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Groundwater-Climatic changes Nexus and Food Security Challenges in Indus Basin of Pakistan

Short Communication

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Extended abstract

Food, fiber and shelter are the basic human needs for their existence on the planet, while land, water and air are the essential natural resources to support the life. Pakistan is the 8th largest food producing country and ranks 5th in list of countries by population. Current population of Pakistan is 220 million with annual increasing rate of about 2% (Hassan et al., 2019; Qureshi, 2015). To feed this tremendously increasing population we need to grow more food for which both horizontal and vertical expansion of irrigated agriculture is imperative for Pakistan. An increase of 50% in food, 40% in energy and 30% in water is needed to by 2030 to feed the growing population and support the required economic development in both developed and developing countries (Yang et al., 2016). Agriculture in Indus River Basin (IRB) in Pakistan mainly depends on irrigation where 90% of food grains and almost 100% of cash crops (mainly fruits, vegetables, sugarcane, cotton and rice) are produced from irrigated lands (Ringler & Anwar, 2013). Even then, about forty seven percent of the population of Pakistan is food insecure as well as the access to food is uneven and malnutrition is widespread in the country (Hassan et al., 2017; Kirby et al., 2017). We -need to study the water-food-energy nexus and devise the new ways and means to meet the future challenges. (Yang et al., 2016). River Indus- 2900 km long- is the lifeline for economy of the country as its – along with five tributaries- supports livelihood and food security by providing about 171 km3 of water annually for irrigated agriculture in the basin (Ringler & Anwar, 2013). Schematic diagram of Indus Basin Irrigation System is shown in Figure 1.

Many studies have indicated that over 1 billion people in developing countries lack access to safe drinking water (Vojinovic & Abbott, 2017). Climate threats like droughts, floods, global warming, sea water intrusion, glacier melting, over depletion of aquifer are the greatest challenges being faced by the mankind on the planet, and we need to fight against these threats for our survival (Yang et al., 2014; Zakir-Hassan et al., 2021).

Precision agriculture is an approach to farm management that uses information technology to ensure that crops and soil receive exactly what they need for optimum health and productivity. Under the current situation of food-land-water-climate nexus, precision agriculture can play a vital role in getting more food per drop and per unit of land. Information communication technologies (ICTs) and tools like Internet of things (IoTs) can bring a revolution in food production (Khan et al., 2021). Use of water in agriculture can be optimized making use of climate smart hydro-informatics and other tools like robotics/drones/sensors/loggers to boost up the food production (See et al., 2007). Groundwater has been identified as one of the major drivers for bringing green-revolution through irrigated agriculture. But groundwater resources are under sever threat due to unplanned excessive pumping, complexity in defining rights and entitlements, capacity and awareness issues, and lack of implementation of effective and holistic regulation. One depleted well is shown is shown in Figure 2.

Water availability – including groundwater- is under stress due to excessive consumption, contamination of aquifers, inadequate waste management, lack of proper water distribution technologies, intensive farming etc. (Vojinovic & Abbott, 2017). Recently, government has promulgated the National Water Policy 2018, Punjab Water Policy 2018 and Punjab Water Act 2019 where due importance has been accorded to the groundwater development, protection and management. Depleting freshwater resources, growing population, emerging health concerns, environmental degradation, and climate change are the major threats for precision agriculture to support the food-security and livelihood in the IRB. Therefore, it is imperative to make use of hydro-informatics, information communication technologies (ICTs), the use of latest mobile applications, robotics, sensors, loggers to optimize the food production using climate and energy smart technologies.

Keywords: Food-Security; Irrigated-Agriculture; Groundwater; Punjab; Pakistan

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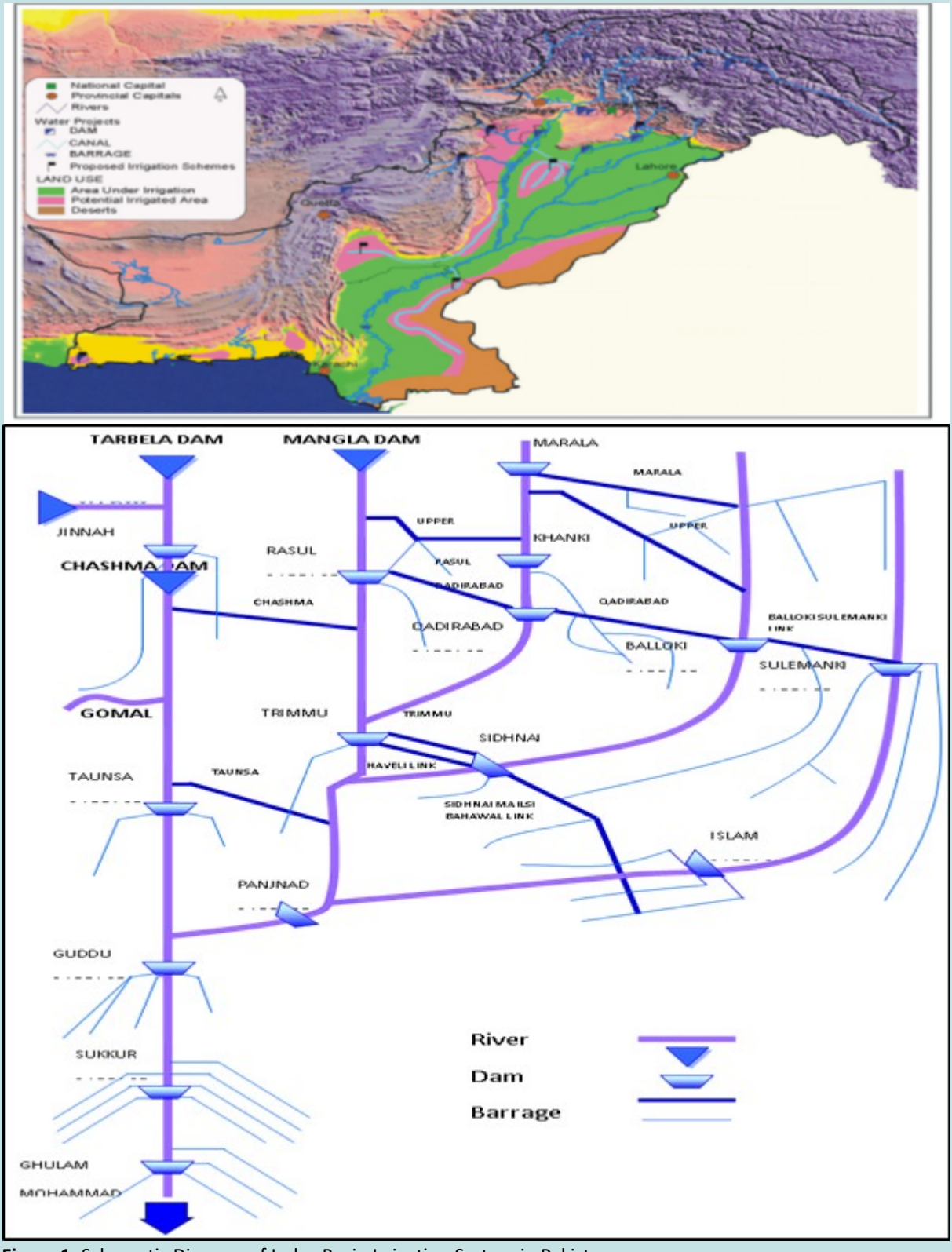

Figure 1: Schematic Diagram of Indus Basin Irrigation System in Pakistan

Figure 2: A case of deleted will in South Punjab area of Indus Basin in Pakistan (cost of groundwater extraction has increased 130% due to gradually falling groundwater levels)

References:

1. Hassan, G. Z., Hassan, F. R., & Shabbir, G. (2019). Impact of climate change on groundwater use for sustainable agriculture and food production in Indus Basin of Pakistan Paper presented at the 1st International Conference on Sustainable Agriculture: Food Security under Changing Climate Scenarios: April, 3-5, 2019, Ghazi University, Dera Ghazi Khan, Punjab, Pakistan.
2. Hassan, G. Z., Hassan, F. R., & Shabir, G. (2017). Food security challenges under climatic changes and groundwater-energy nexus- case study of Punjab-Pakistan: 23rd International Congress on Irrigation and Drainage-ICID, 8-14 October 2017, Mexico City, Mexico.
3. Khan, M. R., Nabeel, E., Amin, M., Punthakey, J. F., Mitchell, M., Allan, C., & Hassan, G. Z. (2021). Improving groundwater management to enhance agriculture and farming livelihoods: Integrating web and mobile based applications for groundwater management: Report No 162, Institute for Land, Water and Society, Charles Sturt University, Albury, NSW 2640, Australia. Retrieved from https://cdn.csu.edu.au/__data/assets/pdf_file/0003/3930186/ILWS-Report-162-Integrating-web-and-mobile-based-applications-for-groundwater-management.pdf
4. Kirby, M., Ahmad, M.-u.-D., Mainuddin, M., Khaliq, T., & Cheema, M. J. M. (2017). Agricultural production, water use and food availability in Pakistan: Historical trends, and projections to 2050. Agricultural Water Management, 179, 34-46. doi:10.1016/j.agwat.2016.06.001
5. Qureshi, A. S. (2015). Improving food security and livelihood resilience through groundwater management in Pakistan. Global Advanced Research Journal of Agricultural Science, Vol. 4(10) pp. 687-710, . doi:http://garj.org/garjas/home
6. Ringler, C., & Anwar, A. (2013). Water for food security: challenges for Pakistan. Water International, 38(5), 505-514. doi:10.1080/02508060.2013.832122
7. See, L., Solomatine, D., Abrahart, R., & Toth, E. (2007). Hydroinformatics: computational intelligence and technological developments in water science applications—Editorial. Hydrological Sciences Journal, 52(3). doi:10.1623/hysj.52.3.391
8. Vojinovic, Z., & Abbott, M. B. (2017). Twenty-Five Years of Hydroinformatics. Water, 9(59). doi:10.3390/w9010059
9. Yang, Y.-C. E., Brown, C., Yu, W., Wescoat, J., & Ringler, C. (2014). Water governance and adaptation to climate change in the Indus River Basin. Journal of Hydrology, 519, 2527-2537. doi:10.1016/j.jhydrol.2014.08.055
10. Yang, Y. C. E., Ringler, C., Brown, C., & Mondal, M. A. H. (2016). Modeling the Agricultural Water–Energy–Food Nexus in the Indus River Basin, Pakistan. Journal of Water Resources Planning and Management, 142(12). doi:10.1061/(asce)wr.1943-5452.0000710
11. Zakir-Hassan, G., Hassan, F. R., Shabir, G., & Rafique, H. (2021). Impact of Floods on Groundwater—A Case Study of Chaj Doab in Indus Basin of Pakistan. International Journal of Food Science and Agriculture, 5(4), 639-653. doi:10.26855/ijfsa.2021.12.011

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