Space | Human | Memory: Integrated Conservation of Bozcaada's Cultural Heritage through Geographic Information System

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Abstract

Islands represent complex cultural landscapes shaped by unique nature–culture interactions and the communities that inhabit them. Bozcaada (Tenedos), one of Turkey’s largest inhabited islands, exemplifies this complexity through its rich multicultural history, distinctive architecture, and traditional practices such as viticulture and fishing. However, increasing tourist pressure since the 2000s has led to the commodification of the island’s physical and cultural environment. This transformation has disrupted local production systems, altered spatial patterns, and undermined the balance between natural, built, and social elements.

Recognizing Bozcaada as a living heritage site, this study proposes an integrated conservation strategy rooted in participatory and interdisciplinary methods. Conducted within the framework of the Middle East Technical University Graduate Program in Conservation of Cultural Heritage in 2023, the research draws on expertise from urban planning, architecture, and history to analyze Bozcaada’s transformation and to develop tools for its sustainable management.

At the core of the study is *Bozcaada▪GIS*, a Geographic Information System-based platform created to compile and analyze spatial and social data. By integrating land use records, architectural documentation, visual materials, and oral histories, *Bozcaada▪GIS* enables multi-scalar analysis of the island’s evolving structure. In-depth interviews and community engagement further enrich the system by offering insights into human–space–nature relations. More than a technical tool, *Bozcaada▪GIS* functions as a living archive that documents and visualizes cultural memory while remaining open to continuous updates.

Through participatory mapping and open data access, the project fosters local awareness, ownership, and involvement in conservation planning. It reflects a holistic approach that integrates physical, social, and historical values into a dynamic and adaptive framework. The study demonstrates how GIS can support cultural heritage conservation in island contexts by enhancing knowledge sharing, guiding policy-making, and strengthening interdisciplinary collaboration. *Bozcaada▪GIS* offers a replicable model for managing culturally significant and environmentally sensitive landscapes.

1. An Island Settlement: Bozcaada

Island settlements are examples of unique ecosystems with natural boundaries and self-sufficient life practices, including local production. Communities living in these ecosystems inhabit distinct environments shaped in partnership with nature. Within these limited settings, they also develop shared socio-cultural identities through the relationships they must establish with one another (Yardımcı, 2001). Such distinctive identities foster a strong sense of belonging (Hay, 2006). In short, island settlements are cultural heritage areas that bear the traces of their past and continue to thrive through their distinctive natural and built environments, social fabric, and ecosystems.

Bozcaada, as an island settlement, is located very close to the mainland of Çanakkale, yet it also occupies a position that connects easily to the Northern Aegean islands. Historically known as the last port before the Bosphorus, Bozcaada has long held strategic importance. Reflecting this, the island has been inhabited almost continuously from antiquity through the establishment of Turkish Republic (Takaoğlu and Atabay, 2021). This long history of settlement has fostered a multicultural society on the island. Due to its geographic location, Bozcaada hosted a significant Greek population and was one of the three areas excluded from the population exchange between Greece and Turkey (Grigoriadis, 2021). As a result, Greek and Turkish communities were able to continue living together, and the legacy of this shared life remains visible today.

The settlement area is concentrated in the northeastern part of the island. However, scattered structures such as monasteries and vineyard houses can also be found throughout the landscape. The tradition of viticulture—closely tied to the island’s unique ecosystem and native grape varieties—continues today, with vineyards located primarily outside the historic center. In addition to vineyards, this non-residential area includes natural conservation zones, olive groves, and beaches (Figure 1).

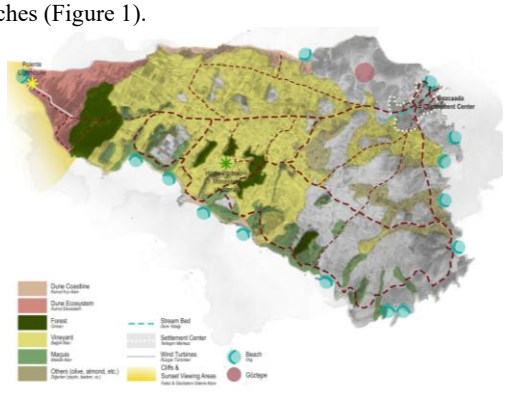


Figure 1. Natural Features of Bozcaada

In addition, the cultural diversity resulting from Bozcaada’s multicultural past is reflected in its built environment. The Cumhuriyet District, historically known as the Greek district, is located on the northwestern side of the island, while the Alaybey District, on the southeastern side, was predominantly inhabited by Turks. These two districts are separated by a now-closed stream. This ethnic distribution is also evident in the island’s urban morphology. The Cumhuriyet District features a more rigid, grid-like street pattern, whereas Alaybey District is characterized by larger building blocks with interior courtyards. At the architectural scale, the Cumhuriyet District includes churches, Greek houses, and taverns, while Alaybey District contains traditional Turkish structures such as mosques and public baths (Figure 2).

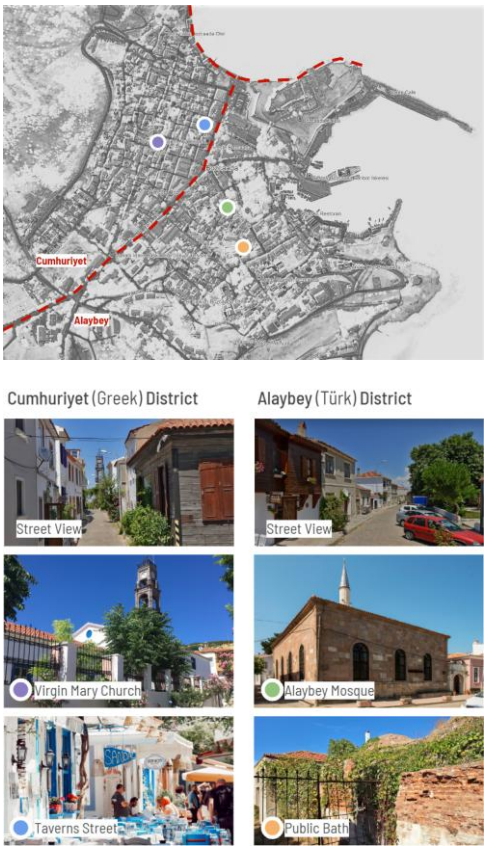


Figure 2. Above: Urban fabric of Bozcaada. Below: Images showing significant structures in the urban fabric.

Bozcaada is a settlement where traditions and local production persist alongside a distinctive architectural fabric. The continuity of social life from past to present is evident in events such as the Ayazma Fair, as well as in ongoing region-specific practices like viticulture and fishing.

However, Bozcaada now faces serious challenges that threaten its physical and social integrity. Many of these issues have emerged as a result of top-down governmental decisions. The lack of support for viticulture and fishing—once the island’s key livelihoods—the inability to meet the spatial needs of the permanent population, and the departure of the Greek community due to policies such as the closure of Greek schools have all contributed to a shift in priorities (Akpınar, Saygın and Karakaya, 2011). Over time, tourism has come to dominate the island’s development agenda. This shift has led to a rent-oriented approach, turning Bozcaada’s natural and environmental values into sources of economic exploitation.

As the local population declines and local production activities diminish, daily life becomes increasingly difficult under the pressure of mass tourism. As a result, the island's original cultural values are gradually being lost. During this process, the island’s demographic structure has changed, giving rise to new group identities. The growing tension between native islanders, newcomers, and tourists reflects the evolving demographic, social, and economic landscape (Yardımcı, 2021).

These transformations have also affected the historical character of the settlement. The authenticity of both traditional and modern-period residential buildings has been compromised. Structures that once supported the island's commercial and industrial life have been altered or left unused, while new buildings—often designed as pastiches to attract tourists—threaten the coherence of Bozcaada’s built environment. These tourism-oriented imitations and artificially created spaces contribute to the degeneration of the island’s architectural identity. Bozcaada is an island where the delicate balance between the local population, culture, and production, and the influx of newcomers, tourists, and an externally driven economy is under strain. Despite its continuous habitation and rich built, natural, and multicultural environment, Bozcaada now stands at a critical juncture.

The historical character of the settlement is also affected by these changes. The loss of authenticity in traditional and modern period residential buildings, the alterations or disuse of structures that represent the island's commercial life and industrial character, and the fact that newly constructed structures are imitations designed to create tourist attractions threaten the character and integrity of Bozcaada's built environment. Structures and artificial environments that cause degeneration while imitating tourism-oriented traditional architecture are among the significant problems facing the island. Consequently, Bozcaada today represents a built, natural, and multicultural social environment shaped by a fragile balance between the local population, culture, and production, and the pressures introduced by newcomers, tourism, and an externally driven economy. Despite its continuous habitation, this balance is increasingly at risk.

2. Methodology: Bozcaada▪GIS

In light of these evaluations, Bozcaada requires comprehensive strategies that address the island as a whole, support the preservation of its original fabric, and ensure the continuity of its local identity. To this end, various dimensions of the island—particularly its social and cultural structures—should be analyzed in depth, and a series of solution-oriented proposals should be developed with regard to its natural, social, and spatial characteristics.

Developing effective strategies first requires an understanding of the island’s spatial dynamics. Therefore, within the scope of this

project, a conceptual approach has been formulated to evaluate Bozcaada’s natural, built, and social environments at three distinct scales, with careful consideration of the temporal dimension (Figure 3).

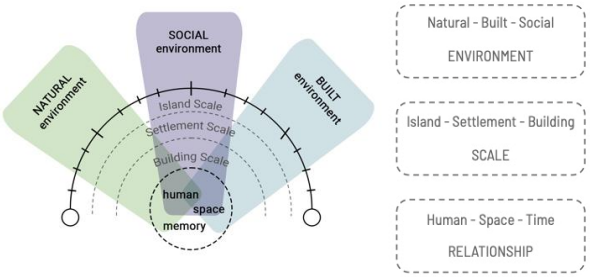


Figure 3. Conceptual approach

To present this conceptual approach, Geographical Information Systems (GIS) were selected as the primary spatial information method. Fundamental GIS principles—such as data storage, structuring, visualization, querying, sharing, and monitoring—were employed (Figure 4). These principles were integrated with the developed conceptual approach to enable a comprehensive analysis of Bozcaada’s natural, built, and social environments. In line with this spatial information framework, a GIS-based methodology was established to support the development of an integrated conservation plan for the island (Table 1).

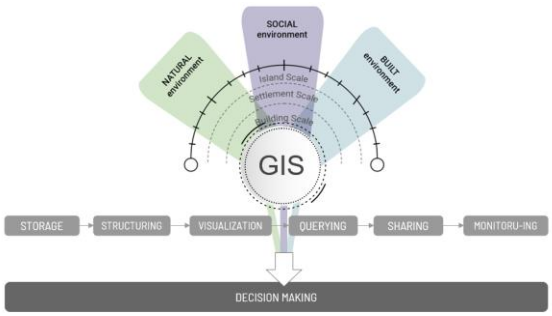


Figure 4. Spatial Data Management of Bozcaada GIS

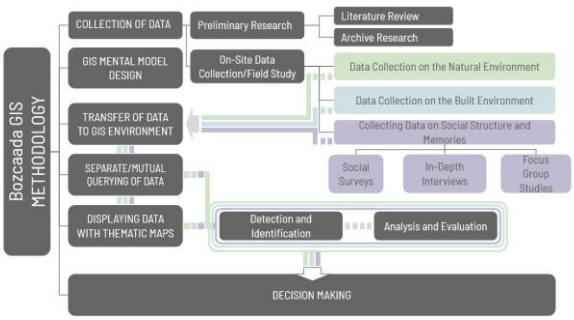


Table 1. Methodology of Bozcaada▪GIS

In line with this methodology, information on the natural, built, and social environments was first stored in a GIS environment. The collected data were classified and structured according to their attributes. By querying different data categories both individually and in relation to one another, analyses were conducted within the GIS platform, and mapping studies were carried out to visualize these spatial relationships. The spatial data were prepared at three different scales—namely the island, settlement area, and building scales—and corresponding evaluations were also presented spatially.

Building on this spatial analysis, the findings were shared with various stakeholders to ensure that decisions regarding conservation and development are grounded in comprehensive, evidence-based knowledge. By making the data accessible to local authorities, community representatives, planners, and conservation experts, the aim was to promote informed, inclusive, and sustainable decision-making processes that reflect the island’s ecological, social, and cultural complexities. In doing so, the GIS study was conceptualized as a 'living database' for Bozcaada, emphasizing its ongoing and adaptive nature. This highlighted the importance of maintaining a continuous and up-to-date record of spatial data to ensure the long-term transmission of the island's cultural heritage to future generations.

This methodological framework laid the foundation for the comprehensive data collection process described below.

2.1 Collection of Data

Data collection was carried out in multiple stages. The first stage consisted of a preliminary study that included a literature review and archival research. As part of the archival research, various written and visual sources—such as satellite images, historical maps, settlement plans produced over the years, and other historical data—were gathered and evaluated to better understand the island’s physical and social environment.

The on-site data collection phase involved fieldwork, during which qualitative data was obtained through surveying, mapping exercises, in-depth interviews, focus group discussions, and social surveys over a period of 10 days in October 2023 (Figure 5). These methods were employed as appropriate to examine Bozcaada at three spatial scales: the island scale, the settlement scale, and the building scale.

Figure 5. Focus group meeting held during field survey.

Pre-prepared survey sheets were used during the fieldwork to assess the physical environment in terms of land use, architectural condition, and spatial quality. At the same time, data on the social structure and collective memory—key components of the project—were also recorded. Three different tools were used for this purpose. First, one-on-one interviews

were conducted with local residents using questionnaires developed prior to fieldwork. Second, more detailed insights into the social environment were gathered through in-depth interviews. Finally, focus group discussions were held with participants from different age groups and professions. By ensuring the participation of diverse groups through these data collection measures, a wider understanding of the holistic experience of the community could be gained. These sessions provided valuable information on human-space relationships, production cycles, ritual sites, traditions, the transformation of the settlement over time, and the current challenges and expectations of the island community.

2.2 Design of GIS Mental Model

A GIS mental model was developed to structure the classification of data related to the natural, built, and social environments of Bozcaada (Table 2). These data sets were organized and correlated to one another, enabling decisions about their spatial representation within a GIS platform specifically designed for the island, named *Bozcaada▪GIS*. Based on this conceptual model, a systematic process for integrating data into the GIS was established and documented in an accompanying Excel table (Table 3).

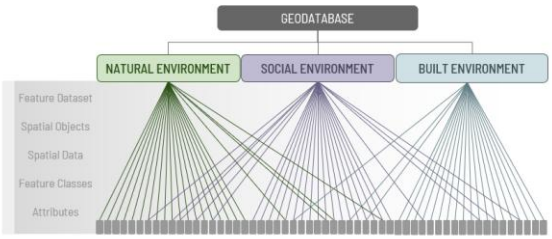


Table 2. Mental Model of Bozcaada GIS

Using this structure, data on the island’s social environment were also incorporated into *Bozcaada▪GIS*. As a result, various elements of the island’s natural, built, and social fabric could be input as GIS feature classes. For example, topographical data and coastline boundaries could be layered with components of the built environment, such as distinctions between public and private land use.

FEATURE CLASS	ALIAS	GEOMETRY	ATTRIBUTE
COAST_L	coastline	polyline	coastline
TPG_LINES	topography lines	polyline	topography lines in each 10 meters
CONS_SITES	conservation sites	polygon	urban conservation site 1st degree archaeological site 2nd degree archaeological site 3rd degree archaeological site 1st degree natural conservation site 3rd degree natural conservation site
FORTIFICATION	castle	polygon	area of the castle
NBGHD	neighbourhood	polygon	name of neighbourhood
BLOCK	blocks	polygon	block no
LOT	lots	polygon	lot no landuse registration status survey type
TRAD_BLDG and NEW_ER	traditional buildings and modern era buildings	polygon	building no number of floors height min. height original use original use detail current use current use details registration status usage period construction material and technique covering material roofing material roof form building condition material condition distortion detail mass change state mass change type facade change state facade change type
NEW	new buildings	polygon	building no number of floors height min. height current use current use details registration status usage period construction material and technique covering material roofing material roof form building condition imitation type
RUINS	ruins	polyline	registration status
for each street element	street elements	point	street lights, canopy, bins, street furnitures, electricity pylons, fountains, flower pots
POS_STREET	streets	polygon	type of road width of road
POS_SQUARE	squares	polygon	use of open space
POS_SHORE	coasts	polygon	use of coast
SOC	social structure	polygon	religion places traditional production places winehouses fisherman shelters traditional coffee shops (kahvehane) traditional pubs (meyhane)
OLD	old photos	point	date use of place

Table 3. An example table of geodatabase in Bozcaada GIS

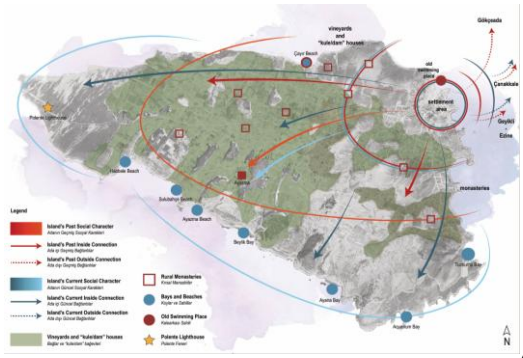
2.3 Transfer of Data to GIS Environment, Data Analysis, Living Archive and Evaluation

In the third phase of this study, data collected from various sources concerning the natural, built, and social environments were classified and transferred to the GIS environment. These datasets were then queried and analyzed—both independently and in relation to one another—and visualized through thematic maps (Figure 6). This multi-scalar analysis aimed to go beyond the mere processing of spatial data.

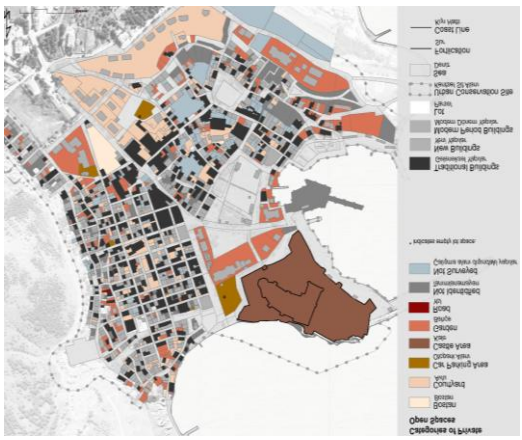
By processing and analyzing this information within *Bozcaada▪GIS*, the digitization of island memory and its transmission to future generations became possible. In this context, the concept of a “living archive” refers to a dynamic and participatory system that not only records historical data but also documents ongoing changes and social transformations. Its “living” nature lies in its capacity to be continuously updated with new entries and insights.

Data related to the social environment—including results from face-to-face interviews, focus group discussions, and visual and oral archival sources—were consolidated, linked with spatial data, and transferred to the GIS environment. This process incorporated both historical memory spaces and contemporary user experiences. In doing so, not only physical

data but also locations imbued with social meaning and collective memory were made spatially visible (Figure 7).



(a)



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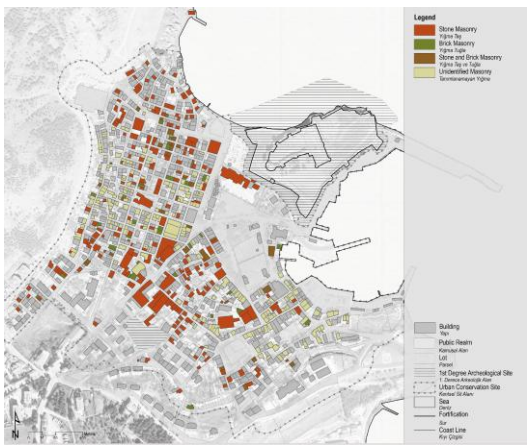


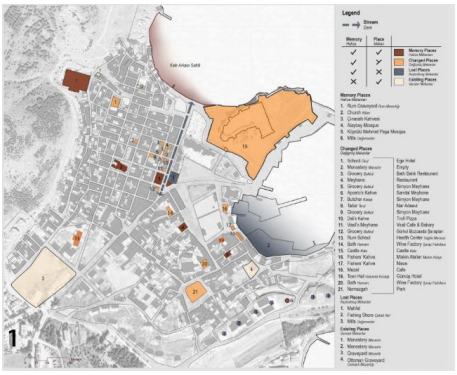
(c)

Figure 6. The analysis presented at different scales (a) island scale, (b) settlement area scale, (c) building scale

The memory spaces revealed through this analysis stand as key outcomes of the process. For example, archival photographs and interview data indicated that a location once central to Bozcaada’s fishing economy and social life—traditionally known as Çekek Yeri, or haul-out area—has since been transformed into a modern port. This transformation illustrates the loss of a socially meaningful space and its transition into a memory space. Related data were incorporated into *Bozcaada▪GIS*, becoming part of the evolving archive and enabling future generations to access these spatial narratives. Through this work, the spatial footprints of social focal points were identified, making it possible to observe the continuity or disruption of place over time.

Beyond documenting memory spaces and social focal points, the analysis also facilitated the mapping of the island’s core values, existing problems, and untapped potentials. These insights formed the foundation for transitioning from interpretation to vision-oriented conservation planning. Embracing the idea of “restoring balance” within Bozcaada’s cultural landscape, specific sites within the settlement area were identified as either problematic or holding potential. Accordingly, proposals were developed at both urban and architectural scales.

The outcomes of this evaluation process were also shared with local stakeholders, enabling their feedback and fostering a more participatory and grounded approach to conservation planning. In this way, *Bozcaada▪GIS* functions not only as a technical tool but also as an evolving and inclusive archive—one that documents the present, retains the traces of the past, and informs decision-making for the future.



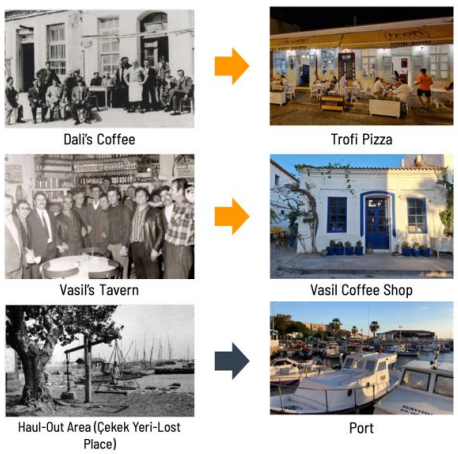


Figure 7. Above: Analysis map of memory sites. Below: Photographs showing the changes in selected memory sites over time (from Hotel Fahri and the authors' archives)

3. Conclusion

In conclusion, this study demonstrates the potential of Geographic Information Systems (GIS) as a comprehensive tool for cultural heritage conservation in complex historic urban landscapes, particularly in multicultural island settlements. GIS

was employed within an integrated conservation approach and exemplified through the Bozcaada case. Data on the island’s natural, built, and social components were compiled in a GIS environment, forming a comprehensive and structured database. This database enabled detailed analyses of the island’s current conditions, and the results provided a foundation for informed future decision-making. In this context, GIS functioned not merely as a data storage tool, but as a dynamic platform for conservation through relational data analysis, thereby enhancing the applicability of the results.

Aligned with the principles of cultural heritage conservation, memory transfer in Bozcaada was realized through written, visual, and verbal forms, all embedded within the GIS database. This process not only documents present-day data but also ensures its transmission to future generations. The study facilitated both data acquisition and dissemination while establishing a “living archive” model of conservation. Collaboration with local residents and authorities was essential to this process, strengthening both the reliability and richness of the information recorded.

Surveys, in-depth interviews, and focus group meetings with local inhabitants played a key role in understanding Bozcaada’s social values. These engagements helped identify places of social significance, which were then spatially mapped and integrated into the GIS system. As a result, the conservation approach expanded to include sociocultural dimensions alongside natural and architectural data, contributing to a more holistic and publicly engaged model.

What distinguishes this study from other GIS-based projects is its integration of historical and sociocultural data with spatial information. By addressing the relationship between people, time, and place in a holistic manner, the study offers a robust foundation for conservation planning and decision-making. The resulting GIS database serves as a flexible and evolving model that can be adapted for future projects.

Ultimately, this study presents a participatory conservation model that bridges expert knowledge with local insight, forming a living archive. In the case of Bozcaada, the integration of GIS into the conservation process has proven particularly valuable due to the island’s layered, multicultural identity and complex heritage landscape. As a settlement shaped by centuries of coexistence between Greek and Turkish communities, Bozcaada embodies not only architectural and environmental richness but also deep-rooted social memory, intangible cultural practices, and evolving demographic dynamics. These multiple layers of heritage—tangible and intangible, historical and contemporary—require an approach that is as context-sensitive and multifaceted as the context itself.

The GIS-based model developed in this study enables the visualization and analysis of these intertwined dimensions. By mapping memory spaces, tracing shifts in land use, and recording the lived experiences of diverse community members, the system captures the complexity of Bozcaada’s cultural landscape. As new data continues to be added and interdisciplinary collaborations expand, the system is expected to grow and diversify. In doing so, it supports an ongoing dialogue between the past and the present, between local communities and decision-makers. This model thus offers a replicable framework not only for Bozcaada but also for other culturally layered, socially diverse, and environmentally sensitive heritage places. It underscores the necessity of adaptive, inclusive, and dynamic tools in ensuring the sustainable conservation and management of complex historic urban landscapes.

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