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Looming water crisis in Pakistan: Challenges and options in a climate-changed world

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ABSTRACT

The looming water crisis reaching an alarming level in Pakistan represents every sign that it is on its way to a severe water shortage. Climate change has impacted the behavior of glaciers, greenhouse gas emissions, eco-degradation of watersheds, and unpredictability of weather are affecting the water resources in Pakistan. Pakistan is ranked among the most water-stressed countries globally. The per capita annual accessibility of water has decreased from 5140 m3 in 1950 to 1000 m3 now. It is a fast-impending water shortage. The lack of effective resource management and planning of the government aggravated the crisis. This is a literature review-based study. The study aims to highlight and explore the causes and strategies to face the looming water crisis in Pakistan. The research revolves around the following questions, what are the causes of the looming water crisis in Pakistan? and How can Pakistan deal effectively with its water scarcity? The data is of a secondary nature. The findings emphasize the options of implementation of adaptation and mitigation strategies to face the challenges of water scarcity.

Introduction

Water is a priceless gift of nature for all living beings on this planet. All living creatures either simple unicellular organisms or multicellular and complex cellular organisms like human beings require water for their existence. The main sources of water are rainfall, rivers, melting of snow on glaciers, Oceans, and underground water. Human beings cannot live without water for a very long time. As a rule of thumb usually a human being only survives for three days without water Subject to the climate and other factors of the region. The population of Pakistan is increasing at a rate of 3.2% annually. Currently, the total population is above 220 million therefore, the drinking water needs of the country are increasing progressively (Muhammed et al., 2004). The problem of water scarcity is speedily approaching.

As reported by the International Monetary Fund (IMF) Pakistan positions third among countries struggling with water deficiency despite the canal system of Pakistan being one of the best in the world. One of the main causes is the lack of appropriate measures to preserve water. About 30 million acre-feet of water are left unexploited each year due to poor management. The condition is more severe in the Monsoon season and each year are thronging very valued water into the sea. According to a Report from the World Bank Pakistan is wasting water yearly in sea having a financial value of 70000 million US Dollars.

Pakistan is fast transitioning from being categorized as water-stressed to water-scarce. The per capita obtainability of water is declining every year in Pakistan. In Pakistan water accessibility per capita annually is 1,017 cubic meters, dangerously close to the shortage verge of 1,000 cubic meters. Pakistan holds thirty days' water storing capacity which is very low when compared with the rest of the world. More than 80 percent population of the country faces a "serious water shortage." The UNO Report which is endorsed by the Pakistan Council of Research on Water Resources (PCRWR) has warned that Pakistan would face absolute water scarcity by the year 2025.

Pakistan is heading towards the most water-stressed state in the area by 2040 `, with its use of water position fourth highest globally. This crisis will not only disturb agriculture sector of Pakistan, which shares to 23 percent of Gross(GDP) of Pakistan and employment 42 percent of its labor force but also it will bring an existential risk to energy and food security, and consequently national security.

Objective and Research Questions

The study aims to highlight and explore the causes and strategies to face the looming water crisis in Pakistan. The research revolves around the following questions

What are the causes of the looming water crisis in Pakistan?

How can Pakistan deal effectively with its water scarcity?

Methods

The nature of the study is a literature review. The epistemology of this study is post-positivist employs both theory and practice and defines many features of research. Descriptive, historical, and exploratory approaches are used to find the answers to questions. The data utilized in this study is primarily derived from secondary sources such as books, research papers, magazine articles, newspapers, and official reports. An analytical technique is applied to data analysis. The data was collected from both electronic and print sources. Print materials comprised books, research journals, newspapers, and published reports, whereas electronic sources encompassed JSTOR, Springer, Web of Science, and Google Scholar. The current study applied an analytical

approach, employing the method of integrative review to explain and interpret the existing state of knowledge on the topic (Neuman, 2014). An inclusive review of approximately 120 readings, including books, published documents, research papers, and reports, was conducted from libraries (Main Library University of the Punjab, Quaid-e-Azam Library, Punjab Public Library, and Minhaj University Library) and internet sources also consulted.

Limitations

Climate change is a complex phenomenon, making it challenging to separate its particular effect on the water crisis. The research is restricted by the methods used, such as dependence on secondary data.

Delimitations

This research focuses on the looming water crisis in Pakistan in perspective of climate change. This study depends on secondary data and literature reviews

Climate Change

The climate is the average condition of the weather in an area usually over a sequence of years as shown by wind, temperature, and rainfall. Climate change is the variation in the climate of a region as a consequence of man-made and natural disturbances for example the decline of greenhouse and the effects of the ozone layer (Jan et al., 2017).

Climate change may result from numerous reasons, including variations in natural changes, solar radiation, long-term variations in the orbit of Earth, and human-created impacts on the planet. The 20^{th} century observed the most considerable warming inclination of the last century, with average temperatures increasing by approximately 0.6°C. However, future temperature increases are expected to exceed this speed, with foreseeable increases ranging from 0.1 to 2°C per decade.

Climate change and water crisis

Pakistan is extremely exposed to climate variation with effects becoming escalating tangible. As reported by the Global Climate Risk Index (CRI), from 1996–2015Pakistan is the 7^{th} most at risk country in the world that is damagingly disturbed by change in climate (Jan et al., 2017).

Table: 1 *Climate Risk Index (2000-2019) (1999-2018)*

Country	Climate Risk Index(CRI) score	Mortalities	Mortalities per 100 000 inhabitants	Losses in million US$ PPP	Losses per unit GDP in %	Number of events (2000–2019
Mozambique	25.83	125.40	0.52	303.03	1.33	57
Pakistan	29.00	502.45	0.30	3 71.91	0.52	173
Haiti	13.67	274.05	2.78	392.54	2.30	80
Thailand	29.83	137.75	0.21	7 19.15	0.82	146
Puerto Rico	7.17	149.85	4.12	4149.98	3.66	24
Nepal	31.33	217.15	0.82	233.06	0.39	191
Bangladesh	28.33	572.50	0.38	1860.04	0.41	185
Myanmar	10.00	7056.45	14.35	1512.11	0.80	57
Philippines	18.17	859.35	0.93	3179.12	0.54	317
The Bahamas	27.67	5.35	1.56	426.88	3.81	13

Source: (Eckstein et al., 2021)

Climate change, mainly for Pakistan, is an important matter disturbing the accessibility, timing, and unpredictability of the supply of water resources. Water from molten glaciers adds to approximately 60% of the flows. The state is previously fronting climate-connected fears to water resources as is obvious from the variation in patterns of monsoon, retreating glaciers, increasing temperatures, and repetition of droughts and floods.

The melting of glaciers will carry for wider effects. Firstly, the process of continuous melting, more water will be provided to the glaciers reliant on perennial rivers in the Himalayas (Dars et al., 2021). This may create positive effects on dry season water availability. Second, the probability of Glacier Lake outpouring flood may upsurge. Third, eventually, the dry season stream upstream of the Himalayan rivers could be significantly decreased, creating severe eco-environmental problems. When rise in population, water demand will possibly be increased ultimately. Consequently, the gap between demand and supply will possibly increase eventually, with the rise in dry season release, sediment supply in the rivers may rise and may create a threat to the current dams and reservoirs in the county (Muhammad et al., 2004). Consequently, extra melting means greater deposit heaps, which decrease the life of dams and reservoirs.

Table: 2 *Most affected countries by extreme weather incidents (2000-2019)*

	Most affected countries by extreme weather incidents (2000-2019)
1	Myanmar
2	Puerto Rico
3	Pakistan
4	The Bahamas
5	Mozambique
6	Philippines
7	Bangladesh
8	Haiti
9	Thailand

Bold: states where Approximately 90% of the losses or deaths happened in one year

Source: (Eckstein et al., 2021)

Challenges

Pakistan is among the most water-scarce states in the world and has been facing water scarcity issues for many years. Pakistan is facing following challenges in the perspective of water shortage.

Rise of Temperature

Pakistan has been facing a noteworthy rise in temperature over the past few decades. The average temperature in Pakistan has increased by 1.2°C since 1961, which is greater than the worldwide average. The northern regions of the country, mainly Azad Kashmir and Gilgit-Baltistan, have warmed by 2.5°C and 2.2°C, respectively, which is higher than the global average.

Pakistan spans polar, temperate, and tropical climates is a particular apprehension as far as consequences of global warming are concerned (Arshad et al., 2017). As temperature rises many mountain glaciers may vanish. A report by the Intergovernmental Board on Climate Change (IPCC) forecasts that the main effects in Temperate Asia under global climate change are projected to be: the vanishing of important portions of mountain glaciers and the scarcity of water sources (Ahmed, 2002). Several large glaciers are located in Pakistan, comprising the second-largest glacier of the world in non-Polar areas the Siachen Glacier (Lodhi et al., 2024, p.148).

Melting of Glaciers

Pakistan is predominantly vulnerable as its glaciers are receding at a faster rate than glaciers somewhere else in the world (Naz et al., 2024). Retreating the Himalayan Glaciers in the Indus River System contributes to possible natural disasters like floods and droughts (Aslam et al., 2021, p.204). Pakistan is concerned about the melting of these glaciers for the reason that it might cause land sliding, and scarcity of water (Xu, et al., 2009, p.529).

The rate of glacier reduction has been quickening, with the glacier retreating just 2 km in the last two centuries, but about 850m in the last 20 years, leading to a serious condition. According to the Working Group on Himalayan Glaciology if the melting of glaciers continues unchecked, by 2035 Pakistan could lose its glaciers (Rees & Collins, 2006, p.2162). At this stage melting of glaciers will initially consequence in more river flows by 2050-60, intensifying dangers of enormous

floods, larger landslides, severe earth erosion, lake busts, and deposition of reservoirs, etc (Wang, Wu et al., 2019).

In the process of continuous melting, more water will be provided to the glaciers reliant on perennial rivers in the Himalayas. The current floods in Pakistan were consequences of climate change which caused melting glaciers of the Hindu Kush-Karakoram, Himalaya and uncommon monsoon rain (Wester et al., 2019). The side in mountainous areas are rich with glaciers, and fast snow melting and glacial disappearance ultimately can reason for droughts mainly for the people living on highlands and reliant on usually melted water for their requirements. Dry season flow upstream of the Himalayan rivers could be significantly decreased, creating severe eco-environmental issues (Naithani et al., 2001).

Further with the rise in population, water requirements will probably increase. Consequently, the gap between demand and supply will be broader. With the rise in dry season release, sediment supply in the rivers may upsurge. This may create a risk to the current dams and reservoirs in the area (Muhammed et al., 2004). More retreating means greater silt loads, which decrease the life of reservoirs and dams.

Water storage capacity

The water Storage capacity of Pakistan is 150m3 which is too little, and it will be incapable of meeting needs in the future. China has 22,000 cubic meters and America has 6,000 cubic meters of storage capacities per head (Shehzad et al., 2020). The per capita accessibility of water is little due to the small storing size of water reservoirs in Pakistan. In terms of water storage capacity in Dams 0.2M acre-feet per year is declining due to the increase of deposits. During the monsoon season, 50 million acre-feet of rainwater is received in the Indus Furthermore, in the Indus river system approximately 142 million acre-feet are river inflows. On an average basis, there is a reduction of about 77.3 million acre-feet to approximately 39.3 million acre-feet. During the Rabi season, there is no water inflow for approximately 33 days in Kotri and Mangla which supply water for irrigation and drinking use in Badin, Hyderabad, and Thatta (Mumtaz, 2023).

Reduction in Capacities of Major Reservoirs

Pakistan is facing a serious issue of water scarcity, and the reduction in the capacities of main reservoirs is a substantial backer of this problem. Water storage capacity is a maximum 30-day supply that is very low compared to the recommended 1,000-day storage capacity for a state with its climatic characteristics.

Table: 3 *Reservoir Sedimentation*

Reservoir	Storing Capacity		Storing Loss		
	Original Million Acre-Feet (MAF)	Year 2009 Million Acre-Feet (MAF)	Year 2009 Million Acre-Feet (MAF)	Year 2012 Million Acre-Feet (MAF)	Year 2025 Million Acre-Feet (MAF)
Mangla	5.34 (1967)	4.46 (83%)	0.88 (17%)	0.90 (17%)	1.14 (21%
Chashma	0.72 (1971)	0.37 (51%)	0.35 (49%)	0.29 (40%)	0.38 (52%
Tarbela	9.68 (1974)	6.78 (70%)	2.90 (30%)	3.18 (33%)	4.30 (44%
Total	15.74	(74%) 4.13	(26%) 4.37	11.61 (28%)	5.82 (37%

Source: (Sufi et al., 2011).

Freshwater shortage

Pakistan positions 14 among the 17 'extremely high water risk' nations of the world. Pakistan is located at 69.34 degrees east in latitude and 30.35 degrees north in longitude. Due to this position, Pakistan greatly depends on ice melting and snow for water. However unluckily, the ice and snow in higher mountainous areas are melting quicker and before time, which is causing a deficiency of freshwater availability. Only 20% of the people of Pakistan's drinking water is available, whereas 80% of the population is forced to drink unsafe water (Daud et al., 2017) because of water shortage.

Ground water system in Pakistan:

Pakistan's Agriculture is primarily reliant on groundwater irrigation particularly where scarcity of surface water is observed. During the period of 1976-1997, dependence on groundwater for irrigation increased from 31.6 to 62.2 billion M^3 Because of the Shortage of surface water due to climatic change (Muhammed, et al., 2004). In Pakistan because of uncertainty of supply of water, over the past 40 years' farmers moved to groundwater pumping, resulting in a substantial increase in tube wells and doubling of uses of groundwater in agriculture.

Table 4: *Estimated Ground Water Resources in Provinces*

Provinces	Million (Acre /Feet)	Billion (m3)
Balochistan	2.1	2.5
Punjab	43.2	52.8
KPK	3.1	3.8
Sindh	18.4	22.5
Total	66.8	81.6

Source: (Farooq, 2023)

Groundwater has turned into a vital source of water, for irrigation, industries and domestic sectors (Arif et al., 2022). Though, extreme pumping has resulted in to decreasing water tables and Declined quality of water in several areas, comprising Lahore, where the water table has been decreasing at a rate of 0.5 meters annually for the past three decades. In other regions, for example Sindh and Baluchistan and, water tables have retreated down to approximately 1,000 feet, and in some cases, salty water has encroached into freshwater resources, decreasing the obtainability of quality groundwater (Lashari et al., 2007). In some areas the unmaintainable pumping amount has also resulted the impurity of groundwater.

Hydrological droughts

When the reduction of surface water triggers very little watercourse flow and ventilation of lakes, rivers, and reservoirs is referred to as a hydrological drought. The rainfall during the years 1997-2000 has been remarkably small as in this duration, the precipitation over most of the areas of the country has been less than 50% of the usual, producing serious loss to agricultural production Pakistan has faced many droughts in the last two decades, of which the most serious one happened in 1998-2002. Surface water obtainability was decreased by over 30%. The drought continued during the dry period from 1999 to 2000. During that period, the total surface flows in the main rivers decreased from 162.1 billion cubic meters to 109.4 billion cubic meters, whereas precipitation was under normal. The drought lessened canal diversions substantially, producing a net deficiency of about 51% of canal sources with respect to 'normal' periods. As a result, irrigation-based agriculture grieved to a large scale throughout the drought.

Floods

The last fifty years of data regarding floods in Pakistan displays that the amount of incidents during last ten years has significantly augmented in the last twenty years, which parenthetically is the era in which the average temperatures of the earth have been the maximum since the middle of the eighteenth century.

Table 5: *Occurrences of floods in Pakistan 2003-2015*

Year of Flood	Affected people	Loss of Lives
2003	4376	484
2007	2 million	918
2010	20 million	<1781
2011	8.9 million	434
2015	2.5million	367

Source: Website Report https:// Pakistan weather portal .com

Currently, the Indus Delta faces major threats due to inadequate freshwater flows. Another main danger is the rise of sea level, which could considerably damage the coastal mangroves and wetlands.

Shrinking Wetlands

In Pakistan, 19 sites are declared as of international importance covering an area of about 1,343,627 hectares, and are under threat due to climate changes. Predictions of a warmer climate and changes in precipitation patterns would considerably distract wetland environmental functions through changes in biogeochemistry, hydrology, and biomass accumulation.

Main sources of rain fall

Monsoon and western depressions are two main sources of rainfall in Pakistan. Pakistan receives about two-thirds of its water yearly from precipitation in summer with the remaining in winter. The usual rainfall during the years 1961- 2010 for the months of July to September is 137.5 millimeters. In 2018 during the post-monsoon season in the months of October, November, and December26.4 millimeters of rainfall was recorded. While, during post-monsoon rainfall the accurately recorded rate of rainfall was 15.6 millimeters, displaying a drop of 40.9 percent. Large share of rainwater is used for irrigation purposes whereas the residual is wasted because of lack of storing capacity and late or building of new dams. Currently, Pakistan has 13 main zones of potential hill torrents, which if not managed efficiently can badly disturb all water-connected stuff.

Indus Basin Treaty and water sharing with India

Indus Basin Treaty was signed on 19th September 1960 between India and Pakistan with the mediation of the World Bank. According to this agreement, the three western Rivers Jhelum Indus and Chenab accepted the right of Pakistan, and the three eastern rivers Sutlej, Beas, and Ravi recognized the Indian right (Mustafa, Akhter, & Nasrallah, 2013). Furthermore, this treaty also acknowledged some special rights of India over non-consumptive uses. The only source of water for Pakistan is the Indus River, which has six other tributaries, from which three were given to India.

Moreover, India has constructed hydro projects and dams on the rivers given to Pakistan (Briscoe et al., 2006; Atef et al., 2019). These projects are creating an issue of water shortage for Pakistan because the Indians regulate water flow entering into rivers in Pakistan (Malik, 2019), fulfilling the majority of the water needs of Pakistan. The Irrigation System of the Indus River is disturbed by noteworthy incompetence, consequential in a considerable quantity of water loss at the canal and waterway. Unfortunately, approximately 70% of the water streaming through the system remains unused, and agriculturalists at the end of the system seldom receive water (Begum, 2011).

Managing of water is poor; water charges and retrieval rates do not produce the income wanted to protect operation and repairs prices; there is a nonexistence of supervisory implementation; and agriculturalists carry on to use old-style flood irrigation strategies (Qureshi, 2011) that overwater harvests and have caused to waterlogging of soils in areas of the Indus Basin.

The ineffective supply system of water

The unbalanced, obsolete and ineffective distribution of the water supply system has caused low water productivity in Pakistan. For example, approximately 90 percent of the available water in the country is consumed for agriculture. Moreover, the water supply is connected to the command area of the canal, and agriculturalists are required to use water even when it is not required. Consequently, the production of a unit of water leftovers is deficient. This defective and inflexible water supply system also clarifies the low productivity of water (defined as the average crop production per unit of used water) (Cai & Rosegrant, 2003). The average productivity of crops per unit of water consumed is much lesser in Pakistan than worldwide, and there is a noteworthy gap between real and potential yields. Research explores, that in Pakistan, the productivity of water for cereal crops is approximately 1/3 of that in India and 1/6 of the productivity recognized in China.

Table 6: *Yield gap for major crops*

Crop	National average yield (Averageof last3years Tonne per Hectare)	Progressive farmers 'yield	Yield gap(%)
Cotton	1.8	2.6	30.8
Maize	2.9	6.9	58.5
Wheat	2.6	4.6	43.5
Sugarcane Sindh	54.5	200	72.8
Rice	2.1	3.8	45.6
Sugarcane Punjab	49.9	130	61.6

Source: Munir et al., 2021

Wastage of Un-Used Water

In the plain areas, sometimes agriculturalists do not require water for irrigation, mostly during the rainy season and winter. As a result, farmers usually halt the entry of water into their cropped fields through the canals. Consequently, the extra water flows downstream through the water passages (Munir et al., 2021). This excess water could be stored in farm-scale pools or small tanks for the succeeding growing seasons.

Gaps in Governance

The water system in Pakistan is plagued by ineffective governance, resulting in numerous issues. The governing structure of Pakistan is characterized by multiple authorities with overlapping responsibilities, as a consequence of ineffective reforms in the past. This has led to the duplication of work, unclear definition of areas of management, and disputes among provinces over water sharing (Janjua et al., 2021). The Indus River System Authority (IRSA) lacks its monitoring system, making it challenging to function as an arbitrator between provinces in water-related disputes. Moreover, cities like Karachi experience unpredictable supplies and quality problems due to ineffective administration and inadequate economic resources. Consequently, the poor are disproportionately affected, with restricted access to sufficient and affordable water. Ultimately,

the weak governance has resulted in the supply of poor-quality water to the people, exacerbating the already pressing problems in the sector.

Waste water of domestic and industrial Sectors

The domestic and industrial sectors have a considerable effect on water pollution. Most water use in these sectors comes from groundwater, resulting in over-extraction and a drop in the water table. It is calculated that 1.5 million acre-feet of industrial wastewater and 2.5 million acre-feet of municipal wastewater are produced yearly, with only 3% being treated and the remaining being discharged directly into freshwater bodies. This severely affects the ecosystem, as untreated wastewater pollutes surface water bodies and eventually impacts drinking water and food supply, creating severe health threats (Khalil & Kakar, 2011). Moreover, it is calculated that 30,000 hectares of agricultural land are irrigated with contaminated water, and 25% of vegetables consumed in Pakistan are produced using this method.

Options

Pakistan can overcome the scarcity of water if it handles the issue strategically. There is a desire to take immediate action, to address the water shortage. There is a need to introduce major alterations in plans and structure, to meet scarcity, to ensure a safe life in the country (Altaf, 2019).

Integrated planning and development of water resources

There is a necessity for effective usage of resources of water. Pakistan can overcome its water issue if it is planned tactically. The government of Pakistan approved policy in 2018 focusing on water resources development, management, and governance. However, there was no mechanism prevailing for the application of the National Water Policy and consequently, a water preservation plan was required. National Water Conservation Strategy (NWCS) 2023-2027 describes the set of attainable actions to produce a balance between supply demands in three areas, guarantee the preservation of water, lessen wastage, and protect its equitable supply both across and within provinces (Ministry of Water Resources Government of Pakistan2023).

Hill torrents in the mountainous regions of Pakistan have an unexploited source of surface water, which has not been fully advanced (Khalil & Kakar, 2011). In Pakistan, there are 14 different hill-torrent regions, with a total potential of approximately 19 Million acre feet (MAF) at about twelve hundred places. Approximately 60 percent of this water can be developed for agriculture as well and this water provides a great chance to irrigate nearly 0.006 Billion acres of agriculture wasteland in the mountain torrent zones.

Table 7: *Provincial Water Developmental Potential of the hill torrents*

Province	Water Development Potential (MAF)
Baluchistan	7.86
Khyber Pakhtun khwa	7.3
Sindh	0.78
Punjab	2.7

Source:(Kahlown & Majeed, 2003.

Proper Management of Water Resources

Pakistan's Government approved the National Water Policy (NWP) for 2023-27 in 2018focusing water resources progress, management, and governance. However, there was no mechanism prevailing for the application of the National Water Policy and consequently, a water preservation plan was required. So, the National Water Conservation Strategy (NWCS) for 2023-27 launched which describes the set of achievable actions to produce a balance between demand and supply in three sectors, guarantee conservation of water, lessen wastage and protect its impartial supply both across and within provinces.

Promote Preservation of Natural Resources and Sustainability

There is a necessity for tree plantation and forests can support steadying the climate (Qureshi & Akintuğ, 2014). Pakistan has the highest number of glaciers that are melting because of the increase in temperature.so, it is essential to regulate greenhouse discharge and protect the glaciers (Nabi et al., 2019).

Develop a groundwater governing framework to control groundwater exploitation.

To lessen and regulate the over-pumping of groundwater caused by mining, groundwater use must be controlled and appropriately priced through proper legislation and its firm application. Subsidies provided to consumers of groundwater in stressed regions, specifically, may be withdrawn (Iqbal&Iqbal,2015). Moreover, encourages optimal extraction of groundwater in waterlogged regions to lower the water table and encourage groundwater restoration anywhere technically and economically possible.

Up-gradation Irrigation Infrastructure such as the Drip Irrigation system

Drip irrigation, is a kind of irrigation system that transports water straight to the roots of plants, drop by drop, through a system of emitters and tubes (Usman et al.,2016). Every droplet of water is utilized to the fullest as a consequence of this method (Aziz et al.,2021). Drip irrigation is a significant method to save and lessen the waste of water during irrigation. In Pakistan with the help of this technique may solve the issue of shortage of water particularly in semi-arid and arid regions.

Construction of New Reservoirs

To use water presently going to waste, there is a utmost requirement to construct dams, for storage of water. Many small dams can be constructed to meet the water shortage (Randhawa, 2017). These storages could be at suitable locations in the Northern Regions or downstream of Tarbela. Water and Power Development Authority and provincial irrigation departments have already found most of the locations and the building of dams for the growth of water reservoirs is comprised in their short and long-term policies

High-efficiency irrigation systems

The high-efficiency irrigation systems should be introduced and disseminated all over the country. There is a huge space between real and possible harvests in Pakistan, for example, the usual harvest of crops use of per unit of water is considerably less in Pakistan than at the global level. The productivity of water can be enhanced by cumulative the crop per unit of water used or by decreasing the quantity of water consumed for a similar crop (Farooq et al., 2009). However, in Pakistan, there is an ability to both increase crop harvest and decrease the deepness delta of water by suitable devices and methods like exactness land flattening, appropriate plan of the field,

effective technologies of irrigation and suitable irrigation systems (Ashraf, 2016), for example bed implanting, and by applying suitable irrigation arrangement.

Surplus water storing

Waste of extra water in the fields, sometimes agriculturalists do not want water, mainly in rainy and winter seasons. Agriculturalists usually halt the water of canal entrance into their harvested arenas. The extra water streams downstream over the waterways, but in its place could be deposited in farm-scale pools on small reservoirs for the following growing season.

Unsuitable Crop Zoning

Unsuitable Yield Zoning High delta harvests for example sugarcane and rice are Cultivated in zones that are categorized as dry regions, where surface water is inadequate and underground is very deep and salty. Farming of these yields in these regions generates massive burdens on groundwater, consequential in its reduction and salinization. Rationally, rice and sugarcane should be limited to being cultivated in those zones that are semi-arid where adequate water exists with restricted dependence on water reserves.

Conclusion

Pakistan is presently facing severe water scarcity, largely because of climate change. Which is anticipated to worsen the country's already brittle water security. Water obtainability of Pakistan is declining by 5-7% every year because of climate change that brought changes in rainfall patterns, retreating of glaciers, and amplified evaporation rates. Increasing temperatures are also disturbing the snowpack in the Himalayas regions, which provides 70% water off in Pakistan, leading to decreased water flow and augmented droughts.

By 2050, water scarcity in Pakistanis is estimated to deteriorate, with some forecasts proposing that the country will confront a shortfall of over 30 million acre-feet of water per year. This crisis has an important effect on the agriculture and food sectors, which are closely linked. To meet this looming crisis, it is important to introduce sustainable water management plans, intensify water storing capacity, and improve climate-resilient agriculture policies to guarantee food security. With a practical approach, Pakistan can efficiently manage its water shortage and guarantee a sustainable future for its population and economy.

Recommendations

To overcome the challenges of the looming water crisis in Pakistan, many measures may be taken.

I. Well-organized use of water in all sectors mainly agriculture where more than 90% of water is being spent.

II. Progress extra freshwater storing capability to meet the prevailing water-related pressures and the challenges evolving from climate change.

III. Collecting rainwater and consuming it for non-potable needs can decrease the demand for groundwater sources.

IV. Financing in climate-resilient structures, such as sea walls and flood defense systems, can help lessen the effects of climate change.

V. Encourage research to evaluate the impact of climate change on obtainable water resources and explanation for these effects in future resource expansion plans.

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