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A case for building climate change resilience and adaptation through community-based conservation of water bodies

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Abstract

Continued global warming has resulted in climate change-induced extreme weather events such as heat waves, wildfires and heavy rainfall occurring worldwide. The most effective long-term solution to mitigate the impacts of climate change is to reduce carbon emissions by phasing out fossil fuel usage and activities that contribute to carbon emissions. In the short term, it is crucial to adapt to and enhance resilience to climate change-induced extreme weather events. As the climate continues to change, there is a growing need for proactive adaptation processes. Numerous proactive measures and reactive strategies have been proposed to mitigate the impacts of such extreme weather conditions. One notable measure focuses on conserving and rejuvenating water bodies to bolster climate change adaptation and resilience. This paper takes Sahibi river as a case study to illustrate the potential for building climate change resilience and adaptation within communities. In addition to discussing the river's historical context, its present state, its significance to communities, the prevailing threats, and the impact on life post cessation of the river's flow, this paper underscores the crucial role of citizens and community engagement in the conservation and rejuvenation of the river. Such engagement represents humankind's best hope for addressing this climate crisis.

Keywords: climate change, extreme weather events, heat waves, wildfires, heavy rainfall, water bodies rejuvenation, collective community participation, robust citizen engagement

Introduction

Climate change impacts are increasingly evident worldwide. Wildfires in Canada, Greece, Hawaii, Spain, and Portugal have ravaged millions of hectares of land. Meanwhile, torrential downpours in Greece, Libya, and closer to home in Northern India—particularly in Himachal Pradesh and Uttarakhand—have led to extensive floods, causing significant devastation. These intense rainfall events have not only triggered landslides but have also washed away roads and bridges, disrupted water schemes, severed communication networks, and submerged cities, towns and farmlands. These disastrous occurrences are a direct result of extreme weather events induced by climate change and irresponsible land use practices that neglect ecological safeguards. Additionally, climate change acts as a crisis multiplier, heightening the risk of compounded extremes where multiple events happen simultaneously or in rapid succession, such as a landslide caused by a heavy rainfall after a wildfire or a heat wave. For years, the Intergovernmental Panel on Climate Change (IPCC) has been sounding the alarm, emphasising that the water cycle is intensifying and will continue to do so as the planet warms. Climate scientists caution that as humans further warm the planet, droughts and extreme rainfall events (as witnessed) will become more frequent and intense.

Climate change is intricately woven into global patterns of social inequality and injustice, existing at multiple levels—between affluent and impoverished nations, among the wealthy and the poor, between women and men, and across generations. The initial casualties of climate change impacts are the poorest, most vulnerable and marginalised communities that have contributed the least to the climate crisis. These disadvantaged groups, with minimal contributions to Greenhouse

Gas (GHG) emissions, bear the brunt of the consequences created by historical emitters who persist in expanding their use of fossil fuels. These marginalised communities not only face heightened exposure to the impacts of climate change but also exhibit greater susceptibility to the damages caused by these changes, coupled with diminished capacities to cope with and recover from such adversities. Consequently, climate change transcends being solely an environmental crisis—it is a social crisis deeply entangled with global patterns of social inequality and injustice.

With the ongoing changes in climate, marked by a rise in extreme weather events like heavy rainfall and wildfires, there is an escalating demand for proactive adaptation processes. Various measures, both proactive and reactive, have been suggested to alleviate the impacts of such extreme weather events. One key approach underscores the significance of optimising green and blue spaces—embracing forests, lakes, rivers, and the like—while minimising reliance on grey infrastructure, such as concrete and impermeable surfaces. The conservation and rejuvenation of degraded water bodies stand out as a pivotal measure that can contribute significantly to fostering climate change resilience and adaptation within communities.

While significant strides have been taken in advancing the science and policies to support the conservation and rejuvenation of water bodies, a specific challenge lies in engaging citizens who may lack an understanding of climate change and the vital role of water bodies, and in garnering their support. It is crucial to ensure that citizens are active participants in the decision-making process, necessitating transparency, access to information, and robust citizen engagement. This inclusive approach goes beyond merely enhancing resilience and adaptation to climate change impacts; it also addresses the core issues of social inequalities and injustices embedded in climate

change debates. By adopting such an approach, not only the exposure of the most vulnerable to the impacts of climate change is reduced but also their susceptibility to climate-related damages is diminished their susceptibility, while simultaneously bolstering their capacity to cope with and recover from these challenges.

Given this context, the current paper seeks to utilise a stakeholder-centric methodology, complemented by secondary data and palaeochannel mapping, to scrutinise the Sahibi river. The catchment of this river spans across three states—Rajasthan, Haryana and Delhi.

Methodology

The paper employed a literature review and a stakeholder-centric approach to glean insights into the historical context and the current state of the Sahibi river, understanding its significance to communities, the existing threats to the river, the repercussions on the way of life following the cessation of its flow, and the level of citizen involvement in its conservation and rejuvenation. The stakeholder-centric methodology entailed collecting primary data from communities that either influence or are affected by the Sahibi river or its associated wetland, Najafgarh jheel. A total of 16 stakeholders from villages near the Sahibi river and its wetland were interviewed as part of this process. This qualitative data was further complemented by palaeochannel mapping, a recent initiative that involved contributions from concerned citizens. The mapping process included the analysis of satellite images, toposheets and administrative maps using geographic information system (GIS) software to identify the original path of the river.

Results and Discussion

1.1. Sahibi river's historical context and current state

The Sahibi river, also known as Sabi, is an ephemeral river that springs to life during the rainy season, historically causing substantial floods. The catchment area of the Sahibi river basin can be categorised into two main segments. Firstly, the upper Sahibi river basin, primarily situated in the northeastern regions of Rajasthan and extending into the southern districts of Haryana. Secondly, the lower Sahibi basin, predominantly located in the Jhajjar district of Haryana and the rural southwest territory of Delhi.

Interviews conducted with villagers residing near both the present and palaeochannels of the Sahibi in Rajasthan and Haryana have provided valuable insights into the river's past characteristics. During its prime, the Sahibi maintained a consistent flow for a majority of the year, experiencing dry spells only in the summer months. Renowned for its dynamic course changes, the river reached depths of up to 10 feet, with flood events causing it to surpass this measure. The river's width ranged from 400 m to almost 3 km during periods of high water flow. The monsoon season transformed many of the villages near the river, typically situated on elevated terrain, into islands. Some villages, such as Kotkasim, had protective embankments to mitigate the risk of flooding.

The recent execution of palaeochannel mapping has unveiled that the Sahibi river once spanned about 317 km, originating from the eastern slopes of the Saiwar hills in the Neem ka Thana district of Rajasthan. Various streams from the villages of Rajasthan, including Ada Nala, Buj Ganga, Sota, Surkhali, and Ban Ganga, would contribute to the river's flow. Due to its extensive journey through arid and sandy terrain, the Sahibi river exhibited significant strength primarily during the

rainy season. Historical records indicate notable floods in the years 1845, 1873, 1917, 1930, 1933, 1960, 1963, 1972, and 1977.

The riverbed becomes discernible in its upper stretch but fades from view thereafter. Notable sightings include its visibility under the road bridge between Sodawas and Karoda villages and beneath the Ajarka railway bridge near the Rajasthan–Haryana border. The old railway bridge, boasting 87 piers, serves as a testament to the river's former substantial width.

Flowing from Ajarka, the river continues its course towards Kotkasim, entering Rewari in Haryana near Akoli village where the Masani barrage was constructed on the river. From the Masani Barrage in Rewari, Haryana, the river's course becomes elusive until Dadari Toe village, where Outfall Drain No. 8 from Jhajjar enters Delhi near Dhansa. This drain supplies water to the Sahibi (also known as Najafgarh drain) in the Delhi region. Additionally, the Badshahpur and Dharampur drains from Gurugram, along with 126 major and minor drains in Delhi, discharge wastewater into the Sahibi before it merges with the Yamuna River downstream of the Wazirabad barrage.

The current and palaeochannels of the Sabi river host a series of crucial wetlands, each contributing to the ecosystem's richness. Notable among them are the Masani Barrage Wetland, Matanhail Forest, Chhuchhakwas–Godhari, Khaparwas Wildlife Sanctuary, Bhindawas Wildlife Sanctuary, Sarbashirpur, Sultanpur National Park, Basai Wetland, Najafgarh Jheel, and Najafgarh Drain Bird Sanctuary. These wetlands collectively serve as habitats for endangered and migratory birds, adding to their ecological significance.

Beyond their ecological importance, archaeological excavations have been carried out along the course of the Sahibi river, revealing a rich historical tapestry. Along its eastern banks, proto-historic (3000–600 BC) ceramics have been unearthed. Moving through time, excavations have uncovered Northern Black Polished Ware (700–200 BC) indicative of the early historic period. Subsequent findings include Kushana Red Ware (30–375 AD) and Rangmahal Pottery (late Kushana period to the 6th century AD), pointing towards settlements along the river's banks throughout various historical epochs (Margabandhu and Sharma 1978–1979).

1.2. Significance to communities

The insights gained from interviews with villagers underscore the profound significance of the Sahibi river to local communities. In the past, groundwater was easily accessible within 10 feet in villages situated along the banks of the Sahibi, fostering a thriving agriculture in the region. Farmers cultivated a diverse array of crops, including pearl millet (*bajra*), sorghum (*jowar*), cluster beans (*guar*), green gram (*moong*), and moth bean (*matki*) as kharif crops. During winters, wheat (*gehu*), mustard (*sarso*), chickpea (*channa*), and watermelon (*tarbhuj*) were cultivated. Winter crops, particularly benefited from the high soil moisture content near the river, eliminate the need for irrigation. Despite lower crop yields, the produce maintained high quality with organic fertilisers being used in cultivation.

The presence of Munja grass—locally known as Jhunda or Sarkanda—along the riverbanks played a crucial role in preventing soil erosion. This versatile grass served various purposes, from crafting traditional furniture and making ropes to creating trellis systems for climber plants and

roof thatching. The abundance of water supported lush vegetation with native trees like margosa (*neem*), sacred fig (*peepal*), banyan (*barghad*), gum arabic (*babool*), and prosopis cineraria (*khejri*) gracing the landscape. The river, teeming with small fish, not only contributed to ecological diversity but also provided a livelihood for the Kahar community (particularly in Kotkasim), traditionally known for their role as palanquin carriers.

1.3. Prevailing threats and impacts on way of life

The Sahibi river has experienced a consistent decline in its flow since 1978, with the last recorded flow noted in the mid-1990s. Multiple factors contribute to this dwindling, including mining activities in the Aravalli hills, loss of vegetation, reduced rainfall, and the obstruction of seasonal streams due to the construction of check dams, roads and other structures. The villagers have observed a gradual decrease in rainfall during the monsoon season over the years. This trend was supported by a 2021 study that analysed rainfall data from nine stations within the Sahibi basin in Rajasthan over a 57-year period (1961–2017). The study indicates a decreasing trend in both monsoon and post-monsoon rainfall, although not statistically significant (Chahal, Bhardwaj and Singh 2021).

The groundwater levels in areas adjacent to the Sahibi have drastically dropped, now ranging from 100 to 220 feet, with some places reaching levels close to the bedrock. Notably, villages like Nikhri near the Masani barrage in Haryana experience elevated groundwater levels. This is attributed to the discharge of surplus water from the Lal Bahadur Shastri recharge channel and the diversion of wastewater from nearby Sewage Treatment Plants (STPs) into the dry riverbed near the barrage.

The overall decline in groundwater levels has resulted in the desiccation of vegetation in the area, adversely affecting crop quality and diversity. This limitation has confined cultivation primarily to wheat and pearl millet, with crops like chickpea—traditionally grown in the wet soil adjacent to the river during winters—struggling due to decreased soil moisture content after the river's drying. In the Kairthal–Tijara district of Rajasthan, farmers have started growing cotton using groundwater over the past decade. This change is driven by the more lucrative nature of cotton cultivation, fetching a selling price ranging from Rs 7000–9000 per quintal as compared to Rs 2000 per quintal for pearl millet.

In areas where groundwater has significantly depleted, villagers have reported the presence of fluoride in the water, which has adverse effects on their health. Adding to these challenges is the diversion of untreated wastewater into the dry bed of the Sahibi from urban and industrial areas. For instance, Rewari city and the Dharuhera Industrial Area discharge untreated wastewater into the riverbed near the Masani barrage. Similarly, the Bawal Industrial Area directs wastewater into the dry bed near Ahir Baghola village, resulting in groundwater contamination and deaths of animals and birds.

Residents in villages such as Nikhri and Kharkhara, near the Masani barrage, have expressed concerns about groundwater contamination, citing the presence of froth observed in borewell waters. This highlights the pressing need for effective wastewater management and pollution control measures to safeguard both water resources and community well-being.

The desiccated riverbed has become a contested arena for conflicting interests, witnessing encroachment by agricultural lands, residences, and linear infrastructure. In Majri Khola, villagers have forsaken their houses constructed on elevated ground in line with traditional wisdom and have relocated to new dwellings on the riverbed. Conversely, in Kotkasim, houses and roads have surfaced on the previously flowing river, representing a misguided form of development.

This unwise development on the riverbed poses a significant threat to life and property, especially in the event of heavy rainfall that could potentially trigger floods in the river. It underscores the importance of thoughtful urban planning and land use policies to mitigate risks and ensures the safety of communities residing near these vulnerable areas.

1.4. Citizen involvement

In recent years, the memory of the Sahibi river has experienced a revival in Delhi. Notably, efforts to rejuvenate the Sahibi river's path in Delhi, also known as Najafgarh drain, gained momentum in government circles last year. The focus of this initiative was on restoring the 12 km Timarpur–Basai Darapur segment of the river. The ultimate goal is to extend the restoration efforts to cover the entire 57 km stretch of the river in Delhi, envisioning its transformation into a navigable waterway.

This renewed interest in the river's revitalisation can be attributed to the efforts of the Indian National Trust for Art and Cultural Heritage (INTACH) in their pursuit to protect and rejuvenate Najafgarh jheel through a petition filed in the National Green Tribunal (NGT). The petition shed

light on the Sahibi river's significance as the primary water source for the jheel, drawing attention to the interconnectedness of these water bodies.

A significant breakthrough in the potential revival of the Sahibi river has recently unfolded through a noteworthy initiative by the NGT. This development emerged in response to a petition filed by Prakash Yadav, a resident of Kharkhara village in Rewari district. In the petition, the plaintiff brought to the NGT's attention the release of untreated wastewater from multiple STPs in Rewari town and Dharuhera Industrial Area into the dry bed of the Sahibi near the Masani barrage.

In its judgment, the NGT emphasised the critical need for collaborative efforts among the three states—Rajasthan, Haryana and Delhi—to manage the river's catchment area and establish a minimum environmental flow. The overarching goal is to restore the river's ecology and support aquatic life. Additionally, a palaeochannel mapping exercise was concluded with contributions from concerned citizens, mapping the original course of the river.

Conclusion

The findings discussed above offer policymakers valuable insights to develop a strategy for river rejuvenation and management, with active community participation serving as a cornerstone for ensuring the long-term sustainability of the Sahibi river. Engaging and involving communities in preservation efforts is crucial as it transforms them into stakeholders in the river's well-being, fostering a sense of ownership and responsibility.

This collective participation establishes a more holistic and inclusive approach to river conservation, ultimately leading to more effective outcomes and lasting positive impacts. Recognising and incorporating the perspectives and contributions of local communities in the decision-making process is essential for the success of any river rejuvenation initiative, thereby ensuring that the strategy aligns with the needs and aspirations of those directly connected to the river's ecosystem.

People's movements of resistance around the world provide powerful inspiration. Examples like the Māori tribe's victory in granting legal rights to the Whanganui River in New Zealand, the Ecuadorian referendum to stop oil drilling in Yasuni National Park and the battle for the Niyamgiri hills in Odisha, India showcase the impact of community-led initiatives. These instances offer profound hope and demonstrate the significance of collective community participation in addressing environmental challenges. The successes achieved by these movements exemplify the transformative power of local action in shaping a more sustainable and just future. Incorporating a social equity and justice perspective through such collective efforts is therefore crucial in navigating and resolving the climate crisis.

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