators is extremely useful in several types of planning including environmental pollution control strategies. Most importantly, through GIS techniques used in preparing atlas maps, it is possible to combine various layers of information for identifying different types of soil, land use, vegetation distribution, stream network etc.

2. Glacier Monitoring of Pakistan

Geomatic Center has taken the initiative of Glacier monitoring of Pakistan using GIS and Remote sensing technology. Under this initiative, two glaciers i.e. Baltoro and Siachen were chosen for monitoring purpose. Detailed analysis including stream network analysis, terrain analysis and change detection was carried out for the years 1978 to 2018 using satellite imagery.

Achievements of Management Information System (MIS) 2018-19 are as follows:

- ▶ Establishment of Server room and deployment of Local Area Networking (LAN)
- ▶ Revamping of website through NITB, MoIT& Telecom
- ▶ Deployment of new Hi-tech server for Geomatic Center (Central Environmental Application)

Climate Change

GCISC shows that mean annual temperature has increased over Pakistan in the recent past with greater increase in Sindh and Balochistan. The observed increase is higher in winter when compared with summer. The month wise analysis shows that the maximum increase has been observed in December and February. During the last century, the average temperature over Pakistan has increased by 0.6°C, which is in conformity with the increase of average global temperature. Similarly, mean annual precipitation has also shown increase over most parts of the country. The increase is higher in summer as compared to winter with September and June showing the greatest increase. Future climate change projections based on all the four IPCC-AR5 RCPs scenarios show that the average rise in temperature over Pakistan by the end of the century will be about 1°C higher compared to global average. Within the country, the northern regions will experience relatively more warming than the south. This increase particularly in temperature is associated with a number of adverse impacts, including the increasing frequency of extreme events (floods, droughts, heat waves, and cyclonic activity), steady regression of most glaciers (except a small minority in the Karakorum Range) that supply the bulk of the country's water supply and changes in the rainfall patterns.

Impacts of Climate Change on Water Resources

The primary effect of climate change is the disruption of the water cycle and it is important to understand the impact that climate change is having on drinking water supplies, sanitation and food.

In many regions around the world, incidence of hydrological extreme events is rising day by day. However, in Pakistan it is in many different forms, especially flash flooding in mountainous streams in the north. Analysis of the available long-term record (1969-2014) of annual total flow volumes and annual maximum flows of the Indus River at Besham Qila (a flow gauging station upstream of Tarbela dam), shows no statistical evidence of a significant and sustained change in the aggregate average annual flows in the upper Indus Basin (UIB) upstream of Tarbela Dam. However, there is a significant increase in the annual maximum flows. This has specially been found in the water availability analysis of the Kabul River Basin, a snow melt-fed basin, where there is a sharper peak with a clear shift in the annual peak flow by a month. Also, more increased frequency of larger magnitude annual maximum flow events has come out as a key finding of this Kabul River Basin study. Another modeling work focused on the Gilgit River Basin, a glacier-fed basin, revealed that faster melting of glaciers under increased temperatures would bring more flows a month earlier but with a flattened peak. More rigorous modeling analysis is currently going on to gain more clear insight of the state and fate of Karakoram glaciers and associated impacts on the river flow regimes in Pakistan.

Impacts of Climate Change on Agriculture

Agriculture is one of the major sectors likely to be adversely affected by climate change. Climate change can disrupt food availability, reduce access to food, and affect food quality. Projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity. Crop simulation models-based studies depicted significant reductions in wheat and rice yields in the arid, semi-arid and rainfed areas of Pakistan under various IPCC climate change scenarios. In general, the increase in temperature leads to a shortening of the Growing Season Length (GSL) for wheat and rice crops in all regions of the country. The studies further report that South Eastern side of Pakistan is more vulnerable to consecutive heat days stress during flowering and ripening stages of wheat. This vulnerability is increasing both spatially and temporally to all the major wheat producing zones from Lower Sindh to Potohar till end of 21st century under both Representative Concentration Pathways (RCPs i.e. RCP 4.5 and RCP 8.5). In the absence of a change in management practices and technology, an overall reduction will be registered for all cereal crop yields.

Study on Smog in Punjab

Seasonal climatology plays a vital role in transport of different kinds of air pollutants affecting day-to-day human activities. Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPPLIT) model based findings have indicated that buildup of anthropogenic aerosols mainly has been taking place in winter (December, January, February, March) and post-monsoon (October, November) for which region wise point source locations were identified. It was found that 65 percent of the sources were detected within Pakistan. Secondly, sectoral contribution of pollutants (NO_x, SO_x, PM 2.5, CO and NMVOCs) based on the data of last 10 years (2008-17) was determined using the Intergovernmental Panel on Climate Change (IPCC) methodologies. The outcomes demonstrate the transport sector as biggest contributor (43 percent) in total air pollutants emission in Punjab while the rice residue burning adds just 20 percent. Besides, Industry and Power sectors hold 25 percent and 12 percent, respectively. Overall, the energy sector occupies 80 percent of the total air pollutants emissions in Punjab. The emissions of NO_x, being main pollutant responsible for smog formation, are highest from transport sector (58 percent). Industry and Power collectively holds 34 percent share in NO_x emissions while rice residue burning is just at 9 percent.

Zoological Survey of Pakistan

During the current financial year the baseline surveys of Deosai NP (GB), Machiara NP (AJ&K), Lal Sohanra NP (Punjab) has been carried out. Wetlands of Punjab, Sindh and Khyber Pakhtunkhwa were visited for mid-winter waterfowl census during December and January in 2018- 2019. The data

has been sent to Wetlands International. During the current financial year, the studies on Houbara bustard and Indus Blind Dolphin were carried out. Both these studies are part of national level survey, which will be completed in 2020.

Conclusion

Pakistan is facing environmental challenges, which include climate change impacts, loss of biological diversity, deforestation and degradation of air and water quality. The present government has launched Ten Billion Trees Tsunami Program (TBTTP) to lead the country towards aiming at revival of forestry and control air, weather, wildlife, forestation, watershed management and soil conservation to combat the negative impacts of climate change.
