



RESEARCH PAPER

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Climate changes impacts on water resources and management by using water evaluation and planning (WEAP)

Zaib Un Nisa¹, Hameed Ur Rehman^{2*}, Kaleem Ullah³, Waheed Ullah⁴, Feroz Khan⁵, Asif Ali⁶, Mehboob Khan⁶, Syed Muhammad Saqlain⁷, Haleema Sadia⁸, Shahid Raza⁹, Umair Ali¹⁰, Bilal Ahmad Zafar Amin¹¹, Kausar Malik¹²

¹College of Earth and Environmental Sciences, University of the Punjab Lahore, Pakistan

²Department of Zoology, Kohat University of Science & Technology, Kust-26000, Kohat, KP, Pakistan

³Department of Environmental Science, International Islamic University, Islamabad, Pakistan

⁴Environmental Science, COMSATS University Islamabad Abbottabad Campus, Pakistan

⁵Department of Zoology and Biology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan

⁶Research Officer Plant Protection Agriculture Research Department Government of Baluchistan, Pakistan

⁷Department of Geology, Bacha Khan University Charsadda, Pakistan

⁸Department of Biotechnology, University of Information Technology, Engineering and Management Sciences Quetta, Pakistan

⁹Department of Biotechnology, Lahore Garrison University, Lahore, Pakistan

¹⁰University of Lahore Institute of Molecular Biology and Biotechnology, Pakistan

¹¹Department of Environmental Sciences, COMSATS University Islamabad Abbottabad Campus, 22060, Pakistan

¹²Professor National Centre of Excellence in Molecular Biology, University of the Punjab, Lahore, Pakistan

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Abstract

Water is an important constituent for existence of life on earth, which comprises minerals, significant for humans as well as for world and water life. The current study was indicated that the climate changes impacts on water resources and management by using water evaluation and planning. The higher rain fall 2000 mm was recorded in 1994 and 2006, while lower 700 mm was recorded in 2009 respectively. The higher annual mean humidity was recorded 550 1982, while lower humidity 450 was recorded in 2001 and 2002 respectively. WEAP (Water Evaluation and Planning) shows that water demand for agriculture is 2,100.00 and for Islamabad city is 1,440.00 sum of water demand was 3,540.00. The demand site coverage in agriculture and big city was 68% and 65% recorded in August respectively. WEAP revealed that water demand for agriculture is increasing with the passage of time.

* **Corresponding Author:** Hameed Ur Rehman ✉ 03449002451h@gmail.com

Introduction

Water is an important constituent for existence of life on earth, which comprises minerals, significant for humans as well as for world and water life. Lakes and surface water pools are the earth's most important freshwater incomes and deliver in numerable profits. They are used for home and irrigation purposes and deliver ecosystems for water life especially fish, thereby operative as a source of important protein and for important elements of the biospheres biological variety. They have significant social and financial profits as a result of recreation and tourism, which are socially and attractively significant for people throughout the biosphere (Arain *et al.*, 2008). Human and natural events disturb almost all segments of the water cycle, frequently with additive effects. Over time the human events such as jungle clearing, agriculture and afforestation etc have worrying effects on the water cycle containing evapotranspiration, flow commands, sea level and groundwater table. Human events effect cloud creation via the release of aerosols and their vaporous precursors (Kruger and Grabi, 2002). Major threats to water resources for humans comprise aquatic contamination (the pollution of surface water and groundwater ponds with elements and microbes), water shortage (the alteration of run-off rules and the alteration frequently dropping of the groundwater table) and maximum significantly. The worldwide climate alteration with significances such as

rearrangement of precipitation, increasing sea levels (Stolberg *et al.*, 2003). The water systems susceptibility and their sensitivity to environment alteration have been an active research subject in the past decade (Arnell 1996). In opinion of the uncertainties related with environment and hydrologic representations, the profits of developing measuredguessespersist controversial. Water resources administration arrangements are very adaptive by nature (or through official involvement) and the typical differences in climatic and socio-economic circumstances have provided water directors with involvements that support them manage with probable variations in environment designs (Strzepek 1998). The current study was aimed to investigate the climate changes impacts on water resources and management by using water evaluation and planning.

Materials and methods

Study site

Soan valley lies to the south of northern mountains are a part of Potohar Plateau. Soan river starts from Murree hills and passing through the steep slopes. It enters the plains near Chirah. Four major streams Ling river, Sill river, Korong river and Lai nullah adds flood to the Soan river. The Soan river falls between longitudes 71.45 to 73.35 east and latitude 32.45 to 33.55 north. Most of the Indus river area is drained by the left bank tributary of Soan river (Figure 1).

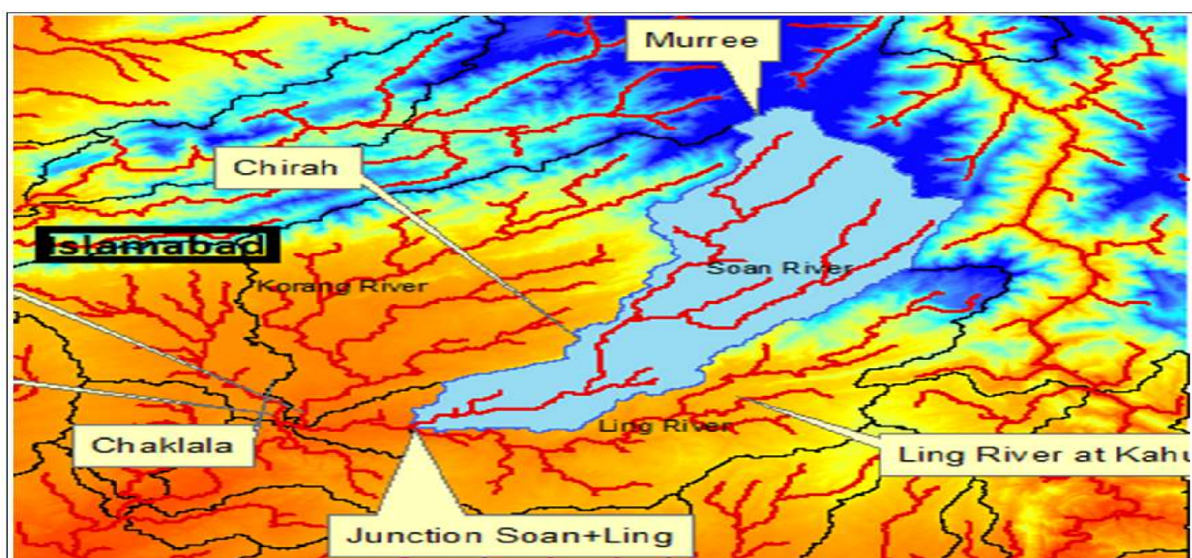


Fig. 1. Short view of river Soan.

Data collection and statistical analysis

The data on different climatic parameters such as rainfall and temperature and total river inflows shortage of water in Soan river are collected from Pakistan meteorological department (PMD) and water and power development authority (WAPDA) Lahore. The collected data are analyzed by using mathematical and statistical method. Statistical analysis refers to a collection of calculation method used to process large amount of data in short time and to report overall trends in it. Complete statistical analysis determines unusual events in historical data. Statistical analysis involves the determination of central tendencies and the measure of dispersion in data. The total annual mean flows and linear trend lines are calculated by using Microsoft excel. Climatic are also analyzed on monthly and yearly basis to represent a clear picture of data.

Description of WEAP model

The WEAP model can use and represent water resource system like natural river inflows, precipitation, evaporation and evapotranspiration as input data. After data entry operational processing can be represented include water flow in channel, storage and release of water from reservoir hydropower release and consumptive demands. These are operational features can be identified as time varying or steady state. As a catalogue WEAP provides water demand and supply system. Additionally WEAP allows us to develop sets of variable and equations for further refinement. It also has features to adapt the analysis to local constrains and conditions with possible data exchange with other software such as MS Excel.

Results

The higher rain fall 2000 mm was recorded in 1994 and 2006, while lower 700 mm was recorded in 2009 respectively.

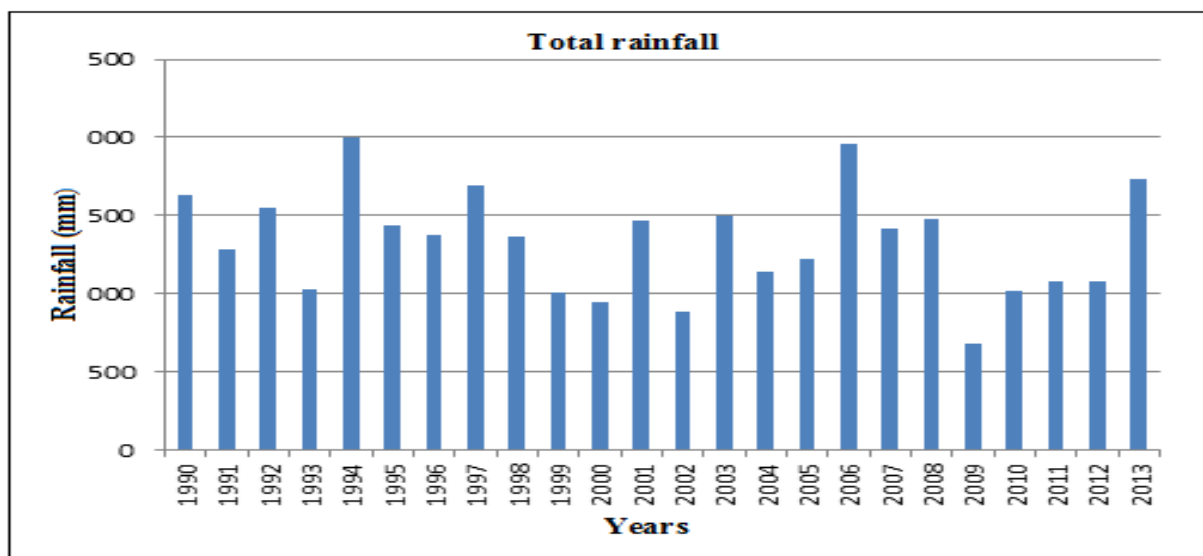


Fig. 2. Annual rainfalls from 1990 to 2013.

The higher annual mean humidity was recorded 550 1982, while lower humidity 450 was recorded in 2001 and 2002 respectively (Figs 2&3).

WEAP shows that water demand for agriculture is 2,100.00 and for Islamabad city is 1,440.00 sum of water demand was 3,540.00. The demand site coverage in agriculture and big city was 68% and 65% recorded in August respectively (Figs 4&5).

In big city the water demand was 640 and 650 million cubic meter in 2014 and 2015, while lower water demand was 600 million cubic meter recorded in 2000 respectively.

In agriculture the water demand was 350 million cubic meter recorded in 2000, while in 2015 the water demand 345 million cubic meter respectively (Fig.6).

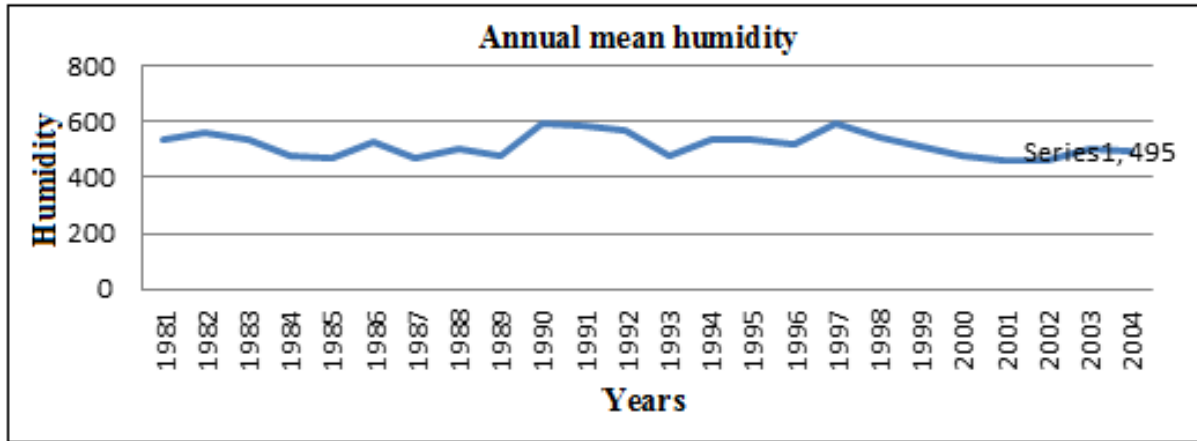


Fig. 3. Line graph total humidity from 1981 to 2004.

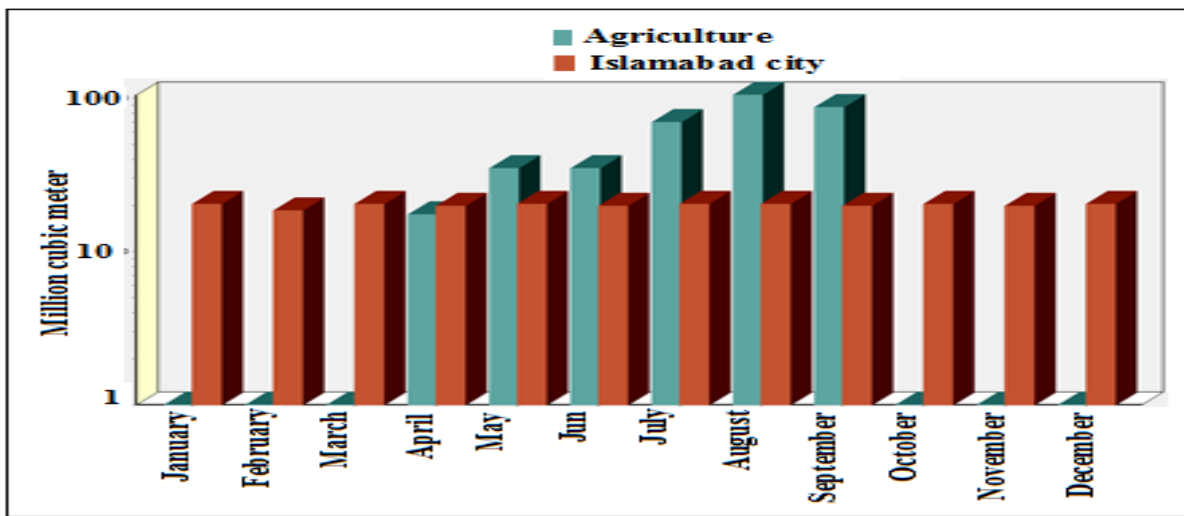


Fig. 4. Graph of water demand monthly.

In big city, the higher water demand was 75 million cubic meter in 2015, while lower water demand was 60 million cubic meter recorded in 2000 respectively. In agriculture the higher water demand was 45

million cubic meter in 2000, while lower water demand was 40 million cubic meter in 2015 respectively (Fig. 7).

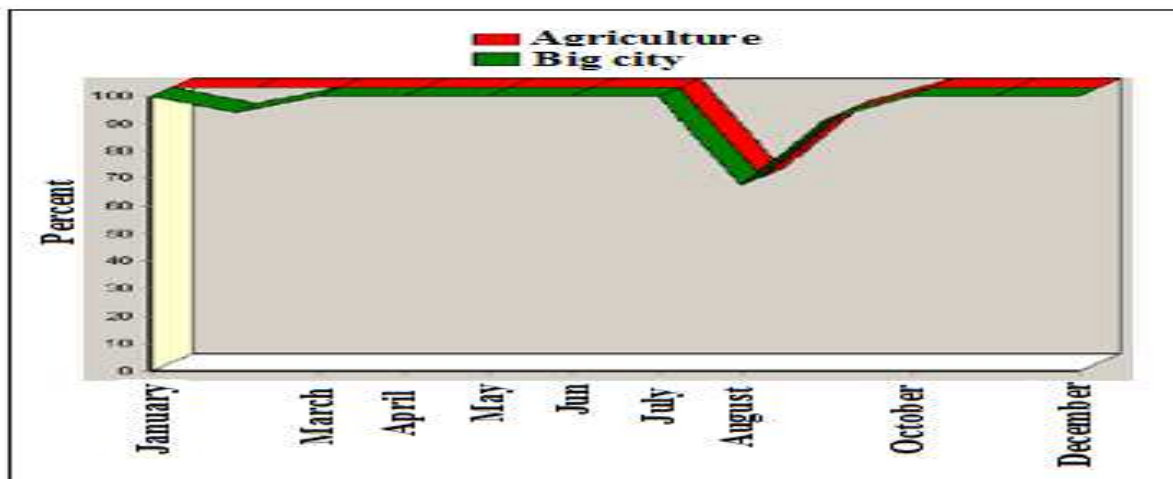


Fig. 5. Graph of demand site coverage.

Discussion

In the present study, the higher rain fall 2000 mm was recorded in 1994 and 2006, while lower 700 mm was recorded in 2009, respectively. The higher annual mean humidity was recorded 550 1982, while lower humidity 450 was recorded in 2001 and 2002

respectively. WEAP shows that water demand for agriculture is 2,100.00 and for Islamabad city is 1,440.00 sum of water demand was 3,540.00. The demand site coverage in agriculture and big city was 68% and 65% recorded in August respectively.

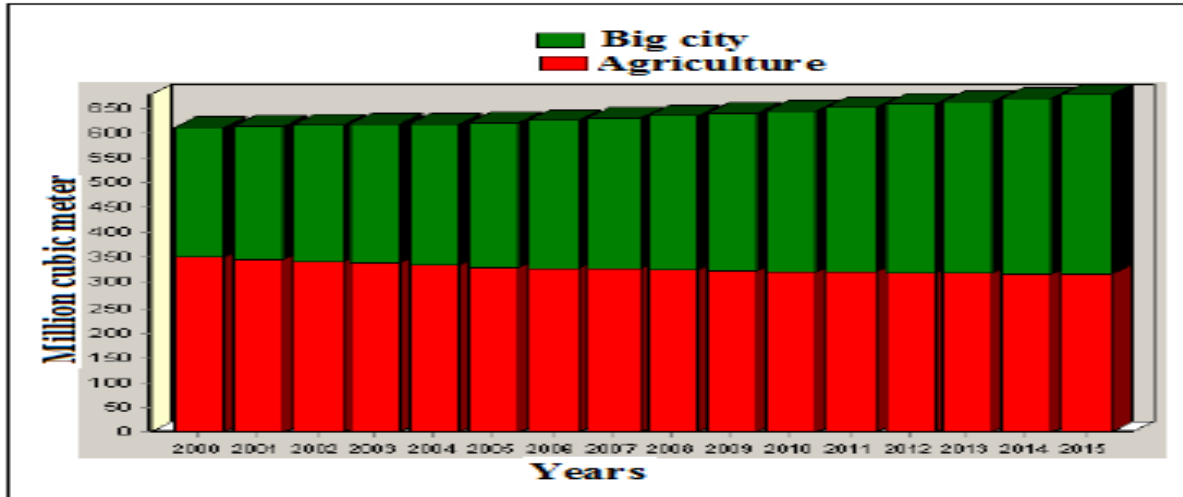


Fig. 6. Water demand in all branches.

A study was conducted by Arias *et al* 2014 and reported that the investigation of climate alteration impact on water incomes has been focused on expecting the potential properties that variations in rainfall, temperature and CO₂ absorption will reason

on stream flow. For this purpose, two simulation sets were performed. The first evaluates the effect reason in stream flow by variations in each of the variables like rainfall, temperature and CO₂ concentration.

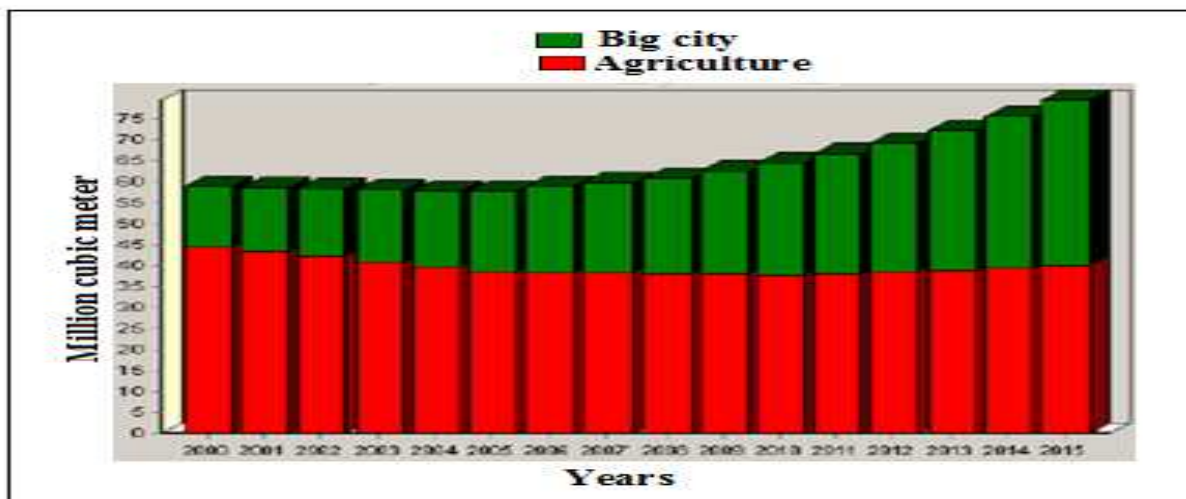


Fig. 7. Unmet demand in all demand site.

Climate alteration is easier to perceive on worldwide to local scales. Monitoring systems for perceiving alteration are especially appreciated when they are local or include local systems that are combined to

allow local assessment. Also required for planning and operative assessment is a comprehensive set of limitations that describe current and future climate situations by the Cohn and Lins, 2005. Pakistan is

fronting aquatic supply and demand difficulties due to demographic densification development and due to agricultural and industrial procedure. Aquatic demand and supplies is growing day by day than the aquatic supply. Another cause behind aquatic scarcity is periodic difference in rainfall. Therefore, the present aquatic connected issues can be explained by correct supervisions of water incomes. The country is facing like floods and drought circumstances due to stay in the building of water reservoir and immoral results. The country has old water administration plans which have been unsuccessful to resolve aquatic scarcity issues. Therefore, there is need to build large reservoir on emergency basis to achieve this periodic changeability in rainfall.

Conclusion

Analysis of total annual water rainfall is showing that annual rainfall in the study area is increasing. There are significant changes in between different nodes point along Soan river because of irregular and variable flow conditions. Water evaluation and planning model indicated that total water demand for agriculture and Islamabad city was 2100.00 and 1440.00 million cubic meter, respectively. WEAP revealed that water demand for agriculture is increasing with the passage of time.

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