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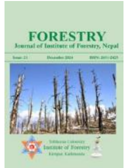

Religious, Cultural and Archaeological Significance of Salinadi River Catchment

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KEYWORDS

Watershed
Land use land cover
Geographic information system
Total dissolved solid
Carbon oxygen demand

ABSTRACT

Nepal's water resources, deeply woven into the cultural, religious, environmental, and social fabric of the nation, are increasingly under threat due to human activity and climate change. These water resources, particularly those in the Kathmandu Valley, hold significant spiritual and historical value, with sacred water bodies central to Hindu and Buddhist rituals, pilgrimages, and festivals. However, rapid urbanization, agricultural expansion, and deforestation have stressed these critical resources, with water quality and availability increasingly compromised. This study focuses on the Salinadi watershed, an area renowned for its cultural and ecological significance, to examine the interrelationship between cultural heritage, land use changes, and water quality. By documenting key religious, archaeological, and environmental sites within the Salinadi catchment, this research assesses three decades of land use and land cover changes and investigates water quality variations along the river, from upstream to downstream. Results indicate a significant transformation in land cover, with urban development causing notable ecological strain, while water quality is deteriorating due to both cultural practices and agricultural runoff. This study highlights the urgent need for integrated conservation strategies that balance the preservation of cultural heritage with sustainable water management, aiming to safeguard both the ecological integrity and spiritual value of the Salinadi watershed.

INTRODUCTION

Nepal's water resources are not only vital for sustenance but also carry deep cultural, religious, environmental, social, and economic significance. Water bodies throughout the country are profoundly intertwined with Hindu and Buddhist traditions, often serving as sacred sites for rituals, festivals, and pilgrimages. These water sources are seen as manifestations of divine power, and their preservation is integral to the spiritual well-being of the communities that depend on them. Beyond their religious and cultural importance, these bodies of water also offer valuable archaeological insights, revealing the historical evolution of human settlements and their long-standing relationship with the land.

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They underscore the intricate connection between people and water, passed down through generations. However, the growing pressures of human activity, coupled with the impacts of climate change, have placed these vital water resources and associated watershed ecosystems under significant strain. Challenges such as water scarcity, declining water quality, and the loss of biodiversity have become increasingly prevalent IPBES Report (2019). These environmental issues not only threaten the ecological balance but also endanger the region's food, water, and ecosystem security, creating urgent calls for more sustainable management practices (Allan et al., 2019; Caldwell et al., 2012; Cao et al., 2022).

The Kathmandu Valley, with a population of 1.5 million (Central Bureau of Statistics, 2021), is one of the most densely populated and culturally significant areas in Nepal. Rapid urbanization, agricultural expansion, and infrastructural development intensify the stress on local water resources, especially in sacred watersheds. Holy water sources, historically regarded as powerful sites for spiritual practices such as cleansing, healing, initiations, and death rites, are increasingly exploited for these cultural functions (Altman, 2002). However, this overuse has led to a noticeable decline in both the quality and availability of water, a trend repeatedly emphasized in various studies (Bhatnagar et al., 2016; Butler, 2022; Limbu, 2024; Mujawar et al., 2019; WaZza et al., 2018; Yonzon & K.C., 2019).The effects of these pressures are particularly severe in culturally significant watersheds like the Salinadi, where the delicate balance between cultural, environmental, and social factors demands immediate and focused conservation efforts. The Salinadi River, a tributary of the Bagmati, is both an ecological and spiritual asset, central to Hindu and Buddhist traditions and renowned for the annual 'Swasthani Brata Katha' pilgrimage. The Salinadi's catchment area, however, faces critical challenges from population pressure, deforestation, and unmanaged land use changes that affect its water quality and threaten its cultural and historical sites.

This study focuses on three interlinked aspects of the Salinadi watershed: (1) its cultural and archaeological importance, rooted in centuries-old traditions and practices, (2) land use land cover (LULC) changes driven by urban expansion and agricultural practices, and (3) water quality variations along the river, affected by human and agricultural runoff. By examining these dimensions together, this paper aims to provide a comprehensive understanding of the watershed's status, highlighting the need for integrated conservation efforts to safeguard both its ecological health and cultural significance. This approach not only facilitates the sustainable management of water resources but also emphasizes the importance of preserving Nepal's cultural heritage through informed conservation strategies.

The general objective of this study was to comprehensively document and evaluate the present condition of the Salinadi catchment area, with a particular emphasis on its rich religious, cultural, and archaeological heritage. The specific objectives of the study were as follows:

- To systematically document and provide a detailed record of all sites within the Salinadi catchment area that hold historical, religious, cultural, or archaeological significance.
- To assess the transformation of land use land cover within the catchment over a period of three decades from 1990 to 2021.
- To evaluate the current status of water quality in the Salinadi River to recommend practical management strategies at local and national levels.

MATERIALS AND METHODS

Study area

Salinadi originates in the Mahabharat Range and flows through the historic Newari town of Sankhu, now part of Shankharapur Municipality in Kathmandu District. It converges with the Manohara River near Changunarayan before ultimately joining the Bagmati River (DHM, 2020). The catchment area covers approximately 46.73 square kilometers, much of which lies within Shivapuri Nagarjun National Park (ICIMOD, 2015). Topographically, the watershed ranges in altitude from 1,283 to 2,353 meters above sea level. Its geology consists primarily of fluvio-lacustrine sediment deposits, including sandy, loamy, and bouldery materials mixed with clays, fine gravels, and various sand and silt compositions (Dangol, 2004). The climate is classified as warm temperate to subtropical, with dry, cold winters and hot, warm summers. Mean summer temperatures range from 28°C to 32°C, while mean winter temperatures average around 10.1°C.

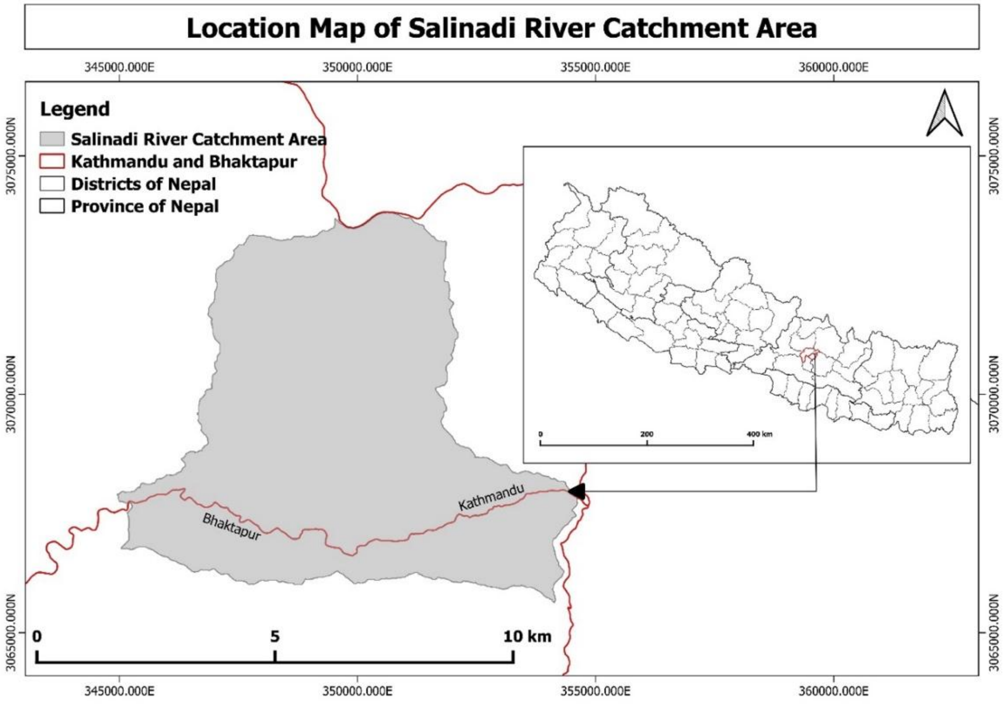

Figure 1: Location map of Salinadi catchment area.

Data collection

Field visit: Field visit was carried out in the month of March 2021 to gather primary information on the current status of the Salinadi watershed. During field visit, the research team documented the physical characteristics of the river and recorded sites of religious, cultural, environmental, and historical significance within the catchment area. These observations were essential for understanding the spatial relationship between cultural sites and areas affected by environmental changes.

Key informant interview (KII): To gain deeper insights, semi-structured interviews were conducted with local experts, including senior citizens, priests, academic professionals, archaeologists, and local political leaders. Approximately, four KIIs focused on the historical, cultural, social, archaeological, and religious importance of the Salinadi watershed was done. They also covered current challenges and potential conservation actions. Additionally, other four KIIs representing staff from the Department of Forests and Soil Conservation, the Department of Archaeology, and university professors contributed for their expertise and suggestions for sustainable management, which provided a foundational perspective on integrating cultural preservation with environmental protection.

Focus group discussions (FGD): The Covid pandemic lockdown from 2020 until 2021 with strict rules to follow the safety precaution recommended by Government of Nepal had severely restricted the focal group discussion part of this report making. Despite all this scenario, maintaining physical distance, four focus group discussions were conducted, as minutes of the discussions and signatures of the participants were not mandatory in the situation and hence not managed following safety measures; therefore, exact number of concerned participants' information could not be delivered. Participants mainly included members from the "Siddhartha Janak Dharma Karma Sewa Sangh," local farmers, senior citizens, social activists, and representatives from local NGOs. These discussions provided community perspectives on the watershed's cultural and ecological value, emphasizing community-driven conservation efforts. The FGDs also addressed specific issues such as water quality degradation due to ritual activities, land-use changes impacting local traditions, and potential strategies for improving environmental stewardship.

Water quality testing: To assess the ecological health of the Salinadi watershed, water samples were collected from three strategically selected stations along the river, each representing different levels of human and environmental impact. Three water samples were taken from each station, totaling nine samples, to ensure accuracy and consistency in data. The samples were collected in March 2021, a period that represents post-festival conditions in the Salinadi catchment area. This timing was chosen to capture the cumulative impact of human activities, particularly those associated with the Swasthani Brata Katha festival, which typically occurs in January-February and attracts thousands of devotees for ritual bathing and offerings.

Sample site 1 (Narayaneshwor Mahadev Kunda – Upstream): This site, located at the headwaters of the river, represents a relatively undisturbed area with minimal human impact. The water quality at this site serves as a baseline for natural conditions, reflecting the river's state before significant human intervention.

Sample site 2 (Swasthani Temple - Midstream): Situated near the Swasthani Temple, this site experiences high human activity, particularly during religious festivals. The data collected in March 2021 reflects the residual impact of the Swasthani Brata Katha festival, which had concluded approximately one month prior. This timing allows for the assessment of longer-term effects of ritual activities, such as the accumulation of organic pollutants from offerings and ritual bathing.

Sample site 3 (500 meters south of Swasthani Temple - Downstream): This downstream site, located near agricultural fields, captures the cumulative influence of both religious and agricultural activities on water quality. The March 2021 sampling period coincides with the pre-monsoon season, when agricultural runoff is relatively low but still present due to irrigation practices. This timing ensures that the data reflects the combined impact of upstream pollution and agricultural activities.

By collecting data in March 2021, this study captures the post-festival conditions and provides insights into the longer-term effects of human activities on water quality.

This approach ensures that the findings are representative of both peak human disturbance (during festivals) and baseline conditions (during non-festival periods), offering a comprehensive understanding of the Salinadi River's ecological health.

Parameters measured: On site measurements included temperature, EC, pH, and TDS, using portable devices to capture immediate water conditions. For a more detailed analysis, laboratory tests at Kathmandu University evaluated Total Carbon (TC), Inorganic Carbon (IC), Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD). The methodologies adhered to APHA's *Standard Methods for the Examination of Water and Wastewater*, ensuring reliable results. Measuring EC, TDS, COD, and BOD helps gauge the water quality impacted by various land uses and cultural practices. By comparing these parameters across sites, the study can establish a link between religious activities, agricultural practices, and water pollution, identifying areas where cultural preservation intersects with environmental challenges. The methods employed for water sample analysis are detailed in Table 1.

Table 1: Methods used for water quality analysis

S. N.	Parameters	Units	Methods used	Methods based on	Equipment Used (Model/Brand)
1	Total pH		Electrometric method	4500 - H+ B, APHA 22nd edition	HANNA Instruments HI98107
2	EC	μS/cm	Measured by placing a conductivity probe in the water and measuring the flow of electricity between the electrodes.		HACH HQ40d Multi-Parameter Meter
3	TDS	Mg/l	Oven drying	2540 C, APHA 22nd edition	HANNA Instruments HI98311
4	BOD	Mg/l	Wrinkler Azide Modification	5210 B, APHA 22nd edition	Laboratory-based Winkler method
5	COD	Mg/l	Open Reflux method	5520 B, APHA 22nd edition	Laboratory-based reflux apparatus
6	NBOP	Mg/l	COD fractionation test		Laboratory-based COD fractionation
7	TOC	Mg/l	Wet Oxidation method	5310 D, APHA 22nd edition	Shimadzu TOC-L Analyzer
8	IC	Mg/l	Titration method	2310 B, APHA 22nd edition	Laboratory-based titration setup
9	TC	Mg/l	TOC+IC		Shimadzu TOC-L Analyzer

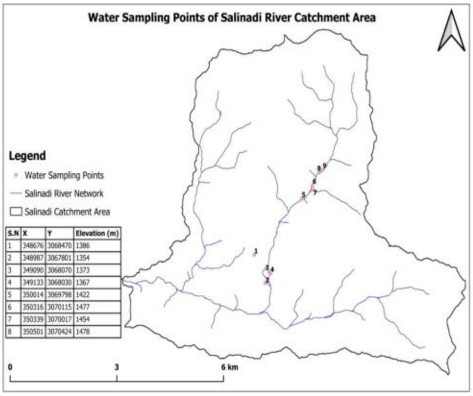

Figure 2: Water sample collection point

Land use land cover (LULC) analysis

The study utilized QGIS 3.8 software for image processing and to create Land Use Land Cover (LULC) maps over multiple time periods (1990, 2000, 2010, and 2021) based on Landsat satellite imagery with a 30-meter spatial resolution. Table 2 outlines the sources and specifications of these images. The LULC classification included six categories: Agricultural Land, Forest, Built-Up Area, Grassland, Shrubland, and Barren Land. By comparing these maps, the study was able to visualize temporal changes in land use, particularly increases in built-up areas and reductions in agricultural land, which have implications for cultural and ecological dynamics within the watershed.

This spatial analysis was crucial for linking land cover changes with cultural and environmental impacts. Urban expansion near culturally significant sites threatens traditional land uses and reduces open spaces essential for community rituals. Additionally, the loss of natural land cover increases runoff and pollution, which directly affects water quality at culturally important sites along the river.

Table 2: Data source for land use land cover classification

Date	Image	Spatial Resolution	Cloud Cover	Source
1990	Landsat 5 TM- OLI	30 m	< 5 %	http://rds.icimod.org
2000	Landsat 5 TM- OLI	30 m	< 5 %	http://rds.icimod.org
2010	Landsat 7 TM- OLI	30 m	< 5 %	http://rds.icimod.org
2021	Landsat 8 TM- OLI	30 m	< 5 %	https://earthexplorer.usgs.gov/

RESULTS AND DISCUSSION

Origin and history of Sankhu Valley and Salinadi

Sankhu (Shankharapur Municipality) is an ancient town in the northeastern Kathmandu Valley, at the foothills of the Shivapuri Mountain range. According to the FGDs, the origin of the town is steeped in local myths, with locals believing the valley was once a lake drained by Goddess Bajrayogini and the settlement is thought to have been developed by priest Jogdev and King Sankhadev, with evidence of its existence dating back to the Lichhavi Period. The name "Sankhu" is derived from its conch shell shape and reflects historical ties to Tibet, suggesting cultural exchanges over centuries.

It was found during the KII that the Manichuda Lake, situated at 2,403 meters, plays a crucial role in the region's hydrology, feeding into the Salinadi River. This river, known by several names, flows southward through Sankhu Valley and merges with the

Manohara River before joining the Bagmati. The annual Swasthani Brata Katha ritual attracts millions of Hindus, who believe that bathing in the Salinadi purifies their sins and grants their wishes, following the myth that Goddess Parwati bathed there during her meditation. Locals rely on Salinadi for drinking water, particularly from Lapsichaur, although concerns have arisen regarding its decreasing flow, reportedly halved over the past fifty years. The Salinadi Hydropower Project, operational since 2007, harnesses its water for approximately 232 kW of electricity.

Newar Guthi and its association with Sankhu

According to the KIIs, the Newars, original inhabitants of the Kathmandu Valley, have preserved their unique cultural identity, including the Nepal Bhasha language, while the institution of guthi—socio-religious associations—has been central to their community life, overseeing religious rituals and social welfare from the Licchavi to Malla periods. In Sankhu, guthis support the disadvantaged by providing housing, education, and medical assistance, reflecting the community's commitment to social welfare and cultural preservation.

Historical, religious and archeological sites

Historically, Sankhu featured eight gates, important landmarks, each with unique significance. Only five have been renovated to reflect the town's rich heritage.

Bhau Dhwakha (Bride Gate): The gate holds special significance in Sankhu as it serves as the main entry point into the town. Traditionally, it is the gate through which a new bride enters the town upon arrival. This gate symbolizes the beginning of a new journey and is steeped in cultural and ceremonial importance.

Mhyamachaa Dhwakha (Daughter Gate): This gate is also called "Sangal Dhwakha" in the local language. It is the gate to bid farewell to a newly married daughter and her husband.

Dhunila Dhwakha: The gate known locally as "Dya Dhwakha" holds significant cultural and religious importance in Sankhu, particularly during the Bajrayogini festival. This gate serves as the ceremonial entry point for the main chariot of Bajrayogini, a revered goddess, into the town each year during the festival. It symbolizes the welcoming of divine presence and blessings into the town.

Mahadyo Dhwakha: The gate known locally as "Si Dhwakha" in Sankhu serves a solemn and important role as the gateway through which deceased members of the community are carried for funerary rites. This gate is specifically designated for the procession of funeral corteges, reflecting cultural practices and traditions surrounding death and mourning in the local community.

Naari Dhwakha: The local name of the Salinadi is "Naari", from which the name of the gate is derived. This gate holds special significance during the Salinadi festival, where it serves as the entry and exit point for the deity Madhav Narayan and devotees participating in the festivities.

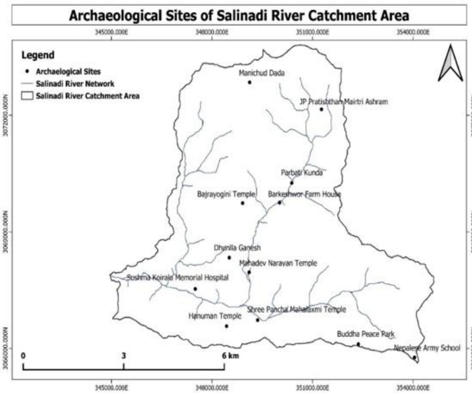

Figure 3: Map of archeological sites of Salinadi catchment area

Land use land cover (LULC) classification and changes

LULC analysis from 1990 to 2021 reveals substantial changes in land cover within the

Salinadi catchment area, reflecting increased human activity and its environmental implications (Figure 4). Over the 30-year period, forest cover increased by 23.36% (from 23.15 km² in 1990 to 28.57 km² in 2021), possibly due to reforestation efforts and decreased reliance on forest resources. In contrast, agricultural land decreased by 58.82%, a significant decline from 20.88 km² to 8.78 km². This reduction indicates a shift away from traditional farming toward urban development, particularly between 2010 and 2021, when built-up areas expanded from 0.28 km² to 7.36 km²—an increase of over 1283.83%.

The complete disappearance of grasslands and shrublands in this period also highlights a loss of biodiversity and ecosystem services, impacting water quality and sedimentation in the Salinadi. Increased built-up areas contribute to surface runoff, which raises pollutant levels in the river, particularly downstream. The rapid urbanization of culturally significant sites further underscores the urgent need for sustainable land management to preserve both ecological and cultural resources. Table 3 and Table 4 (LULC Changes and 2021 Area Coverage) summarize these shifts, underscoring the transformation of the watershed's natural landscape and its implications for the local ecosystem and water quality.

Table 3: Change statistics (in %) of LULC in Salinadi catchment area from 1990 to 2021

S.N.	Land Cover Types	% Change between		
		1990 and 2000	2000 and 2010	2010 and 2021
1	Forest	9	-1.3	23.36
2	Grassland	479.21	-19.29	-100
3	Shrubland	475	-100	0
4	Agricultural Area	6.33	2.079	-58.82
5	Barren Land	0	0	0
6	Built-up Area	0	87.37	1283.83

Table 4: Land use land cover of Salinadi catchment area in 2021

S. N.	Land Cover Types	Area (Sq.Km)	Description
1	Agricultural Land	8.78	Wet and dry croplands, orchards, and agricultural land
2	Forest	28.57	Evergreen broadleaf forest, deciduous forest, scattered forest, low-density sparse forest, mixed forest, and degraded forest
3	Built-up area	7.36	Urban and rural settlements, commercial and industrial area, construction areas, airport
4	Barren land	1.39	Bare rocks, cliffs, other permanently abandoned land
5	Shrubland	<1	Mix of trees (<5m) and other natural covers
6	Grassland	<1	Dense coverage grass, moderate coverage grass and low coverage

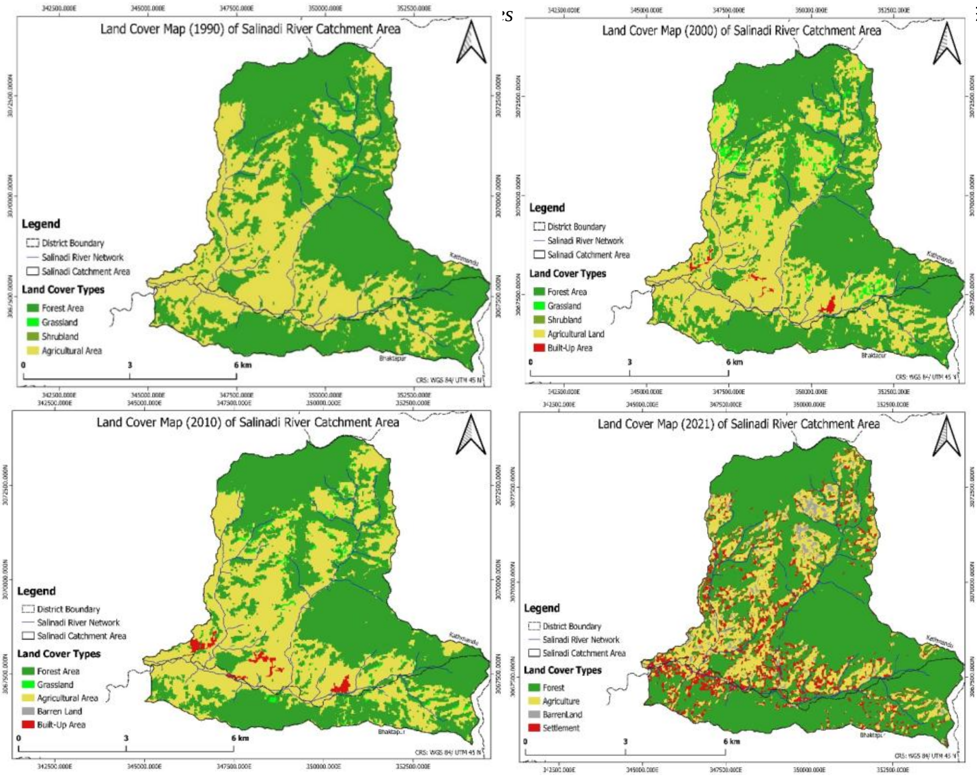

Figure 4: Land use land cover classification of Salinadi catchment area for last 30 years

Water quality of Salinadi (integrated with cultural and environmental analysis)

The physico-chemical properties of the Salinadi were analyzed at three key sampling sites along the river to assess variations in water quality due to cultural activities and land use changes (Table 5 and Table 6). The results reveal a clear gradient of water quality decline from the upstream to downstream sites, with the Swasthani Temple site showing the highest levels of pollution due to religious activities.

Table 5: Physio-chemical parameters value of water of Salinadi catchment area measured in field

S. N.	Sample	pH	Temperature (ºC)	EC (µS/cm)	TDS (ppm*)
1	1 Narayaneshwor Kunda	7.60	16.7	52	25
2	2 Swasthani Temple	7.54	19.8	86	42
3	3 500m south of Swasthani temple	7.10	19.6	98	47

Note: EC is Electrical Conductivity and TDS is Total Dissolved Solid.

Table 6: Chemical parameters to determine the water quality of Salinadi (values are expressed in ppm i.e., mgL-1)

S. N.	Sample	TC	IC	TOC (x)	NBOPs (y)	COD (y)	BOD (y)
1	Narayaneshwor Kunda	17.2	13.08	4.12	4.06	6.91	2.85
2	Swasthani Temple	54.37	39.22	15.15	12.74	24.40	11.66
3	500m south of Swasthani temple	31.99	24.62	7.37	6.62	12.06	5.45

Note: TC = Total Carbon; IC = Inorganic Carbon; TOC = Total Organic Carbon; NBOPs = Non-Biodegradable Organic Pollutants; COD = Chemical Oxygen Demand; BOD = Biological Oxygen Demand.

Upstream site (Narayaneshwor Mahadev Kunda): This site displayed favorable water quality conditions, with a near-neutral pH (7.60) and low electrical conductivity (EC) and TDS levels, indicating minimal human impact. The relatively low levels of Total Carbon (TC), Inorganic Carbon (IC), and other pollutants highlight the pristine nature of this area, serving as a baseline for the study.

Midstream site (Swasthani Temple): Located in a high-activity religious area, this site showed increased levels of TC, IC, Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD). The elevated values reflect significant organic pollution due to ritual bathing, offerings, and other activities associated with the Swasthani festival. High levels of COD and BOD point to reduced oxygen levels, impacting aquatic life. This site exemplifies the intersection of cultural practices and environmental stressors, where traditional religious activities contribute directly to water quality degradation.

Downstream site (500 meters south of Swasthani Temple): This site captures the cumulative impact of upstream pollution and agricultural runoff. Elevated TDS, EC, and TOC levels reflect contributions from both religious and agricultural sources. Observations during the field visit indicate that chemical fertilizers and irrigation runoff from nearby agricultural fields introduce additional pollutants, further impacting water quality. The downstream site, therefore, represents a compounded environmental burden, showing the interdependent effects of cultural and land use practices.

Linkages between LULC, water quality, and cultural significance

The findings of this study illustrate a close relationship between Land Use Land Cover (LULC) changes, water quality, and cultural activities within the Salinadi watershed. These linkages are consistent with previous research on watershed management and the impacts of human activities on river systems.

LULC impacts on water quality

The expansion of built-up areas in the Salinadi catchment has contributed to increased surface runoff and sedimentation in the river, raising pollutant levels and deteriorating water quality downstream. This finding aligns with studies by McGrane (2016) and Freeman et al. (2019), who observed that urbanization significantly alters hydrological processes by increasing impervious surfaces, which in turn reduces infiltration and increases pollutant loads in rivers. Similarly, Ishtiaque et al. (2017) documented rapid urbanization in the Kathmandu Valley, noting that the conversion of agricultural land and forests into built-up areas has led to increased runoff and sedimentation in the Bagmati River system, of which the Salinadi is a tributary.

The decline of natural land cover, such as forests and grasslands, exacerbates these effects by reducing the land's ability to filter contaminants before they reach the water. This is consistent with findings by Uddin et al. (2015), who reported that the loss of forest cover in Nepal has led to increased soil erosion and sedimentation in river systems. In the Salinadi catchment, 58.82% reduction in agricultural land and the complete disappearance of grasslands and shrublands over the past three decades highlight the urgent need for sustainable land management practices to mitigate these impacts.

Cultural activities and water pollution

The Swasthani Temple site, located midstream, showed elevated levels of Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD), indicating significant organic pollution due to ritual bathing and offerings during religious festivals. This finding is supported by studies such as Bhatnagar et al. (2016) and Mujawar et al. (2019), who documented similar patterns of water quality degradation in sacred rivers in India due to mass bathing and ritual activities. For example, Bhatnagar et al. (2016) found that religious activities in the Ganges River led to a 40% increase in BOD levels during festivals, which is comparable to the 11.66 mg/L BOD observed at the Swasthani Temple site in this study.

The downstream site, located near agricultural fields, showed elevated levels of Total Dissolved Solids (TDS) and Electrical Conductivity (EC), reflecting the cumulative impact of agricultural runoff and religious activities. This is consistent with findings by WaZza et al. (2018), who reported that agricultural practices, particularly the use of chemical fertilizers and pesticides, contribute significantly to water pollution in river systems. In the Salinadi catchment, the combined effects of cultural practices and agricultural runoff have created a compounded environmental burden, as evidenced by the 47 ppm TDS and 98 μS/cm EC levels at the downstream site.

Sustainability challenges

The cumulative effects of cultural, agricultural, and urban practices in the Salinadi watershed highlight the need for integrated watershed management that respects both cultural heritage and environmental sustainability. Similar challenges have been documented in other culturally significant watersheds, such as the Ganges River in India (Butler, 2022) and the Bagmati River in Nepal (Limbu, 2024). For instance, Limbu (2024) emphasized that the Bagmati River, once considered sacred, has become one of Nepal's most polluted rivers due to uncontrolled urbanization, ritual activities, and agricultural runoff. These findings underscore the importance of adopting community-based conservation strategies and scientific land-use planning to address the dual challenges of cultural preservation and environmental degradation.

CONCLUSION

The findings of this study demonstrate that rapid urbanization**,** agricultural expansion**,** and cultural practices have significantly altered the land use and land cover (LULC) of the Salinadi watershed, leading to increased surface runoff**,** sedimentation**,** and water quality degradation**.** Elevated levels of Total Organic Carbon (TOC)**,** Chemical Oxygen Demand (COD)**,** and Biological Oxygen Demand (BOD) at the Swasthani Temple site, along with increased Total Dissolved Solids (TDS) and Electrical Conductivity (EC) downstream, highlight the cumulative impact of human activities on the river's ecological health. These findings underscore the urgent need for sustainable land management practices and community-based conservation strategies to mitigate the environmental impacts of urbanization, agriculture, and cultural activities in the Salinadi watershed.

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