IJEMS | SCIENTIFIC ARTICLE

Historical Evolution of Water Management in Liguria: From Agricultural Landscapes to Coastal Gardens

PATRIZIA BURLANDO
University of Genoa, Italy
patrizia.burlando@unige.it

Liguria is an Italian region on the Mediterranean, consisting of a narrow hilly arc overlooking the sea, with the Magra River being the only watercourse of significant flow. Despite its limited territorial extent scarce surface water, Liguria has always been a land of considerable agricultural diversity. Historically, water use was shaped by the contrast between the communal management of public resources and the individualism associated with private properties. This study examines the transformation of an arid landscape arid terrain into fertile land through sustainable water management management practices. The construction of terraces on steep slopes for cultivation, as well as the building along with the development of canals and cisterns for the ingenious use of water, are well documented through extensive historical records and cartography. Coastal agricultural systems, such as those in the Cinque Terre and Chiavari, offer emblematic examples of water management. In noble estates, water played a key examples of water management. In noble estates, water played a key role not only in sustaining Mediterranean vegetation through elaborate hydraulic systems but also in maintaining productive agricultural areas. Liguria's centuries-old expertise in water management provides valuable insights for addressing contemporary challenges. Integrating traditional practices with technological innovation may offer sustainable solutions for the future.

Key Words: landscape architecture, mediterranean, terracing, gardening, historical cartography

CC BY-SA © 2025 Patrizia Burlando
https://doi.org/10.70908/2232-6022/18.421-442

INTRODUCTION

Water resource management has been a crucial component of Mediterranean civilizations since antiquity. Liguria is an Italian region over-

looking the Mediterranean Sea, characterized by a predominantly hilly morphology that descends directly to the coast. In this mountainous and rugged coastal landscape, water initially played a central role in shaping the environment and later in the development of human ac-
[422] tivities. Along with its steep topography, the region's limited territorial extent and Mediterranean climate – marked by heavy winter rainfall and dry summers – have significantly influenced water use practices. From Roman hydraulic systems to modern water management interventions, Liguria offers a unique perspective on both ancient and contemporary water practices, providing valuable insights into the governance of water resources today, when sustainable use is increasingly essential.

This study focuses on both historical and modern hydraulic systems in Liguria, examining key examples of water infrastructure and their implications for sustainability and environmental management. Particular emphasis is placed on the role of water not only in shaping the landscape but also in its collection and efficient reuse, which has been fundamental to the socio-economic development of the region. By analyzing geography, agricultural practices, and historical structures, this research highlights the interactions between humans and nature within the Ligurian context. It explores the technical and symbolic aspects of water management, assessing how these practices contribute to the sustainability and resilience of the territory.

METHODOLOGY

This research is based on a multisource and interdisciplinary methodology combining fieldwork, archival research, cartographic analysis, and bibliographic review. Fieldwork, carried out between 2022 and 2024, included on-site surveys, photographic documentation, and informal interviews with local stakeholders (farmers, municipal officers, and cultural heritage operators). Archival research was conducted in the Soprintendenza Archivistica and Bibliografica della Liguria (Archivi di Stato di Genova e della Spezia),[1] the Civic Library of Società Economica di Chiavari,[2] and the Istituto Internazionale di Studi Liguri

[1] General historical and documentary background information was obtained through the consultation of sources held at the Soprintendenza Archivistica e Bibliografica della Liguria.

[2] The research also involved the consultation of the Civic Library of Società Economica di Chiavari, which preserves a rich documentary heritage concerning the history of

Bordighera,[3] providing historical records of land management and hydraulic infrastructure. The study also employed comparative map analysis through historical cadastral maps, aerial photographs, and GIS-based cartographic data, which made it possible to reconstruct transformations in land use, terraces, and water systems over time. Finally, a [423]
comprehensive review of secondary literature supported the interpretation of these findings within the broader disciplinary framework of landscape architecture, agronomy, and heritage studies. This integrated methodology ensured both the diachronic depth and the spatial accuracy required to assess the relationship between water management, agricultural practices, and landscape heritage in Liguria.

LIGURIA

Geography, Morphology, and Infrastructure Networks

Liguria is characterized by a complex morphology in which steep hills alternate with narrow coastal plains. This configuration has influenced land use from the Roman period to the present, informing both hydraulic infrastructure and modern water management practices. The hills, often covered with dense oak and chestnut forests, feed seasonal streams flowing toward the sea, presenting both opportunities and challenges for water supply.

Adaptation to such a challenging environment has led to innovative engineering solutions. One notable example is the system of terracing, designed to optimize water resources for agricultural practices in terrain otherwise unfavorable for cultivation. Additionally, the region's proximity to the sea facilitated the development of ports and hydraulic infrastructure essential for trade and fishing, both vital components of the local economy.

The Porto Antico of Genoa and the Gulf of La Spezia have historically played key roles in Liguria's maritime transport. The nearby town of Lerici served as a trade hub connecting Lunigiana, Tuscany, Parma, and Genoa, as the inland routes along the easternmost Ligurian coast were difficult to traverse. The Gulf of La Spezia also provided a safe harbor for sailors. Land connections between the western and eastern parts of

traditional crops in the Chiavari plain – a key resource for reconstructing the historical memory of the area from both historical and agronomic perspectives.

[3] Data relating to the Hanbury Gardens and, more broadly, to the history of the Ligurian landscape were consulted at the Istituto Internazionale di Studi Liguri in Bordighera, which preserves significant historical and documentary sources.

the region improved only in the 19th century with the construction of the railway and new infrastructure.

Roman Aqueducts and Water Supply Infrastructure

[424] Roman influence is evident in the numerous aqueducts and hydraulic systems found throughout infrastructures present in Liguria. Built using advanced technologies for their time, these systems ensured water supply to coastal cities and inland settlements. A notable example is the Roman aqueduct of Genoa, which transported water from mountain springs to the city through a complex system of canals, conduits, and cisterns.

The aqueducts reflect a deep understanding of hydrology and local topography. Their construction and maintenance demonstrate sophisticated engineering skills that enabled the Romans to overcome the challenges posed by the region's rugged terrain.

The Historic Aqueduct of Genoa, originating in the Roman period and expanded until the 19th century, provided a continuous water supply to the city and its port for centuries. Beginning in Cavassolo in the upper Bisagno Valley, it crosses forests, valleys, and urban districts, incorporating engineering works such as the canal bridge over the Geirato stream (1777) and the bridge over the Veilino stream (1837), which offers a panoramic view of the Monumental Cemetery of Staglieno. Today, the pedestrian route along the aqueduct serves as a cultural itinerary that blends history, nature, and architecture, demonstrating how water heritage can be preserved and adapted to contemporary needs (VisitGenoa 2025).

Cisterns and Water Collection Techniques in Historic Structures

In addition to aqueducts, cisterns were an essential element of ancient water systems. Many historic cisterns remain in use today, while new projects incorporate them to address the increasing periods of water scarcity.

Historically, these structures, often carved into rock or built with stone masonry, were used to collect and store rainwater. In rural areas, cisterns ensured a reliable water supply for irrigation and domestic consumption, especially during droughts. A significant example can be found in the Cinque Terre, where the scarcity of natural springs led communities to develop innovative water conservation solutions.

Cisterns are also present in Liguria's historic parks, where they con-

tinue to supply water for garden irrigation. One notable case is Villa Rezzola in Pugliola (Lerici), a property inherited by FAI – Fondo per l'Ambiente Italiano[4] in 2020. Through a PNRR-funded program for the enhancement of historic parks and gardens, restoration and redevelopment activities have been initiated. Villa Rezzola is an extraordinary example of an early 20th-century residence, where the myth of Mediterranean leisure takes shape through the harmonious relationship between architecture and nature (Fondo per l'Ambiente Italiano 2025). [425]

The park, designed on an ancient agricultural property, enjoys a spectacular location overlooking the southwesternmost part of the Gulf of La Spezia, with views of the Palmaria, Tino, and Tinetto islands. The ongoing project aims to restore the architectural layout – comprising staircases, pergolas, and pathways – and to rehabilitate the vegetation, counteracting the decline of botanical species while reinforcing the original character of this Mediterranean garden of water and shade.

The intervention highlights the balance between the two defining aspects of the park: the formal garden in the upper section and the naturalistic landscape in the lower part. A key element of the restoration is the reactivation of the historical water system that once connected these areas.[5]

A distinctive feature of the formal garden is the presence of numerous water elements set within the Mediterranean woodland. Originally designed for aesthetic and recreational purposes, these features required a sophisticated hydraulic system, including fountains, nymphaea, cascades, and a large storage basin. This reservoir, integrated into the architectural design of the park, interacts with the adjacent pergola, where the reflection of *Wisteria sinensis* (Chinese Wisteria) enhances the water's visual impact.

[4] The FAI – Fondo per l'Ambiente Italiano ETS is an Italian non-profit foundation supported by private citizens, companies, and public institutions for the protection of Italy's historical, artistic, and landscape heritage, in the spirit of Article 118 of the Italian Constitution. Founded in 1975 on the model of the British National Trust and affiliated with INTO – International National Trusts Organization, FAI preserves collective heritage by saving, restoring, opening to the public, and enhancing Italian monuments and natural sites, which it receives as donations or concessions. FAI also oversees the protection of landscape and cultural assets in accordance with Article 9 of the Constitution (Wikipedia 2025d)

[5] See note 2.

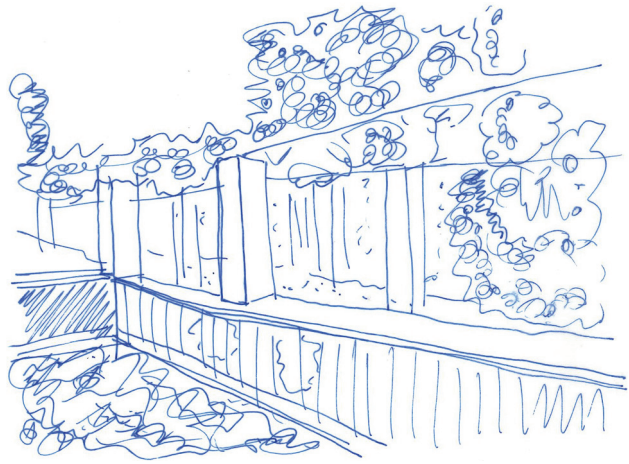

FIGURE 1

Water Collection Basin with the Pergola in the Background: Garden of Villa Rezzola in Pugliola (Lerici)

Originally, this system was fed by external water sources, but today the basin functions solely as a storage tank. With a depth of over two meters and a surface area exceeding 60 square meters, it has significant volumetric capacity. Water remains a defining feature of the Rezzola estate: while the historical hydraulic system was initially designed to satisfy *voluptas* et *venustas,* today it addresses the *utilitas* required for the park's sustainable maintenance.

Once fully restored, Villa Rezzola – like all FAI properties – will be open to the public. However, its upkeep will require a substantial water supply – an increasingly scarce resource in Liguria, especially in the summer months – for both irrigation and the reactivation of its historic water features.

THE AGRARIAN LANDSCAPE OF LIGURIA

Water Management and Traditional Cultivations

A defining feature of Liguria's landscape is its terraced agricultural system, which, combined with an efficient water management network, has sustained centuries of viticulture, olive growing, and vegetable farming, originally intended for subsistence.

Terracing not only gives Liguria its distinctive landscape but also represents a functional and sustainable solution for mitigating soil erosion and optimizing the use of limited water resources. The dry-stone walls supporting the terraces regulate rainwater drainage and create microclimates favorable to plant growth (Brancucci et al. 2000).

In addition to the coastal hillsides, historically transformed into ar-

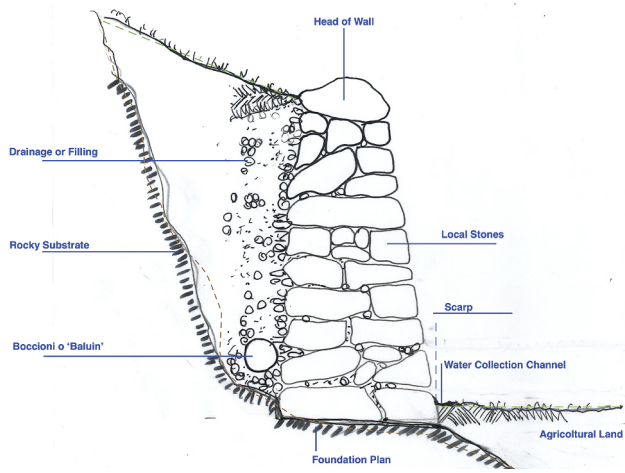

FIGURE 2

Components of a Dry Stone Wall



FIGURE 3

Cinque Terre: Terraced Landscape behind Vernazza (Photo by Mario Manfroni)

tificial terraces over millennia, Ligurian agriculture also occupied narrow strips of land along the coast, often near river mouths. These locations were strategically advantageous due to the consistent presence of freshwater, essential for agriculture.

Travelers and writers of the past frequently described these cultivated lands as an idyllic landscape, where the interaction between humans and nature created a harmonious symbiosis. The dedication required to maintain the terraces reflects the significance of the local agricultural community and its ability to adapt to a challenging environment, transforming it into a valuable resource.

Case Study: Terraces vs. Coastal Plains

Case Study Selection

The case studies discussed – namely the Cinque Terre, the Tigullio villas and gardens, and selected inland terraced areas – were chosen
[428] because they represent complementary dimensions of water management and landscape transformation in Liguria. The Cinque Terre, listed as a UNESCO World Heritage Site since 1997, provide an emblematic example of terraced agriculture and collective water management that achieved global recognition for its cultural and ecological value. In contrast, other Ligurian terraced systems, such as those in the Val Fontanabuona or the Ponente valleys, remain outside the UNESCO framework yet reveal similar practices and challenges in maintaining hydraulic infrastructures and productive landscapes. The comparative analysis between UNESCO and non-UNESCO sites highlights both the universal values acknowledged at the international level and the ordinary, yet equally significant, practices that characterize Liguria's water-landscape systems. The inclusion of historic villas and gardens (e.g., the Genoese villas in Tigullio) broadens the scope, demonstrating how water management was not limited to rural productive contexts but also shaped the design of aristocratic landscapes. This multiscalar selection (productive terraces, heritage landscapes, and designed gardens) is consistent with the research objective of exploring water as a unifying infrastructure across different landscape typologies.

The Terraces of Cinque Terre

The Cinque Terre in eastern Liguria represent a global icon of agrarian landscapes. This area is characterized by extensive terracing, with dry-stone walls supporting vineyards and olive groves, demonstrating a perfect balance between tradition and functionality. These terraces serve as a model of sustainability, preserving soil and fostering biodiversity. According to the *Codice dei Beni Culturali e del Paesaggio* (Wikipedia 2025b) and the *European Landscape Convention* (Council of Europe 2000), landscapes are a cultural and collective heritage essential for quality of life. The uniqueness of a landscape is shaped by various factors – geological, natural, climatic, historical, cultural, and economic – which give individuals a sense of belonging to a specific place (Norberg-Schulz 1979). Human life is deeply intertwined with both natural and man-made landscapes. In 1997, the Cinque Terre, along with Porto Venere and the islands of Palmaria, Tino, and Tinetto, were de-

clared a UNESCO World Heritage Site, recognized as 'a cultural area of exceptional value, illustrating a harmonious relationship between humans and nature, resulting in a landscape of extraordinary scenic beauty, reflecting a traditional way of life preserved for a thousand years and continuing to play an important socio-economic role in the [429] community' (UNESCO 2003).

The UNESCO designation is based on three criteria (ii, iv, v):

ii Demonstrating significant architectural, artistic, or landscape development within a given cultural area.

iv Representing an outstanding example of an architectural, technological, or landscape development illustrating a significant period of human history.

v Serving as an important example of human settlement and land use representative of a particular culture, especially when threatened by irreversible changes.

The combination of unique landscape techniques, exemplary land use, and the threat of uncontrolled transformation makes this territory unparalleled and irreplaceable (Burlando 2009).

In this transformation, humans not only modified steep surfaces for agriculture but also developed water collection and management systems to cultivate olive trees, vineyards, and vegetables. Terraces built with dry-stone walls help stabilize the soil, prevent landslides, and retain rainwater, crucial for irrigation. This system optimizes water resources while allowing cultivation in otherwise inhospitable hilly areas. Historically, more than 60% of Liguria's territory was terraced.

Today, however many of these terraces, including those in the Cinque Terre, are abandoned. This lack of maintenance disrupts territorial balance, leading to increased hydrogeological instability due to uncontrolled water runoff.

Despite significant funding for terrace restoration, the abandonment of traditional agricultural and pastoral activities has resulted in reforestation and land rewilding, negatively affecting landscape conservation, cultural identity, and biodiversity. While it may no longer be feasible to preserve the entire historical landscape, a balanced territorial planning strategy is necessary – integrating new natural landscapes while partially maintaining those that reflect centuries of human labor.

Coastal agriculture in Liguria continues to exemplify sustainable

farming and intelligent resource management. However, land abandonment remains a challenge for preserving traditional landscapes. In recent years, renewed interest in terrace restoration and ancient agricultural practices has emerged, supported by initiatives to safeguard
[430] Liguria's agricultural and landscape heritage. A significant example is the Stonewallsforlife project in the Anfiteatro dei Giganti in Manarola (Cinque Terre), funded by the EU LIFE Programme.

This initiative, set to conclude in 2025, focuses on restoring traditional agricultural terraces. Activities include dry-stone wall reconstruction, replanting of crops, and restoring drainage channels, with active participation from local businesses reclaiming abandoned farmland. The project allocates land to local farmers based on sustainability criteria, encouraging biodiversity conservation and water efficiency while promoting youth engagement in sustainable agriculture. By preserving traditional farming techniques and promoting environmental sustainability, Stonewallsforlife is helping safeguard both the natural and cultural heritage of the Cinque Terre (Parco Nazionale delle Cinque Terre 2024).

Case Study: Chiavari – Coastal Plain vs. Terracing

The coastal cultivations of Chiavari represent an exemplary case of agricultural management in Liguria, a region that, despite its hilly terrain and limited water resources, has developed highly specialized farming techniques, particularly along its coastal areas.

Chiavari is a small town on the eastern Ligurian coast, surrounded by terraced hills. It also includes a flat area along the alluvial plain of the Entella River and a coastal plain. This entire area, characterized by fertile alluvial soils and close proximity to the sea, is particularly suited for viticulture, despite the challenges posed by the maritime climate and sandy soils near the beach.

Historically, as seen in the Vinzoni map of 1773 (figure 4), the entire hillside behind the walled historic village – built at the foot of the castle – was entirely terraced. The coastal cultivations of Chiavari played a key role in Ligurian agricultural history, contributing not only to the local economy but also to the preservation of the landscape. As in the Cinque Terre, the terraces of Chiavari helped shape a unique and irreplaceable landscape image, which still attracts visitors from around the world today.

In Liguria, beyond vineyards, fruit trees and citrus groves, olive cul-

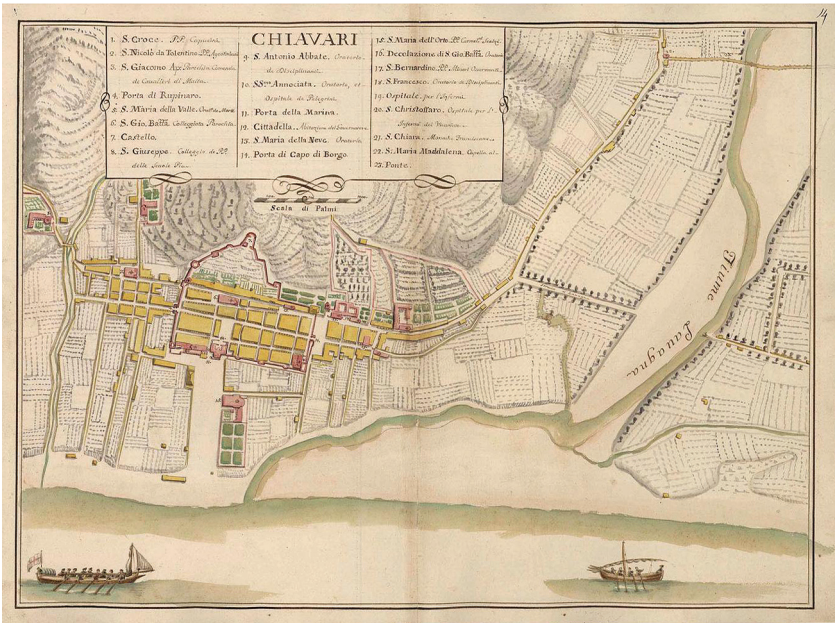

FIGURE 4 Chiavari, Map by Matteo Vinzoni (1773)

tivation spread widely, likely introduced by Benedictine monks during the Middle Ages (Liguria Ponente 2017), particularly in the Taggia area. From there, olive trees expanded toward the Lavagna valley, located on the western (left) bank of the Entella River. In the past, favorable climatic conditions supported the growth of the Lavagnina olive, though increasing cultivation eventually led to higher production costs.

Despite the extensive terracing in the hills, Chiavari's coastal plains were also densely cultivated and inhabited. The 18th-century Vinzoni map documents irrigated vegetable gardens near the coast, adjacent to settlements and providing protection from sea winds. As Quaini (1973) notes, in the early 18th century Genoese magistrates expressed concern about increasing illegal encroachments on public beaches, particularly in Savona, Chiavari, and Lavagna, as villas and gardens expanded toward the coast. The Vinzoni map also shows that the flat area in front of Chiavari, near the river mouth, was entirely cultivated. Coastal properties were enclosed by protective walls, except on the seaward side, where a light pergola, possibly made of reeds, was likely adjusted seasonally according to weather conditions.

Because of limited surface water availability, water management in

Chiavari's coastal agriculture has always been crucial. Historically, water was conveyed through a network of ditches and canals along the terraces to collect and distribute rainwater. Cisterns and wells also stored water for dry periods, ensuring irrigation during the summer.

[432] In the coastal plains, well sweeps (*pozzi a cicogna*) were used to draw water directly from the Entella River. From 1932 until recent years, irrigation in the Chiavari plain was maintained through an underground pipeline that extracted water from the Lavagna River for agricultural use. However, excessive riverbed dredging lowered the riverbed, reducing water levels and rendering the canal unusable.

Traditional Agriculture in Chiavari Chiavari's landscape still preserves a defining feature of local agriculture; the combination of vegetables, vines, and fruit trees.

Local publications from the mid-19th century mention traditionally cultivated species, such as:

- Potatoes: *Quarantine* and *Cannelline,* often grown alongside olive cultivation on hillsides.
- Cabbages: Various types, including *cavolo broccolo lavagnino* (its seeds are still preserved today), *cavolo lombardo,* and *cavolo gaggetta,* named after a local dialect term.
- Other crops: The *Chiavari root,* scorzonera, and the *Lavagna pea.*

Fruit trees were widely cultivated, especially apple, pear, and peach orchards. Because of the fragmented nature of land holdings, planting was rarely systematic, allowing farmers to maximize the use of available land. Trees were pruned with high canopies to permit vegetable cultivation beneath them.

- Peaches: Varieties included *Mazenghe* (May), *Zunine* (June), and *Settembrine* (September).
- Pears: Included *Noci* and *Giambattà.*
- Plums: *Fiaschette* variety.

In 1817, Gallesio's *Pomona Italiana* (1917) documented fig trees (Ficus carica) in the Prupissalutto variety. According to Gallesio, Renette and Carle apples were also common.

Additionally, *Arundo donax* (giant reed), which grows along the Entella River, was widely used in local agriculture:

- as a windbreak to protect fields from sea salt,

- as plant supports for vegetables such as tomatoes, green beans, peas, and zucchini,
- as stuffing for chairs, using its durable leaves.

[433]

Viticulture in Coastal Plains: The Vineyards on the Beach A unique agricultural practice developed in Chiavari's coastal plains: vineyards planted directly on the beach or near the coast. This rare approach differs from the typical preference for well-drained soils away from sea salt exposure. However, local viticulturists adapted to these conditions, achieving remarkable results.

Vines grown on the beach benefit from:

- Mild climate: The sea moderates temperatures year-round, reducing frost risk and aiding uniform ripening.
- Solar reflection: Light-colored sand reflects sunlight, enhancing photosynthesis and grape maturation.
- Constant ventilation: Sea breezes keep plants dry, reducing fungal diseases and humidity-related issues.

Nevertheless, coastal viticulture faces challenges, particularly salt exposure, which can damage leaves and alter grape flavors. To mitigate this, farmers use high pruning, install natural windbreaks, and monitor irrigation carefully, as sandy soils drain quickly and increase salinity risks.

Traditionally, vines were trained using chestnut stakes with willow and reed trellises, and pruned using a system similar to today's Guyot method. The main grape varieties cultivated in the Chiavari plain include:

- Vermentino: A highly valued white grape producing fresh, mineral wines with a light saline note due to its coastal proximity. Initially used as a table grape, it later became a key variety for winemaking.
- Albarola (Bianchetta Genovese): Another local white variety, traditionally grown alongside vegetables. It produces light, fragrant wines, ideal for pairing with Ligurian seafood. It was known for high yields but lower quality.
- Dolcetto and Sangiovese: Red varieties, less common along the coast but still cultivated in some vineyards.

These wines are appreciated for their freshness and minerality, influenced by the maritime climate and sandy soils. Their subtle saline

character distinguishes them within the Italian wine landscape. The vineyards on the beach of Chiavari demonstrate how traditional agricultural techniques can be adapted to unconventional environmental conditions without compromising quality. This viticulture reflects cen-
[434] turies of expertise and deep respect for the local environment. Today, interest in traditional practices is increasing, with local wineries reassessing coastal viticulture as a distinctive and valuable aspect of Ligurian winemaking.

The coastal cultivations of Chiavari exemplify how Liguria's agricultural traditions – based on efficient resource use and innovative techniques – have enabled successful farming in a naturally challenging environment. This adaptive expertise has transformed the coastline into one of the region's most fertile and distinctive areas. Chiavari's agricultural and cultural heritage remains unique, deserving continued recognition and conservation (Mazzino and Burlando 2016, 50–53).

HISTORIC SYSTEMS OF PARKS, GARDENS, AND VILLAS IN LIGURIA

The Role of Water in Landscape Systems

Water has always been a central element in Liguria's historic gardens and villas, serving both functional and decorative purposes. The presence of water features in these landscapes reflects a long-standing tradition of integrating technical expertise with aesthetic objectives. Moreover, water played a crucial role in linking individual landscape complexes with the surrounding territory. Its use as a symbol of wealth and power is evident in the grand hydraulic works of noble estates, not only in the formal garden areas but also in the productive agricultural sections of these properties.

Liguria's compact and mountainous geography is defined by a dense network of ridges and valleys that run perpendicular to the coastline, with numerous small rivers and streams of limited flow. Because of the region's topography and the presence of these watercourses, large landholdings were uncommon, as properties were often intersected by public roads or water systems. In some cases, such as Villa del Principe Doria in Genoa, the connection between the estate and the hillside was maintained via a bridge over a public road (Via San Benedetto, located behind the main building) (Maniglio Calcagno 1983). A similar example can still be seen at Villa Rostan in Genoa Multedo, where the 19th-century landscape parterre, now converted into a football field, is ac-

cessible from the main villa only by crossing a small bridge over the historic *Via Antica Romana di Pegli* (Maniglio Calcagno 1985).

An essential unifying element in Liguria's landscape remains its rich network of rural pathways, which connect parish churches, small villages, parks, gardens, and agricultural estates.[6] This intricate system, [435] combined with watercourses and the coastline, has shaped not only Genoa but also the entire Ligurian region.

The Role of Historic Villas and Gardens in the Contemporary Landscape

Today, Liguria's historic villas and their extensive estates play a key role in preserving cultural landscapes and serve as vital green lungs, particularly in urban areas. These spaces help mitigate heat island effects, reduce air pollution, and enhance biodiversity. Additionally, as many historic properties have been transformed into public parks and now function as open green spaces for local communities, providing significant social and environmental benefits.

Case Study: Villa Scassi (Genoa-Sampierdarena)

Sampierdarena, the first urban periphery west of Genoa's historic center, played a strategic role in industrial and maritime development between the 19th and 20th centuries due to its location along the Polcevera valley, connecting the Ligurian Sea with northern regions. Once characterized by an agricultural landscape and a network of villa gardens, the area underwent profound transformations as the port expanded, severing the hinterland from the sea and dramatically altering the coastline. Today, Sampierdarena retains fragments of its historical landscape but faces numerous challenges related to traffic, urban decay, and the loss of historical memory (Mazzino and Burlando 2016).

Originally a maritime village with shipyards active since the thirteenth century, Sampierdarena became, by the fourteenth century, a vacation destination for Genoese noble families. Between the fifteenth and sixteenth centuries, they built magnificent villas with terraced gardens, citrus groves, fountains, and statues, making the area renowned across Europe. The landscape, once celebrated for its beauty and for the scent of citrus blossoms detectable from ships offshore, gradually disappeared as industrial and port facilities expanded (Mazzino and Burlando 2016).

[6] Consider the Alta Via del Monti Liguri which connects all of Liguria through a complex system of routes from the far west, Ventimiglia, to the far east, Fiume Magra.

Villa Imperiale Scassi, built between 1560 and 1564 for Gio Vincenzo Imperiale by the Ponzello architects, was one of Genoa's most prestigious buildings. Following the architectural tradition of Galeazzo Alessi, it earned the nickname *la Bellezza*. Located along the ancient
[436] Roman road (now Via D'Aste), the villa was spatially connected with other significant residences, including Villa Grimaldi and Villa Cristoforo Imperiale.

Over time, the villa underwent several transformations: during the Siege of Genoa in 1800, it was used as a barracks and military hospital (Wikipedia 2025a). In 1801, Count Onofrio Scassi commissioned as industrial and port facilities expanded restorations. By the late 19th century, it had been converted into a school, and in the 20th century, the construction of a hospital and Via Cantore drastically altered its configuration, severing the villa from its garden and its original landscape context. The garden, poetically described by Gio Vincenzo Imperiale in *Lo Stato Rustico* (Wikipedia 2025c), followed a classical orthogonal composition and was organized into three main sections. The first included two lateral spaces with labyrinths of aromatic plants; the second, located uphill from the building, featured three large terraces visible from the northern facade; the third consisted of agricultural terraces along the hillsides. The water system included three large basins, nymphaea, fountains, and a circular pool with a statue of Pegasus, integrating both functional and decorative elements. The garden also housed pavilions, a medieval tower, a dovecote, and rustic buildings (Mazzino and Burlando 2016).

The interconnected system of villa, gardens, and water infrastructure is well documented in Matteo Vinzoni's 18th-century map,[7] which

[7] See Mazzino and Burlando (2016) and Vinzoni Map of Sampierdarena. Matteo Vinzoni, born in 1690 in Liguria, was an important cartographer of the Republic of Genoa who worked alongside his father, Panfilio, also a cartographer. Matteo distinguished himself through a meticulous and scientific approach to cartography: he did not merely collect information but personally visited the sites he mapped, studying their geography and history. This method earned him the title of 'official' cartographer for the Republic of Genoa, although he did not receive adequate compensation for his work. His methods were considered innovative and influential for the development of modern cartography. Vinzoni (1773) created the *Atlante dei Domini della Serenissima Repubblica di Genova e Terraferma,* a groundbreaking cartographic collection for its time. The atlas, divided into two volumes – *Riviera ligure di ponente* and *Riviera ligure di levante* – was presented to the Senate of Genoa in 1773. It contains forty-four detailed maps of Liguria, the French Riviera, Lower Piedmont, and Lunigiana, all made with remarkable precision

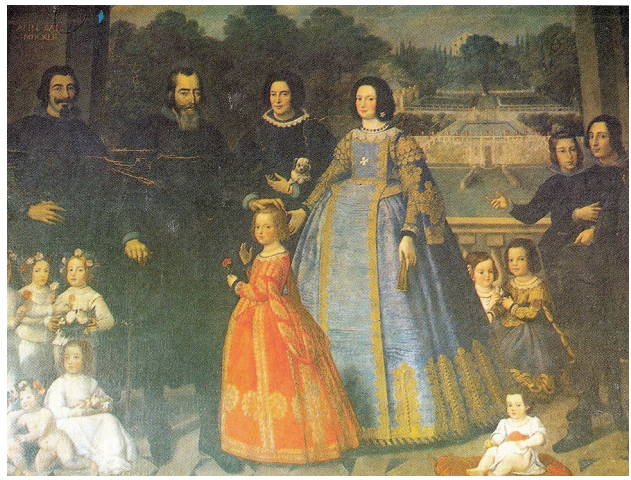

FIGURE 5

Portrait of the Imperiale Family

NOTES Painting by Domenico Fiasella (1642), https://it.m.wikipedia.org/wiki/File:Domenico_Fiasella-ritratto_famiglia_Imperiale_(1642).jpg

illustrates its central role in Sampierdarena's landscape, embedded in a rich agricultural and residential context. The system of fishponds and fountains exploited the natural slope to ensure water collection and distribution, serving both functional and aesthetic purposes. Beyond contributing to the monumental architecture – comprising nymphaea, grottoes, basins, and sculptural fountains – the water was also used to irrigate surrounding terraced fields, integrating aesthetic and agricultural functions harmoniously.

The connection with the agricultural landscape is evident in the third section of the garden, consisting of agricultural terraces visible in Vinzoni's map as an integral part of the region's historic cultivation. These terraces, designated for aromatic plants and other traditional vegetation, extended along the hillsides up to the valley's summit. At the highest point of the garden, the straight axis, inclined relative to the lower sections, was interrupted by a circular basin and ended in an open space resembling an *hortus conclusus*. This linear pathway, aligned with

for the period. Vinzoni was also known for his determined character, sometimes irascible, but consistently committed to accurately documenting borders and political disputes of his time. Despite physical difficulties and adversities, he continued his work until his death in 1773 in Levanto, leaving behind a crucial cultural heritage for Liguria. His maps were created with great care and precision, often enriched with artistic details such as wind roses and symbols linked to the places depicted. Although his name is not widely known to the general public, his contribution to cartography and the history of Liguria is invaluable, with numerous visual testimonies still preserved in the archives of Genoa and other Ligurian towns.

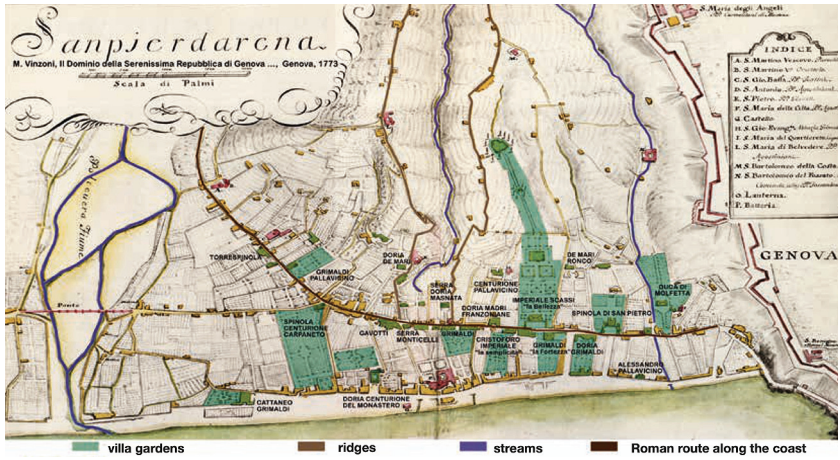

FIGURE 6 Sampierdarena, Map by Matteo Vinzoni (1773)

a minor watercourse, suggests the presence of a water feature, similar to the cascading water chains of Villa Lante in Bagnaia, Villa Aldobrandini in Frascati, or the Royal Palace of Caserta (Maniglio Calcagno 1983). In Domenico Fiasella's painting (figure 5), columnar trees, possibly cypresses, are depicted in this section, also symbolically represented in Vinzoni's map.

During the 19th and 20th centuries, the complex underwent significant modifications. By the late 19th century, part of the garden was sacrificed for the construction of a hospital in the upper portion of the site, altering the original relationship between the villa and its surrounding park. The upper section's water features were entirely removed by these interventions. The opening of Via Cantore in 1930 created a severe division between the main building and the garden, disrupting the spatial and visual continuity of the original design. This urban intervention further fragmented the historic integrity of the complex, significantly reducing the park's size and its connection to the surrounding landscape. Despite the disappearance of the historic hydraulic system and the agricultural landscape, Villa Imperiale Scassi's park remains an essential green lung for Sampierdarena's urban environment. The surviving water features, such as basins and nymphaea, now serve only a decorative purposes, whereas the historical water system played a crucial role in sustaining agricultural production and park maintenance. This transition highlights the loss of the balance between functionality and beauty that defined the original design.

Nonetheless, despite its fragmentation, the remaining park retains important environmental and social value, providing vital green space in a densely urbanized area and continuing to evoke the site's rich historical heritage. For comparison, the Voight's plan (1914),[8] documenting the Hanbury Gardens during Thomas Hanbury's ownership, provides essential information about both natural and artificial water systems, including the Rio Sorba, vital for irrigating and cultivating of the entire garden. The valley of the Rio Sorba, known as the *Vallone,* was designed to restore the original natural reserve, aiming to recreate the coastal landscape as it had been before agricultural transformations prior to the Hanbury family's arrival. The plan sought to preserve and propagate the 'spontaneous vegetation in the wildest parts of the property' (Hanbury et al. 1938, 45). The area east of the Rio Sorba was left in its natural state, while interventions on the valley floor and along the slopes focused on restoring native vegetation. At the same time, cisterns were constructed to collect water, sourced partly from existing streams and partly from rainwater collection. [439]

Today, water management presents a critical challenge, made more severe by climate change and increasing water scarcity. Integrating traditional techniques with technological innovations offers sustainable solutions for the future. An exemplary case is the plain of Marinella, a rare flat agricultural area in Liguria formed through the gradual silting of the ancient Roman port of Luni. Here, a dense network of canals still ensures efficient irrigation for local crops, particularly basil, representing a contemporary model of integrated water management. The Ligurian landscape is the product of its communities' adaptability and ingenuity. The conservation and restoration of historic water systems, combined with modern technologies, can contribute to sustainable resource use while, preserving the region's landscape and cultural heritage.

DISCUSSION

The results highlight how water management in Liguria is not only a technical practice but also a cultural construct, shaping the region's identity through agriculture, heritage, and design. Comparing UN-

[8] Hortus Mortolensis is the plan attached to the alphabetical catalog of plants of the Hanbury Botanical Gardens, *Enumeratio Plantarum in Horto Mortolensi Cultarum* (Giardini Hanbury 2025).

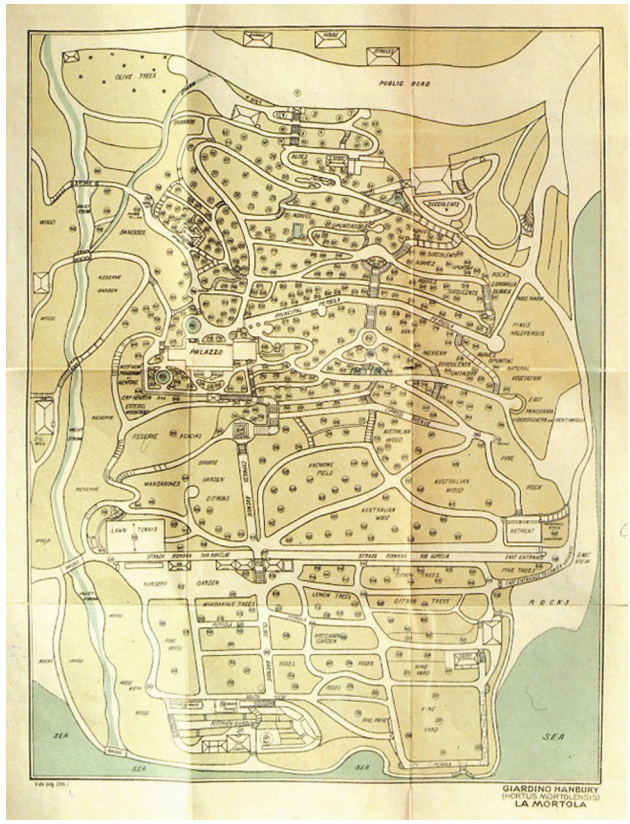

FIGURE 7

Hortus Mortolensis, Map by Alban Voigt (1914)

ESCO and non-UNESCO sites reveals both the strengths and limitations of international recognition: while the Cinque Terre exemplify the global value of terraced water systems, many other Ligurian valleys demonstrate comparable practices without formal acknowledgment, raising questions about criteria of visibility and conservation. This suggests the need for broader policies that value both exceptional and ordinary landscapes.

Furthermore, the analysis of villas and gardens shows continuity between functional and aesthetic uses of water, indicating that hydraulic infrastructures historically transcended the rural/urban divide. These insights contribute to ongoing debates in landscape architecture and heritage studies concerning the role of water as ecological infrastructure and the relevance of traditional practices in contemporary climate adaptation strategies.

CONCLUSIONS

This research demonstrates that water has historically functioned as both an ecological and cultural infrastructure in Liguria, connecting terraced agriculture, collective management, and landscape design. By combining fieldwork with archival and cartographic analysis, the study highlights how these systems embody a resilient model of adaptation to scarce resources and steep topographies.

The comparison between UNESCO-listed and non-listed landscapes underscores the importance of recognizing not only iconic sites but also the ordinary practices that sustain regional identities and ecological balance.

Theoretically, the study contributes to the literature on landscape resilience and heritage management, showing how water infrastructures embody a longue durée dimension in landscape architecture. Practically, it suggests that contemporary policies on climate adaptation and sustainable land management can build upon these traditional systems, reinterpreting them as resources for present and future resilience strategies.

REFERENCES

Brancucci, G., A. Ghersi, and M. E. Ruggiero. 2000. *Ligurian Terraced Landscapes: Reflections on a Study Methodology*. Alinea.

Burlando, P. 2009. *Coastal Landscape Network: A Blue-Way for Porto Venere*. Alinea.

Council of Europe. 2000. *European Landscape Convention*. https://www.premiopaesaggio.beniculturali.it/convenzione-europea-del-paesaggio/.

Fondo per l'Ambiente Italiano. 2025. 'Villa Rezzola: restauro e valorizzazione del parco.' https://fondoambiente.it/il-fai/beni/villa-rezzola-restauro-e-valorizzazione-del-parco/.

Gallesio, G. 1817. *Pomona Italiana: A Treatise on Fruit Trees*. Presso Niccolò Capurro.

Giardini Hanbury. 2025. 'Hortus Mortolensis.' https://giardinihanbury.com/giardino/hortus-mortolensis.

Hanbury, C., D. S.-J. Hanbury, M. Ercoli, and M. Lorenzi. 1938. *La Mortola Garden: Hortus Mortolensis*. Oxford University Press.

Liguria Ponente. 2017. 'Sulla diffusione dell'olivicoltura nel Ponente Ligure.' https://liguriaponente.wordpress.com/2017/01/14/sulla-diffusione-dellolivicoltura-nel-ponente-ligure/.

Maniglio Calcagno, A. 1983. *Architettura del paesaggio: evoluzione storica*. Calderini.

Maniglio Calcagno, A. 1985. *Giardini, parchi e paesaggi nell'Ottocento a Genova*. Sagep.

Mazzino, F., and P. Burlando. 2016. *Rediscovered Landscapes: Experiences in Landscape Architecture*. The Plan.

Norberg-Schulz, C. 1979. *Genius Loci: Landscape, Environment, Architecture*. Electa.

Parco Nazionale delle Cinque Terre. 2024. 'Stonewallsforlife: assegnati terreni recuperati alle aziende agricole.' https://www.parconazionale5terre.it/dettaglio.php?id=79662.

Quaini, M. 1973. *For the History of Agrarian Landscapes in Liguria: Notes on Historical Geography Regarding the Medieval and Modern Agrarian Structures of Liguria*. Chamber of Commerce, Industry, Crafts, and Agriculture of Savona.

UNESCO. 2003. *Cultural Landscapes: The Challenges of Conservation*. UNESCO World Heritage Centre. https://unesdoc.unesco.org/ark:/48223/pf0000132988.

Vinzoni, M. 1773. *Il Dominio della Serenissima Repubblica di Genova in terraferma*. https://archive.org/details/ge-0036-m.r.-cf.-2.9/page/n127/mode/1up.

VisitGenoa. 2025. 'La via dell'Acqua: acquedotto storico di Genova.' https://www.visitgenoa.it/it/la-dellacqua-acquedotto-storico-di-genova.

Voigt, A. 1914. *Junk's Nature Guide: The Riviera*. W. Junk.

Wikipedia. 2025a. 'Assedio di Genova (1800).' https://it.wikipedia.org/wiki/Assedio_di_Genova_(1800).

Wikipedia. 2025b. 'Codice dei beni culturali e del paesaggio.' https://it.wikipedia.org/wiki/Codice_dei_beni_culturali_e_del_paesaggio.

Wikipedia. 2025c. 'Giovanni Vincenzo Imperiale.' https://it.wikipedia.org/wiki/Giovanni_Vincenzo_Imperiale.

Wikipedia. 2025d. 'FAI - Fondo per l'Ambiente Italiano.' https://it.wikipedia.org/wiki/FAI_-_Fondo_per_l%27Ambiente_italiano.