

Reflections

Developing a cultural geomorphology of hazards for heritage conservation: reflections from Majuli Island of India

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Cultural Geomorphology attempts to find the relationships between cultural elements and geomorphological features of a region. Such studies have proven invaluable to understanding the interactions between culture and geomorphology and have formed an important part of the epistemology of nature-society studies. Using concepts of Cultural Geomorphology, the current study argues for the need to develop a Cultural Geomorphology of hazards. The study shows that such a work will be invaluable in preserving the knowledge of cultural heritage sites that are at risk of being permanently lost because of the changing landscape brought about by natural hazards or climate change related events.

Keywords: cultural geomorphology, hazards, cultural heritage, Majuli, Brahmaputra River, riverbank erosion

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Cultural geomorphology: an introduction

There is a long history of research in human geography on cultural landscapes and landscape morphology dating back to Sauer's (1925) influential essay *The Morphology of Landscape*. In this paper, we seek to engage once more with this geographical writing on cultural landscape, though shift the focus to recent work on wet ontologies and bring this into conversation with the emergent fields of 'cultural geomorphology' and 'landscape geomorphology'. Cultural geomorphology is a relatively

recent concept in geomorphology developed principally in Italy in the early years of this century. It first evolved from the concept of geomorphosites of Panizza (2001). Panizza and Piacente (2008, 205) defined it as:

the discipline that studies the geomorphological component of a territory, which embodies both a cultural feature of the landscape and its interactions with cultural heritage (archaeological, historical, architectonic etc.).

Cultural Geomorphology is thus an attempt to reconcile the elements of culture in geomorphological features. Pioneering works on the culture-geomorphology continuum have focused on two aspects: firstly, geomorphological features as a component of cultural landscape and heritage of a region; and secondly the interrelationships between the cultural component and geomorphological processes (Panizza & Piacente 2008, 2009; Reynard 2009; Brandolini *et al.* 2011). The first aspect is also called geomorphosites (Reynard & Panizza 2005) best manifested in the cataloguing, documentation, and description of geomorphological features that are intrinsically linked to the cultural heritage of a region (Reynard 2009). Such aspects of cultural geomorphology along with other similar approaches of linking culture and society with geomorphology like geoarchaeology (Lewin 2010; Dall'Aglio *et al.* 2011; Brandolini *et al.* 2019; Brandolini & Career 2021) and geoheritage (Stefani & Zuppiroli 2010; Pica *et al.* 2016; Pelfini *et al.* 2016; Acquotta *et al.* 2018) have made advances in the epistemology of nature-society relationships.

The landscape of cultural geomorphology thus contains all elements of culture like painting and spirituality expressed on geomorphological sites (Panizza & Piacente 2009). This mix of anthropogenic and geomorphological factors is a cultural asset that needs to be preserved, safeguarded, and understood (Wimbledon *et al.* 2000). The above discussion shows the role that geomorphological processes play in the development of cultural heritage. However, there is also a case to show that geomorphological processes also have a profound impact on cultural heritage sites. The current work is an attempt to show these impacts of geomorphological processes on cultural heritage and introduce certain elements of Cultural Geomorphology to the study of natural hazards and their impacts on cultural heritage of a region.

Cultural geomorphology of hazards

The impact of hazards and disasters on cultural heritage is well documented and studied. The United Nations Sendai Framework for Disaster Risk Reduction has incorporated the preservation of cultural heritage in disaster resilience strategies (UNDRR 2015) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Centre for European regions has highlighted natural hazards and the climate change related factors as elements that can have future impacts on cultural heritage sites (UNESCO 2015). A number of studies have highlighted the role that various natural hazards like floods (Anderson & Neff 2011; Wang 2015), erosion (Nicu 2016; Sahay & Roy 2017), landslides (Bromhead *et al.* 2006; Owen *et al.* 2011; Margottini 2013), earthquakes (Dimitriou 2012; Rai *et al.* 2016), and climate change (Wisner 2010; Marzeion & Levermann 2014; Fatoric & Seekamp 2017) have on cultural heritage sites. Such impacts are only likely to be exacerbated in the coming decades because of global warming and its associated phenomena.

In light of the above discussion regarding the impact of natural hazards on cultural heritage sites' degradation, it is crucial to preserve these treasures. However, preservation can prove unfeasible, thus in addition we must prioritize cataloging and documenting these sites for future reference. This is particularly true for sites that are in danger of being lost. For example, sea level rise or riverbank erosion will lead to loss of land where tangible cultural heritage is situated and in such cases preservation may not be an option. Such a method will be similar to the study of geomorphosites like the Atlas of Gemorphosites (Kale 2017) that catalogued the geomorphosites of India.

Studies on mapping, documenting, and cataloguing cultural heritage sites threatened by hazards are now becoming common. Bratton and others (2013, 173) have proposed a form of documenting heritage sites based on "visually impressive and artistic digital tools". They have used the case of Giants Causeway in Northern Ireland to support their methodology of documenting tourist 'honeypots'. They

argue that digital documentation of hazard threatened heritage sites can lead to digital preservation and integrated hazard management. In this way, the approach can help in conservation of potentially irreplaceable sites that are vulnerable to hazards. Lee (2009) has used Light Detection and Ranging (LiDAR) technique to digitally capture a list of World Heritage Sites in danger of being destroyed by hazards. Another major project has been the mapping of Portofino Natural Park in Italy (Faccini *et al.* 2018) using aerial photographs, bibliographical research, field work, and park archives. Another novel concept currently being used for heritage management is virtual heritage (Cayla & Martin 2018).

Using the above examples of heritage conservation using digital technologies and the concept of cataloguing of geomorphosites, we argue for a new epistemological and methodological framework that can be used to map, document, and catalogue cultural hazard sites that are in danger of being destroyed because of natural hazards and disasters. To support our point, in the present paper, we have shown how riverbank erosion is permanently degrading land in Majuli Island in India and the impact that this has on the cultural landscape of Majuli. We further argue that a cultural geomorphology of hazard in Majuli can help to catalogue the heritage of the island for posterity even though the heritage site may itself be lost to the river.

Majuli: cultural landscape

Majuli Island on Brahmaputra River in Assam state is one of the largest inhabited river islands in the world. The island is formed because Lohit River, an anabranch of Brahmaputra River separates from the main river and after a course of almost 85 km remerges in it (Sahay & Roy 2017). At the confluence of the main river and its anabranch, another major Assam River, the Subansiri meets Brahmaputra River (see figures 1 and 2).

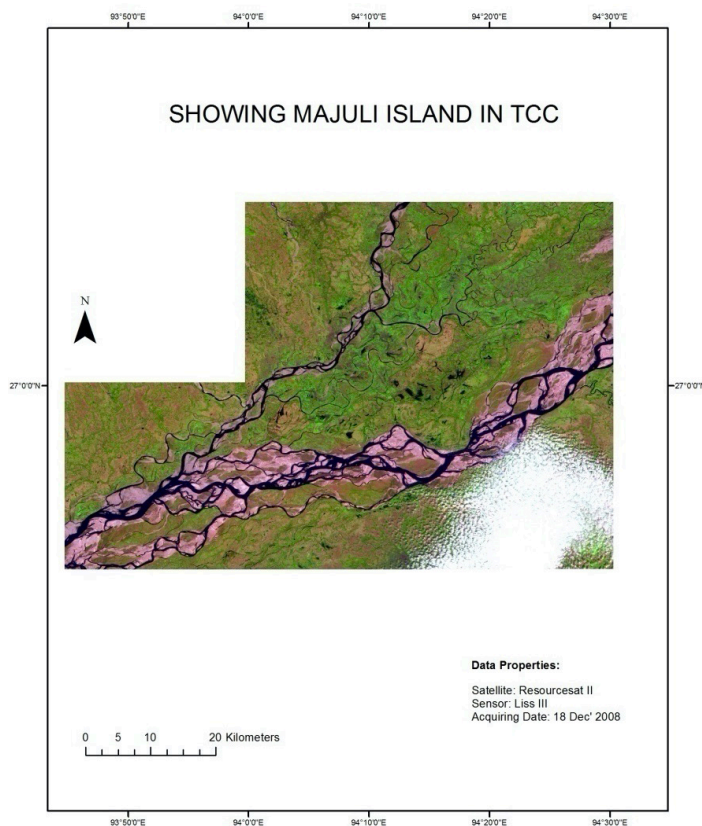


Fig. 1. Majuli river island at the confluence of major rivers.

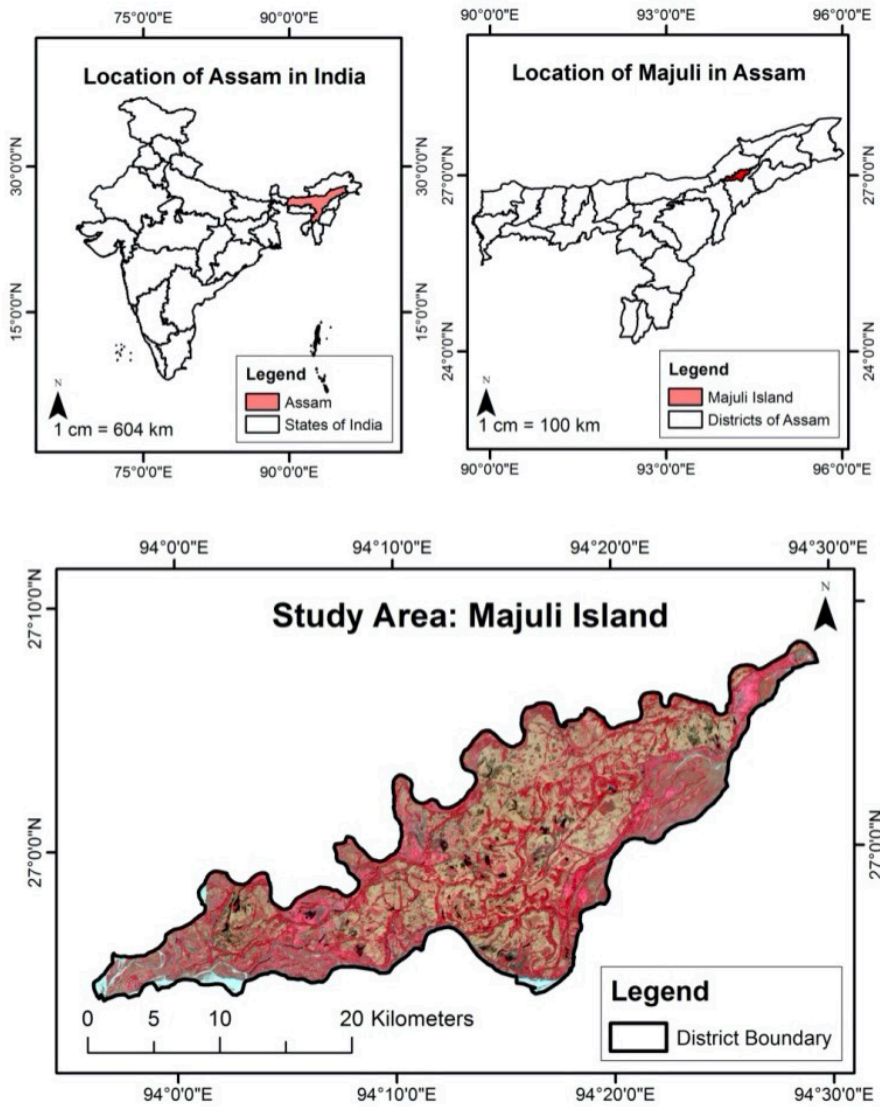


Fig. 2. Majuli island in Assam: location and setting.

Thus, Majuli lies at the meeting point of several major rivers, carrying huge amounts of water and silt, and is therefore, always prone to flooding and erosion. Majuli is a multiethnic society, yet it is culturally homogeneous (Nath 2009). Demographically, it is a mixture of different ethnic groups, such as the *Assamese*, *Mishings*, *Kacharris*, *Deoris*, and *Nepalese*, who have migrated to make their home on Majuli (Sahay & Roy 2017). Yet all of these groups have accepted the island's unique Vaishnavite culture and helped in its preservation, protection, and propagation (Nath 2009). This Vaishnavite culture started on Majuli in the fifteenth century by Assamese religious and social reformer *Shankardeb* (*ibid.*) and is the worship of Lord Vishnu and his reincarnation Lord Krishna. The

centre of Neo-Vaishnavism is the monastery called *Satra*. Originally there were 65 *Satras* on Majuli and every inhabitant of the island is associated with a *Satra* (Sahariah *et al.* 2013). The *Satra* becomes a part of a person's life and is involved in every culture, social or religious event of that person's life (Chetry 2020). Moreover, *Satras* also play a role in the wider social life of the entire island (Roy *et al.* 2020). Each *Satra* specializes in an activity like for example mask making or folk tradition (Mago *et al.* 2022). For example, *Chamaguri*, a small *Satra* in the Kamlabari division of Majuli specializes in mask making (Chanda 2019). These masks are in great demand not just in Majuli but in the rest of Assam and India in general. Masks made in the *Satra* are used in various enactments of mythological plays like *Ramayan*, *Mahabharat*, and *Ras Leela* (Monga & Das 2017). This has been true for more than 500 years now and this extraordinary longevity was recognized by the state government of Assam when the Majuli Cultural Heritage Act was passed by the State Assembly of Assam in 2006, which granted Majuli the status of a Cultural Heritage Site of India (Sahay & Roy 2017). However, the institution of *Satra* and the island of Majuli itself is in danger of disappearing because of riverbank erosion in Brahmaputra River (Hazarika 2012; Bharasa & Gayen 2020).

Riverbank erosion and its impact on Majuli

Various studies have shown that since the 1897 and 1950 earthquake of Brahmaputra valley (Valdiya 1999; Bilham & England 2001; Baro & Kumar 2015), Brahmaputra River is eroding land throughout its course in Assam and Bangladesh (Coleman 1969; Haque & Zaman 1989; Baro & Kumar 2015; Devi & Bora 2016). Being an island, Majuli is particularly susceptible to the erosional work of the river. According to various estimates (Nayak & Das 2008; Nayak & Panda 2016), the area of Majuli has shrunk from its peak of 1246 km² in 1951 to around 484 km² currently (Sahay 2017). Such large-scale change in the geography of Majuli has led to changes in the economy, society, and culture of the island (Das 2014). Most obvious is the economic impact. Riverbank erosion has led to loss of farmland in an overwhelmingly agricultural society (Dey 2012). The economic disruption that it has brought has been the chief cause of large-scale outmigration of working age population from the island (Sahay & Roy 2017). Riverbank erosion has also affected the institution of *Satra* (Sarma 2013). River Brahmaputra has in many instances eroded the land where *Satras* were built (Singh & Goswami 2011; Sarma 2014). Some of the larger and resource strong *Satras* like the *Auniati Satra*, *Uttar Kamlabari Satra* and *Dakhinpat Satra* have changed their location multiple times and are still operating (Sahariah *et al.* 2013), albeit from a smaller area, but other poorer and smaller *Satras* have been unable to relocate and have thus shut down. While there were historically 65 *Satras* that operated in Majuli, currently there are only 22 active *Satras* (Sahariah 2013; Bharasa & Gayen 2020).

The loss of *Satras* is a loss to the collective culture of the island. However, in light of the continuing erosional work of Brahmaputra River and the inability of mitigation measures to stop this erosion raises serious question over the ability of currently existing *Satras* to continue operations. Already about one-third of the *Satras* have been lost and the loss of remaining *Satras* though inevitable will be a major blow to the cultural heritage of the island.

From the above discussion, it is clear that *Satras* are a rapidly vanishing element of the social and cultural life of Majuli. While the *Satra* culture of Majuli is recognised as a cultural heritage of India, there is no clarity whether the existing *Satras* would continue operating in the face of constant loss of land. Thus, geomorphological process in Majuli is having a profound impact on the cultural landscape of the island. In such a situation, it is necessary to catalogue and document the social, cultural, and physical elements of the *Satras* that exist as of now. We have been trying to do that since 2019 and have till now visited 18 of the currently existing 22 *Satras*. We have been collecting data on the physical location as well as the cultural and social significance of each individual *Satra*. A preliminary map of the location of the 18 *Satras* visited is given in figure 3.

While the project to collect and document the cultural and physical aspects of *Satras* is continuing, the aim of the present paper is to show the importance of such cataloguing in preserving the cultural heritage of Majuli in light of constant riverbank erosion threatening the most important cultural heritage of the island.

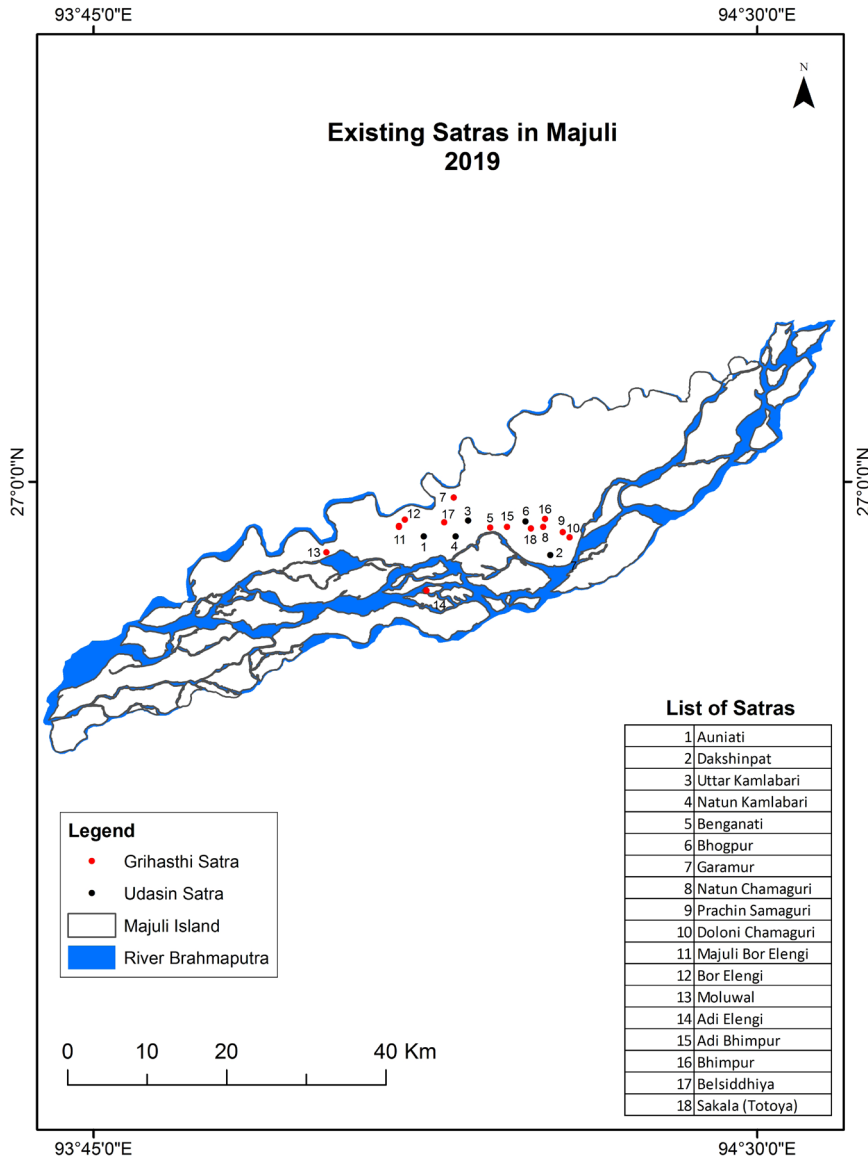


Fig. 3. Surviving *Satras* of Majuli. Source: based on fieldwork data.

Wet ontologies and cultural geomorphology of Majuli

In the context of Majuli's *Satra* culture, the issue of riverbank erosion presents a complex challenge when viewed through the lens of cultural landscape and cultural geomorphology. Scientifically, cultural landscape refers to the interplay between human activities and the physical environment (Taylor & Lennon 2011), while cultural geomorphology explores how human actions influence landforms and processes (Sahariah *et al.* 2013). The *Satras*, pivotal to Majuli's cultural landscape, stand as repositories of tradition, spirituality, and communal identity, often positioned along the banks of the Brahmaputra River. However, the river's erosive forces, driven by geomorphological processes like hydraulic action and mass wasting, pose a significant threat to these cultural

institutions. From a cultural landscape perspective, the erosion of riverbanks not only compromises the physical integrity of the *Satras* but also erases tangible and intangible aspects of cultural heritage (Singh 2022). As the Brahmaputra encroaches upon these sacred sites, it not only causes loss of property but also disrupts the social fabric and spiritual significance of the *Satra* culture. Culturally, the riverbank erosion engenders a sense of vulnerability and displacement among the islanders, challenging their resilience and sense of place. Thus, the problem of riverbank erosion in Majuli reflects the intricate interplay between human culture and geomorphological processes, underscoring the imperative for interdisciplinary approaches that integrate cultural preservation with sustainable land management strategies to safeguard both the tangible and intangible heritage of the *Satra* culture amidst dynamic environmental changes.

However, the relationship between the people of Majuli and Brahmaputra River is far more nuanced and complicated than just as a case of erosion and displacement (Saikia 2019). For the inhabitants of Majuli, the Brahmaputra is not merely a geographical feature; it is the lifeblood of their existence, shaping their daily lives, cultural practices, and spiritual beliefs (Boyd 2022). From a wet ontological perspective (Steinberg & Peters 2015; Peters & Steinberg 2019), the river is not simply a physical entity but also a symbol of interconnectedness, continuity, and resilience as it embodies both practical necessity and cultural symbolism. Hydrologically, the river serves as a vital source of water for irrigation, drinking, and fishing; sustaining agricultural livelihoods and ensuring food security on the island. Moreover, the seasonal floods and sediment deposition patterns of the Brahmaputra dictate land use practices and settlement patterns, influencing the spatial organization of human activities on Majuli. Culturally, the river holds deep spiritual significance, woven into the fabric of religious rituals, folklore, and collective memory. It is revered as a sacred entity, respected for its power to nurture life, and facilitate transcendental experiences. Socially, the Brahmaputra fosters a sense of communal solidarity among the islanders, uniting them in shared experiences of both bounty and adversity. Thus, through the lens of wet ontologies, the relationship between the people of Majuli Island and the River Brahmaputra emerges as a dynamic dialectic, wherein water shapes human perceptions, behaviors, and cultural landscapes, while humans, in turn, imbue the river with symbolic meaning, social significance, and ecological value.

Thus, it is evident that the *Satras*, positioned along the riverbanks, represent tangible manifestations of the myriad relationships that people of Majuli have with Brahmaputra River, serving as repositories of tradition, spirituality, and communal heritage. By preserving, documenting, and cataloguing *Satras*, we will not only be safeguarding the physical structures but also documenting intangible aspects of cultural heritage tied to these institutions. This holistic approach ensures that the cultural landscape of Majuli, shaped by the Brahmaputra and the *Satra* culture, is accurately represented and protected for future generations, fostering a deeper understanding of the island's rich history and identity.

Conclusion: A Cultural Geomorphology of Hazards

The intent of this article is to argue for the development of a new epistemology and methodology for conservation of cultural heritage sites that are at risk of being destroyed because of a hazard or a disaster. While all heritage sites are affected by hazards or climate change, most of the time the risks are manageable and heritage sites have a well-developed early warning system as well as mitigation strategies. However, in certain cases like for example sea level rise and riverbank erosion, the hazard is an existential threat that is likely going to destroy or engulf the entire heritage site permanently in the future. Even in the absence of such a threat, there is no certainty that any new hazard will not cause destruction of the heritage site in the future.

Using the above argument, we propose the development of a rigorous scientific method for mapping, documenting, and cataloguing heritage sites that face hazard threats. These efforts are not meant to substitute current methods of heritage conservation, but they can complement those efforts and also help in raising awareness and *ex situ* education of cultural heritage.

In our own research, we have been trying to document the cultural heritage of Majuli represented by *Satras*, which are a unique cultural heritage of Majuli but are also on the brink of extinction because of riverbank erosion. As geographers and geoscientists working in the cross section of

hazards and society, we can document and catalogue the cultural and physical elements of the existing *Satras* and thereby preserve this unique cultural heritage of Majuli.

From the discussion above, it is also clear that culture and geomorphology of any region is intrinsically linked to each other. This has given rise to a new branch called *cultural geomorphology*. While cultural geomorphology is a relatively recent addition to the discipline, there is a need to expand the epistemology of it to include the impact geomorphological processes like hazards have on cultural heritage sites. *We therefore need to develop a new Cultural Geomorphology of hazards.*

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