



CANALISED URBAN WATERWAYS AS ECOMORPHOLOGICAL TRAJECTORIES: A COMPARATIVE STUDY FOR PALIMPSEST LANDSCAPES OF ISPARTA AND CHELMSFORD (EKOMORFOLOJİK SÜREÇLER İÇİNDE KENTSEL SU KANALLARI: ISPARTA VE CHELMSFORD'UN PALIMPSEST PEYZAJLARI ÜZERİNE KARŞILAŞTIRMALI BİR ÇALIŞMA)

Saruhan MOSLER¹

¹Suleyman Demirel University Faculty of Architecture Department of Landscape Architecture Isparta/Türkiye
aslimosler@sdu.edu.tr, ORCID: 0000-0001-8971-9780

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Corresponding Author/İletişim yazarı: Saruhan Mosler

E-mail: aslimosler@sdu.edu.tr



ÖZET

Bu çalışma, Antroposen kentte aktif ekomorfolojik etkenler olarak yapay kanallara dönüştürülmüş kentsel su yollarını, Türkiye'deki Isparta ve Birleşik Krallık'taki Chelmsford şehirlerinde karşılaştırmalı bir inceleme ile ele almaktadır. Isparta'nın Çayboyu Kanalı ile Chelmsford'un Chelmer ve Can nehirleri tarafından şekillendirilen kanal koridoruna odaklanan çalışma, kentsel su yollarının kentsel morfoloji, mekânsal hafıza ve kamusal alan arasındaki ilişkileri nasıl oluşturduğunu ve dönüştürdüğünü araştırıyor. Kanalize edilmiş su sistemleri, iklim değişikliği ve kentsel gelişim baskıları çağında kent formu, canlı hareketi ve günlük deneyimi etkilemeye devam eden palimpsest peyzaj katmanları ve mekânsal koridorlar olarak inceleniyor. Bu çalışma, her bir su yolunun kentsel gelişiminin evrimleşen süreçleri içinde nasıl değiştirildiğini, marjinalleştirildiğini ve yeniden etkinleştirildiğini inceliyor. Bulgular, şehir merkezlerinin entegrasyonunun yalnızca standart tasarım çözümlerine veya konuma değil, aynı zamanda ekolojik ve günlük mekânsal ilişkileri görünür ve erişilebilir kılma yeteneğine de bağlı olduğunu göstermektedir. Bu bağlamda, ekomorfolojik süreçler nehir restorasyonu, ekolojik ve morfolojik yaklaşımlar ve çok türlü kentsel çalışmalar hakkındaki tartışmalara katkı sağlamaktadır. Son olarak, makale, iklim belirsizliği altında kent merkezlerini mavi-yeşil altyapıyla yeniden birleştirmeye yönelik mekânsal senaryoları desteklemek için kanalize edilmiş su yollarına daha geçirgen ve uyarlabilir yaklaşımların kullanılabileceğini öne sürmektedir.

Anahtar Kelimeler: su kanalları, kentsel su yolları, ekomorfolojik süreçler, palimpsest peyzaj, mavi-yeşil altyapı

ABSTRACT

This paper examines canalised urban waterways as active ecomorphological agents in the Anthropocene city through a comparative study of Isparta, Türkiye, and Chelmsford, United Kingdom. Focusing on Isparta's Çayboyu canal and associated stream system, and Chelmsford's canalised corridor shaped by the Rivers Chelmer and Can, the paper investigates how urban waterways form and modify relationships between urban morphology, spatial memory and public space. Canalised streams and rivers are reviewed as palimpsest landscapes and spatial corridors that continue to influence urban form, multispecies movement, and everyday experience in the age of climate change and redevelopment pressures. This study reviews how each waterway has been altered, marginalised, and reactivated within the evolving processes of urban development. The findings demonstrate that the integration of town centres depends not only on standard design solutions or location, but also on the ability to make ecological and everyday spatial relations visible and accessible. In this sense, ecomorphological trajectories contribute to debates in river restoration, ecological and morphological approaches and multispecies urban studies. Finally, the paper suggests that more permeable and adaptive approaches to canalised waterways could support spatial scenarios for reconnecting town centres with blue-green infrastructure under climate uncertainty.

Key words: Canalised waterways, urban rivers, Ecomorphological trajectories, Palimpsest landscape, Blue-green infrastructure

1. INTRODUCTION

Urban waterways are among the most enduring, yet transformed, features of the Anthropocene city. As urbanisation has progressed, streams and rivers have frequently been channelised, narrowed, buried or turned into hard-engineered corridors for flood control, drainage, transport, industrial production and redevelopment. These interventions have often turned waterways into technical infrastructure, fragmented pedestrian and ecological continuity and weakened riparian habitats. Canalised streams still influence the spatial, ecological and cultural life of cities. They shape the urban form, document the history of settlement patterns, promote riparian vegetation and the movement of multiple species, and construct microclimates. Furthermore, past industries, everyday practices and collective memory are intertwined in the formation of modified waterways. And future possibilities for blue-green urban resilience can be read.

Rivers and streams record a shifting legacy of both human and nature-induced disturbances within urbanised systems (Alberti, 2016; Alberti & Marzluff, 2004). Their spatial and ecological scales connect neighbourhoods, town centres, riparian edges, infrastructural networks and wider territorial systems, creating a continuous flow of water, sediment, species, materials, people and memory. From a cultural-ecological perspective, waterways connect historical socio-cultural ecologies with the collective memory of societies and cities, even when these layers have been overwritten by modern hydrological engineering. Due to climate change, increased flood risk and ongoing development of the riverfront, the need to reconsider the role of urban waterways in town centres and their integrated planning and design into urban public spaces is becoming more critical (Shinde et al., 2023). Ecomorphology combines concepts of landscape ecology with the spatial morphology of landscapes and biophysical systems (Palazzo, 2022; Marcus, Berghauser & Barthel, 2019). Changes in the spatial hydrological and morphological domains can be seen as past trajectories and can guide future planning decisions (Gurnell et al., 2007). The trajectory path looks at possible diversifications and changes in landscape structures over time (Cushman & McGarigal, 2007), and how systems can adapt in the best possible way.

This paper investigates these relationships through the concept of ecomorphological trajectories. The term is used here to describe the changing interactions between ecological processes and urban form over time, from historical riparian landscapes, industrial uses, and vernacular settlement patterns to contemporary canalised corridors, regeneration landscapes, and emerging multispecies habitats. By foregrounding this concept, the paper examines

ecomorphological trajectories as the historical spatial relationships of waterways that physically link different areas of the city together (spatial continuity), while also shaping ecological capacity, cultural heritage and memory, and town-centre integration in the Anthropocene city.

To address this question, the paper compares two canalised urban waterways: the Çayboyu canal and associated stream system in Isparta, a mid-sized city in southwestern Türkiye, and the canalised river corridor of Chelmsford, Essex, where the Rivers Chelmer and Can have shaped the historic town centre and its subsequent cultural landscapes. Although these cases differ geographically, culturally, and in terms of planning, both waterways have been affected by flood management, urban expansion, infrastructural rationalisation, and changing values of public space. The comparison considers the degree to which each waterway is linked to the town centre in terms of spatial continuity within the canal corridor, town integration, pedestrian access, public space use, ecological function and its capacity to host multispecies movement and everyday urban life. Furthermore, cities need to be prepared and adaptable to climate uncertainties to be resilient.

2. THEORETICAL FRAMEWORK: ECOMORPHOLOGICAL TRAJECTORIES AND RIPARIAN PALIMPSESTS

Palimpsest landscape, in physical geography, exemplifies landscape layers that have been shaped and reshaped over a long period of time, under climatic conditions or by processes that are no longer present in that region, superimposing layers upon layers as a blanket across the landscape's surface (Bailey, 2007; Bloom, 2002). In landscape theory, palimpsest represents a landscape as a layered system, erased and overlaid with newer forms and elements, holding rich depth of information and clues within a larger landscape system (La Riccia, 2017). Landscape is a way of seeing and a mode of presentation, shaped by societies and cultures, that reflects environmental conditions and symbolises cultural codes (Cosgrove, 1998; Whyte, 2004). In the concept of palimpsest, time, depth, contextual and natural biophysical factors are all concealed beneath the landscape surface; some are exposed, and others are continuously evolving (Heatherington, 2020). Urban landscapes embody dynamic natural and anthropogenic palimpsests in which ecological processes, cultural practices, infrastructural interventions, and historical morphologies continuously overlap. This condition is particularly evident in cities where rapid modernisation has altered, fragmented or obscured older environmental systems in the Anthropocene. Among these systems are rivers and streams, which connect local urban form to larger territorial and ecological networks, but also contain fragments of collective memory, everyday practice and multispecies life.

From the earliest civilisations, streams and riverbanks were favoured by societies for settlement and habitation (Mumford, 1934), and were key to the development of modern towns and cities, which brought control and dominance over natural features such as streams and water management (Petts et al., 2002). Palazzo (2022) addresses the importance of bridging ecology and morphology and notes that they have been addressed separately by landscape ecological principles (Forman, 2014) and by the role of green space in providing vital ecosystem services and achieving goals of improved environmental quality (Niemelä et al., 2011). Industrial practices transformed rivers from natural systems to anthropogenic ones by utilising them for navigation and movement and harnessing water for supply and power, modifying and adapting them as society changed.

Urban streams are heavily altered by anthropogenic factors, such as hard engineering, which can lead to severe flash floods and increased concentrations of nutrients and contaminants. Walsh et al. (2005) refer to this as the "urban stream syndrome," a condition characterised by reduced biodiversity and an increase in dominant, pollution-tolerant species, frequently observed in canalised waterways. While adopting creative drainage design techniques is a primary way to mitigate stormwater impacts, engineering alone is insufficient. Because urban ecosystems are human-dominated, stream ecology research must expand to incorporate social, behavioural, and economic approaches.

Rivers have always been an intrinsic part of urban social life and helped shape the long-term identities of cities like London, Budapest and Vienna. This appreciation, however, was largely lost in the late 19th century. The Industrial Revolution was accompanied by intensive use of rivers and riverfronts for dumping and waste. Thus, the vital waters of these rivers were converted to unwanted, out-of-the-way backyard landscapes by rampant pollution and ecological degradation (Castonguay & Evenden, 2012; Shinde et al., 2023).

Many urban waterways were heavily engineered in the twentieth century, through urbanisation, mainly conversion into concrete infrastructure, but they continue to actively shape urban morphology and ecological relations. Their presence influences microclimates, multispecies movement patterns, vegetation, urban ecology, public spaces and the spatial organisation of surrounding neighbourhoods. These waterways are also part of rich cultural and economic histories, including vernacular water uses, local industries, settlement patterns and everyday social practices. Urban streams are not to be perceived as engineering problems or passive landscape features, but as active agents of the formation and transformation of cities.

The traditional understanding of anthropogenic factors in the making of cities comprises various agents that shape the built environment. To understand the Anthropocene as a fundamental threshold, a multi-layered, mixed-species understanding is needed. The riverine ecology comprises the floodplain, tree cover, riparian zones, wetlands and waterbodies, and the related multispecies, all in constant flux. The urban riverine edge intersects with traditional urban grain, spatial and ecological realities. The physical traces of spatial and ecological memory actively contribute to the survival and adaptation of existing fauna and the aforementioned spontaneous emergence of ruderal flora. Other species that would otherwise remain in their natural environments are now being pushed into cities due to changing micro- and macroclimatic conditions.

3. METHODOLOGY

This research is a qualitative comparative case study of the historical and contemporary relationships between urban waterways' position in relation to industrial use and change, settlement patterns and the form and use of public space. Waterways are regarded as living transects and multi-layered riparian palimpsests, shaped by ongoing anthropogenic modification and ecological processes. For the comparative analysis, the two canalised corridors from Isparta, Türkiye and Chelmsford, United Kingdom (Figure 1), are evaluated against five ecomorphological criteria. The criteria are applied through a combination of mapping and archival analysis and theoretical frameworks.

Spatial Continuity evaluates the waterway as a continuous urban corridor. Visual permeability assesses the visibility of the water and riparian edges from the surrounding public realm. This parameter was analysed by empirical observation of sightlines, level changes and architectural barriers that hide or celebrate the presence of water. Pedestrian Accessibility considers physical access to the water edge, walkability along the corridors, crossing intervals, and the integration of riverside paths into civic and commercial pedestrian networks. Spatial Memory concerns the legibility of historical, industrial, and vernacular layers in the contemporary landscape. Reviewing archival data – such as John Walker's 1591 map of Chelmsford and historical data for Isparta's past water-based industries – with the existing structures on site.

Ecological performance: This was based on field observations of non-engineered edge habitats and a review of current flood risk strategies, including the Chelmsford Local Plan and municipal information for Isparta.



Figure 1. Case study sites in two different geographical locations: Chelmsford in England and Isparta in Türkiye (Adapted from Google Earth by the author).

3.1. Case study 1: Isparta Stream in Isparta

The first case study is Isparta, with a population of central district approximately 273.638 (Türkiye İstatistik Kurumu, 2026) in southwestern Türkiye, between mountainous regions. Historically, the settlement organisation, industrial, social and morphological development were defined by the Büyük Isparta Çayı (also called Andık and/or Belönü Stream) (Figure 2) and the Çayboyu canal (Figure 3) in the town centre (Beyhan & Gürkan, 2015). According to Gökarslan & Köse (2023), these watercourses had already shaped the local industrial landscape by the 1870s. Along the stream landscape, mills, hammams, and dyeries, as well as water-powered industries such as leather, madder, and carpet production, were gradually established, forming a new industrial district (Gökarslan, 2024). The Izmir-Aydın Railway in the Eski Tabakhane district served as an outlet for exporting local products, including leather, madder, and carpets, to international markets. The formation of Greek Orthodox neighbourhoods and new urban forms along streams followed the growth of local industries and the change of the settlement patterns (Gökarslan, 2024; Gökarslan & Köse, 2023; Temurçin & Uluşar, 2013; Aydın & Şahin, 2018; Haştemoğlu & Tekin, 2023). The stream, a derelict canal, was restored and redesigned between 1999 and 2004 to create a green-and-blue recreational corridor and a hydrological

channel for water to flow through the city (Özgüner et al., 2012). Today, the Çayboyu canal functions as a partial recreational corridor with a planted canal edge. With its green, vegetated pathways, it is a well-visited and loved open linear green space that people use every day. However, its relationship with the town centre remains uneven, fragmented, and shaped by historical ecclesiastical architecture, traditional, mostly derelict houses, and contemporary redevelopment pressures. This grounded approach maps the ecomorphological transect of the site, tracing the stream's dynamic trajectories over generations that have created its recent stage as an urban canal and recreation corridor, such as the Çayboyu canal. Most importantly, the impacts of climate change, such as more frequent droughts (Baykal et al., 2023), and an increase in urbanisation, including in middle-sized cities like Isparta (Baykal et al., 2023), increase the risk of more intense, heavier rain and flash floods, emphasising the vulnerability of settlements in the town centre along the canal. Therefore, new studies in the stream bed between the Ethnography Museum and Demirköprü, along with various options, including expanding the stream bed to accommodate infrastructure or conducting in-depth studies, should be key to the canal and stream system's new ecological modifications (Isparta Belediyesi, 2026). In the general provisions and explanation reports of the Antalya-Burdur-Isparta Planning Region 1/100.000 Scale Environmental Plan, there are definite and binding decisions regarding flood and flood control. These decisions are more wide-ranging, including decisions such as Prohibition of Construction in Flood Areas and Disaster Exposed Area Decisions (Antalya-Burdur-Isparta Planlama Bölgesi 1/100.000 ölçekli çevre düzeni planı değişikliği, 2026).

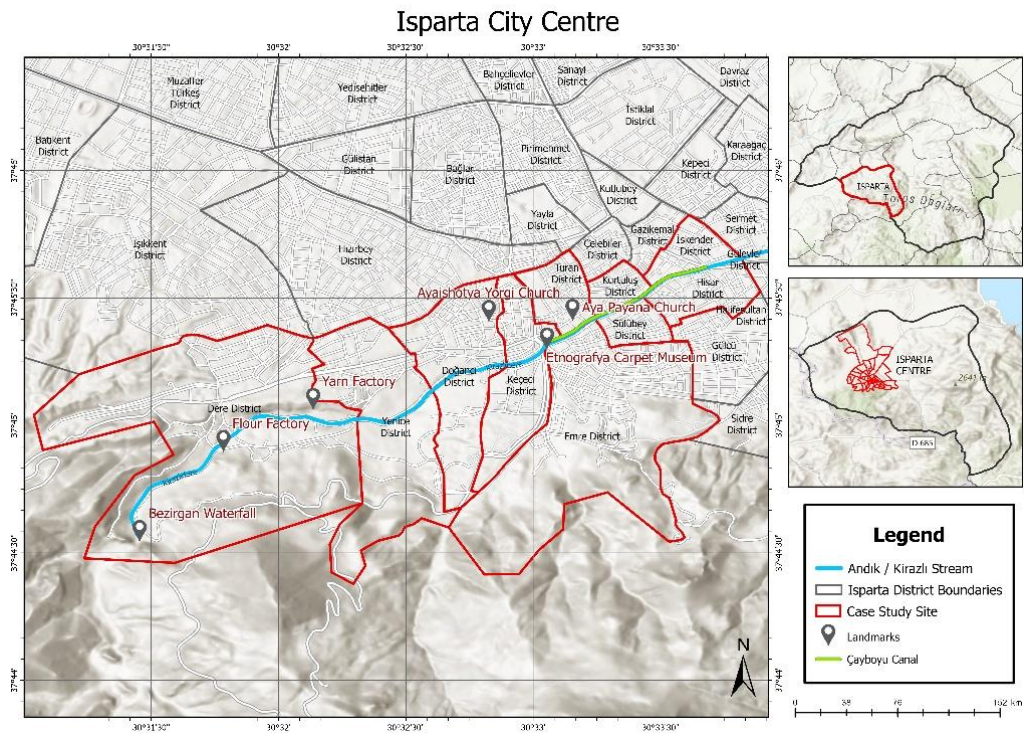


Figure 2. The Andık Stream continues as the Çayboyu canal, highlighted in blue (Created by Uzun).



Figure 3. The restored section of the Andık Stream and the Çayboyu canal corridor can be seen with dense, tree-lined edges and pedestrianised pathways connecting streets, aligned on both sides (Adapted from Google Earth by the author).

3.2 Case study 2: River Chelmer and Can in Chelmsford

The second case study is Chelmsford, with a population of **188,803** (Office for National Statistics, 2026) in Essex, east of England (Figure 4). The Rivers Chelmer and Can have played a significant role in shaping and transforming the urban fabric. Previous work on Chelmsford identifies the rivers as active morphological agents that shaped settlement growth, industrial landscapes, public-space edges, and later regeneration opportunities. The earliest archival data is a map from 1591. John Walker map of Chelmsford (Essex Record Office, 2026) (Figure 5) depicts the river Chelmer running through the town centre, forming its spatial spine to this day (Fuller & Home, 2007; Mosler, 2020). The river corridor has shifted from an economic and infrastructural armature to a marginalised urban edge and, more recently, to a potential catalyst for reconnecting the town centre with blue-green public space. Along the Chelmer and Can river corridors, mills were the primary industrial infrastructure for many centuries. In 1797, the Blackwater navigation canal was opened on the River Chelmer to directly link the town centre with Heybridge Basin and the North Sea as a water highway (Fautley & Garon, 2004). The canal was used to transport goods, coal, and waste, and was the most important mode of transport in the 18th and early 19th centuries until the arrival of the Chelmsford railway station in 1843. After the railway, trade and canal use declined. River Chelmer runs through the town centre and was finally canalised in the 1960s after the 1958 flood disaster, when rapid surface runoff caused the River Can and River Chelmer to burst their banks. The flooding was so extensive that at the height of the storm, Chelmsford was entirely cut off by the floodwaters. A major flood-alleviation project was rolled out across the city centre, fundamentally altering the rivers' hydrodynamics. Today, the canalised section cuts through the town centre and flows east to the Blackwater Navigation canal and River Can, discharging into the North Sea via Heybridge Estuary. Recent urban regeneration projects have increased the visibility of the rivers and created more accessible open spaces for the town. Projects such as the Bond Street development scheme and Waterside schemes have been vital in reconnecting rivers within the urban grain. The newly opened bridge connecting waterside neighbourhoods on the River Chelmer, such as the Bow Bridge Road, is one of these projects (BBC, 2025). In terms of flood risk, Chelmsford is ranked sixth in Essex County for properties at risk of surface water flooding. Chelmsford is also recognised nationally as a Flood Risk Area (FRA) by the Environment Agency (Essex Design Guide, 2018), and the canalised sections of the river in the town centre create major flood risks more frequently than ever. The Council's Local Plan provides a new planning framework to meet local development needs for the period 2013-2036, sets out information on the geography,

demography and population of Chelmsford and identifies a series of challenges and opportunities, including green infrastructure and urban regeneration alongside waterways (Chelmsford Local Plan, 2026). The Chelmsford City Council Policy Board set up the Waterways Working Group in 2019, involving representatives from the Environment Agency, to explore ways to improve involvement, river use, the river environment, and connectivity and access.

Specific sections of the canal in the town centre appear as concrete structures, particularly the end section of the Bond Street area (Figure 6), which is linked by a bridge, creating inaccessible and visually unpleasant sections. Overall, the canal edges create both visual and physical barriers, contrasting with the town centre's traditional brick architecture (Figure 7; a, b, c). The Roman Bridge, as the most visible river-related historic architectural component, serves as a spatial memory connecting the High Street to Moulsham Street (Figure 7; d). The ecologically richest and most vegetated section is along the curvy modern bridge connecting Bond Street with High Street, which provides a more visible, accessible concrete embankment. Most of the town centre is bordered by the concrete channels; in these areas, the water edge is not integrated into the public urban grain, and there is a riverside café with tables on the waterfront.

This trajectory offers a useful comparison with Isparta, as both cases are characterised by channelised and managed waterways. However, they differ in their historical urbanisation processes, regeneration contexts, public space treatment and levels of integration with the town centre.

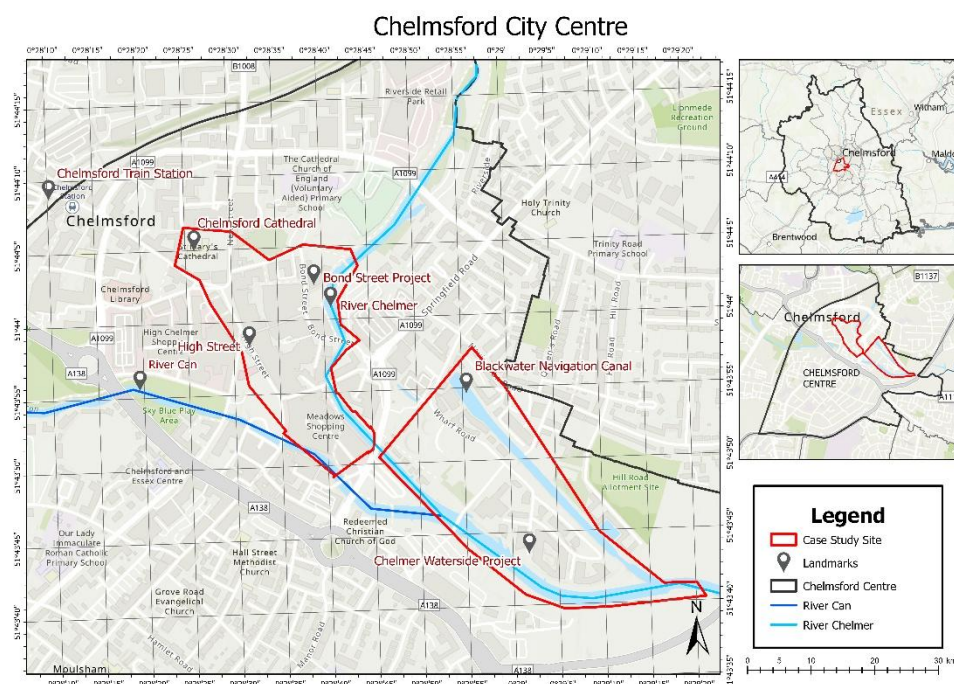


Figure 4. Chelmsford city with River Chelmer and River Can running through the city centre. The Blackwater Navigation Canal flows east, opening to the North Sea (Created by Uzun).



Figure 5. Left side: John Walker Map of Chelmsford from 1591, highlighting the High Street in yellow (Essex Record Office, 2026). Right side: 2026 Google Earth image of the High Street showing the same form of the High Street (Adapted from Google Earth by the author).



Figure 6. The Bond Street Shopping district is located along the River Chelmer. The channelised section is designed here to link the new public space to a tree-lined waterfront. The concrete canal continues through the town centre (Adapted from Google Earth by the author).



Figure 7. Sections of the channelised River Chelmer in the town centre, with their concrete edges, provide habitat for wildlife and ruderal vegetation. The canal edges create visual and physical barriers, contrasting with the traditional brick architecture. From the top-left corner to the right: A. Concrete structures with the bridge, B. The water edge is in front of a riverside café. C. Modern Bridge connecting Bond Street with the High Street. D. The Roman Bridge (Author's own)

4. COMPARATIVE FINDINGS

A comparative framework (Table 1) evaluates the two case studies, analysing the positioning of each canalised waterway in the town centre in terms of spatial integrity, visibility and accessibility, function, cultural memory and ecomorphological capacity. The framework interprets the waterway as an active ecomorphological agent whose role is conditioned by historical urban form, accessibility to public spaces, everyday use and cultural memory.

Table 1. Comparative framework for Chelmsford and Isparta case studies

Comparative dimension	Isparta: Çayboyu canal and stream system	Chelmsford: Rivers Chelmer and Canals	Comparative implication
Historical trajectory	The waterway shifted from being an active agent of vernacular production (mills, hammams, dyehouses) to a controlled recreational corridor.	The rivers shaped the town's historic morphology (navigation, milling) before channelisation and, subsequently, urban renewal.	In both cases, canalised waterways function as socio-ecological palimpsests, where past infrastructural decisions continue to constrain or enable future spatial continuity.
Spatial continuity	Continuity is very fragmented. Spatial mapping reveals that although a linear green-blue corridor is provided, its bridges and regeneration sites show socio-ecological integration with the wider urban form is broken by hard channelisation, traffic routes and segregated pedestrian networks.	Visual legibility of continuity through central river front spaces, modern bridges and regeneration sites. However, morphological analysis shows that the blue-green network is still interrupted by infrastructure and enclosed corridors.	Isparta has higher cultural continuity but lower structural integration. Chelmsford has a better formal spatial legibility but requires more socio-ecological connectivity.
Visual permeability	Visibility is inconsistent. The recreational corridor allows for daily visual contact, yet changes in topography, hard embankments, and road infrastructure obscure vital ecological transitions and limit visibility.	The river is highly visible in regenerated riverfront areas. Yet, concrete sections continue to create visual barriers, limiting continuous spatial engagement.	Visual integration depends on whether the waterway is actively designed as a public-facing socio-ecological landscape or engineered infrastructure.
Pedestrian accessibility	Supports walkability in restored stretches (Cayyolu), but full physical access is interrupted due to a lack of management and care.	Pedestrian access is provided by riverside walks and recent regeneration projects.	Chelmsford offers a robust model of formal pedestrian integration, while Isparta reveals a critical need to weave everyday recreational use back into broader town-centre movement networks.
Spatial memory	Spatial memory is culturally rich; however, it is physically and visually uneven. The canal remains deeply linked to vernacular settlement patterns, but this palimpsest is increasingly obscured by urban regeneration and changing historic urban grain.	Memory is built into the historic navigation canal and historic structures like the Roman Bridge. Yet, ongoing regeneration risks aestheticising the corridor, undermining deeper industrial and morphological histories.	Isparta provides a deeply embedded palimpsest condition, whereas Chelmsford highlights the risk of surface-level heritage interpretation in modern urban design.
Ecomorphological capacity	Engineered channel edges are hard and physically restrict the riparian zone. However, the observation of informal plant growth indicates a strong structural potential for spontaneous urban adaptation, even under the restrictive morphology.	Provides physical space for robust blue-green infrastructure in the corridor. But spatial analysis shows this is still limited, where recent urban regeneration favours rigid, aestheticised edges over permeable, renaturalised transitions.	Both cases demonstrate that the ecomorphological capacity is strongly limited by the physical structure of the channel, and that future multi-species adaptation requires a transition from hard boundaries to permeable edges in terms of structure and space.
Climate and flood adaptation	Rigid channelised shape leads to high vulnerability. The lack of permeable surfaces and the proximity of settlements increase the risks of surface runoff, which necessitates a systemic change towards adaptive blue-green infrastructure for flood mitigation.	Recognised as a high-velocity Risk Area. Adaptation requires moving beyond localised hard defences to continuous, ecologically permeable flood-adaptation corridors that can absorb climate-induced extremes.	Both systems epitomise the failure of mid-century hard engineering. They both necessitate renewing and readapting forms to the changing climatic conditions.
Planning and design implication	Widening riparian edges, softening embankments, and integrating public green spaces for movement and reconnect the corridor to the urban core.	An adaptive, resilient riverfront and channel development should prioritise restoring riparian connectivity and denaturalising river hydrological systems.	Urban waterways must be re-conceptualised as living, adaptive systems, integrating urban grain, space usage and climate resilience.

This comparative framework presents a review of their ecomorphological roles in the transformation of the town centre. Isparta depicts the ongoing evolution of cultural memory and the vernacular urban grain, despite pressures of urban regeneration, as well as structural multi-species adaptation within a fragmented, canalised system. Chelmsford, on the other hand, illustrates the potential for river corridors to emerge as visible urban public spaces and as agents

of urban regeneration. In Chelmsford, rivers and the canal are regarded as assets to be actively used in shaping the public realm, while in Isparta, the stream and canal have been partly regarded as regeneration agents. Together, the two cases suggest that the integration of the town centre depends not only on design intervention but also on the ability to make historical, morphological, and everyday spatial relations legible in the contemporary urban landscape.

The results show that although canalisation creates spatial continuity along the corridors, the hard edges created lead to structural and spatial interruptions. Both waterways continue to form urban corridors, but hard engineering heavily impacts riparian habitats, spatial continuity, and hydrological flow.

More specifically, the Çayboyu canal (Figure 8) reflects vernacular settlement histories. However, fragmented edge conditions weaken its position as a continuous armature for public space. Chelmsford also has a more legible public space but is susceptible to aestheticised regeneration. In regeneration landscapes the Chelmer–Can corridor is more visible but the historical and structural layers may be degraded if riverfront design is based on visual amenity rather than functional integration.

In both cases, it is shown that ecomorphological capacity is not limited to formal restoration, since the physical emergence of spontaneous vegetation and edge habitats can be visual indicators of multi-species adaptation. The Çayboyu Canal (Figure 9) is a tree-lined pedestrian corridor that provides shade and a wind corridor for summer cooling. The street is separated by a hedge and trees, and the waterscape is lawn-covered. The stone walls line the canal and provide a softer morphological edge than the hard concrete walls. Usually, the water level is low depending on the amount of rain. Generally, structurally permeable waterway designs are preferable to rigid ones due to climate uncertainty. Canalised waterways are physically at risk during flooding events and cannot withstand intense water flows and surface runoff. Therefore, future planning of urban waterways must move away from fixed concrete channels and toward more adaptive and spatially integrated corridors.

A three-fold approach is presented for future planning scenarios for the spatial re-integration of waterways into urban public spaces through form-based and nature-oriented design solutions:

1. Softening riparian transition boundary conditions: Hard concrete walls erode transitional riparian zones, physically disconnecting the waterway from the surrounding urban grain. Re-establishing permeable, vegetated edges is the basis for supporting ecomorphological capacity,

reducing surface runoff, and creating accessible, everyday public spaces that encourage human and non-human use.

2. Variety of spatial and hydrological forms: Smooth, straight concrete channels lack natural structural variations, which are important for flood attenuation and landscape diversity. Different physical conditions (floodable terraces, broad embankments, and different edge profiles) are introduced to allow the corridor to better absorb climatic shocks, while improving the spatial experience and recreational value for the public.

3. Re-establishing physical and pedestrian connectivity: Rigid weirs, gates and disconnected infrastructural crossings need to be re-evaluated where they limit the continuous movement of water, sediment and multi-species life. Redesigning these structural barriers is important to connect riverside pathways with wider community networks, thereby fully integrating the form of the waterway into the public realm of the town centre.



Figure 8. The Çayboyu Canal, Left image: a tree-lined pedestrian pathway, Right image: The stone walls with vegetated embankment (Author's own).

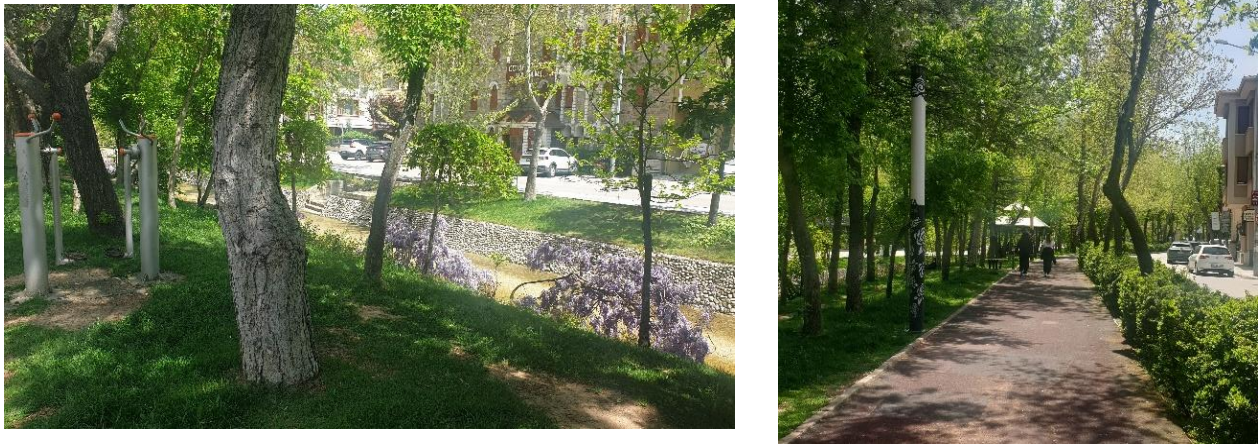


Figure 9. Left image: The Çayboyu canal water edge is well used by locals for recreation and outdoor exercise. Equipment is visible on the left side. All vegetation has been planted after the canal restoration. Right image: The tree-lined pathway provides thermal comfort through its green foliage (Author's own).

5. DISCUSSION

The comparative analysis demonstrates that canalised urban waterways are part of the urban hard infrastructure as well as a vital element of structural green/blue infrastructure. In both Isparta and Chelmsford, the waterway still functions as an organising element within the urban fabric, defining movement, public space, socio-ecological systems and cultural memory. Canalisation has imposed rigid geometries upon dynamic hydrological systems; however, the spatial and morphological agency of the waterways is not extinguished. Instead, it is found in linear corridors, on riparian edges, in pockets of vegetation, along pedestrian routes, in traces of history and in areas prone to flooding. This persistence underpins the paper's central argument that canalised waterways should be thought of in terms of ecomorphological trajectories: relations between spatial-structural systems in which past transformations and future adaptive potentials are linked. The study also suggests that canalised waterways are riparian palimpsests. Settlement, industrial production, flood protection, regeneration and everyday use have shaped their present-day forms. The Andık stream and its canal system in Isparta used to feed vernacular neighbourhoods, mills, hammams, dyehouses, leather production, madder processing and carpet economies. The traditional neighbourhoods along the stream survive in the building plots, heritage buildings such as churches, and in the canal's alignment within the urban grain. Chelmsford has a different relationship: whilst the main town centre high street form is intact and aligns with the river, cultural references are more legible in the form of building plots and infrastructural elements like the Roman bridge, rather than intact vernacular heritage. The Rivers Chelmer and Can have been transformed by navigation, milling, flood-control infrastructure, industrial decline, and modern riverfront regeneration.

In both cases, therefore, the waterway is not a neutral landscape feature; it is an archive of socio-economic transformation inscribed in the morphology of the town centre. The cases also highlight the ongoing relationships of the Anthropocene city with its nonhuman surroundings, including rivers, streams, and topography. The drive to control nature, in this case, is to stabilise, straighten, and accelerate dynamic water systems, particularly through hard engineering. In the twentieth century, the canalisation of complex riparian environments into simplified hydraulic corridors was primarily aimed at conveyance and flood control. This rationalisation created visible spatial continuity along the watercourse, but also reduced ecomorphological capacity by narrowing riparian zones, interrupting structural transitions, limiting hydrological flexibility, and separating people from the everyday public use of water. This is a version of Anthropocene friction in which engineered urban order is still challenged by water movement, surface runoff, spontaneous vegetation growth, sediment processes, and multi-species occupation.

The present state of the canals embodies the conflict between spatial legibility and ecomorphological capacity. Chelmsford has a broader formal public-space integration with riverside regeneration schemes, a shopping district and High Street routes. If these interventions focus only on visual amenity and not on structural repair, flood resilience, and historical interpretation, they risk aestheticising the river corridor. However, Isparta has a more dynamic cultural and industrial memory in the Çayboyu corridor. However, its discontinuous edges, rigid channelisation, and uneven links to the town centre weaken its potential as a continuous armature for public space. By comparison, waterway integration can only be successful if it is not solely about physical proximity or the visual quality of urban design. It also depends on the legibility and accessibility of the waterway's spatial processes, historical strata, and everyday social uses. Such canalised corridors also hold considerable morphological importance. The emergence of spontaneous vegetation and informal ruderal growth reflects structural adaptations to hard edges, demonstrating how non-human species occupy the restrictive forms of engineered urban systems. In this sense, these spontaneous interventions are visual indicators of adaptation capacity within the urban form. Therefore, the structural importance of porous margins, widened riparian corridors, and physically accommodating multi-species movement is vital to consider in canal design.

The uncertainty of climate increases the urgency of such morphological shifts. Both cases illustrate the limitations of hard infrastructure for flood mitigation amid increased rainfall intensity, surface runoff, and pressure to redevelop urban areas. In the future, planning should move away from hard concrete channels towards more flexible, permeable blue-green corridors.

The corridors are to be designed with absorptive physical forms that accommodate changes in climatic seasonal variability and biodiverse conditions.

By conceptualising Isparta's Çayboyu canal and Chelmsford's canalised river corridor as comparative riparian palimpsests, the paper contributes to debates in urban morphology, ecomorphologies, cultural memory, and spatial urban studies. The canalised waterway acts as an archive of spatial memory and a structural framework for network futurity, providing alternative morphological scenarios for re-connecting town centres with blue-green infrastructure in the face of climatic uncertainty.

6. CONCLUSION

This paper has examined canalised urban waterways as components of ecomorphological trajectories through a comparative morphological study of Isparta's Çayboyu canal and associated stream system, and Chelmsford's canalised river corridor shaped by the Rivers Chelmer and Can. The comparison shows that the influence of canalised waterways continues to affect urban form, public-space experience, spatial potential, and cultural memory even when they are converted into hard-engineered infrastructures. These waterways are living transects where historical industries, settlement patterns, flood events, redevelopment pressures, and the movement of multispecies remain physically interwoven. The results show that Isparta and Chelmsford epitomise distinct yet analogous riparian palimpsests. The Çayboyu corridor in Isparta holds a rich cultural and industrial memory of water-related labour, everyday recreational use and vernacular urban grain, but its hard canalisation and fragmented boundaries hinder its structural integration with the town centre. Regeneration, bridges and riverside public space have made the river corridor in Chelmsford very visible, but the risk is that the morphological and historical layers of the riverfront may be simplified if development continues to focus largely on visual amenity. In both cases, canalisation produces spatial continuity along the watercourse but also structural discontinuity due to concrete edges which constrain riparian transition, spatial permeability and hydrological flexibility. The paper's main contribution is the argument that ecomorphological trajectories provide a useful lens for reading canalised waterways as historical, structural and adaptive systems. It is the convergence of urban morphology, cultural ecology, form-based river restoration and blue-green infrastructure. It indicates that ruderal vegetation, informal permeable edges and non-human movement should not be regarded as marginal by-products of urbanisation, but as physical evidence of adaptive ecomorphological capacity within the urban matrix. Here, the canalised waterway is an archive of spatial memory, as well as a structural framework for future resilience. Moving away

from rigid channel-based flood control towards more porous, flexible, and structurally permeable blue-green corridors in future planning and design is important for a resilient city model. This involves a form-based mitigation approach that uses nature-oriented design solutions, including de-channelisation where possible, widened riparian transitions, restored pedestrian connectivity, and stronger cultural interpretation.

Future town centre planning may develop network futures through the spatial guidance of the historic urban landscape palimpsest, where human and non-human cohabit climatic uncertainty. In this comparative study of Isparta and Chelmsford, the palimpsest landscapes of the two cities – as the cumulative layers of stream modification, industrial memory, settlement morphology, morphological disturbance and everyday public use – should not be considered as mere remnants of the past. Rather, these layered landscapes may serve as interpretive and design frameworks for determining where spatial continuity, riparian reconnection and climate-adaptive transformation are most urgently needed. Canalised waterways show how older socio-ecological structures continue to shape contemporary urban form, even when they have been overwritten by concrete channels, regeneration schemes or flood-control infrastructure. Read through the palimpsest landscape concept. Their palimpsest condition is thus both diagnostic and projective: it reveals historical-structural traces, physical constraints, and also guides future possibilities for, and ecomorphological potentials – can be redirected towards more resilient, legible and multi-species urban corridor forms. These solutions offer active ecomorphological infrastructures: spatial memories of past urbanisation encoded in living frameworks for climate-adaptive multi-species cities.

Permission from the ethics committee and/or legal/special permission is not required.

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