

Climate Change and Water Security Scenario of an Agrarian Locale in Upper Punjab

Muhammad Waqas¹, Aneela Afzal², Arif Mahmood Khan³ and Nasir Mehmood Khan⁴

<https://doi.org/10.62345/jads.2024.13.1.13>

Abstract

Climate change is exacerbating both water scarcity and water-related hazards as rising temperatures disrupt precipitation patterns and the entire water cycle. Water is crucial for all types of living creatures; therefore, its availability and quality are important for humans, too. However, water-related issues have increased all over the world, and people are facing more difficulties than in the past. Water scarcity is the most obvious issue, which results from the imbalance between water demand and supply. It has numerous negative effects on community health and societal development. This study was undertaken in the agriculturally oriented rural locale of district Rawalpindi in Pothwar, region of Punjab, Pakistan. The study primarily assessed the magnitude of water scarcity and, further investigated the impact of water scarcity on the health of the local community and looked into the problems faced by women and children. A sample size of one hundred respondents was selected using the probability technique of Simple Random Sampling. Both qualitative and quantitative techniques were used in collecting and analyzing data for this field research. The major sources of water in the locale are distant natural wells. The research indicated that local inhabitants faced many difficulties in tapping distant natural water resources to meet their daily needs. Water is generally stored in plastic drums and plastic tanks, but some local people have also constructed underground concrete tanks. The water used for drinking and meeting various others' needs is contaminated, impure, unclean and hard. As a consequence, several diseases such as diarrhea, vomiting, kidney disorders and jaundice are common in the locale inhabitants because of water scarcity, which forces the people to use water from contaminated resources. Further, they have to bear expenses on the disease treatment, and spend extra money for fetching water.

Keywords: Climate Change, Water Scarcity, Water Resources.

Introduction

Water is an essential resource for human and other living organisms' survival and maintenance of their good health. The unavailability of water to meet daily needs is a serious issue faced by one out of every three people around the world. This fact highlights the adverse effects on the health of people facing such scarce water conditions and its various resulting effects on daily life (Besada & Werner, 2015).

¹PhD Scholar, Department of Sociology, PMAS Arid Agriculture University Rawalpindi.

Email: malik_wiki9999@yahoo.com

²Department of Agricultural Extension, PMAS Arid Agriculture University, Rawalpindi.

³Department of Sociology, PMAS Arid Agriculture University, Rawalpindi.

⁴Department of Sociology, University of Chakwal, Pakistan



Without water, there could be no sustainable agricultural activities, and thus, it could result in causing interruption and, ultimately, depletion of various food chains. Water resource is an important factor contributing to the growth and development of the economy. Almost every industry, from agriculture to electrical power generation, industrial manufacturing, beverages, apparel, and tourism, is ultimately dependent on water for its survival, maintenance and sustenance (Morrison, 2009). Thus, water security could be defined as the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies (Grey & Sadoff, 2007).

Naturally occurring water resources are rapidly depleting in numerous regions of the world. Furthermore, more than one-third of the world's population, approximately 2.4 billion people – live in water-stressed countries, and by 2025, the number of such countries is expected to rise to two-thirds. Conditions of water scarcity and conflicts arising as consequences of its distribution are indications of a rising gap between water demand and supply. Water demand is rising fast due to rapid population growth and brisk economic activities. Still, water sources of supply are not growing at the same speed because of severe financial and physical limits on supply augmentation (Saleth, 2011).

The need for clean, hygienic, safe and uncontaminated water for drinking, cooking, bathing and other household purposes and needs has long been recognized. However, it is estimated that over 1 billion people still lack clean, safe and adequate domestic water supply sources, and 2.4 billion people lack adequate water even for hygiene and sanitation purposes. In most countries, there are rapidly increasing degrees of water uncertainties arising from over-pumping of the aquifers, falling water reservoirs, and sharp deterioration of the aquatic ecosystems (Emmanuel et al., 2009).

In addition, climate change is predicted to further reduce the availability and quality of water in certain regions. At the country level, water scarcity can be defined by such factors as agricultural, domestic and industrial consumption and the water necessary for maintaining ecosystems that would approach or exceed the total annual available supply. Depleting surface water levels and groundwater resources has led to serious environmental problems, such as increasing loss of soil fertility. This over-exploitation of both surface and groundwater reservoirs is most likely to increase the salinity of land, thus having adverse effects on the ecosystem and biodiversity. Scarce water resources and their contamination are adversely affecting agriculture, food security, socio-economic growth and development (Gohar & Cashman, 2016).

Water scarcity leads to the destruction of the environment, and conflicts commonly take place in different national sectors as industrial, agricultural, and domestic spheres compete for scarce water resources. The poor segments of society are the ones who suffer the most when there is a water shortage problem. Water shortages can lead them to travel long distances on foot to fetch it, pay high prices for purchasing it, food insecurity and health problems because of drinking water from contaminated water sources (Mijinyawa, 2008).

The number of people without access to clean, safe and uncontaminated resources of water is expected to rise from just over 1 billion to 2 billion by 2025. Therefore, water scarcity represents major political, economic, and human rights issues threatening to intensify conflicts, food insecurity problems and poor health, hygiene and sanitation conditions. Population growth, economic development and its profligate use place an undue strain on existing water resources. Conflicts over limited water resources have been the center of attention several times. Not only has a future of inter-state water wars been forecasted, but also the internal civil conflicts that marked the previous decades have been linked to an increasing scarcity of natural resources like

water or cropland. Evaluating these findings from a political ecology point of view allows for gauging the potential of water scarcity conflicts within this setting (Lecoutere, 2010).

The next great advancement is groundwater use, a silent revolution which has happened in the last half-century, particularly in almost all arid or semi-arid regions across the world. Worldwide groundwater extraction rose from a base level of 100-150 mm³ in 1950 to about 950-1,000 mm³ in 2000. In turn, farmers extract 900 mm³ of water to generate \$210–230 billion, with a gross productivity of about \$.23-26 per mm³ extracted (Gunn & Lamas, 2008). Regions across the world identified as water shortage hotspots are Sub-Saharan Africa, South Asia (particularly Afghanistan, Pakistan and parts of India), and Southeast Asia (particularly Myanmar, Vietnam and Indonesia). The number of people who will be affected by water scarcity is estimated to reach 5 billion by the year 2025, and climate change will account for about 20 per cent of this increase in water scarcity (Ehrhart, 2009).

Objectives

1. To assess the magnitude of water scarcity in the local community.
2. To find out the consequences of water scarcity on the health of people and
3. To investigate the effects of water scarcity on the problems faced, especially by women and children.

Methodology

The study locale is the agriculture-oriented village of Ausia, Tehsil Murree, district Rawalpindi, in the northern upper part of the Punjab province of Pakistan. It is an ancient historical village situated on Kohala road 2 km from Bhurban of district Rawalpindi Pothwar region in upper Punjab, Pakistan.

For the current study probability technique of simple random sampling has been used to select a representative sample. The sample was selected by first developing a sampling frame of the whole population using the latest list of voters and modifying it with the help of personal contacts to delete the dead or migrated persons. Further included in the list were those who had recently attained voting age or had migrated to this village, as well as newly born infants. After developing a representative sampling frame, a sample size of one hundred respondents was randomly selected using a random table.

Data Collection

The combinations of different qualitative and quantitative data gathering techniques were used in this study. The purpose of using different techniques was to collect data using as many techniques as possible so as to enable the researcher to approach the same aspects of the problem under investigation from different perspectives. Data were collected through socio-economic census survey forms, key informants, participation observation, informal, in-depth and semi-structured interviews, focus group discussions and case study methods.

Data Analysis

Collected data were analyzed both by quantitative and qualitative techniques of data analysis. Data collected through the socio-economic census survey forms was analyzed through the use of frequency distribution and percentage techniques through SPSS and presented in a tabular form. The qualitative data gathered through the use of participant observation, informal, in-depth and

semi-structured interviews, focus group discussions and case study methods were analyzed by the qualitative techniques of these matrices.

Results

Age-wise distribution of the respondents is shown in table 1. Respondents under thirty were only three, and over sixty were twenty-one; most of the respondents were between thirty and fifty. This is the age group which was far more responsible for the maintenance of household chores and had a greater workload. The research questions were much more related to that group. Table 1 indicates that the majority of the respondents belong to the age group of thirty to fifty.

Table 1: Distribution of the respondents with regard to age

Age	Frequency	Percentage
20-29	3	3.0
30-39	12	12.0
40-49	33	33.0
50-59	31	31.0
60	21	21.0
Total	100	100.0

As mentioned in the table 2, females are responsible for the household chores, and the major part of their work load is bringing water from long distances, which affects directly on their health. Table 3 exhibits that majority of the interviews were conducted to the head of households even they are male or female because they know the situation of water scarcity in the household. Most of the interviews were conducted with females because fetching of water was a task primarily performed by females in the region.

Table 2: Distribution of respondents with regard to gender

Gender	Frequency	Percentage
Male	43	43.0
Female	57	57.0
Total	100	100

Table 3: Distribution of respondents with regard to relationship with household

Gender	Frequency	Percentage
Himself	88	88.0
Son	7	7.0
Wife	4	4.0
Mother	1	1.0
Total	100	100.0

Available Water Resources

There are two major sources of water in the village such as natural wells and water through boring. The natural wells are located at a long distance from the residential dwellings and can be tapped only after covering long distances, mostly on foot. As such, villagers faced numerous difficulties

in fetching water from those natural wells. Available underground water reservoirs were very scarce and very deep, and it was very difficult for them, most attempts at boring were mostly unsuccessful as the village was located in a hilly terrain made up of hard rocks. When successful, it required a deep boring at least as deep as 90 feet.

Amount and Level of Water Available

The amount and level of water resources available through natural wells and the boring of ground resources were becoming even more and scarcer and more limited than in the past. One of them was that as amount and levels of water in those naturally occurring wells were falling because, in the past, villagers carried out proper maintenance, cleaning and caring of those wells. Still, at the time of the study, villagers needed to carry out proper maintenance, cleaning and care of those wells. As a consequence, the amount level and quality of water available decreased. The researcher found that the amount, levels, and quality of water available in those wells rose during the winter season and fell during the summer season. Also, amounts, levels and quality of water available in those wells in which hand pumps were installed showed a substantial fall in levels, amounts and quality of water available after 4 or 5 years and also during summer seasons as against winter seasons. Most significantly, the fall in the quantity, levels and quality of water available fell more appreciably in wells up to 50 feet deep as opposed to wells at least 90 or more feet deep. Another reason for the falling water amounts, levels and quality of water available in naturally occurring wells was that villagers had boring and installed pumps close to the natural wells.

Sources of Water Contamination

The water used by local villagers for drinking purposes and for meeting their various other needs was, in large part, contaminated, unclean, impure and hard water. It was found that it contained different kinds of insects, various types of germs, debris and impurities. The major reason for this contamination was because it was, for the most time, fetched from naturally occurring wells which were open without any protection. There was no system in place for carrying out their cleanliness, maintenance and taking care of those wells by local people and animals as well as humans drank from those wells. As such, local villagers were using contaminated, impure and unclean water from those unprotected naturally occurring wells for drinking, cooking, washing, cleaning and meeting their other day-to-day needs because they had no other options available. Even the water available from human-constructed wells through various boring techniques was not clean and free of contamination, insects, germs and impurities. For instance, water from those human-constructed wells was contaminated with zinc and mud particles was mixed in it. It was observed that all sources of water being used by local villagers had various types of contaminations and impurities ranging from many types of insects, germs, various types of harmful metallic elements and other impurities, including mud, sand, etc.

Effects on Health

There were many adverse effects on the health of local villagers because of using such contaminated water due to scarcity of water in the local region. As such use of contaminated water was causing different types of surgical and physiological ailments and illnesses among local villagers; for instance, females fetching water from distant sources suffered from various kinds of pains in their necks and sometimes used to fall sick and suffer from fevers of various intensities while performing the task of fetching water from long distances. The local village was located on hilly terrains, and tracks travelled by them for fetching water from those distinct sources were

uneven, bumpy, rocky and rough, which had many adverse effects on their physiological and physical well-being and their overall health conditions. It was noted that females in family ways were affected the most by various physiological and surgical illnesses and ailments when fetching water on foot with a pitcher on their head on those rough, bumpy, rocky and uneven hilly tracks for their households. It was found that a large number of women in the family way were involved in this fetching activity, and that was having many adverse effects on their overall health conditions, even having adverse physiological and surgical effects in the form of ailments and disabilities and on the babies carried in their wombs by them. Children of different age groups were very vulnerable to various kinds of surgical and physiological ailments and disabilities due to drinking contaminated water fetched from distant natural water resources. They sometimes suffered from dehydration and diarrhea caused by drinking such contaminated, impure, and unclean water.

Diseases

Many infectious diseases were found to be affecting the health of local villagers due to scarcity of water, which forced those people to use water from such contaminated water resources. It was found that such infectious diseases as diarrhea, vomiting, kidney disorders and Hepatitis were common among people of this locality. Because of using water from such contaminated natural water resources, local people had various types of kidney disorders, infections of urinary bladders and stones in the gall bladder and several gastric ailments, and as a consequence, they suffered from different symptoms and illnesses of those infectious diseases. Those villagers who were using water from human-constructed wells containing such harmful elements as zinc and various other impurities also suffered from many symptoms and effects of different types of physiological and surgical ailments. Several other infectious diseases were also found among local people due to using contaminated water from few available natural and human-constructed water resources in the local region, such as enteric fever, gastroenteritis, and skin and bone diseases, e.g., rickets.

Socio-Economic Effects

There were several adverse effects of using water from contaminated sources due to water scarcity on the socio-economic conditions of the local people. Local people were suffering from various ailments and disabilities due to drinking or using contaminated water from few available contaminated, impure and unclean water resources. As such, they had to finance their own and their family members' treatment expenses, which used to take a major chunk from their already limited household budgets; as a consequence, the local families could not finance the nutritional, educational and various necessary needs, desires and wants of their family members. They had to purchase medicines and injections and had to provide treatment expenses of various pathology and radiology laboratory tests and other treatment expenses of their own and their family members. As such, it was found that whenever any local villager suffered from any physiological or surgical ailments or disabilities to local doctors for their treatment, the first question those doctors usually asked local people suffering from any ailment was which source of water they were using for their drinking and other daily needs and wants. The majority of the local people could not afford the cost of allelopathic or modern modes and means of treatment facilities. As a consequence, they were suffering from several infectious diseases and disabilities. They had no choice but to seek their treatment through traditional practitioners such as hakims and other herbal specialists, faith healers, homoeopaths, self-medication and other informal and traditional means that further added

to their disease burden and multiplied their treatment expenses many folds because ultimately, they had to seek modern practitioners as a final resort.

Conclusion

Water is one of the most significant of all-natural resources. Water and climate change are intimately linked. Extreme weather events are making water scarcer. Life is basically dependent on water, but nowadays, water-related problems are increasing all over the world, and people face more problems than in the past. This study describes all the aspects of water scarcity in the study area. Water scarcity is not only the problem of this village but it is a global problem. It is concluded that the local community faced a lot of problems due to water shortage. Researchers observed there are many adverse effects of water scarcity on the health of local villagers because they use contaminated, unclean and impure water for their daily needs because of water scarcity in the village. There are also socio-economic effects of water scarcity on the budget of people. Females and children are affected more due to water scarcity in the village.

In light of this research, the following recommendations are proposed to policymakers:

- There should be proper cleaning, maintenance and care of natural wells.
- The storage places of water should be properly cleaned.
- Such programs should raise public awareness regarding water conservation, household-level rainwater harvesting, and climate-smart agriculture practices.

References

- Besada, H., & Werner, K. (2015). An assessment of the effects of Africa's water crisis on food security and management. *International journal of water resources development*, 31(1), 120-133.
- Casagli, N., Tofani, V., Sassa, K., Bobrowsky, P. T., & Takara, K. (Eds.). (2020). *Understanding and Reducing Landslide Disaster Risk: Volume 3 Monitoring and Early Warning*. Springer Nature.
- Ehrhart, C., Thow, A., Blois, M. D., & Warhurst, A. (p008). Humanitarian implications of climate change: mapping emerging trends and risk hotspots. *Humanitarian implications of climate change: mapping emerging trends and risk hotspots*.
- Emmanuel M, A., & Ekanem M, E. (2009). Water uncertainties in Southeastern Nigeria. Why government should be interested in management. *International Journal of Sociology and Anthropology*, 1(2), 38-46.
- Gohar, A. A., & Cashman, A. (2016). A methodology to assess the impact of climate variability and change on water resources, food security and economic welfare. *Agricultural Systems*, 147, 51-64.
- Grey, D., & Sadoff, C. W. (2007). Sink or swim? Water security for growth and development. *Water Policy*, 9(6), 545-571.
- Gunn, E. L., & Llamas, M. R. (2008). *Can human ingenuity, Science and Technology help solve the world's problems of water and food security?* Research Gate.
- Lecoutere, E., D'Exelle, B., & Van Campenhout, B. (2010). Who engages in water scarcity conflicts? A field experiment with irrigators in semi-arid Africa. *SSRN electronic journal*.
- Mijinyawa, Y., & Dlamini, S. S. M. (2008). Impact assessment of water scarcity at Somntongo in the lowveld region of Swaziland. *Scientific research and essays*, 3(2).
- Morrison, J., Morikawa, M., Murphy, M., & Schulte, P. (2009). *Water Scarcity & climate change. Growing risks for business and investors*. Pacific Institute, Oakland, California.
- Saleth, R. M. (2011). Water scarcity and climatic change in India: the need for water demand and supply management. *Hydrological Sciences Journal*, 56(4), 671-686.