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Living heritage and water infrastructures in Braj: Reclaiming socio-cultural and ecological connections

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Abstract

India faces its worst water crisis, with 600 million people under extreme water stress and 70% of its water contaminated. Amid this crisis, the traditional water infrastructures of the Braj region, steeped in Vedic cultural heritage, offer valuable insights into sustainable water conservation. These systems embody religious and socio-cultural traditions, architectural ingenuity, and knowledge-based water practices that historically sustained communities. This study examines these infrastructures through the lens of "Living Heritage," as defined by ICCROM (2003), emphasizing their role in shaping ecological, social, and cultural interactions, especially for rural women. Despite their significance, current conservation efforts focus largely on aesthetic restoration, neglecting the historical and emotional ties that communities once held with these spaces. The study reveals a disconnect between local populations and these heritage sites through ethnographic fieldwork, semi-structured interviews, emotional and cultural mapping, and direct observations in Braj. The findings argue that these vital infrastructures risk becoming lifeless relics without meaningful engagement of local communities, particularly women, and the integration of sustainable tourism and culturally rooted conservation practices. This research advocates for recognizing Braj's water systems as living heritage, urging a shift towards inclusive, sustainable conservation approaches that revitalize their ecological and socio-cultural relevance for future generations.

Keywords Traditional water infrastructures · Vedic cultural landscape systems · Socio-cultural and religious practices · Living heritage · Traditional knowledge-based water conservation practices

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Abbreviations

ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
UNESCO	United Nations Educational, Scientific and Cultural Organization
ITUC	Integrated Territorial and Urban Conservation
ISKCON	International Society for Krishna Consciousness
UPBTVP	Uttar Pradesh Braj Teerth Vikas Parisad
NGO	Non-Governmental Organization

1 Introduction

Presently, water scarcity is affecting 40% of the world's population. (World Bank 2017, 2023; Anderson 2015; Guppy and Anderson 2017). The availability of freshwater per capita worldwide since the 1960 s has decreased by 55% (Kashyap 2019). Based on the daily domestic practices that different sectors currently use water for, the projected water demand by 2030 will increase by 50% (UNESCO 2012). It is anticipated that by 2050, 2.3 billion people will be experiencing severe water shortages, primarily in North and South Asia and Africa (OECD 2012). India is suffering from "the worst water crisis" in its history, with about 600 million people facing high to extreme water stress and about 200,000 lakh people dying every year due to inadequate access to safe water (NITI Ayog 2019). Among the countries, India is most at risk from the consequences of climate change, according to the Global Climate Risk Index 2020. Centre for Social Research (CSR), located in New Delhi, clearly states that 90% of climate-related occurrences involve water, such as storms, floods, and droughts (NITI Ayog 2019). Unfortunately, India is dealing with twin problems of drought and flooding on a considerable scale each year. Droughts are also frequent in numerous parts of India during the summer months, even if floods have become routine in many areas during each monsoon. Every year, 600 million people in the nation deal with a high-to-extreme water problem (NITI Ayog 2019). Issues such as water pollution, decreased water percolation, shrinking of water bodies, irregularities in monsoon, and excessive use and wastage of water are responsible for increased water scarcity (World Bank 2023).

Hence, it is inescapable and mandatory to reconsider the historical water infrastructures to reduce water stress, ensure water sustainability and water equity, and recharge groundwater to save the future in the age of climate change. Water is essential for life, and heritage conveys humankind's manifold spiritual and material relations with water through time. It can be found in both natural and cultural heritage related to life and inherently linked to water (Willems and Schaik 2015). Understanding these water-related cultural heritages guided us in assessing the long-term consequences of specific managerial strategies and their applicability in particular conditions, also providing meaningful insights for future populations to serve them with better water requirements (Hein et al. 2019; Hein 2020). The ancestors have shaped water resources' form, function, and course to nourish human civilization on earth (Hein et al. 2019; Hein 2020). These water resources were managed and designed by early human societies with large-scale water infrastructures

such as Aqueducts[1] in Rome, Qanats[2] in Persia, Hydraulic Gardens and Fountains in France, and large Reservoirs, Stepwells,[3] and Temple Tanks in ancient India to celebrate water in religious rituals, socio-cultural celebrations, recreational activities, and trading all over the world for ages (Chakrabarti and Amirthalingam 2020). Societal interpretations that have brought water through art, religion, and history, which in turn have been shaped in the form of water-storing and water-harvesting infrastructures, are one of the primary key concerns to understand the intangible character of water through human societies (Hein et al. 2019; Hein 2020; Krause and Strang 2016). The water infrastructures in Braj are excellent examples of human creation on earth, narrating physical manifestations of divine powers, including socio-cultural and religious practices, and the existence of the river Yamuna, miraculously shaping the cultural and sacred landscapes of Braj (Vaudeville 1980). Broadly, the water infrastructures in Braj have been categorized under the following categories, as discussed by the various research scholars mentioned below:

1.1 Water infrastructures as elements of Vedic cultural landscape systems in Braj

In the doab region of the Indo-Gangetic plains, the landscape of Braj Bhoomi,[4] with patches of forests, grasslands, groves, gardens, hills, water infrastructures, cow-herding communities, gurukuls,[5] raslila[6] sites, and traditional agricultural practices, is the existing reference of Vedic cultural landscape systems from ancient India. The region expresses its outstanding religious-cultural values, including traditional farming, gardening, and temples along Yamuna River banks, and the Aravalli Hills, showcasing the resilient character of its cultural landscapes (Sinha 2011). The sacred landscapes of Braj in Northern India (Uttar Pradesh, Rajasthan, and some parts of Haryana) exemplify nature veneration; the five elements of nature, Water, Fire, Land, Sky, and Air, with the association of Lord Krishna and his beloved Radha, are evident in a rich corpus of mythological texts (Vaudeville 1976, 1980; Sinha 2014). The rituals and enactments linked to Krishna mythology are part of the traditional Hindu belief systems tied to environmental values and advocate resonating strategies for landscape reclamation and regeneration (Sinha 2014). Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan are cultural and religious villages associated with Krishna's birth, his neighborhood places, his beloved's house narrating his childhood and adulthood stories, playful activities, and mythological folklore, which have been poetically described in Hindu mythology by famous poets and authors (Sinha 2006, 2011, 2020). The water infrastructures in Braj are the physical manifestation of the

[1] **Aqueducts:** A structure like a bridge for carrying water across a valley or low ground.

[2] **Qanat:** An ancient method of water management that uses gravity to transport water from underground sources to the surface, primarily for irrigation and drinking.

[3] **Stepwells:** These are the extraordinary examples of water storage infrastructures having rock-cut square, circular or octagonal wells filled with ground water accessed by a circular flight of stairs or steps.

[4] **Bhoomi:** Sacred Land.

[5] **Gurukuls:** House of the Teacher.

[6] **Raslila:** Dance of Divine Love.

divine love of Radha and Krishna in the form of pokhars, kunds, sarovars, wells, and temples along the ghats and the Yamuna River (Sinha 2006, 2013). These sites were constructed by the local people and Krishna himself, expressing cultural, religious, and mythological events (Sinha 2006, 2011, 2013, 2014). The gorgeous water bodies in the heart of Vans (forests) were not only settings for Krishna and the Gopis' amorous frolic, but also sites for other gods to propitiate him (Sinha 2006, 2013). In Govardhan's steep terrain, 108 ponds were revealed (Saha et al. 2010; Sinha 2006). They provide water for fields and orchards, as well as for the livestock. Others are constructed as square and rectangular kunds (tanks) with ghats (steps) and elaborately carved pavilions, while some are ponds with irregular edges (Sinha 2006; Arya 2019; Saha et al. 2010). Some are supplied by surface flow and rain, while others are fed by natural springs (Saha et al. 2010; Laskar 2022). An example of an iconic landscape is the kund (water tank) in the van (garden-grove), which derives its distinct connotations and shape from a particular narrative associated with these locations in Braj (Shah 2007). In Mathura, several kunds, such as *Potra Kund, Kankhal Kund, and Balbhadra Kund,* were created in association with Lord Krishna's childhood (Sharma et al. 2022; Sharma and Shiva 2024). In Govardhan, kunds such as *Manasi Ganga, Radha Kund*, and *Kusum Sarovar* were created in relation to Krishna's social life (Sharma et al. 2022; Sharma and Shiva 2024; Sinha 2011, 2013, 2014, 2023). *Pavan Sarovar* in Nandgaon was created to show Krishna's adulthood and playful activities with his friends and cows (Sharma et al. 2022; Sharma and Shiva 2024; Sinha 2006). In Vrindavan, kunds such as *Brham Kund, Shyam Kund*, and *Govind Kund* were created to express Krishna's love for Radha (Sinha 2006, 2011, 2013, 2023). In Barsana, the kunds, such as *Radha Sarovar, Priya Kund, Vrishbhanu Kund, Kirti Kund, Dohini Kund,* and *Prem Sarovar,* were associated with Radha and her eight best friends playing water sports, cultural activities, including their meeting, intimacy, separation, and performing raslilas with Krishna (Anand 1992). The management of these water infrastructures, such as kunds and sarovars, by the local priest communities in these villages represents the liveliness of Radha and Krishna till today (Tater et al. 2023). These water management systems of India, as major cultural significance sites located on higher-order streams, clearly suggest that water resources were the key element in maintaining and developing these cultural sites (Tater et al. 2023).

1.2 Water infrastructures as architectural marvels in Braj

These unique and outstanding water infrastructures are not only examples of vernacular architectural style but also demonstrate their engineering and technological understanding of the cultural and regional geography, religious landscapes, and thoughtful vision for future generations (Chakrabarti 2017; Geva 2023). These water infrastructures were based on traditional knowledge of hydrology, geology, and topography; they respond to seasonal climatic variations (Agarwal and Narain 1997). They were designed per the context through an integrated approach for sustainable land utilization, watershed management, identification of vulnerable areas, and wastewater collection systems (Chaturvedi 2018; Agarwal and Narain 1997). Widely spread and popular

cultural practices in India are performing religious and cultural rituals on the banks of a river and kunds through architectural celebrations in the form of ghats, temples, pavilions, palaces, resting places, and cremation grounds. The complete ritual forged a dialectic relationship between a performer and the water source by fulfilling the religious need, and the water source was also resanctified, and its value as a sacred object in the landscape is reinforced (Shinde 2010; Geva 2023; Sinha 2014). Moreover, these water infrastructures were designed with varied architectural styles, materials with dressed stone masonry, soil and rubble masonry, illustrating the spectacular examples of wealth and their social status (Murthy et al. 2022; Chakrabarti 2017; Geva 2023). In the Braj region, water as a sacred element in the form of wells, sarovars, pokhars, and tanks had been jewelled with vernacular architectural elements shaped by the motifs of Krishna and Radha (Sinha 2006, 2011, 2013; Chauhan 2024). In Barsana, Nandgaoun, Gokul, and Govardhan, the narratives of architectural language shift to ghats, wells, kunds, and bavris, building cultural landscapes of pause, benevolence, frugality, and celebration (Arya 2019; Sinha 2020). The spatial distribution of water stipulates diversity, control of spaces, built environment, and social values, discussing the degree of influence on contextual architectural planning, landscape design, and use of local materials (Kanekar and Arya 2025; Arya 2019; Geva 2023; Sharma and Shiva 2024; Sharma et al. 2022; Sharma et al. 2021). Arcaded corridors, pavilions, pillared halls, sculpted walls, steps, chattris, stone jalis, erotic sculptures, and sacred animals are significant architectural features of these water infrastructures (Tadgell 1990). The sun's movement was the guiding element in designing these water infrastructures to know the exact time and the playful act of light and shadows. Architecture as an instrument was explored and articulated through the use and relation to the water to connect people (Kanekar and Arya 2025; Arya 2019). The various researchers also mentioned that during the time of the Bhakti Movement (7th–seventeenth centuries) in India, the great saints established the Traditional Pilgrimage Route with unique architectural marvels along the water sources. The route focused on 133 sites, including forests, 73 sacred places, 12 main forests, and 36 kunds (Sinha 2006; Entwistle 2025; Gupta 1984; Shah 2007) The cultural and religious functions of these sites are continuing. However, the natural and built environment has been partially changed, with some changes in their architectural character (Saha et al. 2010).

1.3 Water infrastructures as elements of social interactions for women in Braj

Women and water are significantly linked, as their role as domestic water managers is universally recognized in both the provision and use of domestic water (Singh et al. 2005). Diverse facets of water resources have played significant roles in making women independent and enacting a social platform to perform religious rituals and cultural celebrations (Arya 2019). Water infrastructures have encouraged women to hold social gatherings and interactions as domestic water managers. Since then, water has been an influential element of their social lives (Singh et al. 2005; Arya 2019; Nawre 2018). In the Braj region ghats, kunds, wells, baolis, pokhars, ponds, and hand pumps are the cultural and social identities of the

communities, articulating the eternal relationship between water and women. For ages, these cultural and social identities have witnessed celebrations, contentment, gratitude, and hospitality from society to society (Nawre 2018). Fetching water from the wells, sacred bathing in kunds, and bathing domestic animals in pokhars are important examples of women's relationship with water throughout the day. Since these water infrastructures were located far away from their individual household near the forest areas, rivers, and sacred gardens, walking in groups with their kids to fetch water was the key factor for their interactions and play areas for their kids. Lord Radha, as a lead female character and main consort of Lord Krishna, with her best friends, used to play with water in pokhars and sarovars with Lord Krishna, fetch water from wells, and perform sacred bathing in kunds, exemplifying the divine relationship of women with water (Haberman 2001; Habib 2010; Sinha 2006).

The social mapping of the mentioned villages indicates that the highest or dominant castes typically reside near the center of a village. In contrast, others are located toward the periphery in decreasing order of status. The people who are ranked lowest typically live on the fringes of the village. Additionally, distinct or adjacent castes live in distinct communities where they can exercise their rights to possess and use the resources allotted to them within their social sphere (O'Reilly 2006). The water infrastructures and resources, such as wells, pokhars, and sarovars, located in a common property are considered as communal property. On the other hand, it is also evident that a privately owned well or water site is conveniently located for the general public, to which all community members have equal access and rights. However, only local people in the vicinity have access to these public water infrastructures, and entry and exit regulations about the use of water sources are further governed by caste, religion, or other ethnic identity criteria (O'Reilly 2006). The necessities of rural women concerning water have been recognized for decades, leading to coordinated initiatives aimed at meeting these needs through rural water supply programs focused on implementing affordable, enhanced water technologies that local communities can construct and sustain independently (Singh et al. 2005).

Research scholars defined and discussed the socio-cultural and religious significance of these water infrastructures through human-induced socio-cultural practices performed along these water sites and understood their indestructible and unadulterated connections with the divine powers. However, there is a lack of literature on examining these water infrastructures from the perspective of local communities, especially women and other stakeholders who convey these divine connections with these water infrastructures.

Hence, the present study focuses on raising a question on the meanings and associations of these water infrastructures to the villagers, rural women, and particularly other stakeholders who perceive these meanings and associations during economic, political, social, and cultural changes in Braj. The study has selected six villages, namely Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan, which have direct associations with Lord Krishna and his beloved Radha. These villages are also religious centers and pilgrimage places of the Braj region. Further, the study has observed five types of water infrastructures in selected villages of Braj

and documented their present condition and relationship with local communities, women, and other stakeholders through the living heritage theory.

1.4 Literature review

Numerous research papers on water infrastructures in Braj have been reviewed to understand their socio-cultural, religious, and ecological significance, traditional water conservation practices, and existing conditions. The literature review further leads the present study to understand whether these water infrastructures have been studied from the perspectives of living heritage.

1.4.1 Socio-cultural and religious practices along the water infrastructures in Braj

Religious practices along the kunds Cultural and religious practices were performed along the kunds to celebrate the divine love of Krishna and Radha in the form of festivals (Vaudeville 1976; Sinha 2006, 2011, 2014). The kunds in Govardhan near congested communities serve as dynamic public areas for the community and are used to perform ritual activities, specifically by females at festivals and in daily basis rituals (Vaudeville 1976; Sinha 2006). They are believed to symbolize Radha and Krishna's coexisting aquatic forms (Sinha 2011). Manasi Ganga and Radha-Shyam Kunds are community spaces for bathing, festivals, rituals, *kirtans, bhajans*,[7] and social gatherings. Secular and religious endeavours blend to form a lively public life (Sinha 2011). In Vedic India (1500 BCE–500 BCE), there were more than 1000 kunds used for performing religious rituals, sacred bathing for deities, drinking fresh water, irrigation, and domestic uses constructed by the ancient kings or leaders of the tribes through the rural people on the slopes to capture the rainwater (Sinha 2006; Saha et al. 2010). The studies established a close and indestructible relationship between men and their natural environment, a relationship that has been reinterpreted multiple times throughout history. However, while managing and developing these pilgrimage sites, the cultural and religious practices should also be considered in planning and management (Sinha 2006; Arya 2019).

Stepwells as religious observances Known locally as vaavs, stepwells are a creative water management practice common in Gujarat's semi-arid areas. In addition to providing cool, shaded areas to avoid the region's extreme heat, these intricately carved infrastructures functioned as reservoirs that supplied water all year round (Michell and Davies 1989). As places for rituals and ceremonies as well as community gatherings, stepwells also developed into hubs of social, cultural, and religious significance (Tewari 2018; Mankodi 2022). By the eleventh century, stepwell construction had advanced to the point that it was a magnificent feat of art, architecture, and engineering (Chaturvedi 2018; Hansda et al. 2022). With their abundance of etched pictures of the gods, they function nearly like underground temples (Chakrabarti 2017; Hansda et al. 2022; Mankodi 2022; Tewari 2018). These sculptures established a

[7] **Kirtan and Bhajans:** Devotional songs, typically about the life of Krishna, in which a group repeats lines sung by a leader.

sacred space for offerings, prayers, and ceremonial dips. Even though there is a shortage of groundwater, several stepwells still operate as temples today, illustrating the cultural and religious continuity of the original function of stepwells (Michell and Davies 1989; Chaturvedi 2018; Hansda et al. 2022).

Water as a symbolic representation of divine landscapes Water is often thought of as more pure and a better representation of sacred sites, and it is also mentioned in ancient Indian (Hindu) myths as the source of life, strength, and eternity (Kinsley 1998; Ratnagar 2015; Singh 2020) The three most prominent explanations that increase the appeal of sacred sites along rivers (tirthas) and water pools (kundas) are the watery place's association with some great sage or site-based mythology, its unique physical attributes, and its distinctive natural setting and beauty (Ray 2017; Singh 2020). The belief in divine manifestations at a sacred place and its inherent values are reflected in the psychic attachment to that place, the preservation of the cultural traditions and rituals related to water, and the massive number of celebrations and ceremonies that continue to this day (Kinsley 1998; Shinde 2007; Ray 2017; Singh 2020; Sinha 2013). The collective memory and customs are firmly rooted in the historical and mythological significance of Braj's cultural heritage (Chauhan 2024). At the same time, it transmits useful information about the surroundings, water infrastructures, farming methods, religious writings, and sociocultural festivals, creating a tapestry of stories that influence the daily lives of people in Braj (Sinha 2011; Chauhan 2024). In Govardhan, Kusum Sarovar, originally a pool in the midst of a grove of flowering trees at the foothill, has now become the site of a magnificent memorial (chattri) to the Jat ruler Suraj Mal in the eighteenth century (Sinha 2006, 2023). Scholars have also traced the evolution of mythological landscapes from an eternally blooming natural garden that has transformed into a historic monument (Ray 2017; Sinha 2023). The symbolism of water as a purificatory natural element and liquid hierophany is central to this narrative (Shinde 2007, 2010; Ray 2017; Sinha 2013). The chattri, on the edge of the stepped kund and architecturally integrated, forms a unified ensemble of built form and water (Sinha 2006, 2023). Furthermore, the studies also mentioned that rapid urbanization and increasing tourism activities are threatening these water bodies and causing them to become extinct, which leads to soil erosion and accumulation of silt, mud, and pollutants in the Kunds (Sinha 2006; Arya 2019; Saha et al. 2010).

Interface between land and water The regional landscape of Braj has been characterized by the hard urban edge of ghats along the water bodies and the softer pastoral settings of groves (Sinha 2020). Urban and pastoral areas have been referred to as archetypal forms of land–water interface (Kumar and Singh 2017; Ray 2017; Chauhan 2024). The ghats in Mathura, Vrindavan, and Gokul along the river Yamuna have been crafted with temples and shrines (Fallon and Jaiswal 2012; Chauhan 2024; Sinha 2020). These landscapes of ghats have emerged over centuries to allow rituals paying homage to the divine powers of the Yamuna River (Kinsley 1998; Arya 2019; Chauhan 2024; Kumar and Singh 2017; Ray 2017; Singh 2020; Sinha 2023). Organically grown, self-evolving landscapes of ghats along the kunds and Yamuna

are a palimpsest of forms expressing the beliefs and rituals of Vedic humans, which have still sustained today despite the plundering and destruction of Braj many times by invaders (Kinsley 1998; Chauhan 2024; Fallon and Jaiswal 2012; Ray 2017; Shinde 2007 and 2012; Saha et al. 2010; Singh 2020; Sinha 2023).

Sacred pilgrimage routes The religious practice of *Van Yatra* (Braj Yatra, pilgrimage route, Parikrama, or journey into the forest) was established by Narayan Bhatt in the sixteenth century, who is credited with rediscovering Braj's most sacred sites, including forests, sacred gardens, Raslila sites, and kunds (Sinha 2006; Entwistle 2025; Gupta 1984; Shah 2007). During their 84 Kos[8] parikrama, pilgrims visited 23 kunds in and around Govardhan hill (Shah 2006, 2007; Saha et al. 2010). Devotees believe the journey through the lakes and forests offers possibilities for a spiritual interaction with Krishna (Trivedi 2000; Buzinde 2020; Entwistle 2025; Shinde 2012). However, presently, the parikrama route is affected by severe traffic, poor sanitation, and environmental deterioration, particularly during major festivals. Spiritual holiness and urban utility have been compromised by fragmented initiatives brought about by the lack of an integrated urban planning framework (Trivedi 2000).

Community-driven water infrastructures and socio-cultural continuity by community institutions India's community-driven water infrastructures, such as talaab and check dams in Gujarat and ahar/pyne[9]in Bihar, reuse local water collection methods and have produced significant outcomes like women's empowerment, economic gains, and heightened communal strength (Sinha 2006; Arya 2019; Nawre 2018). The instances in Gujarat and Bihar show, water management landscapes can also serve as excellent equalizers (O'Reilly 2006; Nawre 2018; Singh et al. 2005). Reusing the talaab landscape in Gujarat gave women the same rights as men to manage the settlement's water. The most vulnerable members of society in Gujarat were able to thrive economically on the check dams. Through local resource management, the ahar/pyne system in Bihar enabled a community to achieve self-sufficiency (Agrawal and Narain 1997; Nawre 2018). Stepwells, as the most outstanding form of traditional water infrastructure, were functioning as a source of water for communities and a demonstration of significant social, religious, and aesthetic values, thus contributing prominently to the rich heritage of India (Halder and Sarda 2021; Hansda and Bhatt 2022). Protection and maintenance of these water infrastructures emerged as part of the intangible heritage linked with the community institutions, mechanisms, religious practices, and beliefs with their sacred geography, philosophical traditions, festivals, and mythological rituals (Shinde 2007, 2010, 2012a, b; Chaturvedi 2018). The cultural continuity of these sites is a significant sign of successful conservation. Continuous usage and maintenance by the core community bring cultural and spiritual relevance, and frequently added associational values are easy

[8] **84 Kos Parikrama:** It's a 252-km (84 kos) journey that traverses the holy area, visiting significant sites like Mathura, Vrindavan, Barsana, and Govardhan, as well as numerous forests, gardens, and ponds.

[9] **Ahar Pynes** are flood control reservoirs with embankments on three sides, built at the end of diversion channels like pynes.

to manage and protect these sites over the long term (Plieninger et al. 2014; Naz 2011; Sarmiento and Bernbaum 2014).

1.4.2 Traditional water conservation practices

Water conservation science has a long history dating back to ancient India. Conventional, environmentally friendly approaches are practical and affordable solutions for restoring India's deteriorating water resource management (Arya 2019; Laskar 2022; Murthy et al. 2022). Integrating the infrastructure effectively with modern rainwater collection techniques like storage reservoirs, injection wells, and subsurface roadblocks could remedy India's ongoing water crisis (Laskar 2022). To increase rainwater harvesting, rainwater collection systems significantly contribute to climate change (Arya 2019; Cooke et al. 2005; Laskar 2022). It is necessary to implement efficient socio-political policies and raise public knowledge to properly implement a rainwater harvesting system (Bhattacharya et al. 2011; Nawre 2018; Ratnagar 2015). Traditional water management methods are a more acceptable choice because they encourage social cohesion. This cohesion arises from the collective work required to build and maintain the systems, as well as from their fair nature and economic viability as tourist or religious sites, thereby promoting social harmony. (Bhattacharya et al. 2011; Arya 2019; Laskar 2022; Murthy et al. 2022).

1.5 Literature gap

It has been found that recent studies have emphasized these water infrastructures as sacred sites, narrating an indestructible relationship between humans and their natural environment, which signifies that these water sites are still in use. However, the sacred and divine landscapes have been merged in modernized urban landscapes. Moreover, the studies also discussed these water infrastructures by understanding their religious and socio-cultural significance, to cope with the present economic water scarcity[10], and to provide solutions based upon these traditional water harvesting techniques, which further allow reconsidering and restoring these water sites for future generations. Furthermore, the studies also emphasized the transformation of divine landscapes into landscapes of distress, mentioning the extinction of kunds and ghats due to rapid urbanization and continuous negligence. However, despite the valuable insights provided by recent studies, several gaps remain unaddressed. Firstly, the research on socio-cultural and religious practices performed along these water infrastructures focuses on the fact that these water sites are religiously and culturally active, but neglects the fact of who is performing these activities along what kind of water bodies? This lack of information does not provide the types of community engagement, especially for women and other stakeholders. Also, this further leads to giving an unclear version of the types of water infrastructures that are still active. Secondly, various studies also mentioned community-driven water

[10] **Economic water scarcity**: https://www.britannica.com/topic/economic-water-scarcity

infrastructures encouraging women's empowerment and communal strength, which elaborates that women as cultural agents are shaping these waterscapes, but neglects the fact that in a changing scenario, domestic water supplies have been reached by each household. How are women still holding these socio-cultural interactions performed along what kinds of water bodies? Finally, recent studies have addressed these water sites as traditional water conservation practices and promoted their restoration and use in current water conservation practices. However, the studies have not mentioned that, willingly, with the help of community participation, what kind of restoration practices and techniques are being taken in conserving these water infrastructures. These infrastructures might be conserved by governments and financing, but UNESCO has not designated them as heritage sites. People use these sites regularly, making them more than just monuments for admiration.

The literature gap clearly highlights the lack of perception, documentation, and understanding of these sites from the perspectives of local communities, women, and other stakeholders. The research scholars, such as Sinha (2006, 2011, 2013, 2014, 2020, 2023), Arya (2019), and Nawre (2018), have discussed and observed these sites as socio-culturally active cultivators of Hindu philosophy in Braj, sustainable engineers for water conservation and architectural connections with the society, and sources of economic growth for women, respectively. Moreover, Sinha (2006, 2011, 2013, 2014, 2020, 2023) has discussed the engagement of socio-cultural and religious performances performed only along kunds, sarovars, and ghats in Mathura, Govardhan, Vrindavan, and Nandgaon of Braj. However, Arya (2019) has discussed the spatial arrangement and ecology of stepwells, ghats, and other traditional water harvesting infrastructures in Rajasthan, Gujarat, and Haryana. While Nawre (2018) has seen these water infrastructures, such as talaab, ahar, and check dams, as sources of women's empowerment and social equity in Bihar, Rajasthan, and Gujarat. The present study has approached these water infrastructures based on their identified existing types (kunds, pokhars, wells, ghats, and sarovars) in Braj to understand the significant role of these water infrastructures in the eyes of the local community, women, and other stakeholders of Braj. In the realms of water management, wetland recreation, and new studies of water history and heritage, the present study can provide insight, inspiration, and identity-building for the communities that are pertinent to the restoring, redesigning, and reusing of old and current water systems, in addition to creating new ones in Braj. Reusing, modifying, or redesigning obsolete infrastructure can improve communities' and other stakeholders' quality of life and sense of identity and place. Lastly, comprehending and examining the connection between water and living heritage can also improve our understanding of both tangible and intangible heritage in general, specifically in the case of Braj.

Thus, the purpose of this research is to analyze these water sites through the lens of living heritage and seeks to understand these sites from the perspectives of its stakeholders, especially women, while examining whether and how the meanings of these sites and waters have evolved, in contrast to other studies in literature review that prioritize expert and professional viewpoints on socio-cultural, religious and ecological significance of these water infrastructures of Braj.

Furthermore, the paper aims to address the gap through a living heritage approach, particularly emphasising the socio-cultural and ecological connections of

the local communities with kunds, pokhars, sarovars, ghats, and wells. By using ethnographic research conducted at Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan villages of Braj, the present study seeks to provide a comprehensive understanding of driving the transformation in socio-cultural and ecological connections of these water infrastructures with the local communities, and especially with the women.

Moreover, the present study also contributes to the growing body of literature on these water infrastructures by integrating the insights of community engagement and living heritage studies. Highlighting the role of community engagement and community participation and their connections in sustaining these water infrastructures, the paper offers new insights into the complex processes that underpin the resilience of these Vedic cultural landscape systems in a rapidly changing world. Furthermore, the present paper also contributes to the identification of existing types of water infrastructures, such as kunds, pokhars, sarovars, and wells in Braj, their past and present functional uses, and types of communities performing rituals along these sites, their domestication, and their social-cultural and ecological connections.

2 Research methodology

The present study took the following steps to conduct the research. Firstly, a literature review was conducted to understand the socio-cultural and ecological significance of water infrastructures in Braj and to identify the literature gap. Secondly, the theory of living heritage has been used to examine these water infrastructures based upon their continuity in original functions and community engagement, also addressing the literature gap. Thirdly, to understand the perception and relationship of women with these water sites, the purposive sampling method was used, and to understand the views and connections of priests, local communities, and other stakeholders, the convenience sampling method was used. Finally, detailed ethnographic studies and direct field observation have been used to understand the present conditions, and cultural and emotional mapping of these water sites and communities.

2.1 Theoretical framework

To understand the meanings and connections associated with these water infrastructures, the present study has examined these sites through the lens of the living heritage theory defined by the ICCROM program in 2003 (Wijesuriya 2005, 2007a, b, 2010, 2018; Wijesuriya et al. 2013; Puolis 2014).

1. Based upon the continuity in original functions and continuity in community connections, cultural expressions, and continuity in care, as mentioned in Table 2, the living heritage framework has been used to analyse the socio-cultural and religious performances along identified water infrastructures in selected villages and their use by local communities, especially by women.

2. Community participation, women's role, and their relationship with these water infrastructures as cultural agents have been mapped through cultural and emotional mapping and direct field observations.

2.2 Concept of living heritage

Over the past decade, "living heritage" has become an increasingly popular topic (Poulis 2014; Wijesuriya 2018). In 2003, as part of its Integrated Territorial and Urban Conservation (ITUC) efforts, ICCROM initiated a Living Heritage Sites program (Wijesuriya 2018). The program's justification was to highlight the living aspects of heritage sites, their acknowledgement and applicability to modern life, as well as the advantages and people's interests and ability to provide ongoing care as legitimate and long-term stewards of these places (Wijesuriya 2005, 2007a, b, 2010, 2018; Wijesuriya et al. 2013). The living heritage program was defined with the following objectives (Wijesuriya et al. 2013; Wijesuriya 2018; Poulis 2014):

1. Continuity of original function.
2. Continuity of community connections.
3. Continuity of cultural expressions (both tangible and intangible).
4. Continuity of care (through traditional or established means).

With the aforementioned understanding, living heritage can be defined as heritage that maintains the original function or purpose for which it was intended. Through conventional or established means, such a legacy preserves the continuity of social bonds, which continue to develop in tangible and intangible expressions. It would imply that a core community is closely associated with living heritage and that change is accepted. Further, it significantly impacts decision-making processes for current conservation practices (Wijesuriya 2005, 2007a, b, 2010, 2018; Wijesuriya et al. 2013; Poulis 2014). Figure 1a shows the continuity in community connections, and Fig. 1b shows the living heritage approach (Poulis 2014).

Through the living heritage framework approach, conservation primarily seeks to preserve and improve continuity, protecting heritage even when the fabric is occasionally damaged. In order to ensure that history remains relevant to modern society, conservation also seeks to embrace evolution and change across time (Poulis 2014). By evaluating the importance of heritage based on the core community's relationship to it and creating activities for its ongoing care through conventional (or established) mechanisms and practices, a living heritage approach makes it easier to take a distinctly community-centered, interactive, and bottom-up approach to conservation (Wijesuriya 2010; Wijesuriya et al. 2013; Poulis 2014).

The living heritage framework approach has guided the present research study under the following steps mentioned by Poulis (2014).

2.2.1 Identification of the living heritage site and the core community

The water infrastructures, such as kunds, pokhars, sarovars, ghats, and wells, have been observed and identified in Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan in Braj based upon their continuity in functional use by the core community and their relationships with the communities.

2.2.2 Establishment of collaboration with the core community

The hierarchy in the communities (such as priest communities, higher and lower cast communities), and the role of women in using these water infrastructures, has been understood based on their socio-cultural and religious performances along the water bodies and use of water infrastructures.

2.2.3 Mapping of the living heritage site

The water infrastructures have been mapped through detailed field observation and examined through the objectives of living heritage, as mentioned in Table 2, based upon their continuity in past and present conditions.

2.2.4 Assessment of the living heritage site

The assessment of the water infrastructures, as mentioned in Figs. 5 and 6, has been done based upon their continuity in functional use, continuity in community connections, cultural expressions, and continuity in care.

2.2.5 Conservation decisions and actions

The conservation practices and actions based on assessing these water infrastructures in Tables 1 and 2**,** Figs. 5 and 6 have been guided to derive the findings.

2.2.6 Periodic review and revision of conservation decisions and actions based on continuity

The conclusions discuss revising conservation decisions and actions based on continuity in functional use, community connections, expressions, and care of these water infrastructures. Thus, through community participation and engagement with these water sites, the living heritage framework has guided this research in identifying the types of existing water infrastructures in Braj and their socio-economic structure in using and performing rituals along these water infrastructures.

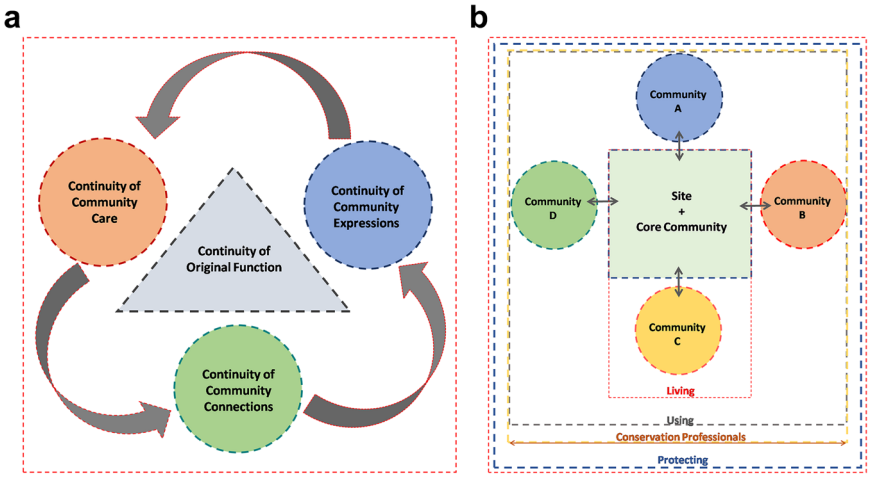


Fig. 1 **a** Continuity of community connections. **b** The living heritage approach

2.3 Data collection methods

The ethnographic qualitative data were collected from the 15 days of detailed field observations, site visits, and semi-structured interviews through the purposive and convenience sampling methods. Water infrastructures of Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan villages of Braj were selected to examine their historical and present conditions, socio-cultural and religious practices, and community connections based upon the living heritage framework. The purposive sampling method was used to understand the perception and relationship of women with these water sites. As per the purposive sampling method, based upon the deliberate choices of participants (Etikan et al. 2016) and the need for research, the author set out the research criteria. The author has identified and selected individual groups of women in selected villages who are proficient and well-informed about a phenomenon of their interest (Cresswell et al. 2011) and willing to provide information through their knowledge or experience (Bernard 2002). Five women in each village participated in the interviews and shared their experiential journey with these water infrastructures, which was further helpful in doing the emotional mapping.

The convenience sampling method was used to understand the views and connections of priests' communities, local communities, and other stakeholders with these water infrastructures. In the convenience sampling method, as per the purpose of the research, the author targeted the priest and local communities and other stakeholders t*hat met specific practical criteria, such as easy accessibility, geographical proximity, availability at a given time, and willingness to participate* (Spradley 1979; Dörnyei 2007), to conduct the interviews. One priest community and two families in higher and lower cast communities in each village

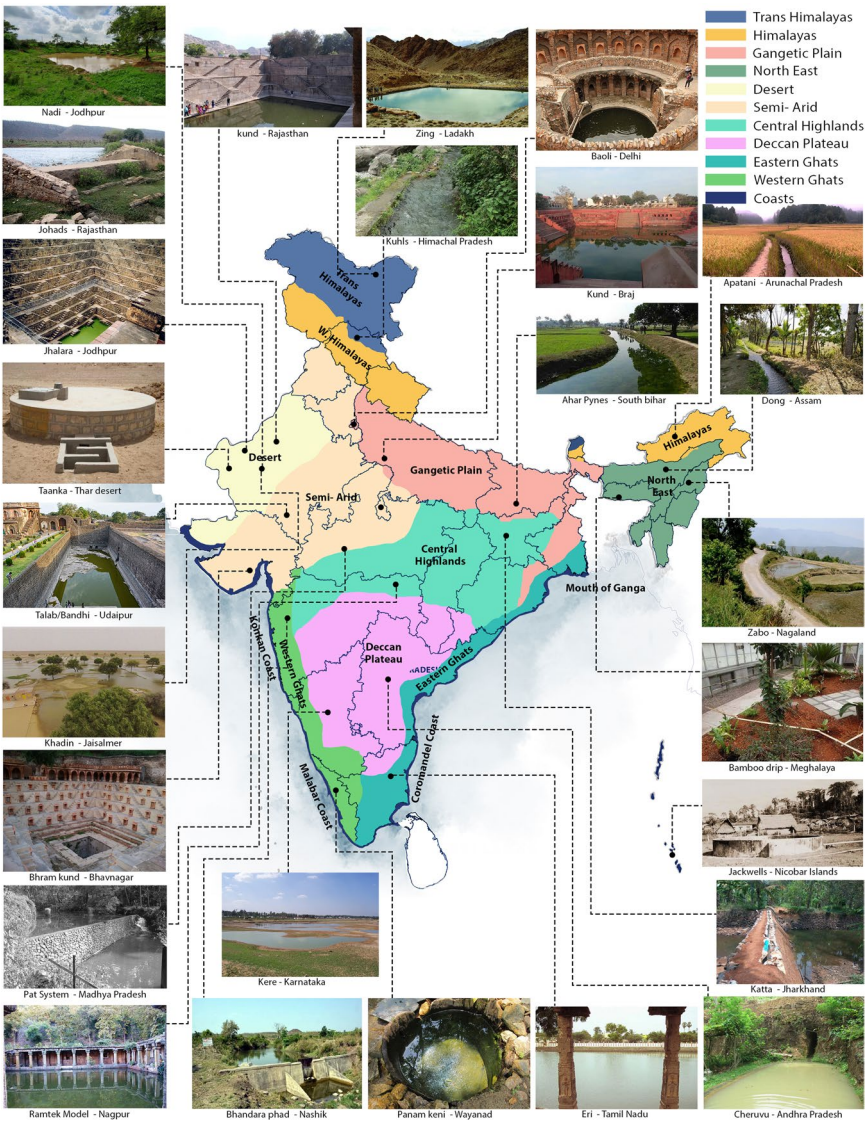


Fig. 2 Traditional water infrastructures as per the cultural geography and landscape character of India

were selected for the interviews. Shopkeepers, school teachers, tourist guides, bikers, and restaurant and hotel managers participated as other interview stakeholders. It was further helpful in the cultural mapping by observing their socio-cultural and religious activities performed along the water bodies, daily rituals, and during festivals.

The author has photographed these sites during festivals and religious events. Furthermore, to investigate the socio-cultural and religious continuity in the functional use

and living dimensions of cultural and religious practices along the water infrastructures, secondary data from archives, various publications, research papers, government websites, and reports have been used as background research.

In the interest of legality, participants were informed of the study's purpose, and approval was obtained before recording interviews or quoting comments. To safeguard their privacy, only the participants' last names were used.

2.4 Tools and techniques

Narrative and thematic analysis methods have been used to analyze the ethnographic data and interviews for emotional and cultural mapping. Excel has been used to create charts and tables. GIS and Google Earth have been used to create the base map and document the existing site conditions. The activity mapping has been done by the students of the School of Planning and Architecture Bhopal through direct field observations.

3 Findings and discussion

3.1 Water infrastructures in India: an overview

The diverse geography and landscapes of India, shaped by climatic conditions, gave rise to water harvesting and water storage structures from cold deserts to semi-arid regions, from barren landscapes to flood-prone basins, and from hilly terrains to coastal areas (Pangare and Pangare 2006). They exhibit the tapestry of socio-cultural, religious, and ecological significance indulged in various and unique forms of architectural marvels since civilizations in India (Pangare and Pangare 2006). The invention of irrigation systems for agricultural practices in deserted landscapes, extraordinary water-storing infrastructures to harvest rainwater in semi-arid regions, and incredible water tanks and kunds to perform rituals in religious landscapes express intertwined and mutually constitutive hydrological relationships of water with humans (Krause and Strang 2016; Arya 2019). In Vedic hymns of ancient India, it has been described in the Rig Veda that the irrigation systems were protected and preserved by cultural customs, managed widely by the community with knowledgeable individuals or groups, and were an exceptional combination of water drawn from aquifers and tanks built by rainwater harvesting infrastructures (Saha et al. 2010). The Rajputana rulers and kings in semi-arid regions of Rajasthan, Gujarat, and some parts of Madhya Pradesh and Uttar Pradesh erected water-related architecture such as Stepwells *(Bavdi, Baori, Vav, Vapi)*, Kunds, Bardi,[11] Jhalaras,[12] Beris,[13] wells, and dams sculpted with their vernacular architectural style

[11] **Bardi:** Shallow wells in depressions.

[12] **Jhalaras**: Rectangular or square shaped stepped kund with steep steps on three sides and a pavilion and temples on the fourth side; designed to collect the subterranean seepage of an upstream reservoir or a lake.

[13] **Beris:** Wells on river beds.

(Arya 2019). These water infrastructures were crafted and curated by understanding India's regional and geographical characteristics, availability of water, climatic conditions, social and economic conditions, and their cultural and religious landscapes (Vyas 2009). Bavdi and Jhalaras were used to sustain groundwater, while Pokhars,[14] Nadi, Taanka, Khadin,[15] Kunds, and Johad[16] were based on surface runoff (Sharma and Shiva 2024; Sharma et al. 2022; Sharma et al. 2021). Moreover, some water infrastructures were constructed as underground tanks, earthen bunds, canals, channelizing water streams, and natural catchments per India's topography and geographical terrains (Koul et al. 2012). Figure 2 shows the types of water infrastructures in India's cultural and regional geography. These water infrastructures were constructed over various periods by ambitious and attentive rulers, keeping in mind the religious, cultural, and domestic water requirements for the societies and communities.

3.2 Water infrastructures in Braj

In association with the divine love of Radha and Krishna, sacred hills and forests of Braj were shaped by the holy Yamuna River. The semi-arid character of the land allowed the region to curate water storage infrastructures such as kunds, pokhars, sarovars, wells, and ghats (Sinha 2006, 2011, 2020), which were further shaped by cultural and religious practices by Braj people, especially women in Braj. The types of water infrastructures observed in selected villages, Mathura, Gokul, Vrindavan, Barsana, Nandgaon, and Govardhan of the Braj region are mentioned in Table 1.

Figure 3 shows the location of the Braj region in India and a map of Vedic cultural landscape systems, which narrates the indestructible connection of humans with nature in the form of traditional agricultural practices, bathing of deities, worshipping of trees, and celebrating festivals along the kunds and ghats.

Figure 4 shows the locations of selected villages, Mathura, Vrindavan, Gokul, Givardhan, Nandgaon and Barsana in the Braj region with the mapping of kunds, wells, and tanks.

3.3 Water infrastructures as living heritage in Braj

Table 2 discusses the comparative analysis between the past and present functions of kunds, wells, pokhars, sarovars, and ghats using the objectives of living heritage defined by the ICCROM program in 2003 to understand the relationship and associations of the communities with these water infrastructures.

Figure 5 shows the analysis of continuity in original functions, community connections, cultural expressions, and community care in kunds, pokhars, wells, sarovars, and ghats, as discussed in Table 2.

[14] **Pokhars:** Large reservoir used for domestic purposes.

[15] **Khadins:** Earthen bunds designed to harvest surface runoff water for agriculture lands from higher slopes to the lower slopes.

[16] **Johad:** Earthen check dams in desert during monsoon.

Table 1 The types of water infrastructures observed in selected villages of the Braj region

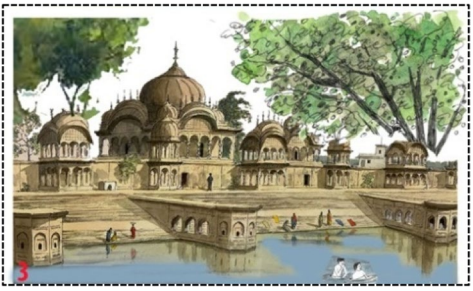
Types of water infrastructures	Images
Kunds: Small water bodies, shaped like rectangles, squares, or octagons, surrounded by steps and ghats. The Kunds also have a minor deity of gods and goddesses and ancestors at one of the edges (Sinha 2006,2011, 2023; Arya 2019). Religious practices such as offering water to the deities and sacred bathing are performed daily and at the time of festivals. Kunds were ecologically rich, inviting various biodiversity. The local priest communities maintained these kunds and were open to the general public	 **Kund**
Pokhars: Small or large reservoirs hold water for drinking and domestic usage, with earthen and natural edges all around (Sinha 2006; Arya 2019). Pokhars were associated with cowherd boys (Gwalas) in Govardhan and used for recreational activities, water sports, bathing, and domestic uses. The pokhars were communal properties located on the fringes of a village, open to the local people living in the vicinity. These pokhars were the sacred elements of the forests and gardens and supported local biodiversity	 **Pokhar**
Sarovars: A large rectangular or square-shaped reservoir with ghats and steps surrounded by all the edges. The sarovars also have well-designed pavilions, arcaded corridors, resting places, and chattries for the tourists (Sinha 2011,2023; Arya 2019). Sarovars were well-maintained water bodies used explicitly for cultural festivals and tourist activities involving cumulative efforts for conservation and rejuvenation by the government bodies, religious organizations, and local communities. These efforts focus on preserving the sanctity and historical significance of these sites while enhancing the experience for visitors and ensuring water quality for rituals and local needs	 **Sarovar**

Table 1 (continued)

Types of water infrastructures	Images
Ghats: A set of wide steps leading down to the water along the banks of the river, called Ghats. Temples of Lord Krishna and Radha, palaces, arcaded corridors, chattries, and resting places were also constructed near the ghats along the Yamuna River (Sinha 2014,2020; Arya 2019). Vishram Ghat is an excellent example of a cultural landscape constructed along the Yamuna River in Mathura, shaped by religious and cultural practices. It is said that Vishram Ghat is the oldest ghat and the resting place for the starting and completion of the traditional Parikrama	 **Ghats**
Wells: A well is a hole dug or drilled into the ground to access groundwater, typically from an aquifer, allowing for the extraction of water using a pump or manually. Folk dances and cultural celebrations were performed on the huge platforms constructed within the wells (Arya 2019). These wells were the main sources of socio-cultural performances celebrated by women and kids	 **Well**

Figure 6 shows the comparative analysis between the objectives of ICCROM, continuity of original functions, community connections, cultural expressions and community care in the context of water infrastructures of Braj, as discussed in Fig. 5.

Figure 7 shows archival images (from Braj Ras: Bliss of Braj Vrindavan) and present images (clicked by the author) of Kunds, Wells, Pokhars, Sarovars, and Ghats with changes to their architecture and built environment. They show the changes in the water infrastructures representing the past and present conditions of kunds, wells, pokhars, sarovars and ghats as described in Table 2.

Table 2 Comparative analysis between past and present functions of the water infrastructures in Braj

Types of water infrastructures in Braj	Objectives of living heritage, defined by ICCROM in 2003				Past functions and uses	Present functions and uses
	Continuity of functional use	Continuity of community connections	Continuity of cultural expressions	Continuity of care		
Kunds	√	√	√	√	The kunds were named after the divine love, intimacy, playful activities, raslilas, and separation of Radha and Krishna. Hence, they were constructed to perform the religious and cultural practices and the sacred bathing of deities	Kunds are still using it today to perform religious and cultural practices. Due to the concretization of all the edges, some of the kunds are polluted, and some are cleaned manually to perform rituals
Pokhars	Partially changed	√	√	×	Pokhars were created for the recreational activities performed by Lord Krishna, Radha, and their friends. They were mainly used for domestic purposes, such as bathing cows	Due to the lack of sewage treatment plants, dirty water is now collecting in pokhars. They are only used for domestic purposes, except for a few, which are still used for recreational activities

Table 2 (continued)

Types of water infrastructures in Braj	Objectives of living heritage, defined by ICCROM in 2003				Past functions and uses	Present functions and uses
	Continuity of functional use	Continuity of community connections	Continuity of cultural expressions	Continuity of care		
Sarovars	√	√	√	√	Sarovars were well-maintained water bodies used explicitly for cultural festivals and tourist activities	The communities have also restored sarovars for sacred baths. They are still active during festivals and tourism. Chandra Sarovar in Govardhan was recently restored by the State Government for tourist and cultural activities
Ghats	√	√	√	Partially changed in Vrindavan due to the change in the course of the river Yamuna	Ghats were the cultural interface between the water body and the human cultural and religious activities. They were constructed to perform rituals and express gratitude to the sacred river and kunds	Ghats become functional at festivals to perform rituals. However, due to the changed course of the Yamuna, they have been abandoned in most of Vrandavan

Table 2 (continued)

Types of water infrastructures in Braj	Objectives of living heritage, defined by ICCROM in 2003				Past functions and uses	Present functions and uses
	Continuity of functional use	Continuity of community connections	Continuity of cultural expressions	Continuity of care		
Wells	Partially changed	√	√	Partially changed	Wells were constructed for drinking water and to store water during droughts. The women of the house were responsible for fetching water from wells, which were the hub of social and recreational activities by women	Due to the lack of sewage treatment plants, dirty water is now collecting in pokhars. These are only used for domestic purposes, except for a few, which are still used for recreational activities

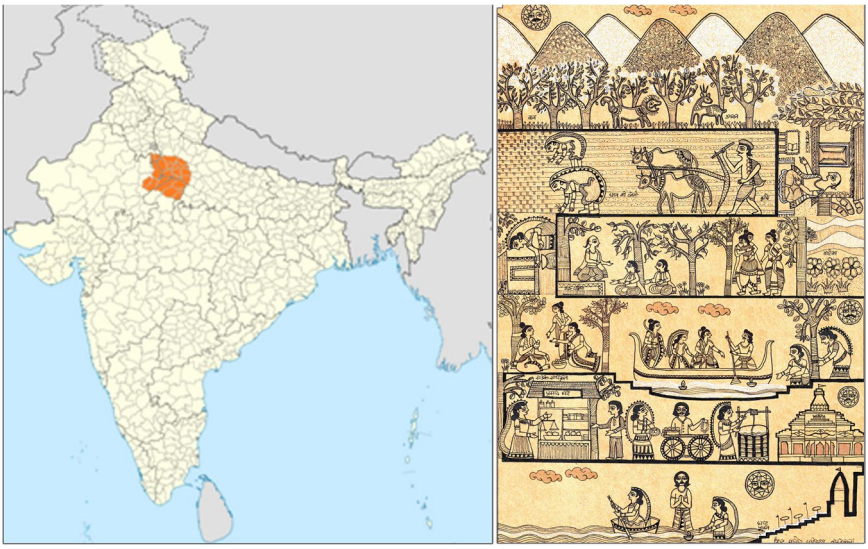


Fig. 3 Location of Braj region in India and map of cultural landscapes

3.3.1 Continuity in functional use and community care

Based upon comparative analysis in Table 2, Fig. 5 shows that kunds, sarovars, and ghats have continuity in their past and present functions. However, pokhars and wells have limited continuity in their original functions. Moreover, continuity in community connections and cultural expressions has been found in all kunds, pokhars, wells, sarovars, and ghats, and continuity of care has been observed only in kunds, sarovars, and ghats. Through detailed ethnographic fieldwork, semi-structured interviews, emotional and cultural mapping, and direct observations, the study has found that Kunds are still in function to celebrate socio-cultural and religious rituals on a daily basis and at the time of festivals. In Barsana, due to developmental activities and road construction, the Gahver Kund has been separated from the Gahver Van by the road and parking areas. Bhanu Kund was used for cremation activities and is still functional, but in poor condition.

Mr. Prasad, an old priest from the priest community from Barsana village who has been performing religious rituals in Gahvar Kund for 25 years, said that:

> *"Gahavar Van was a deep, dense forest in Barsana, the homeland of Shri Radha Rani. This divine forest is inaccessible and secretive too; hence, it was the favourite place for the childhood plays of Krishna. The forest is said to be as old as 5000 years. Many saints had chosen this place to serve Shri Krishna and Shri Radha by singing melodious songs and praising the lords in their own way. Unfortunately, the expanding tourism activities separated the Gahvar Van from the Gahvar Kund, and the serene and green forest now has been encroached by the roads and parking areas, and*

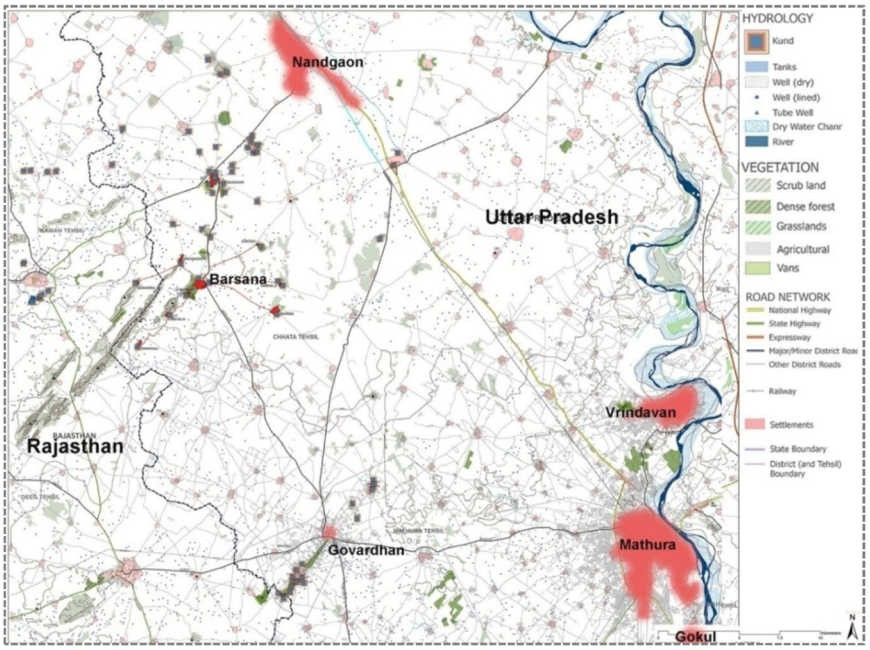


Fig. 4 Location of selected villages and mapping of water infrastructure in Braj region: kunds, wells and tanks

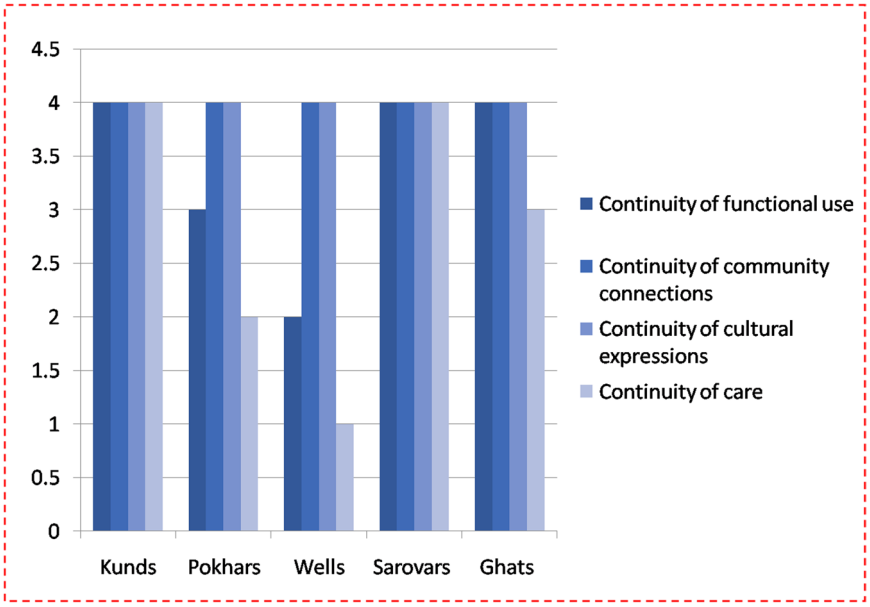


Fig. 5 Continuity between kunds, pokhars, wells, sarovars, and ghats

the sounds of ringing bells have been converted into chaos" [Mr. Hari Parsad, male, age 62, temple priest, priest community].

Mr. Naraian, the resident of the higher-caste community in Barsana village, explained that:

"All the edges of Gahvar Kund have been concretized, and the inlet and outlet are choked, surrounded by housing communities, parking areas, and roads. We need to manually clean the kund and fill it with water at the time of Radha Ashtami. The villages' females perform their daily rituals at the temple but do not take sacred baths daily" [Mr. Ram Narayan Shnakar, male, age 40, farmer, higher-caste community].

Mr. Ahirwar, from the lower-caste community residing near the Vrishbhanu Kund, explained that:

"Bhanu Kund was constructed along with the Jal Mahal by the father of Radha Rani. It was the dearest place of Krishna and Radha performing playful activities. However, cremation activities have now been performed near the kund for many years. Many NGOs took steps to restore the palace and the kund, but due to discourtesy and negligence, nothing has happened. The pond is full of algae. The females used the kund to perform daily rituals. It has been cleaned manually at the time of Radha Ashtami and Holi" [Mr. Vinay Ahirwar, male, age 33 vegetable seller, lower-caste community].

Mr. and Mrs. Agarwal, a couple and tourists from Mathura, mentioned:

"We know the associational values of Radha and Shyam's kunds in the form of their divine love. We always took a holy dip in these kunds during Radhaashatami. These kunds fulfil the wishes of the devotees specifically related to fertility. The women of Govardhan decorate these kunds with flowers and lights during festivals. These kunds are always crowded for daily holy dips and religious rituals" [Mr. Shweta and Jatin Agrawal, 36 and 45 respectively, local tourists from Mathura, a higher-caste community].

3.3.2 Continuity in community connections and cultural expressions

Figure 6 shows 15% continuity in functional use and community care; however 35% continuity in community connections and cultural expressions. The study found that the lack of sewage treatment plants leads directly to Pokhara's pollution. Moreover, with the arrival of modern techniques and water facilities, local people have stopped performing recreational activities except for the farmers and cowherd families, who use pokhars for domestic use and for bathing cows.

Moreover, Mrs. Devi said that:

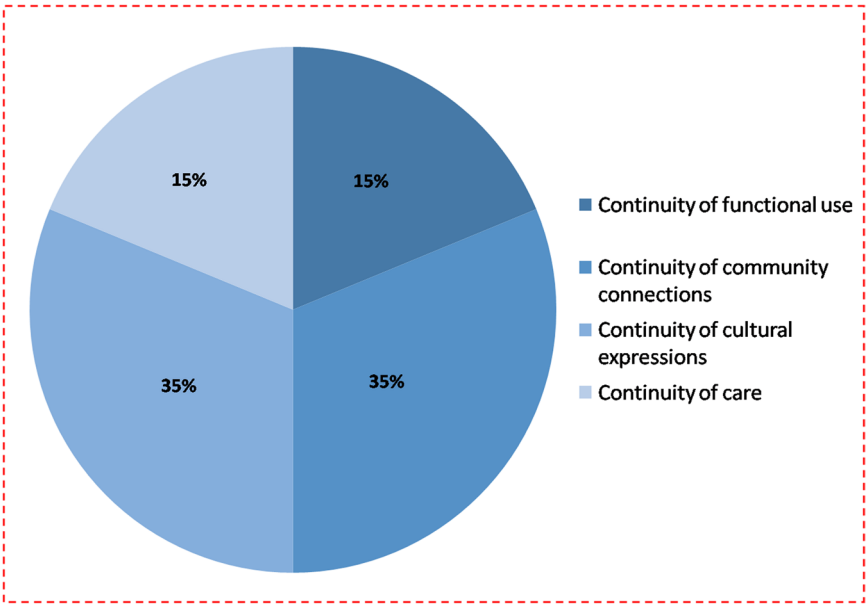


Fig. 6 The comparative analysis between the objectives of the ICCROM

"As higher-caste communities build their houses on sacred hills, due to the lack of sewage treatment plants, all the sewage is directed to flow into the pokhars. No one is taking any steps to clean them, which has led to our kids stopping recreational activities. Now they are only used for bathing animals and irrigating the fields" [Mrs. Kusum Devi, female, age 50, housewife, lower-caste community].

The study also found that Sarovars were mainly constructed for tourist and cultural activities and surrounded by palaces and other architecturally built spaces. Hence, they were maintained by private organizations such as TATA and International Society for Krishna Consciousness (ISKCON), local and state governments, and community participation. However, most of the Ghats in Vrindavan have been abandoned due to continuous negligence and changes in the course of the Yamuna River. Initiatives like the Namami Gange project have included ghat cleaning and riverfront development in Mathura-Vrindavan.

A boat sailor in Mathura explained his grief and said:

"The Mother Yamuna got angry with us and changed her course. Due to this, many of the ghats in Mathura and Vrindavan have been abandoned. Still, we do not understand water's value and throw garbage daily in the Holy Yamuna" [Mr. Suraj, male, age 48, boat sailor].

Furthermore, many of the wells have been completely closed, located within the temple campus and houses of priest communities. In a few sacred gardens, such as Radha Van and Yoshda Van, wells still function for domestic purposes. However, a

few wells are used for irrigation and domestic purposes and are maintained by the lower-caste communities and farmers. The water supply to each household in higher communities is responsible for women's decreased social interactions.

Mrs. Rani, along with her daughter Radha, from Govardhan, explained and suggested that:

> *"Ten years back, the wells were the hub of social interactions. Fetching water from the wells was just an excuse for us to go outside and meet our friends. It was when I, with all my friends and our kids, walked towards the wells to celebrate cultural and folk dances, chit-chatting and discussing our daily lives. Dense trees surrounded the wells and were also part of the sacred gardens where our kids used to play. However, since the water supply has reached every household in the higher-caste communities, social interactions have stopped near the wells. Some of our families and friends have also stopped fishing for water. Now we are taking water either from the higher-caste communities or from the hand pumps. Due to harsh climatic conditions, it isn't easy to go outside. I suggest that these covered wells be converted to small open spaces that will be good and encourage social interaction again for us"* [Mrs. Kamla Rani, female, age 55, widow, higher-caste community].

Moreover, the present study also found that water infrastructures such as sarovars, kunds, and ghats are extensively used to perform cultural and religious rituals at the time of Krishna Janmastmi,[17] Radha Ashtami,[18] Lathmaar Holi,[19] Govardhan Pooja,[20] Gopashtami,[21] and Parikrama.[22]

3.3.3 Disconnect in socio-cultural and ecological connections

The study reveals that in modern societies of Braj, the communities are provided with centralized water resources piped and cloaked under the surface. The movements of water, collection, storage, and distribution have been erased from modern urban societies and memories. The tactile connection experienced through the architecture has been eliminated. It is crucial to make information about these water structures and how they contribute to the formation of societies publicly available in order to start a fruitful conversation and combat the homogenizing and monoculture tendencies of modern India, which, in turn, is also leading to the disappearance of social interactions by women through these traditional water infrastructures daily in domestic practice. Moreover, the present study reveals that socio-cultural connections only thrive on religious activities. However, ecological connections are eliminated due to unawareness, hypocrisy of the priest communities, and insensitive

[17] **Janmashtami:** The celebration of Krishna's birth on the eighth day of the dark fortnight (Krishna Paksha) in the month.

[18] **Radhaashtami**: Birth anniversary of the divine consort of Lord Krishna, Goddess Radha.

[19] **Lathmar Holi:** Festival of sticks and colors for divine love between Radha and Krishna.

[20] **Govardhan puja:** Worshiping of a hill also known as "Mountain of food".

[21] **Gopashtami**:A Hindu festival that celebrates the love of Lord Krishna for cows and the importance of protecting and respecting them.

[22] **Parikrama:** The ritual of moving clockwise around a shrine of devotion as an indication of reverence.

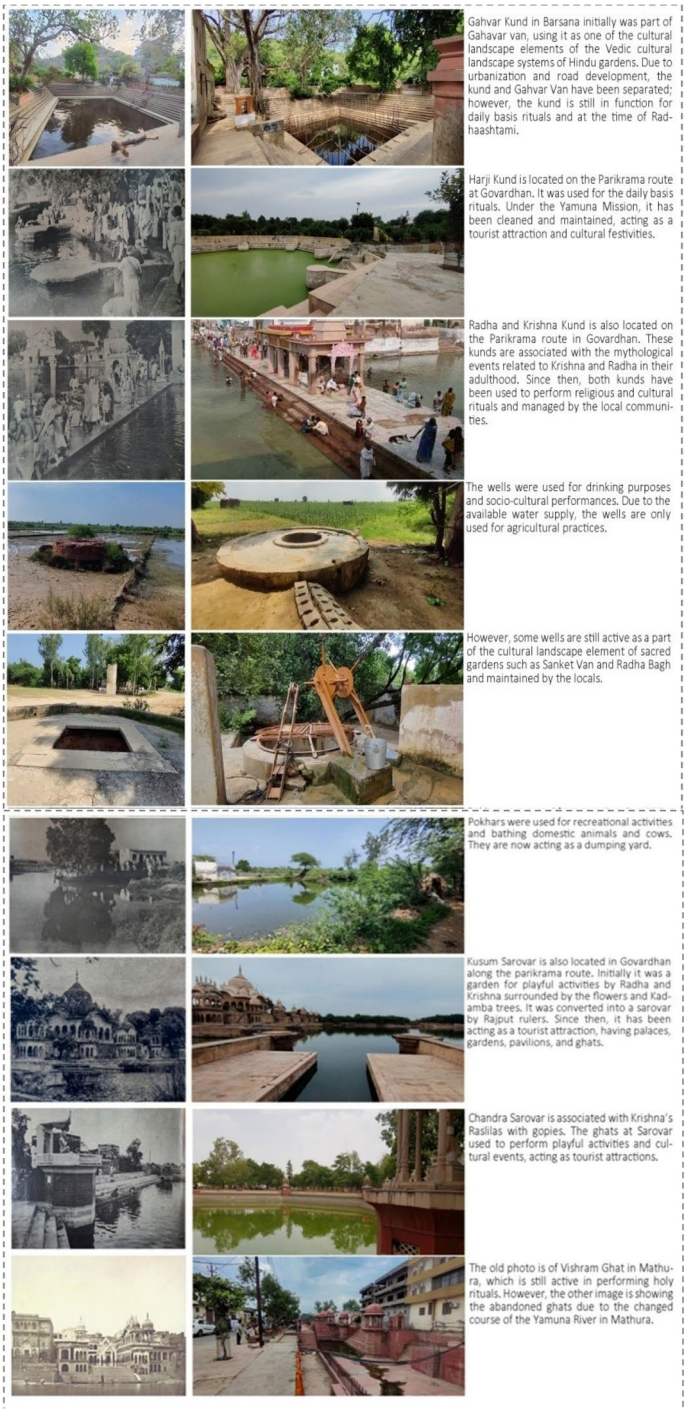


Fig. 7 Changes in the architecture and built environment of water infrastructures in Braj

development approaches by the private organizations and local government. Thinking of these sites as only religious tourist destinations is the root cause of socio-cultural and ecological disconnect.

3.4 Stakeholders' perspectives about water infrastructures in Braj

3.4.1 Women

The study reveals that although men might also take part in rituals, women's duties are frequently highlighted, especially when it comes to reproduction, healing, and cleansing. Women's participation in these rites indicates their larger roles in Hindu society, where they are regarded as spiritual mentors, healers, and nurturers. In order to strengthen their relationship with God, women can be introduced into spiritual activities that include rites at kunds and sarovars. Women have a key role in the rituals performed at kunds and sarovars, which are frequently linked to requesting blessings for fertility and healthy children. They contribute to the general ambience of dedication and celebration by frequently helping to prepare the ritual area and the related celebrations. These Kund and Sarovar rituals can cultivate a feeling of social connections. However, due to the dysfunctionality of the pokhars and wells, the social interaction and recreational activities by women and their kids have decreased. Wells and pokhars as formal hubs have now been transformed into concrete platforms and waste-collecting water bodies, respectively. The study also recommends, as per the suggestion by Mrs. Rani from Govardhan, to convert non-functional wells into green open spaces as part of the gardens for performing recreational activities for women and kids. Figure 8 represents socio-cultural activities including sacred bathing in kunds, offering water to deities, and celebrating religious performances in temples by the women as a cultural agent to shape the natural landscape of Braj in its sacred geography.

3.4.2 Priests and local communities

Priest communities and great saints built temples, shrines, and ghats along the Yamuna River in Mathura, Vrindavan, Gokul, Govardhan, Nandgaon, and Barsana. These sites have been developed and turned into cultural and sacred landscapes to facilitate ceremonies honoring the supernatural powers of the Yamuna River and the divine love of Radha and Krishna. These water places have divine associations that the local communities are aware of. Therefore, they continue to perform religious rites, but they are being indifferent and ignorant about the environment, which allows other stakeholders to make these sites aesthetically appealing. They rely more on laborious cleaning of these kunds during festivals and are not concerned with preserving and maintaining these water infrastructures. Furthermore, the study's thorough ethnographic research and semi-structured interviews show that villagers and priest communities are largely inactive and permit local and state governments to maintain these sites without tying them to their direct ties to Vedic India's cultural landscapes.

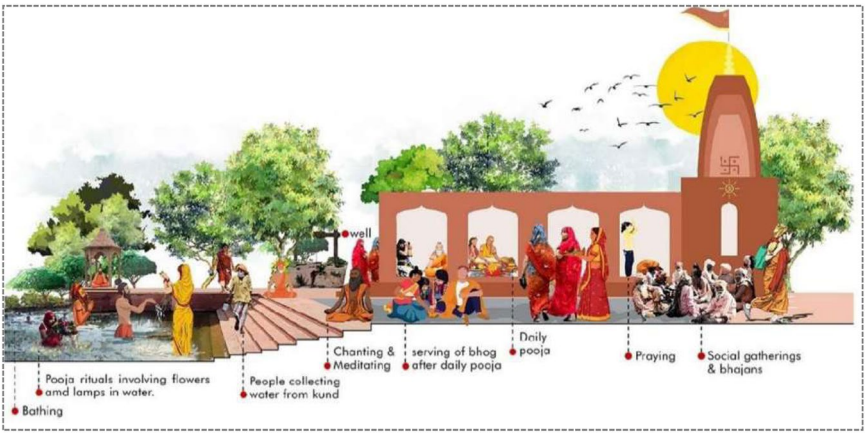


Fig. 8 The relationship of women with kunds and ghats in Braj

3.4.3 External interventions by other stakeholders

Through deep observation and discussions with local stakeholders, the study also finds that, initiatives by local and state government agencies, private partnerships by TATA, ISKCON, and the Braj foundation to aestheticize these sites, stone the natural edges, and provide new infrastructures without understanding their meanings and relationships with the past and present people are not fruitful for restoration in the name of development. Moreover, the study also discusses that current conservation practices by the Uttar Pradesh Braj Teerth Vikas Parisad (UPBTVP), Uttar Pradesh Jal Nigam, Nagar Palika Parisad, and National Mission for Clean Ganga are beautifying these sites, providing aesthetic treatment only for expanding tourism activities without considering their ecological connections and relationships with the sacred gardens and forests. It has also been found that in the year 2023, UPBTVP is constructing a ropeway structure in Barsana from Radha Bagh to reach Radha Rani Temple for making Barsana a smart tourist village without even considering the sacred and heritage values associated with the forests, hills, and sacred gardens nearby Radha and Krishna Bagh, which are already fragmented due to urban settlements and developmental activities. Furthermore, the study observes that no organizations are conserving these water infrastructures from the perspective of women and local communities to revive and repair the lost socio-cultural and ecological connections. The study also reveals that due to landscape transformation in Braj, there is a disconnect between local populations and these heritage sites. Due to the use of sandstones, invasive planting species, and the stoning of the natural edges, the kunds, pokhars, and sarovars are getting polluted and creating heat island effects in extreme summers. Moreover, considering only religious practices would not be enough to restore and conserve these water sites. However, religion is important in the Indian context for conserving such heritage sites. Furthermore, the present study also discusses that over the period of time due to insensitive developmental activities by the local and state government, beautification of these water infrastructures

Fig. 9 Changing scenarios of water infrastructures in Gokul, Govardhan, Nandgaon, Barsana and Mathura

and sacred gardens by Braj Foundation, discourtesy towards natural resources, unawareness about the ecological and socio-cultural connections, ready availability of domestic water supply through pipelines and hand pumps, the architecture and built environment of pokhars, kunds, sarovars and wells have been changed partially since the settlements have developed near by the edges of kunds, wells, pokhars, sarovars and ghats. Moreover, despite being culturally rich and religiously active, the sacred landscape of the Braj region has been transformed into a landscape of distress because of a lack of proper planning, sustainable tourism practices, sewage treatment plants, and continuous negligence towards existing water infrastructures. Figure 9 shows the recent developments by Braj Foundation, beautification and restoration by UPBTVP and local governments and present conditions due to continuous negligence by the priest and local communities of water infrastructures in Braj.

3.5 Theoretical implications

The existing theoretical framework and practices of heritage conservation, encompassing material- and values-based approaches, continue to exhibit a disconnect between historical monuments and contemporary society (Poulis 2014). This framework, influenced by the Nara Document on Authenticity, predominantly prioritizes the preservation of the fabric's authenticity, thereby struggling to incorporate the notion of living heritage sites (Poulis 2014; Wijesuriya 2010). Giving a single governing authority—mostly conservation experts—more control over all stakeholder groups appears to contradict the core community's crucial role in running and maintaining a living heritage site (Poulis 2014; Wijesuriya 2010). Since conservation professionals tend to establish and justify their own association with a site and their right to keep all stakeholder groups, including the core community, under their control, it could be argued that they try to deprive the core community of its unique association with a site. In this way, conservation experts view the idea of a living heritage site in relation to their personal affiliation with the location (instead of the affiliation of the core community with the place) (Poulis 2014). However, the present study discusses that living heritage as a philosophy emphasizes the continuity of the original function and community connections with these water infrastructures, which invariably brings change as the primary driver for the conservation and management of these heritage sites by the local community participation, stakeholders, and government. The study also reveals through the frameworks of living heritage, that the continuity in original functions, community connections, cultural expressions, and community care in kunds, sarovars, and ghats has been found and justifies these water infrastructures as living heritage; however, there is partial continuity in cultural expressions and community care in wells and pokhars seeking serious attention from the local villagers, government, and women to encourage lost sociocultural and ecological interactions. Thus, the case of Braj, by using core community connections and continuity in cultural expression with these water sites, justified that core community participation and their engagement with the heritage sites could also be a successful conservation practice from the Western world's ideology of current conservation practices.

Moreover, in the context of a material-based and values-based approach, the current theoretical framework and practice of heritage conservation are founded on the idea that a site's authenticity cannot be restored and heavily emphasize materiality and its components. It also operates under the concept that conservation professionals hold the power to envision and carry out the conservation process (Poulis 2014; Wijesuriya 2010). The evolution of continuity (all four criteria) in the context of evolving broader conditions over time, particularly the strengthening of continuity and the growth of community power, tends to make it more difficult for heritage authorities to conserve and manage living heritage sites (Wijesuriya et al. 2013; Wijesuriya 2018; Poulis 2014). This has significant ramifications for the original spatial arrangement and the fabric of the sites. Particularly in World Heritage, living heritage sites are unlikely to adhere to current conservation ideas and techniques (Poulis 2014). However, the process of living heritage guided the

present research study in the case of Braj as an interactive, community-led strategy for management and conservation by highlighting a fundamental community and its principles, acknowledging that change is unavoidable, and using traditional knowledge-based approaches and locally produced materials to maintain these water infrastructures throughout time and provide mutual advantages. Moreover, through the objectives of living heritage, the study further explains that kunds, sarovars, and ghats are still commemorating the religious and socio-cultural practices; however, wells and pokhars are used for recreational, domestic, and irrigation practices. The arrival of modern drinking water facilities decreases the social interactions around the wells and pokhars. However, changes in the natural setting, architectural built environment, and political environment of selected villages in Braj deprive the core communities, women, and kids of their socio-cultural and ecological values associated with these sacred and ecological landscapes. Furthermore, living heritage as a product directed this research as a long-term sustainability management plan in safeguarding these water infrastructures with an empowered community engagement in decision-making. Thus, the case of Braj challenges the current conservation practices and conservation professionals in the Western world in the context of living heritage sites.

3.6 Policy recommendations

The study also reveals that female participation in fetching water from wells and performing socio-cultural activities along these water infrastructures was the identity of sacred rural landscapes in Braj. The study reveals that these vital infrastructures risk becoming lifeless relics without meaningful engagement of local communities, particularly women, and the integration of sustainable tourism and culturally rooted conservation practices (Nawre 2018; Arya 2019).

3.6.1 Community-led conservation

The findings also suggested that perceiving these water infrastructures from the perspective of local communities, villagers, and other stakeholders, especially women as cultural agents, is an asset in shaping these cultural landscapes of Braj (as shown in Fig. 8). They also encourage the non-functional wells to convert them into recreational open spaces to revive their socio-cultural relationships with these water infrastructures (Singh 2025; Nawre 2018; Arya 2019). The study recommends community participation in conserving and maintaining these water infrastructures, such as committees for maintaining pokhars and wells to revive lost socio-cultural and recreational activities (Singh 2025).

3.6.2 Sustainable tourism practices

The study further recommends the conservation of kunds in groves and the restoration of padav sthals (resting places) for pilgrims on the parikrama, as kunds are the closest to the idealized representations of divine powers (Halder and Sarda 2021).

Using the ancient boundaries, the outlying kunds that farms encircle should be classified as protected areas with a 200-m buffer zone where groves might be regenerated (Sinha 2006, 2023). The reclamation of kunds and groves will serve as a spur for managing the area as a protected heritage zone and preserving the entire cultural landscape of Braj (Sinha 2006, 2011, 2014, 2023). The study demands a sensitive and holistic framework, sensible and sustainable tourism, and management planning and practices to conserve and restore these water infrastructures along the parikrama route, which will further lead to the revival of lost socio-cultural and ecological connections (Halder and Sarda 2021; Sinha 2006, 2011, 2014, 2023; Shinde 2007, 2010, 2012; Trivedi 2000).

3.7 Limitations

Due to the small sample size in selected villages of Braj and seasonal variability in fieldwork, the research has some limitations. Though the research has included villages that show community participation with the water infrastructures, the eight small villages in Barsana have been partially considered based on their existing types of water infrastructures. The author visited these villages during and before the festivals; hence, the engagement of the communities with these water infrastructures can partially vary.

4 Conclusion

The present study summarizes and concludes through the objectives and frameworks of living heritage theory (Wijesuriya 2018; Poulis 2014) and highlights the continuity in original functions, community connections, cultural expressions, and community care in kunds, sarovars, and ghats and partial continuity, in cultural expressions and community care in wells and pokhars. These findings provide justification for the classification of these water infrastructures as living heritage. Furthermore, the study concludes that while these water infrastructures remain religiously connected with the local communities, their socio-cultural and ecological connections have disappeared. Pokhars and wells are eliminated from their original functions and seek serious attention; however, ghats, kunds, and sarovars are still active but demand an ecologically sensitive care and management plan. Women are socially and ecologically disconnected from the pokhars, wells, and ghats and seek interactive engagement to revive and rejuvenate the lost connections. Perhaps these water infrastructures seek serious attention from the local and state government, private partnerships, and NGOs; beautifying and aestheticizing these sites is not the solution to revive and repair these lost connections. Moreover, community participation and its inseparable bond with these heritage sites can bring back the legacy, the only past connection with the future. Further, the study advocates more comprehensive and inclusive design frameworks, policies and governance to preserve and restore these living heritage sites

to reduce economic water scarcity in India (Bhattacharya et al. 2011; Cooke et al. 2005; Arya 2019; Nawre 2018; Sinha 2020). The study also urges a shift toward inclusive, sustainable conservation approaches that revitalize the ecological and sociocultural relevance for future generations. (Sinha 2006, 2011, 2014, 2023; Mistry et al. 2024). The significant implication of the study is to integrate traditional knowledge systems and advance knowledge and technology to strike a better balance between human needs and the environment in the age of extreme water crises in India (Saha et al. 2010; Arya 2019; Laskar 2022; Murthy et al. 2022; Purwar 2020). Furthermore, the present study concluded that since living heritage aims to recognize the voices of communities, acknowledge their identities and feelings of legacy ownership and custodianship, and capture benefits that might be provided, living heritage frameworks can be a valuable strategy for such sites. It is beneficial in such cases where communities are trying to restore the relationship between their legacy and their communities after modern heritage management systems have cut them off from it (Wijesuriya 2005, 2007a, b, 2011, 2018; Mistry et al. 2024; Poulis 2014). Thus, the case of Braj could be an ideal example of a sustainable management plan for community participation in conserving heritage sites in the context of living heritage.

In the future, the research can be further conducted on longitudinal studies with community-led restoration and cross-regional comparisons of water harvesting systems, including the community connections and socio-cultural interactions with stepwells and Jhalaras in Rajasthan and Gujarat.

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Data availability Secondary data such as government policies are available in a publicly accessible repository.

Declarations

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