



Climate Change Effects on Water Resources and Need of Dams in Pakistan



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Abstract: *Climate change is a global phenomenon; its outcome affects societies around the world. Climate change has become the greatest severe issue of the 21st century. Climate change has a large influence on the atmosphere, farming, health zone, flood, ecology, marine and water levels in Pakistan. When these environmental changes affect the natural system, they may affect the living being indirectly or directly. Due to global warming, Pakistan is frequently suffering climate changes and water resources decline. Pakistan has the 135th position in terms of (CO₂) releases but unfortunately has been ranked 7th position in terms of vulnerability to climate changes. The present study explored how climate change has affected the water resources of Pakistan, why the dams are necessary and what consequences might seem in the upcoming and what kind of strategies should be adopted by the government. There is a need that concerned departments should act on an emergency basis to increase water storage capacity and construct dams in the interest of future generations.*

Key Words: Pakistan, Global Warming, Water Resources, Need of Dams

Climate Changes Effect on Water and Needs of Dam in Pakistan

Water is life and called liquid blue gold due to its importance. Pakistan is not heading toward

but already is in water crises. Every report has warned that due to climate changes, Pakistan has become one of the most extreme water vulnerable countries in the ecosphere (Abbas,

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[Z. 2009](#)). Water is a restrictive and sensitive element in the survival of our natural ecosystems. Globally, it is estimated that nearly two billion people are already high water-stressed. Due to population growth, this number is projected to rise considerably by 2025 ([Abdullah Laghari et al., 2004](#)). Only 20% of the entire population of Pakistan have access to secure drinking water, while 80% of inhabitants used anxious drinking water due to water insufficiency ([Daud et al., 2017](#)).

“Water is not only for life ... water is life. Water is health. Water is dignity. Water is a human right.” ([Moon, B. K. 2007-2016](#))

The statements by UN Secretary-General reflect the significance of water. Water is a need of all aspects of human life. Pakistan is an agrarian country, and water is a vital source for continuous economic progress as well as human existence. Currently, water consumption in the agriculture sector is 93%, while domestic segment 5% and manufacturing sectors 2% use of water possessions. In the time period of 2025, it is estimated that water usage in both household and manufacturing sectors are expected to rise up to 15 percent. In Pakistan, the agricultural sector is a main user of water, and its Indus Basin Irrigation System is the world biggest adjacent irrigation network. It consists of 3 large dams, 85 small dams, 19 barrages, 12 inter rivers canal links and 45 canals command. This irrigation network is the largest infrastructural asset of Pakistan has a net valued at about US\$ 300 billion ([Government of Pakistan 2014](#)).

Water Resources of Pakistan

Climate change has initiated declining glaciers, reduce stream and river flow and

reduction in lakes and ponds. Water assets are intimately related to the environment; thus, the projected climate changes have such severe effects for Pakistani water possessions. Freshwater water assets in Pakistan largely depend on monsoon rain, snowfalls and glaciers melting, and these are extremely intense due to environmental change ([Government of Pakistan 2012](#)). Water is the premier element which compulsory for human beings, animals, insects, plants and for the whole globe. According to the UNO report, Pakistan is at the 7th position in the list of water acute states. Currently, Pakistan has 153 MAF surface water while only 24 MAF underground water resources and may face water scarcity of 33 MAF during the year 2025 ([Iqbal, Z. 2017](#)). Groundwater is already reducing quickly, and prospects for groundwater availability of water to farmers in the future have become inadequate. The average annual flow of IRS is about 142 MAF, in which 104 MAF is averted to the canal networks whereas the main ratio of the residual 35 MAF drainages to the sea. Luckily Pakistan has a large operating groundwater's, God gifted natural reservoirs, which is basically revitalized from the external flows and rainfalls ([Khan, A. W., et al Khan. 2010-2014](#)).

Definition of Term Water Shortage or Scarcity

When a country is below 1,000 cubic meters per person per year, then aspects water scarcity. The terms “water shortage” or “water scarcity” are frequently used interchangeably; whereas mutually use 1,000m³ per capita measurements as a benchmark, “shortage” is an absolute term, and insufficiency is a virtual conception ([Iqbal, A. R. 2010](#)). Planning

Commission endorsed that Pakistan is nowadays turn into a water rare country and its water accessibility is less than 1,000m³/y per capita by 2025. In Pakistan, monsoon rainfall is main source of water, and its rivers are largely fed by glaciers snow melt down from Himalayans glaciers. There is a large inconsistency of monsoon rainfall and also extensive reduction of Himalayans glaciers are expected as a consequence of environment changes, as a result intimidating water availability in Pakistan ([Planning Commission 2010](#)).

Water Demand and Availability

Out of total availability of water on earth planet only 3% availability of fresh water is useful for living being and its 97% parts is saltish which not appropriate for human being, animals and plants is as well. Available 3% water, nearly 66% is ice-covered in glaciers and 33% existing in underground earth surface and some parts in the air United States (Geological Survey USGS (September 4, 2009).

Table 1. Water Needs and its Availability in Pakistan

Water Availability	Water Required	Water Deficiency
125.56 MAF	164.48MAF	38.92 MAF (31%)

The Pakistani irrigation system is one of the biggest in the world allocation of 36 MAF of cultivated lands ([Ministry of Planning and Development 2005](#)).

Table 2. Different Sectors Water Requirement of Pakistan

Agriculture Irrigation Sector	Domestic Sector	Industrial Use
159.54 MAF	3.82 MAF	1.1 MAF

Due to the growth of inhabitants and thus the requirements of water, deficiency is being to rise in every coming year. According to The

Nation (2017), since 1951, per capita, water availability is on its last legs as displayed under ([The Nation 2017](#)).

Table 3. Growth in Population and Deficiency of Water

Years	Population (Million)	Water Availability (in Cubic Meter)
1951	34	5260
1961	46	4159
1971	65	2838
1981	84	2129
1991	115	1611
2001	172	1259
2016	197	908
2025	221	659

Source: *The Nation*, August 21, 2017 “Water Scarcity Looming Large in Pakistan” ([The Nation 2017](#)).

The lack of water storage has enlarged thrust as our water storage ability is only for 30 days. Pakistan is one of the top 4th waters using countries in the globe. The proportion of Pakistanis living in the urban center reached 38.8 percent in 2015 and will increase to 46.6 percent in 2030 and 57.5 percent in 2050 (United Nations 2015). Water use in rural areas averages 45 litres per capita per day and in urban areas averages 120 liters per capita per day. These use rates, in combination with the above-projected changes in the total and urban population in 2015, 2030 and 2050 was used to create a baseline for municipal water withdrawals ([Suttinon, P. et al., 2009](#)).

Why We Need Water Management?

Water is the lifeline and lifeblood of every nation-state. No state can endure without suitable access and management of water. In this respect, nations have a duty to protect and preserve precious water resources ([The News 2012](#)). In the light of the Holy Quran, we can understand the water management concept very clear. Holy Quran provides the guideline about the importance of water for the survival of human beings. Almighty ALLAH has produced water according to the requirement of mankind. Our religion, Islam, teaches us to preserve this important product. The Holy Prophet Muhammad (PBUH) forbidden misuse of water even though making ablution for prayers,

“Saying that the one who exceeds repetition of washing hands and feet more than three times is the one who exceeds the limits which are bad and not liked” ([Abmad, B., at al 2011](#)).

On other place.

“And among His signs is that He shows you the lightening, for fear and for hope, and He sends down water (rain) from the sky, and therewith revives the earth after its death. Verily, in that are indeed signs for a people who understand”. [Al Qur'an \(Surah Ar-Rum, Verse 24\)](#)

Water is the natural creation which endures life on our earth, the sign of water availability is in the form of plant, animal or human lives. Actuality if there is no water, there is no life, if scarcity befalls away from the desired limits, than life is in danger ([Al Qur'an \(Surah Ar-Rum, Verse 24\)](#)).

Similarly, The Holy Qur'an in Surah-Al-Baqar, Verse No. 164 interprets the water issue as:

“Verily in the creation of heavens and the earth and in the alternations of night and day and the ships which sail through the Sea with that which is use to mankind and the water (rain) which Allah sends down from the sky and makes the earth alive therewith after its death and moving (living) creatures of all kinds that. He has scattered therein, and in the veering of winds and clouds which are held between the sky and the earth, are indeed Ayahs (proofs, evidences, signs) for people of understanding” ([Al Qur'an \(Surah Al Baqar, Verse no 164\)](#)).

Surah Qamar Verse No. 11 interprets the water subject as:

“So we opened the gates of the heaven with water pouring forth”([Al Qur'an \(Surah Qamar Verse no 11\)](#)).

In short it indicates that "No water No life". Allah has formed all existing creature on the earth surface out of water. Consequently, where water scarcity comes, there might slowly

lead to elimination of living being and economic mishap. Water availability and its flows is extra to our storing capability and water drainage into the Arabian Sea turn into terrible situation for the lives, as seen in august 2010 flood in Pakistan in the past ([Al Qur'an \(Surah Qamar Verse no 11\)](#)).

Internationally Response Capacity to Water Sector

Water is one of the supreme components for the prosperous life and existence of humanity. However, lots of peoples round the world are distress of water shortage and poor hygiene. Water problems have been a key anxiety in the 21st Century. The World Water Forum is largest water forum at world-wide and it contributes the dialogue of the decision-making procedure on water at the universal level, try to find out balanced and sustainable use of this resource. It was first launched in an effort to support international negotiations on global water issues.

In 2015, the 7th World Water Forum, stakeholders from 170 nations congregated in Daegu & Gyeongbuk of Korea, the largest water-related occasion in the world. The World Water Forum is a largest world-wide forum that is held every three years since 1997 with the cooperation of public, private, academic and industrial sector ([WWF. Climate at the 7th World Water Forum, 2015](#)). Till now, seven meeting have been occurred; 1st meeting in 1997 at Marrakesh (Morocco), 2nd at 2000 at The Hague (Netherlands), 3rd in the year of 2003 at Kyoto (Japan); 4th one at Mexico City (Mexico) in 2006; 5th in Istanbul (Turkey), 2009; 6th at Marseille (France) in 2012 and 7th in Gyeongbuk and Daegu

(“Republic of Korea”) in 2015. On March 18-23, 2018, the 8th World Water Forum was held in the city of Brasilia of Brazil and it was the first time when WWF was held in Southern Hemisphere ([WWF. Climate at the 8th World Water Forum 2017](#)).

Water Sector: Adaptation Action and Strategies

Proper Management of Water Resources: Appropriate management is much needed for sustainable development. It is disgusting note that due to poor water management and absence of storing facility, Pakistan is wasting its 2/3 vital source per annum ([National Water Policy Draft, 2002](#)).

Promote Preservation of Natural Resources and Sustainability: Pakistan must have the objective of promoting to save of its natural resources for the durable sustainability ([Panos South Asia 2017](#)).

Up-gradation Irrigation Infrastructure: Government of Pakistan must introduce new irrigation system and upgrade old one to fulfill the demand of future water needs.

Legislative Framework: There is essential to legislate wastewater management practices, develop institutional capability of relevant stakeholders and promote public awareness ([The Jang, September 8, 2010](#)).

Regular Canals Preservation: To retain open water flow is the first phase to reduce outflow. The banks of silt growing in bulk by the rising bushes and grass upon them and it turn into key base of hurdle in the water flow. Their

regular maintenance would protect continual water flow ([Javed, M. N., et al., 2019](#)).

Construction of Roads and Footpaths on Both Banks: both sideways of the canals, the building of roads and tracks are laid back distant from its attractive magnificence. Its stable usage would make sure constant way of reducing outflow of water to a huge amount ([Ahmad, F., et al., 2011](#)).

Provide an Alternative Source of Water to the Grazing Animals: The grazing animals are source of huge destruction to the water channels. The construction of ponds for animal grazing should be at proper place nearby water canal that will reduce water surplus as well as loss of canal banks ([Ahmad, F., et al., 2011](#)).

Preservation Pakistan's Privileges on Trans-boundary Water Inflows: Arrange a task force on water professionals to investigate entire related disputes containing international laws and treaties. Expand tactics to defend Pakistan's rights on trans-boundary water with neighboring countries. Arrange a common body to find the promises of water agreement between Pakistan and Afghanistan to certify continuity of water in Kabul River and make common interested body to grip on post Indus Basin Water Treaty (IBWT) between Pakistan and India according to climate changes concern ([Javed, M. N., et al., 2020](#)).

Water Storage and Infrastructure: Pakistan is an agrarian state, but it has only three large dams. The water condition looks like to be poorest every year with condensed average

rainfall and inadequate water supply. The finest choice is to go for recycling of sewage water, nowadays absolutely drained in Arabian Sea. In order to make use of this existing land, dams should be quickly built ([Alam, S. M. 2009](#)).

A Practical Way Forward: To reduce water shortage in Pakistan, these steps essential to be taken instantly consist of;

- Strictly implementation on water policy 2018.
- Building of mega dams.
- National Action Plan to be framed for careful usage of existing water.
- Reduce water loss over seepage, leakage and division by lining of canals, distributaries and water channel.
- Enhancement of crops water use efficiency by moving from conventional farming to conservative farming.
- Adopting effective method of irrigation like Sprinkler, Basin and Drip irrigation.

How to Do and Who Should Do?

Execution of the right measure made, needs a complete, stable formation and implementation strategy over a phase program. These are the ways:

- Formation strategies and its implementation done with government equipment.
- Leave it to private segment wherever the consumer is to plan and starts the work.
- Thirdly, a combination of both above strategies.

A lazy management and corrupt reputed might not be able to build up consent, collect required fund resources and start work as

envisioned. The private sector is lacking of leaderships and generally reliant on official way of execution. A mutual approach needs for preparation and implementation of water visualization for our upcoming generation ([Alam, S. M. 2009](#)).

Climate Change and Future of Large Dams in Pakistan

Pakistan has extremely small water storing ability only 150 cubic meters as compare to other arid countries such as, Australia and USA having above 5000 m³ storing capability and China has 2200m³ per capita storing capacity. The dams on the river Murray Darling and Colorado River can grasp 900 days of rivers overflow. The water storage capacity of South Africa is nearly 500 days in its Orange Rivers and India can store water 120 to 220 days in its major rivers, but as comparatively, Pakistan just be able to store water only for 30 days in its Indus Basin River ([Hussain, T., at al., 2020](#)). At Globally, China has been built 85,000 dams and India have made 4500 barrages (medium & Huge), whereas Pakistan is taking only 153 smalls, mediums and large dams. Pakistan has been wasting almost 35 million acer feet water into Arabian Sea annually. Indian are building barrages on Pakistani rivers, as they gave reasoning that Pakistan is wasting her waters into Arabian Sea, as a result why not Indian acquire advantage on it. Pakistani economical values are straightly interconnected with agriculture ([Memon, N. 2012](#)). That's why dams are very essential and vital for every field of life ([Kamal, S., at al., 2012](#)).

Major Water Reservoirs of Pakistan

Mangla and Tarbela dams are two major water

reservoirs of Pakistan. The dead level of Tarbela is 1378 feet whereas maximum preservation level is 1550 feet, however Mangla has dead level 1040 feet and maximum saving level is 1242 feet. In monsoon rains season, large and small reservoirs were full to their capacity, which would enhance agricultural and grow up socio-economic activities in the country. In Pakistan, population has reached almost 20 million, and per capita water demand is increasing day by day. Pakistan has not been capable to build even a single large dam after Tarbela Dam in 1976; meanwhile India has built more than 33 large dams since now. Thus, there is a serious need to build more and more dams in the Pakistan.

Functions of Dams: In previous era, dams were constructed only for water contribution or irrigation. As societies developed, there was a great need for water resource, floods mechanism, and energy generation and sediment control. Nowadays, dams are made for flood control and energy generation as well as giving water to household, farming lands and industries.

Domestic and Industrial Benefit: It was projected that 8% of total available water resources of Pakistan is used at domestic level whereas 92% used for irrigation. Water reserves in reservoir is also utilize for industrial zone, which account for about 24% of GDP in the country.

Agricultural Usage and Flood Mechanism: One of the major advantages of dam is agriculture irrigation and floods control.

Energy Generation: The dams can be used for generate clean and the finest form of energy name as hydropower. Pakistan has a limited reservoir, which causes severe energy crisis.

Kalabagh Dam: A Life Line for Pakistan

Kalabagh Dam is one of the most important dams and amongst the proposed dams in Pakistan since 1987. However, the dam is not still constructed as for various causes ([Khan, M., et al., 2014](#)). Since its start, KBD has been controversial among three provinces including Punjab, Sindh and KPK. Only province Punjab is in the support of KBD while, the other two provinces have showed dissatisfaction and their provincial assemblies approved unanimous resolution for refusing the construction of KBD ([Khan, M., et al., 2014](#)). The KBD is a strategic hydroelectric project on the Indus River at Kalabagh in a Mianwali district and province of Punjab Pakistan ([Shabir, G., et al., 2021](#)). The KBD is placed 194 km distance from Tarbela dam and 16 km u/s of Kalabagh town. The dam site is linked with a railway line and road which are passing near a distance of approximately 13km with the site. Catchment areas of Indus River at KBD site is 286, 194 sq. km. The normal yearly gush of River Indus is 138.69 MAF at the Kalabagh dam location. In kharif season, 83.6% of the discharge occurs and 16.4% occurs at the Rabi season ([WAPDA, 2012](#)).

Cost of the KBD Project: According to WAPDA, projected cost of Kalabagh dam scheme in June 1987 was 2, 650 Million US\$ and at July, 2005, it was 6, 124 Million US\$.

Benefits of the Project: An official Water and Power Ministry meeting was held on 14th

January 2014 about the issues of KBD. They proposed that government must build KBD early as conceivable as it has many remunerations, few are certain under:

Electricity: KBD would surely cause of adequate and low-priced electricity. Thermal power cost Rs. 16 per unit, while hydel power costs Rs 2.5 to Rs 3 per unit. KBD will have a capability of producing 3,600MW electricity which will save USD 4 billion annually, apart from the 30%-line losses ([WAPDA, 2012](#)). The production of energy at KBD would be likely to twenty million barrel of oil annual. If KBD were made then there would have been no load shedding in Pakistan ([WAPDA, 2012](#)).

Agricultural Irrigation: Almost 35 MAF water is lost into the Arabian Sea as lack of large dams and it was a loss of Rs. 132 billion yearly. So, the KBD full live storage 6.1 MAF would be available for irrigation supplies throughout the year ([Ali M. A., et al., 2014](#)).

Flood Stoppage: kalabagh dams are very vital for the prevention of flood in Pakistan ([Ali M. A., et al., 2014](#)).

Inclusive Benefits: the straight profits of KBD would Rs. 20 billion annually ([Ali M. A., et al., 2014](#)).

Baseless Objection of Province Sindh and KPK about KBD

These two provinces raise objection against KBD and basic objection are given such as ([Ali M. A., et al., 2014](#)).

Hostilities by Sindh

Basic objections of Sindh on KBD are under as:

- i. Building of KBD will change Sindh into deserts due to lack of water availability.
- ii. The lower lands of Sindh would be disturbed due to interruption of salt from Sea ([Ghazanfar, M. 2009](#)).

Objections of Khyber Pakhtunkhwa

Basic objections of KPK on KBD are under as:

- i. Nowshehra city will become flooded if KBD might be constructed.
- ii. Mardan, Pibi and Swabi scrap will become water logged zone.
- iii. A lot of peoples of KPK will be displaced due to the construction of Kalabagh dam ([Khan, M. I. 2014](#)).

Conclusion

In this present study researcher presents key facts and information about of need of dams in Pakistan. These environment variations devastated Pakistan's frugality and welfare of society constantly in form of abundance and famine. Due to environment variations Pakistan is facing severe water shortage and it narrowly relate with agriculture and food sector. It's stage to construct barrages for overwhelmed the watersheds in Pakistan. Water is one of the supreme components for the prosperous life and existence of humanity. However, a lot of people round the world are distress of water deficiency and poor hygiene. Water problems have been a key anxiety in the 21st Century. The World Water Forum is the biggest water forum at international level and it contributes the dialogue of the decision-making procedure on water at the universal level, try to find out balanced and sustainable use of water resource. Moreover, dams work has to started on urgency base if not than in

imminently state could face huge economic damages due to water scarcity and substantial flood in Pakistan.

Suggestion for Policy Makers

- Climate changes are now become a core issue of Pakistan. So, management must take it seriously otherwise upcoming generation will be face serious water scarcity, global warming, flood, drought, agriculture and food security problem.
- To handling the climate changes issue, management needs to adopt the practical approach rather than reactive stance.
- It is also suggested that prevailing climate laws about water management and regulation should be modified to discourse new climate concerns.
- Government should strive for the continuation of Kyoto protocol and other international agreement about tackling Greenhouse gas (GHG) emissions of climate changes.
- Government must be strengthened its environment department in the shape of current environmental policies, climate acts, rules and climate action plan in order to coordinate and implement these activities.
- It is very essential that climate change policies need to be enhanced by appealing into consideration major issues i.e., water scarcity and needs of dam, agriculture, and food security, increases forestry plantation to overcome global warming of country. It should be done through counseling in

which all the relevant stakeholders are taken on board.

- Pakistan must tackle and manage water sources at domestic level with proper planning, construct big dams specially Kalabagh dam under the supervision of water governance.
- There is urgent need to recognize and address the climate change issue

officially, politically and technically through expert of relevant field. It is obligation of climate change department and government to revise and implement policies with practically for the tackling of climate changes in Pakistan.

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