A Study of Submerged Heritage from the Salaulim Dam of South Goa

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Abstract- The village of Curdi in South Goa represents one of India's most striking examples of submerged cultural heritage. Following the construction of the Salaulim Dam in 1983–84, Curdi and nineteen surrounding villages were permanently submerged, resulting in the displacement of nearly 3,000 people. Among the most significant structures affected was the Shree Someshwar temple, a vernacular Goan Hindu temple of considerable historical and architectural value. The temple re-emerges only during the summer months, offering a narrow seasonal window for observation.

This study presents a comprehensive investigation of the submerged Someshwar temple through field documentation, architectural assessment, oral histories, and material analysis. The field and lab analysis data reveal a hybrid temple layout combining Goan vernacular traditions, Nagara influence, and laterite masonry typical of the Konkan region (Kumar, V, 2019). The study also tries to highlight the cultural memory of the displaced Curdi community and the 2015 community-led restoration initiative. The study argues that the community represents a special form of living submerged heritage and highlights the need for systematic documentation and heritage planning for seasonally exposed archaeological landscapes.

Index Terms- Curdi in South Goa, Shree Someshwar Temple, Submerged Cultural Heritage, Weathering, Need of Restoration.

I. INTRODUCTION

The village of Curdi in South Goa located in the Sanguem taluka have a deep cultural and historical continuity that can be traced back to at least the 6th century BCE. Situated along the Kushavati River, the community flourished as an agrarian and ritual landscape before its submergence which happened due to the construction of the Salaulim Dam which was tailored to meet Goa's increasing water demands.

Submerged heritage in India is typically associated with permanently drowned landscapes usually called as coastal ruins. Curdi village in South Goa however presents a different phenomenon as a landscape that disappears under the waters of the Salaulim reservoir for nearly nine months each year and re-emerges during the summer. Among the many structures lost below the reservoir Shree Someshwar temple stands out as a cultural landmark. Unlike other temples in the region such as the Mahadev temple relocated near the dam while Shree Someshwar temple remained unshifted due to the presence of a *Swayambhu* (self-manifested) Linga, which according to local belief should not be moved.

As a result the temple exists today in-between materially fragile yet ritually significant state. Despite its significance the structure has never undergone formal documentation by any archaeological institution. This study therefore represents a critical step toward preserving the material, architectural, and intangible heritage associated with the submerged landscape of Curdi.

II. PREVIOUS WORK:

Research on Curdi is limited and scattered. Official government documents provide data on displacement, dam construction, and the relocation of other temples in the Salaulim basin, such as the Mahadev temple. Additional insights come from oral histories of displaced residents and recent documentary work, including remembering Curdi (Film Division, 2016).

Studies on Goan temple architecture offer useful background on Nagara influences and laterite-based construction traditions. However, no archaeological or architectural documentation of the Someshwar Temple exists prior to this study.

III. STUDY AREA

Curdi is located at **15°12′47″N, 74°10′44″E**, within the Salaulim reservoir basin in the Sanguem taluka of South Goa, approximately 65 km from Panaji. The area is part of the Western Ghats foothills, within the Western Deccan Volcanic Province and is dominated by laterite formations, basaltic uplands, and alluvial deposits. The Salaulim river, a tributary of the Zuari, flows through this landscape.

Curdi site / village is accessible from **Panjim**, the route follows NH-66 toward South Goa before turning inland to Sanguem, covering about 74 km, with the last 5–10 km on village roads leading into the reservoir basin. While from **Vasco-da-Gama and the airport**, the drive is roughly 52–54 km through Goa's interior roads toward the Salaulim Dam, followed by the same final village stretch to reach the exposed temple site. Similarly, **Belgaum** travelers enter Goa via NH-748 through the Anmod Ghat and continue towards Sanguem, eventually joining the interior roads that lead to Curdi, where the final 5–10 km must again be covered on local paths once the reservoir water recedes. Access is only possible from March to June (Fig. 1).

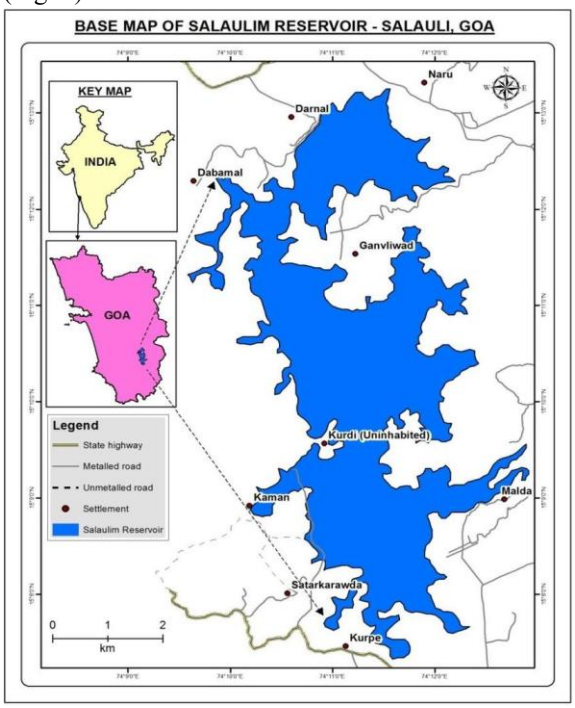

Fig. 1, Location map of Curdi within the Salaulim reservoir (Kathiresan et al., 2017).

IV. LANDSCAPE FEATURES

At the site, the beautiful variation in the landform is observed according to the season is observed. In rainy season site is become submerge under dam water, while during the summer season, the portion of heritage is becoming visible. According to the intensity of dryness, the following structures become visible, such as Shree Someshwar temple; *Natyagruha* (Shezo) with twin arches; *Deepastambha;* Ruins of the police station; Five-shop commercial structure; Portuguese-era laterite road alignments; and Cultivated fields and settlement blocks (*wadas*).

Following the construction of the Salaulim Dam in the 1970s–80s, the village was fully submerged, and its accessibility became seasonal; June–February site remains underwater, while March–May, reservoir levels drop, revealing roads, foundations, and the Someshwar temple (Times of India, 2022) (Fig. 2). This seasonal exposure makes Curdi an important but time-sensitive archaeological landscape.

Fig. 2, Aerial view of Curdi's landscape showing seasonally uncovered heritage features.

V. SIGNIFICANCE OF THE STUDY

The submerged landscape of Curdi depicts a unique intersection between archaeology, hydrology, cultural anthropology, and heritage studies. Shree Someshwar temple specifically offers an exceptional research value due to its hybrid architectural style, ritual continuity, and seasonal visibility. The significance of this study can be understood across three

interconnected dimensions: archaeological, cultural, and heritage-based.

1. ARCHAEOLOGICAL SIGNIFICANCE

Shree Someshwar temple is one of the few seasonally submerged archaeological structures which is accessible for systematic study. Unlike permanently submerged sites which require specialized underwater equipment Curdi offers direct access for a limited annual period allowing detailed architectural observation, material sampling and documentation without diving intervention. The temple's architecture reflects a unique blend of Goan vernacular building methods with traces of Nagara-style influence noticeable in the sanctum layout, plinth form, and spatial hierarchy (Kumar, V,2019). The use of laterite - a material abundant in the Konkan region and the presence of a *Swayambhu linga* situate the temple within indigenous architectural traditions (Kaur et al., 2023). As an archaeological site, Curdi also provides insight into settlement planning, religious infrastructure, and community life before the displacement related structures such as the *Natyagruha, Deepastambha*, market places, and Portuguese-era roads further enhance its archaeological landscape.

2. CULTURAL AND RITUAL SIGINIFICANCE:

Despite the annual submergence of their homes the former residents of Curdi maintain a deep emotional and ritualistic relationship with the submerged site. The yearly gatherings during the summer months involve offering prayers, performing pujas and reuniting with ancestral land. This continuity of ritual practice demonstrates a resilient cultural identity that persists despite environmental transformation and forced relocation. The temple remains a central focus of memory. Seasonal pilgrimages help preserve oral traditions, maintain kinship bonds and preserve intangible heritage. The site thus becomes a living cultural landscape rather than a static archaeological ruin.

3. HISTORICAL SIGINIFICANCE

Curdi challenges standard classifications of underwater heritage. It is not entirely lost beneath water nor is it fully accessible instead it exists in a liminal state where submergence and re-emergence continually reshape its identity. This seasonal nature increases global conversations about heritage affected by dams, climate change and hydropower projects. Curdi represents how communities negotiate identity, memory, and tradition in landscapes altered by development. Recognizing Curdi as a heritage site highlights the need for dynamic conservation approaches that respect both the environmental realities of submergence and the cultural meanings attached to such spaces.

VI. AIMS AND OBJECTIVES

The basic aims and objectives of the study is

- To document the submerged temple complex;
- To record the damages occurring in the temple body;
- To study the various materials observed in the temple premises;
- To prepare the comprehensive conservation plan based on these observations;
- To suggest some remedial measures for the heritage.

VII. SCIENTIFIC METHODS USED IN HERITAGE STUDIES

Scientific methods play a crucial role in accurately documenting and understanding heritage sites such as Curdi's Someshwar temple. The scientific tools like GPS mapping and GIS analysis help to record exact coordinates, track seasonal water-level changes, and create detailed spatial models of the submerged landscape.

A systematic scientific documentation of the temple and surrounding heritages were carried out and samples were collected for the lab testing. To understand the nature of material used such as mud plaster, the particle size and shape analysis were carried out. Similarly to understand the nature of mortar, its grain size and shape and its source of raw material, the sedimentological analysis were carried out. Besides the percentage of lime and mortar were also calculated.

Similarly the roof tile used in temple heritage at the roof areas belongs Indian origin. To understand the basic material of the same the particle size analysis, elemental analysis by using XRD to understand their source material and chemical composition were also studied. The Muffle Furnace instrument was used for carrying out pyro-technological analysis of sample of lime, mud plaster and roof tile powder.

Continuous environmental monitoring of temperature, humidity, rainfall, evaporation, and water-level fluctuations helps evaluate how the reservoir's hydrological cycle accelerates deterioration which were also studied from available data sources of Saluali Dam. Together, these scientific methods create a comprehensive and non-invasive framework for recording, analyzing, and preserving vulnerable heritage sites, ensuring that both physical remains and environmental pressures are thoroughly understood for long-term conservation planning by using literature study.

VIII. FIELD INVESTIGATION

Field studies were carried out during the summer months when the reservoir's water levels dropped sufficiently to allow access to the submerged village. The investigation combined observational, architectural, material, and ethnographic methods.

1. SITE DOCUMENTATION:

Fieldwork involved careful recording of exposed architectural remains which are listed as below

- Study of heritage landform: With the help of Google Earth Images and Survey of India toposheet maps the landform of the study region were studied properly.
- Mapping of foundations: Tracing the surviving outlines of the *garbhagriha*, remnants of the *mandapa*, and the surrounding plinth suggested partial adherence to Nagara-style proportions (Kumar, V,2019).
- Assessing weathering: Laterite blocks displayed varying degrees of exfoliation, sediment deposits, and microbial staining, indicating prolonged hydrological stress.
- Recording significant features: The *Deepastambha*, despite erosion, retained its distinctive Maratha-style form (M. Hall,1994). The *Natyagruha* (Shezo) featured two arched entrances, a greenroom, and ancillary chambers, offering insights into ritual performance spaces.
- The collapse roof of the heritage is totally washed out and the tiles were spread around the temple were from local region.
- Documenting associated structures: The police station ruins, the five-shop complex, and portions of the Portuguese-era road were photographed and mapped.
- Multimedia documentation: High-resolution photographs, drone images and video footage were taken for reference and analysis.

2. MATERIAL SAMPLING:

By applying systematic sampling methods, some important cultural materials were collected for lab analysis. This includes i. pottery ii. pieces of roof tile iii. mud plaster and iv. pieces lime plaster, v. Lime mortar, and vi. roof tiles etc. were collected for the lab analysis.

IX. LAB INVESTIGATION

1. POTTERY:

a) Before starting the experiment, the pottery is cleaned and then washed in the lab and dried-up to five days in normal temperature to remove the dust and soil. Then its dimensions were measured and photos are taken with scale.

b) On the basis typology and technology, the cultural phase of pottery belongs to colonial period of early 20^{th} century.

c) It is a white glazed pottery.

d) To avoid damaging of the surface and to remove residues of this archaeological pottery, it is cleaned gently. First, loose soil is brushed off using a soft brush, and the sherds are then washed carefully with clean water if the fabric allows it. Stubborn dirt is removed with wooden picks or soft tools so as not to

scratch the surface. The pottery is finally air-dried and never scrubbed harshly, ensuring that decorations, slip, and any use-wear marks remain intact.

e) Sources of raw material for the Pottery: To identity the exact sources of clay used for the manufacturing of ceramic – pottery where studied this analysis were caried out by using clay character analysis, sedimentological analysis to define the nature of sediments, their size and shape, percentage of clay and mortar analysis to decide the further method of conservation of this heritage.

f) Pyro technological analysis to understand the temperature of firing of the clay which were used in the manufacturing of the clay (100℃, 250℃, 400℃, 700℃ and 900℃). At the same time the change in the colour and loss of weight of material were noted during this experiment.

2. ROOF TILES:

a) These materials were used for the construction of the roof they were analyzed. This tile belongs to the company called A.F.Costa and the tile was made in 1923 and were manufactured in the Indian land from Goa.

b) To understand the chemical composition for elemental analysis, the powder form of the roof tile is tested under XRD in the laboratory at Department of Archaeology, Deccan College, Pune.

3. MUD PLASTER:

To understand the percentage of the clay and mortar as well as the shape and size of the sediments present in the mud plaster, sedimentological analysis were carried out in the geoarchaeology lab at Deccan College, Pune.

4. LIME PLASTER:

To understand the percentage of the lime and mortar as well as the characters of each grain of mortar with reference to the shape and size in the lime plaster, sedimentological analysis were carried out in the geoarchaeology lab at Deccan College, Pune.

IX.COMMUNITY AND RITUAL CONTINUITY

After the verbal communication with local communities, it found that they have given very fruitful information regarding the heritage and their ritual continuity till today which is described as below:

Historical narratives of Curdi before submergence; reasons for non-relocation of Someshwar temple; ritual practices centered around the *Swayambhu linga;* memories associated with village layout, lifestyle, and festivals (Herald,2019); reflections on annual visits, pujas and the emotional experience of returning to the submerged homeland; storytelling traditions and collective gatherings that reaffirm communal identity. The 2015 community-led renovation, which involved in clearing vegetation, removing silt, and stabilizing loose stones, stands as a testament to grassroots heritage stewardship in the absence of institutional involvement. Their accounts filled critical gaps left by the absence of formal historical records.

X. ENVIRONMENTAL AND HYDROLOGICAL IMPACT

The annual cycle of submergence and exposure exerts powerful forces on the temple's materials:

1. Before construction of the dam the temple was located on the bank of Netravati river.
2. When water levels are high, the submerged temple creates a serene, mirror-like surface.
3. Seasonal community visits and rituals bring colour and life, making the site culturally vibrant.
4. Laterite degradation: Alternate wetting and drying cause expansion, contraction, cracking, and flaking.
5. Mortar loss: Lime and clay bonding agents dissolve or weaken under prolonged immersion.
6. Structural instability: Mud-based walls associated with surrounding structures collapse more rapidly than stone architecture.
7. Vegetation growth: Roots penetrate crevices, accelerating disintegration.
8. Silt deposition: Sediments accumulate inside the sanctum and surrounding areas, gradually burying low-lying features.

These conditions illustrate the extreme fragility of seasonally submerged heritage sites.

X. EFFECTS OF WEATHERING

Weathering is also a very important factor which is responsible for deteriorating the Heritage and which causes the maintenance of heritage. Therefore, the maintenance is directly proportional to the rate of weathering. In the present context the temple is affected by the effect of three types of weathering's; namely physical, chemical, and biological during the field investigation each and every corner of the temple complex were observed and the type of weathering which is responsible to damage the particular part of the heritage were noted in the field notebook (Fig. 3).

On the basis of weathering, it is concluded that the submerged part of the temple which is routinely coming in contact with dam water was badly affected by the chemical weathering process. Mostly this type of weathering is found on the temple base and the lower laterite stones, where repeated immersion has caused softening, flaking, and loss of material.

Fig. 3, Chemical and physical weathering on the temple heritage caused by prolonged water contact.

As far as the physical weathering is concerned, the development of the microcracks, cracks, joints and fractures were observed on the temple is most evident on the lower laterite stones and the exposed base of the structure. The front portion of the temple base shows clear signs of material loss, where the laterite blocks have become uneven, broken, and eroded due to repeated wetting and drying cycles. Small cracks, missing edges, and dislodged stones indicate the impact of hydraulic pressure from the reservoir water. The soil around the base also appears loosened and washed away, suggesting surface erosion and abrasion caused by flowing water and sediment movement (D'Souza, 2018) (Fig. 4).

(a)

(b)

Fig. 4, Vegetation growth (biological weathering) on the heritage (a) Bushes at the entry, (b) big trees in front of temple) (Gurucharan K., 2015).

While due to the effect of vegetation growth on the temple the whole upper portion of the temple was damaged due to the growth of big trees, these trees were removed in 2015, since then heritage is free from big trees.

While the algae and fungi growth in the humid climate are very favourable, therefore on the most of the wall of the heritage they were commonly observed. But due to the continuous maintenance of the Heritage from the devotees, such growth was removed.

At the place the burrows of the burrowing animals were observed in the premises of the Heritage, but the intensity is very restricted.

XI. ARCHITECTURAL INSIGHT

The Someshwar temple retains key architectural features despite significant damage:

1. *Garbhagriha*: A simple square sanctum housing a *swayambhu* linga, signifying ancient ritual importance (Kamat, 2011).
2. *Deepastambha*: A tall lamp tower in a crude Maratha style, representing ritual lighting traditions (M. Hall, 1994).
3. *Natyagruha* (Shezo): A rare surviving performance pavilion with dual arches, greenroom, and storage, indicating the cultural centrality of performing arts.

The temple remained in situ because relocating a *swayambhu* deity is culturally impermissible, reinforcing the relationship between sacred geography and community tradition.

XII. RESULT AND DISCUSSION

The use of scientific heritage documentation methods including GPS and GIS mapping, drone photogrammetry, geophysical observations, and laboratory material analysis enabled accurate recording of the Someshwar temple and its submerged surroundings. These techniques helped trace architectural remains, identify weathering patterns, and understand how hydrology and materials interact at the site. Together with community insights, they provided a well-rounded understanding of Curdi's cultural and environmental context.

Field observations show that the cyclic submergence and exposure caused by the reservoir is the main driver of deterioration. The lower parts of the temple submerge for most of the year indicate severe chemical weathering, softening of laterite, and loss of lime mortar. When exposed in summer physical weathering becomes more visible with cracks, exfoliation, sediment abrasion, and erosion along the temple base and lower stones. Biological factors such as algae, fungi, and earlier root growth have also contributed to damage. Though the 2015 removal of large trees has slowed upper-level deterioration. Despite these key architectural elements including the *garbhagriha, deepastambha,* and *Natyagruha* still reflect the temple's original design and cultural role.

Community involvement also plays a major role in the site's present condition as annual visits, pujas, and gatherings preserve Curdi's intangible heritage and maintain a living connection to the temple. However, unregulated tourism, movement of stones, and vehicle tracks add mechanical stress to already fragile remains. Laboratory analysis of pottery, tiles, mud plaster, and lime plaster provided additional insight into everyday life and construction methods before submergence. Altogether the results highlight Curdi as a rare form of seasonally submerged heritage where environmental stress and cultural resilience coexist highlighting the need for conservation strategies tailored to fluctuating aquatic–terrestrial environments.

XIII. CONCLUSION

Heritage monuments especially temples are playing a virtual role in understanding our past history, culture, past civilization, architecture, artistic tradition, beliefs and spirituality. This monument also serve as identity marks, economic drivers through tourism, spiritual centers and educational resources and such living monuments connect our past, present and future which preserve human consciousness and cultural legacies for the future generations.

In the present studies a detailed documentation has been carried out of a temple heritage which was a well-known Hindu Mahadeva temple heritage submerged nearly half a decade into a constructed dam in South Goa. Most of the parts of this heritage were decomposed by hydration due to submergence as well

as decomposition humid environment and heavy precipitation from the atmosphere.

Therefore most of the art architect, beautiful and aesthetic view as well as some micro work depicted on the temple heritage were lost which would usually decide the outstanding universal value of the heritage similarly the continuity of the practice of prayer and spirituality amongst the people in and around the area also became discontinued.

To overcome this issue and to bring the heritage to its earlier level that is the need of conservation, preservation, restoration and reconstruction as well as relocation of the heritage and the safe area where it will be free from the dam water. Similarly, the art and architect as well as the other aspects which survive by the heritage need to be restored and reconstructed properly. In order to maintain the safety of the heritage a thick fortification wall should be constructed in and around the heritage. The present work is having been carried out with a lot of limitations but a very detailed field and lab investigation is to restore its proper history of this heritage site.

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