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# Water Scarcity in Pakistan: Analyzing Causes, Impacts, and Sustainable Solutions for Future Resilience

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Pakistan is in the fray of a heightening water crisis. The year 2024 has underlined the urgency of this issue. According to a UNDP water report, Pakistan may reach absolute water scarcity level with water availability of less than 500 cubic meters per person by 2025. At present the per capita

availability of water in Pakistan is 930 cubic meters per year. It must be remembered that back in June 2015 NASA had found that the Indus River Basin had acquired the status of the second most water stressed basin. Now Pakistan is water scarce, below the level of a water stressed country. From the Indus River, the lifeblood of the nation, to the parched fields of its agricultural heartland, the signs of distress are evident. According to the World Health Organization, 50 to 100 liters of water per person per day enables conditions for a human to live a dignified life. Based on Pakistan's population, the country requires between 3.5 and 7 million acre-feet (MAF) of water to meet its collective domestic demand every year. While estimates range, Pakistan's collective annual water availability roughly amounts to 193 MAF. (The Worldwide Fund for Nature)WWF reported that 2700 industries throw their untreated discharge in the Ravi and have transformed it into a drain. The United Nations Development Program and Pakistan Council of Research in Water Resources (PCRWR) have warned of an absolute water scarcity and a drought by 2025 if no proper solution is sought. The ground water level of Pakistan is declining rapidly. About 50 to 55 MAF water is pumped out of the ground every year in Pakistan which is causing depletion of water tables, as only 40 to 45 MAF is recharged. Estimated amount of 30 Million Acre Feet water is wasted away which passes through Pakistan every year. Water worth $29 billion every year goes unused and wastes away in the Arabian Sea which invites need for better water management by Pakistan

for using it to its advantage strategically. Approximately 110 to 115 billion cubic meters (BCM) of surface water are utilized annually. Water failure in Pakistan is an raising extremity that threatens the nation's socio- economic stability and public health.

**Causes of Water Scarcity**

1. Climate Change: Pakistan's geographical location makes it highly vulnerable to climate change. Lahore has already been declared to be the second most polluted city of the world. Climate change hazards are also there as the glaciers are melting at a fast pace and pose a serious threat to climate. The rapid melting of glaciers in the Himalayas and reduced snowfall in the northern regions are significantly impacting the river flows. This affects the availability of water in the Indus River system, which is crucial for the country's agriculture and domestic use.
2. Population Growth: With a population exceeding 240 million, Pakistan's water demand has surged. The increasing population puts immense pressure on existing water resources, leading to over-extraction and depletion of available water.
3. Agricultural Practices: Agriculture consumes about 90% of Pakistan's water resources. Traditional irrigation methods, such as flood irrigation, are highly inefficient. Furthermore,

waterlogging and salinity problems exacerbate the issue, reducing agricultural productivity and increasing water wastage.Agriculture is the largest consumer of water; 97 percent of Pakistan's freshwater is used by the sector. Besides water deficiency and drought, there are other issues like water-logging and salinity affecting According to the Economic Survey of Pakistan 2023-24, agriculture contributes 24 percent of Pakistan's GDP.An estimated shortage of around 70 million tons of food is expected by 2025.

4. Water Management: Inefficient water management systems and outdated infrastructure contribute significantly to water wastage. Leaky canals, unregulated water use, and inadequate storage facilities hinder the optimal use of available resources.
5. Water Pollution: Industrial waste, agricultural runoff, and untreated sewage contaminate water sources, rendering them unfit for consumption. This pollution not only reduces the availability of clean water but also impacts public health.

**Impacts of Water Scarcity**

1. Agricultural Impact: Pakistan's economy heavily relies on agriculture, which contributes significantly to GDP and employment. Water scarcity directly affects crop yields, reduces agricultural productivity, and threatens food security. Major crops such as wheat, rice, and cotton are at risk, impacting livelihoods and economic stability.

2. Economic Consequences: The agricultural sector's decline affects various industries and the overall economy. Increased costs for irrigation and decreased agricultural output lead to inflation and economic instability. Additionally, water scarcity affects industries dependent on water, such as textiles and food processing.Water use in main economic sectors like agriculture, irrigation, power generation, mining ,livestock etc.
3. Health Issues: The United Nations estimates that 40 percent of all annual excess deaths in Pakistan can be directly or indirectly attributed to an insufficient supply of clean water.Limited access to clean drinking water leads to a rise in waterborne diseases such as cholera, dysentery, and hepatitis. Contaminated water sources pose severe health risks, particularly in rural and underdeveloped areas.
4. Environmental Degradation: Reduced river flows and over-extraction deplete aquifers and disrupt ecosystems. Aquatic life, wetlands, and natural habitats suffer, leading to a loss of biodiversity and ecological balance.

**Water crisis in future**

As climate change intensifies and population growth accelerates, Pakistan faces a looming water crisis with profound implications for its future. Predictions indicate that by 2025, Pakistan could experience severe water shortages, potentially reaching "absolute scarcity" conditions. The country's water resources are increasingly strained due to reduced glacier melt in the Himalayas, erratic monsoon patterns, and over-extraction of groundwater.Agriculture, which consumes over 90% of Pakistan's water resources, is particularly vulnerable. Inefficient irrigation practices and water wastage exacerbate the issue, while industrial and domestic demands continue to rise. Additionally, transboundary water disputes with India over river sharing further complicate the situation.The impact of water scarcity is projected to be widespread, affecting not only agricultural productivity and food security but also exacerbating socioeconomic inequalities. Rural communities, heavily dependent on agriculture, will face diminished livelihoods, while urban areas could experience increased competition for limited water resources.

To mitigate these risks, urgent measures are needed. These include investing in water conservation technologies, improving irrigation efficiency, and enhancing policies for sustainable water management. Addressing the water crisis requires a coordinated approach involving government, industry, and communities to secure a stable and resilient future for Pakistan.

**Recommendations for Sustainable Solutions**

To tackle water scarcity, Modernizing agriculture through efficient irrigation systems and water-saving technologies is a key strategy in reducing water consumption and enhancing productivity. Transitioning to practices like drip and sprinkler irrigation not only minimizes water wastage but also promotes sustainable farming and soil management. In parallel, upgrading water management infrastructure and reducing losses are crucial steps toward a comprehensive strategy that balances supply and demand. Investment in cutting-edge technologies, such as remote sensing and data analytics, is critical for improving water resource management and developing innovative solutions for conservation and purification. Public awareness campaigns and educational programs encourage responsible water use, driving community action. Strong governance and institutional frameworks are vital for effective water policy implementation. International cooperation is also vital in managing shared water resources, as seen in Pakistan's

dialogues with neighboring countries like India. Effective transboundary water management is essential for addressing water scarcity and ensuring equitable distribution among regions. By integrating these approaches—modernizing agriculture, investing in technology, promoting conservation, and fostering governance and international collaboration—we can tackle water challenges and pave the way for sustainable water management.

**Conclusion**

Water scarcity in Pakistan is a pressing issue with far-reaching implications for the country's economy, health, and environment. Addressing this crisis requires a multifaceted approach involving policy reforms, technological advancements, and public engagement. By implementing sustainable practices and investing in infrastructure and research, Pakistan can work towards mitigating the impacts of water scarcity and ensuring a secure water future for its population.