Chapter 11
Artificial Recharge to the Groundwater Resources Using Rainfall Water Collection:
A Case Study of Kabul, Afghanistan

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ABSTRACT

Afghanistan has a very dry climate with most of the land area suffering from the adverse effects of hydroclimatic extremes. The vast amounts of snow and ice in mountain regions might have greater economic, environmental, and community implications due to such extreme hydrometeorological events. Overflow due to snowmelt from mountain regions is also of great significance for continued water supply. The presence of snow in any basin strongly affects the moisture that is deposited at the surface and is accessible for future runoff. The groundwater research presented here is used to quantify artificial recharge due to rainfall water that is falling from the rooftop of the Faculty of Geoscience building, Kabul University, Af+ghanistan. The main objective of this research is to study the effects of rainfall on groundwater fluctuations, as per collected data from the study site, especially in the spring and rainy seasons (January to April). In addition, we have studied harvesting methods, borehole lithography, and the tectonic setting of the Kabul basin to supplement our research objectives.

INTRODUCTION

Historically, Afghanistan is a country that is known to have a very dry climate. Although people have adapted to the timing and quantity of water arising from mountain snow and glacier melting for prediction of water resources with 3nagement. One of the diverse impacts of climate change is on the spatio-

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temporal distribution of hydrological systems throughout the country, Due to rugged terrain, most of the country depends on water from mountain snow and ice in the mountain lakes and hence adapts to the timing and quantity of water from such freshwater resources. Thus, the estimation, simulation, and prediction of the spatiotemporal variability of freshwater resources are of great importance to water resources management and forecasting (Rasouli, H., et al., 2015).

Due to a large regional dependence on water from lakes of snow and ice from the mountain regions on the hydrological systems, the impact of climate change has far-reaching impacts on the local economy, environment, and community (Hamdard M. H., 2022). Snow is a critical vital water resource for the region, but due to varied precipitations, it is released gradually in the form of meltwater over a longer time period which provides steady streams throughout dry periods to achieve the necessary water supply. In addition to a water shortage, extreme hydroclimatic and associated hydrogeological events can also cause overflow due to excess ice and snow melting from mountain regions causing flash floods in the region. The presence of snow in water basins strongly affects the moisture that is deposited at the surface and is accessible for future runoff (Rasouli, H., 2022a, Belhassan, K., 2020b). The hydrology of mountain regions is largely dependent on the climate conditions of the regions, as mountains usually receive large amounts of precipitation, which may be stored in the form of snow (Rasouli, H., 2022b). Mountains also represent unique areas for the detection of climate change and the assessment of climate-related impacts. Climate change contributes to the increased variability of river runoff due to changes in the timing and intensity of precipitation and snow melting (Rasouli H., et al., 2021c, Rasouli, H.et al., 2021a).

The key waterways drain during the snow melting times (from January to May), rainy periods (March to April), and occasionally through quick overflowing times (May to August), the main elevations of snow cover are Parwan Maintains series, Wardak, Loger, Baba, Spingher, Salang, Kohkurugh, Koha Safi, Hindu Kush Mountains ranges in Afghanistan (, Belhassan, K., 2011), as well as here is certain cold provinces for example; Bamyan, Wardak, Loger, Badakhshan, Pangesher, Parwan, some parts of Kabul, snow covers these areas from September to November and its storing is used for water in Afghanistan (Rasouli, H. and Safi, A. G., 2021a, Belhassan, K., 2020a). Similarly, on the north side of Afghanistan, there are specific glaciers; Pamir Badakhshan, Mymai Badakhshan, and Panjsher Mountains range which are part of the Hindu Kush mountains series in Afghanistan. These are the main sources for Panjsher, Helmand, and Koner Rivers (Shamal S., Rasouli H., 2018, Rasouli H., 2020c). In particular provinces, we use rivers as a mean for irrigation and water supply (Drinking water), such as; Bamyan, Panjsher, Wardak, Parwan, Helmand and Kandahar, Kapesa, but in some of these provinces for instance; Wardak, Parwan, Panjsher spending from spring, and in several provinces for drinking and irrigation benefit from Kariz water, and some other provinces benefit from wells (Rasouli H., 2021b., Belhassan, K., 2020b). Currently 4.14 million people are living in Kabul City, the increase in the population in Kabul leads to unplanned houses, water shortage, and environmental and other social-economic problems. Recently, the rapid population growth and climate change impacts have placed new stresses on environmental pollution, especially air pollution and water resource depletion. Over the period of 1960 to 2008, the mean annual temperature high of Afghanistan increased by 0.6°C with an average increase of 0.13°C per decade; and the mean annual precipitation decreased at an average rate of 0.5mm per month with an average decrease of 2% per decade (Arian, H. et al., 2015., Rasouli H., 2019).

From a geological standpoint, the number of sediments in Kabul Basins arises because of climate change, as different types of sediments are transported from Paghman, Aliabad, Asmayie, Qorugh, and Logger mountains, and such sediments get stacked year after year. These sediments are carried from surrounding mountains by water at diverse periods of time and are made of different thicknesses. In the