Community-Based Participatory Assessment to Inform Pollution Mitigation and a Knowledge-Attitude-Practice (KAP) Framework at Brijghat (Garh Mukteshwar), Ganga River, India

Mahesh Singh[1]; Ganesh Datt Bhat[2]; Parveen Kumar Jain[3]; Lochan Vyas[4]; Sushma Singh[5]; Ngangkham James Singh[6]; Amit Kumar Maurya[7*]

College of Agriculture Sciences, Teerthanker Mahaveer University, NH-24, Delhi Road, Moradabad - 244001, Uttar Pradesh, India
*Corresponding Author

Received:- 12 December 2025/ Revised:- 19 December 2025/ Accepted:- 25 December 2025/ Published: 31-12-2025
Copyright @ 2025 International Journal of Environmental and Agriculture Research
This is an Open-Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (https://creativecommons.org/licenses/by-nc/4.0) which permits unrestricted Non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract— *The river ghats of the Ganga basin are vital socio-ecological zones where intense religious and livelihood activities intersect with fragile riverine ecosystems. At pilgrimage sites like Brijghat (Garh Mukteshwar, Uttar Pradesh), this leads to localized pollution hotspots that degrade both ecological and cultural values. This study presents a community-based participatory assessment conducted through systematic field engagement in September 2024. It combines environmental observation, stakeholder dialogue, and an awareness campaign to diagnose key pollution sources, infrastructure gaps, and community perceptions regarding river health. Findings reveal significant accumulation of plastic and ritual waste, inadequate waste segregation facilities, and moderate levels of ecological awareness among visitors, coupled with a strong underlying willingness to engage in conservation. Critically, this pilot work directly informed the design of a structured bilingual (Hindi-English) KAP survey instrument for future quantitative research. The study concludes that academic-led, participatory diagnostics are a crucial first step in bridging national policy (Namami Gange) and local action. They build trust, generate site-specific insights, and create tailored tools for measuring and promoting behavioral change, forming a scalable, low-cost model for sustainable ghat management.*

Keywords— Brijghat, River Ganga, Solid Waste Management, Participatory Assessment, Environmental Awareness, Namami Gange, KAP Framework.

I. INTRODUCTION

Rivers are the lifeline of India's ecological, cultural, and economic systems. The Ganga River basin alone supports nearly 40% of the country's population, providing water, sustaining agriculture, fisheries, and countless livelihoods (Alley, 2008; Kumar et al., 2019). However, rapid urbanization, increasing pilgrimage tourism, ritual practices, and inadequate waste management systems have severely strained the river's assimilative capacity, negatively impacting water quality, biodiversity, and human health (Nath et al., 2023; Mishra et al., 2021). River ghats, which serve as critical socio-ecological interfaces, have become focal points for pollution accumulation due to unmanaged solid waste, ritual residues, floral offerings, and direct wastewater discharge (Dayal, 2016; Simon & Joshi, 2022).

Brijghat, located at Garh Mukteshwar, Uttar Pradesh, is a major site for religious and recreational activities on the Ganga, attracting large numbers of devotees year-round, especially during festivals and auspicious occasions (Patel et al., 2023).

Activities such as ritual bathing, idol immersion, and religious gatherings, while central to community and spiritual identity, generate substantial non-biodegradable waste, organic matter, and nutrient loads, degrading water quality, sediment health, and the aesthetic value of the riverbank (Kumar et al., 2019; Singh et al., 2017).

The Government of India's flagship Namami Gange Programme recognizes the need for an integrated approach encompassing infrastructure, regulation, and public participation (Nath et al., 2023). Evaluations suggest that technological and regulatory measures alone are insufficient without complementary behavioral change, environmental literacy, and community ownership at the local level (Singh & Sharma, 2018). In this context, Knowledge-Attitude-Practice (KAP) studies are valuable for gauging awareness, identifying perception gaps, and assessing readiness to adopt pro-environmental behaviors (Bharti et al., 2024; Kesherwani et al., 2022). However, effective KAP surveys require contextual grounding.

This study posits that a community-based participatory assessment is a vital prerequisite for designing effective, context-sensitive interventions and research tools. We conducted an academic-led field engagement at Brijghat, combining diagnostic observation, stakeholder interaction, and awareness activities. The primary objectives were to: (1) conduct a situational analysis of pollution sources and infrastructure gaps; (2) explore community perceptions and behaviors through direct dialogue; and (3) utilize these insights to develop a pilot KAP survey instrument for future quantitative research. This approach aims to bridge the policy-practice gap for the Ganga, translating national mission goals into localized, actionable strategies.

II. MATERIALS AND METHODS

2.1 Study Area:

Brijghat is situated on the right bank of the Ganga River at Garh Mukteshwar, Uttar Pradesh. As a prominent religious, cultural, and tourist node, it experiences high visitor flux, particularly during peak seasons. The area suffers from inadequate waste management infrastructure, leading to the disposal of solid waste and garbage directly on the ghat steps and banks. This makes Brijghat a representative site for studying ghat-level pollution dynamics in the Ganga basin (Nath et al., 2023).

(A)

(B)

(C)

(D)

(E)

(F)

FIGURE 1 (A, B, C, D, E, F): Ganga Champions team at Brijghat, depicting garbage accumulation, polluted fountain area, overflowing dustbins, and damaged infrastructure at the ghat

2.2 Research Design:

A qualitative, participatory research design was employed, integrating descriptive and diagnostic approaches. Field interventions were conducted on 28th and 30th September 2024, comprising a diagnostic survey visit followed by a community awareness program. This design allowed for the triangulation of data from environmental observation, stakeholder perception, and participatory engagement, enhancing the reliability of findings (Simon & Joshi, 2022; Barsay, 2022).

2.3 Data Collection Procedures:

Data was collected through three complementary activities:

1. **Systematic Environmental Observation:** Researchers conducted a visual walk-through assessment using a standardized protocol. Observations focused on: a) types and locations of waste accumulation (e.g., steps, entry points, water edge); b) condition and adequacy of waste infrastructure (bins, collection points); c) functionality of water features and other public amenities; and d) general cleanliness. Photographic documentation was used to evidence key findings (Figure 1).
2. **Structured Stakeholder Interaction:** Informal, semi-structured dialogues were held with a purposive sample of stakeholders present at the ghat. This included pilgrims (n≈15), local vendors (n≈5), residents (n≈10), and casual visitors (n≈10). Conversations, conducted in Hindi, explored: a) perceptions of pollution causes and severity; b) attribution of responsibility for cleaning; c) awareness of ecological impacts of ritual waste/plastics; and d) willingness to participate in or support mitigation measures. Key responses and emergent themes were documented in field notes.
3. **On-site Awareness Programme:** An interactive awareness session was conducted with gathered stakeholders. It focused on the ecological impact of river pollution, the importance of waste segregation, alternatives to single-use plastics, and responsible ritual practices. The engagement level and queries from participants were noted as indicators of receptivity.

2.4 Development of a Pilot KAP Instrument:

Insights from the environmental observations and stakeholder dialogues were systematically analyzed to identify key knowledge gaps, prevailing attitudes, and common practices. This analysis directly informed the design of a pilot bilingual (Hindi-English) KAP questionnaire. The instrument includes sections on demographics, knowledge of pollution sources, attitudes towards responsibility and conservation, current disposal practices, and willingness to adopt specific mitigation behaviors.

2.5 Ethical Considerations:

All interactions were voluntary, based on verbal consent. No personal identifiers were recorded. The study adhered to ethical guidelines for community-based environmental research, prioritizing respect for participants and the site's cultural significance (Barsay, 2022).

III. RESULTS

3.1 Situational Analysis: Environmental and Infrastructure Gaps:

Field observations revealed severe solid waste management challenges at Brijghat.

- **Waste Accumulation:** Prominent waste streams included plastic packaging (polythene bags, food wrappers), ritualistic materials (flower offerings, cloth pieces), and general municipal solid waste. This waste was visibly accumulated on the ghat steps, along railings, and in corners of the platform (Figure 1A, 1B).
- **Infrastructure Deficits:** Existing waste bins were insufficient in number, often in poor condition (rusted, damaged), and placed irregularly. Most observed bins were overflowing, leading to littering in surrounding areas (Figure 1D). No bins for segregated waste (wet/dry/recyclable) were present.
- **Aesthetic and Functional Decline:** Decorative water fountains in the ghat complex were non-operational and filled with stagnant, polluted water, detracting from the site's aesthetic and spiritual ambiance (Figure 1C). General maintenance of stairs and walkways was suboptimal.

Figure 1. Field observations at Brijghat, Garh Mukteshwar: (A) Accumulation of mixed waste on ghat steps; (B) Close-up of plastic and ritual waste; (C) Non-functional and polluted fountain; (D) Overflowing and damaged waste bin; (E, F) The university team conducting the awareness program and stakeholder interactions.

3.2 Stakeholder Perceptions and Behavioral Insights:

Dialogues with approximately 40 stakeholders yielded the following thematic insights:

- **Knowledge & Awareness:** A strong spiritual and emotional connection to the Ganga ("Maa Ganga") was universally expressed. However, awareness of the specific ecological harm caused by plastics and non-biodegradable ritual items was low to moderate. Most recognized "dirt" as a problem but lacked understanding of chemical contamination, biodiversity loss, or long-term sustainability issues.

- **Attitudes & Responsibility:** Pollution was frequently framed as a failure of municipal services or government authorities ("Nagarpalika should clean more often"). While acknowledging some personal responsibility, the dominant attitude placed the onus on systemic solutions. Despite this, a strong underlying reverence for the river translated into high expressed concern for its well-being.
- **Practices & Willingness to Change:** Current disposal practices were largely convenience-based, influenced by the lack of proper bins. A significant majority of respondents expressed positive receptivity to the awareness session. Many supported the idea of segregated bins, expressed interest in eco-friendly alternatives for rituals (e.g., clay idols, biodegradable flowers), and endorsed the role of educational institutions in driving change.

3.3 Output: A Context-Informed KAP Survey Instrument

The participatory process culminated in the development of a 25-item pilot KAP questionnaire. Key domains include:

- **Section A:** Socio-demographic profile.
- **Section B:** Knowledge (sources of pollution, impact of plastics, concept of river health).
- **Section C:** Attitudes (perceptions of responsibility, trust in institutions, spiritual-ecological linkage).
- **Section D:** Practices (current waste disposal, ritual material choices, participation in cleaning).
- **Section E:** Behavioral Intentions (willingness to segregate waste, use alternatives, join awareness drives).

IV. DISCUSSION

This participatory assessment underscores that effective river restoration at sacred sites like Brijghat requires initial, grounded diagnostic work to tailor broader policy frameworks to local realities. Our findings align with and contextualize existing literature on Ganga pollution (Kumar et al., 2019; Dayal, 2016). The observed gap between deep spiritual value and limited ecological knowledge confirms the need for targeted communication strategies that connect religious sentiment to environmental stewardship, a challenge noted in similar pilgrimage contexts (CPCB, 2022).

The identified infrastructure gaps—overflowing bins, no segregation—highlight a critical disconnect. While Namami Gange invests in large-scale infrastructure, localized, site-specific maintenance and provisioning at ghats remain weak. This echoes governance challenges in medium-sized pilgrimage towns along the basin (Dayal, 2016). Our study demonstrates that academic institutions can play a vital "bridging" role, conducting micro-level diagnostics and fostering dialogue, thereby operationalizing national mission goals at the grassroots level (Das & Tamminga, 2012).

The most significant outcome is the pilot KAP instrument, derived directly from community input. This addresses a common flaw in externally designed surveys that may miss local nuances. The designed tool is now primed for validation and quantitative administration to measure baselines, track changes post-intervention, and identify precise leverage points for behavior change campaigns. This model of **diagnosis-first, tool-design-second** enhances the scientific rigor and practical relevance of community-based research (Barsay, 2022).

Limitations and Future Research

This study is a qualitative, situational analysis with a modest, purposive sample. Its findings are indicative, not generalizable. The logical next step is the quantitative deployment of the developed KAP instrument to a larger, randomized sample at Brijghat and comparable ghats. Longitudinal studies are needed to assess the impact of awareness programs and infrastructure improvements on actual behavior and waste metrics.

V. CONCLUSIONS AND RECOMMENDATIONS

This community-based participatory assessment at Brijghat provides a granular understanding of pollution drivers and community dynamics, successfully informing the creation of a context-specific KAP research tool. It confirms that local communities hold a strong reverence for the Ganga and a latent willingness to act, which can be mobilized through respectful engagement and improved systems.

We recommend a multi-stakeholder action plan for Brijghat:

1. **Immediate Infrastructure:** Install and maintain clearly labeled, robust bins for waste segregation (biodegradable ritual offerings, plastics, other waste) at key inflow points on the ghat.

2. **Community-Led Initiatives:** Local administration and NGOs should promote the use of certified biodegradable materials for rituals and organize regular "ghat cleanliness drives" co-led by community groups and student volunteers.
3. **Leverage the KAP Tool:** The developed questionnaire should be used by researchers or local agencies to conduct a baseline survey, the results of which can design targeted awareness campaigns.
4. **Strengthen Institutional Partnership:** Formalize collaboration between academic institutions (like Teerthanker Mahaveer University), the local municipality, and the District Ganga Committee to enable continuous monitoring, innovation, and youth engagement.

The proposed model—participatory diagnosis leading to tailored tool development and concrete local recommendations—is scalable, low-cost, and replicable across the numerous ghats of the Ganga basin and beyond, offering a practical pathway to translate the vision of a clean Ganga into on-ground reality.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Alley, K. D. (2008). *On the banks of the Ganga: When wastewater meets a sacred river*. University of Michigan Press.

[2] Barsay, A. (2022). Community participation and behavioural change in urban environmental management: Lessons from Indian riverfronts. *Environment, Development and Sustainability, 24*(5), 6231–6249. https://doi.org/10.1007/s10668-021-01643-7

[3] Bharti, A., Singh, M., & Maurya, A. K. (2024). Effect of diluted sulphuric acid on delinting of cotton seeds. *Ecology, Environment and Conservation, 30*, S170–S175.

[4] Bhatt, G. D., Singh, M., Jain, P. K., Singh, S., Singh, N. J., & Maurya, A. K. (2025). Survey-based assessment of government schemes' impact on rural infrastructure and quality of life in Gajgola Nanak Bari, Moradabad, Uttar Pradesh. *International Journal of Environmental and Agriculture Research, 11*(10).

[5] Central Pollution Control Board. (2022). *River Ganga water quality trend analysis (2015–2021)*. Ministry of Environment, Forest and Climate Change, Government of India.

[6] Das, M., & Tamminga, K. R. (2012). The Ganges and the GAP: An assessment of efforts to clean a sacred river. *Sustainability, 4*(7), 1647–1668. https://doi.org/10.3390/su4071647

[7] Dayal, P. (2016). Managing pollution at religious and pilgrimage sites in India: Challenges and policy options. *Journal of Environmental Planning and Management, 59*(9), 1643–1662. https://doi.org/10.1080/09640568.2015.1085841

[8] Jadeja, Y. D., Patel, R., & Mehta, R. (2022). Solid waste characterization at pilgrimage centers along Indian rivers. *Journal of Material Cycles and Waste Management, 24*(3), 1106–1118. https://doi.org/10.1007/s10163-021-01344-9

[9] Kesherwani, B., John, V., Maurya, A. K., Ravichandran, S., & Raghav, R. (2022). Restoring degraded soils and using wasteland and wetland for sustainable environment. In *Physical and biological sciences: Know-how social solicitation* (pp. 217–235). Krishna Computer Sansthan.

[10] Kumar, A., Mishra, S., & Verma, P. (2019). Anthropogenic pressures and water quality degradation in the middle stretch of River Ganga, India. *Environmental Monitoring and Assessment, 191*, Article 567. https://doi.org/10.1007/s10661-019-7708-4

[11] Kumar, R., Singh, S., & Sharma, R. C. (2019). Application of WQI for assessment of water quality of high altitude lake Dodi Tal, Garhwal Himalaya, India. *Sustainable Water Resources Management, 5*, 1033–1042. https://doi.org/10.1007/s40899-018-0281-1

[12] Mishra, A., Bhattacharya, A., & Kumar, P. (2021). Namami Gange Programme: Progress, challenges, and opportunities for integrated river basin management. *Environmental Policy and Governance, 31*(4), 351–364. https://doi.org/10.1002/eet.1924

[13] Nath, R. K., Sharma, S., & Singh, V. P. (2023). River rejuvenation in India: Governance, policy integration, and community engagement challenges. *Journal of Environmental Management, 328*, 116941. https://doi.org/10.1016/j.jenvman.2022.116941

[14] Pandey, M., Maurya, A. K., & John, V. (2024). Green nanotechnology: Why are they important for sustainable futures? *Futuristic Trends in Agriculture Engineering & Food Sciences, 3*(7), 64–71.

[15] Patel, M., Shah, R., & Trivedi, H. (2023). Ritual practices, waste generation, and environmental perception at riverfront religious sites in India. *Sustainable Water Resources Management, 9*, Article 23. https://doi.org/10.1007/s40899-023-00764-3

[16] Simon, D., & Joshi, R. (2022). Behavioural change and citizen participation in urban environmental governance in India. *Environment and Urbanization, 34*(2), 489–507. https://doi.org/10.1177/09562478221092745

[17] Singh, M., Bhatt, G. D., Jain, P. K., Vyas, L., Singh, S., Bisht, C., & Maurya, A. K. (2025). Community-led environmental stewardship and riverbank restoration: A case study of the Ramganga River in Moradabad, India. *International Journal of Environmental and Agriculture Research, 11*(11).

[18] Singh, P., Kumar, R., & Yadav, S. (2022). Environmental awareness and pro-environmental behaviour among pilgrims at sacred river sites. *Journal of Environmental Education, 53*(4), 289–304. https://doi.org/10.1080/00958964.2022.2034856

[19] Singh, S., & Sharma, R. C. (2018). Monitoring of algal taxa as bioindicator for assessing the health of the high altitude wetland, Dodi Tal, Garhwal Himalaya, India. *International Journal of Fisheries and Aquatic Studies, 6*(3), 128–133.

[20] Singh, S., Malik, Z. A., & Sharma, C. M. (2016). Tree species richness, diversity, and regeneration status in different oak (*Quercus* spp.) dominated forests of Garhwal Himalaya, India. *Journal of Asia-Pacific Biodiversity, 9*, 293–300.

[21] Singh, S., Youssouf, M., Malik, Z. A., & Bussmann, R. W. (2017). Sacred groves: Myths, beliefs, and biodiversity conservation—A case study from Western Himalaya, India. *International Journal of Ecology, 2017*, 3828609. https://doi.org/10.1155/2017/3828609

[22] World Health Organization. (2008). *Advocacy, communication and social mobilization for TB control: A guide to developing knowledge, attitude and practice surveys*. WHO Press.