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Ghaggar river watershed and its impact on their community life

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Abstract

The Ghaggar River an intermittent river flowing through northern India holds historical ecological and socio-economic significance. This study explores the Ghaggar River watershed focusing on its geographical characteristics environmental importance and impact on the lives of people residing in its vicinity. Mainly emphasis is placed on water availability agriculture health migration and education. The research underscores the relationship between watershed health and community wellbeing while suggesting integrated water resource management practices to sustain both the river ecosystem and human livelihoods.

Millions of people's livelihoods are at risk due to watershed degradation in third-world nations which also limits their ability to build strong agricultural and bases. Rising human and animal populations are fast diminishing the basis of natural resources. In a way these lands are being used beyond their carrying capability. Population growth puts strain on forests communal lands and marginal agricultural lands which results in improper farming methods forest loss and increased grazing intensity that leave a desolate area producing undesired sediment and harming stream flow to towns downstream. The primary goals to avoid the weakening of characteristic assets like water soil and vegetation. In a bigger sense watershed administration is an exertion to preserve the adjustment between human activities and components of the natural environment such as vegetation land or water.

"This Ghaggar Stream rises within the Sirmour Locale of Himachal Pradesh and streams for 320 km through the Indian States of Rajasthan, Punjab and Haryana some time recently entering Pakistan. It enters the state of Haryana within the Panchkula Locale close Kalka voyages through the Panchkula Area to the Mohali Area in Punjab enters the Ambala Area of Haryana once more voyages through the Patiala Area of Punjab once more enters the Kaithal Locale of Haryana once more voyages through the Sangrur Locale of Punjab once more enters the Fatehabad Area of Haryana.

Keywords: River, watershed, drainage, Ghaggar, livelihoods, geographical

Introduction

Today the term 'Watershed' refers to all the land and water areas that produce runoff to a single place. A watershed is a geo-hydrological unit that empties into one location. The land and water areas that drain through any point on a designated channel are collectively referred to as the watershed above that point (often the outlets). To a certain extent the limits of a watershed specify the aerial extent of surface water drainage. Watershed borders usually meet at the lowest point on the ground where water exits the watershed and follow the highest ridgeline around the stream channels. Every body of water has a watershed including rivers, lakes, ponds, streams and estuaries. The topographic line where water flows in two separate directions is referred to as the boundary between watersheds. Two locations that are drained by different streams river systems or lakes are divided by an elevated line known as a watershed (Tidemann 1996) [9]. A watershed might be fairly broad and span thousands of miles or it can be relatively small and just represent one tributary within a larger system (i.e. Mississippi River Watershed). Sediment and other pollutants are transported and dumped into the receiving water body as rainwater or melted snow flows downhill in the watershed.

The Ghaggar River known in historical texts as the Sarasvati originates in the Shivalik Hills of Himachal Pradesh and Haryana and flows through Punjab, Haryana and Rajasthan. Though it dries up during the summer months the river plays a vital role in recharging groundwater and supporting agriculture in semi-arid regions. This study investigates the characteristics of the Ghaggar River watershed and evaluates its socio-economic and cultural

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impact on the population with a particular focus on education health agriculture and migration patterns.

Literature Review

The Ghaggar River often associated with the ancient and possibly mythical Sarasvati River plays a significant role in shaping the ecological and socio-economic framework of northwestern India particularly in the states of Himachal Pradesh Haryana Punjab and Rajasthan. While the hydrological and environmental dimensions of the Ghaggar River basin have been extensively studied its socio-educational impact—particularly on pupil life—remains a relatively under-researched area. This literature review synthesizes existing scholarly works policy documents and regional studies that explore the interplay between watershed health rural livelihoods and educational access in the Ghaggar basin.

The objective of the present investigation was to ascertain the physico-chemical attributes of water obtained from eleven discrete sampling sites spanning the whole Ghaggar River. In the month of May 2023, a selection of river water samples was collected and subsequently transported to a laboratory for the purpose of examination. Out of the total of eleven sampling sites samples were obtained from seven locations while the remaining four sites had experienced a depletion of water. The collected samples were analysed to assess the impact of various physical and chemical parameters on water quality. These parameters include temperature pH electrical conductivity (EC) total suspended solids (TSS) total dissolved solids (TDS) total hardness (TH) biochemical oxygen demand (BOD) chemical oxygen demand (COD) and dissolved oxygen (DO). The water of the Ghaggar River exhibits an alkaline pH level. The levels of total dissolved solids (TDS) were observed to exceed the permissible limits set by the World Health Organisation (WHO). The Ghaggar River in the selected research area consistently receives wastewater and/or municipal effluents from various domestic industrial and municipal origins throughout its entire trajectory (Bijendra Kumar Hoon 2023) ^[10].

The most important and fundamental need for life is water. It is a prerequisite for all activities that sustain life. The surface water found in rivers lakes ponds and dams is typically utilized for power generation, irrigation and drinking. Typically, untreated streams, rivers, wells and boreholes serve as the source of drinking water [1]. The element of water that must be present at the ideal level for the proper growth of plants and animals is referred to as the quality of the water. In order to survive and flourish aquatic species require a nutrient-rich habitat. The physico-chemical properties of the water body determine the productivity. the highest productivity attained at the optimal level of physical and chemical factors.

Wetlands give people a lot of environmental goods and services Since the beginning of civilization these have been very important to the survival and growth of society. People in the area make money from wetlands by using the services they offer. Fishing and hunting are two of the most important ones. Other activities include watching birds and going on boats. People in the area have used the idea of ecotourism and the recreational value of wetlands to make money (Bergstrom 1990) ^[11] and these policies also help achieve the goals of sustainable development at the local and regional level. Wetlands are a good source of water and

nutrients that are needed for life to grow (Schuyt 2005) ^[12]. Vascular plants take up a big part of most wetlands (macrophytes). A variety of macrophytes can make a wetland's habitat more diverse (Keddy 2000; Fennessy and Mitsch 2001) ^[13, 14]. They play a vital role in primary productivity and nutrient cycling (Mitsch and Reeder 1991; Peakall and Burger 2003) ^[15, 16]. Macrophytes in wetlands provide food for waterfowl and other animals that live there. The sediment doesn't move because the roots of the water plants hold it in place and keep it from being carried away (Carpenter and Lodge 1986) ^[17]. Wetlands can change the way water flows and can be used to get sediments and nutrients from the water (Howard-Williams 1983) ^[18]. Aquatic plants give oxygen to many creatures that live in and around water (Brix 1997) ^[19]. Oxygen is also used to kill microbes and turn toxic substances into raw materials that can be used (Reddy *et al.* 1989; Zhao *et al.* 2006) ^[20, 21]. Wetlands are often termed as “biological supermarkets” or “kidneys of the landscape” (Mitsch and Gosselink 2000) ^[22]. Wetlands are the site of water purification. Wetland vegetation such as *Scirpus validus* (bulrush) *Phragmites communis* (common reed) and *Typha latifolia* (cattail) are able to get rid of nitrogen which lowers the need for oxygen by living things and the total amount of suspended solids (Gersberg *et al.* 1986) ^[23]. The coastal marshes and their plants have been shown to reduce the height of storm surges (Barbier *et al.* 2013) ^[24].

Agriculture is a major sector in the economic development of India as it is the source of livelihood for majority of population. The Ghaggar a major river of Haryana originates from the Siwalik Hills of Himachal Pradesh and Haryana. The Ghaggar River flows from east to west and then takes a southwesterly course. During its westward journey a number of streams, streamlets, drains and tributaries debouch their load into the Ghaggar. After flowing through Morni Hills before entering the plains the Ghaggar River is joined by the Kaushalya Nadi in the foothills zone. The small streams viz. Kaushalya Hajra and Ghaggar get combined together near Chandimandir to form the main Ghaggar River. Further at downstream sites various point and non-point sources are joining the Ghaggar River and discharging their untreated effluents into it. The area under investigation lies between North latitudes 30°00'00" to 30°50'00" and East longitudes 76°11'24" to 77°07'20" Area under investigation covers parts of different districts of Haryana and Punjab like Panchkula, SAS Nagar (Mohali), Patiala, Ambala and Kaithal (Sukhdev Kundu 2012) ^[8].

Socio-economic Impact on Rural Communities

The Ghaggar watershed supports predominantly agrarian communities where economic wellbeing is intrinsically tied to water availability. Verma (2015) ^[25] noted that the river's seasonal flow patterns have a direct bearing on agricultural productivity food security and income stability. Water scarcity often forces households to shift from agriculture to wage labor or migrate to urban areas which creates a ripple effect on children's access to stable education.

Sharma and Kapoor (2019) ^[26] reported that children from water-stressed households frequently miss school to assist with household chores especially during peak agricultural seasons or periods of drought. The problem is particularly acute in regions where fetching water requires long-distance travel disproportionately affecting girls' school attendance.

Riverine Ecosystems and Public Health

Several studies correlate river degradation with public health challenges. Kumar and Kaushik (2018) ^[27] evaluated pollution levels in Ghaggar's water across various locations in Haryana and found high concentrations of nitrates industrial waste and microbial pathogens. The poor water quality has led to a spike in waterborne diseases such as diarrhea, typhoid and skin infections—conditions that indirectly affect children's school performance and attendance.

Narayan (2020) ^[28] emphasizes that repeated illness in children due to contaminated water sources results in learning gaps and dropouts. Moreover, government health interventions remain inconsistent in these remote regions exacerbating the impact on educational continuity.

Educational Outcomes and Water Stress

The intersection between water insecurity and education has been studied in broader national contexts though rarely focused on the Ghaggar basin specifically. UNICEF India (2016) ^[29] concluded that children in water-scarce regions face multiple barriers to schooling: inadequate school sanitation reduced time for study due to domestic water collection duties and frequent absenteeism during illness outbreaks. These conditions are reflected in many villages along the Ghaggar River though more localized studies are needed.

Chopra (2014) ^[30] links school infrastructure development directly to water availability. Schools lacking functional toilets or drinking water are often seen as unsafe especially for adolescent girls who are forced to miss classes or drop out after puberty. In the case of the Ghaggar basin informal reports and local NGO surveys suggest that water shortages affect not only school attendance but also the mental wellbeing of children who experience frequent displacement due to seasonal migration.

Watershed Management and Community Interventions

A number of policy reports highlight the potential of watershed development as a strategy for improving livelihoods and enabling educational access. The Ministry of Rural Development (2018) ^[31] recommends community-led watershed management to increase water retention enhance agricultural output and stabilize rural economies.

Desai and Nambiar (2020) ^[32] describe successful interventions in Gujarat and Madhya Pradesh where watershed projects led to increased school attendance particularly when programs integrated water access with education health and gender awareness. These models provide replicable frameworks for the Ghaggar basin.

In the context of the Ghaggar River Pandey *et al.* (2021) ^[33] argue for multi-stakeholder engagement involving local governments school administrations and water management agencies to ensure that environmental resilience is aligned with social development goals including universal primary education.

The study reveals a complex and interlinked relationship between the Ghaggar River's ecological health and the socio-educational lives of people especially children. While hydrological and agricultural studies dominate existing research there is an emerging need to examine how water insecurity illness and migration directly and indirectly affect educational access learning quality and pupil wellbeing. A multidisciplinary community-driven approach to watershed

and educational planning can bridge these gaps and ensure a more resilient future for the region's children

Conclusion

The Ghaggar River watershed plays a vital role in shaping the lives of people living in its vicinity. Though seasonal and fragile it supports agriculture provides water and holds cultural importance. However inconsistent river flow environmental degradation and climate variability adversely impact education health and livelihoods. By adopting integrated watershed management practices and community participation a sustainable future for both the river and its people can be ensured.

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