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## CONTENTS

THEME ISSUE GREEN INFRASTRUCTURE: FROM GLOBAL TO LOCAL – EDITORS’ NOTES.....	5
MARIA IGNATIEVA, MADELEINE GRANVIK, ANNI VARTOLA AND CLAUD BECH-DANIELSEN	
GREEN-BLUE INFRASTRUCTURE IN URBAN-RURAL LANDSCAPES – INTRODUCING RESILIENT CITYLANDS .....	11
PER G BERG, MARIA IGNATIEVA, MADELEINE GRANVIK AND PER HEDFORS	
URBAN GREEN INFRASTRUCTURE FOR CLIMATE BENEFIT: GLOBAL TO LOCAL.....	43
NANCY D. ROTTLE	
ECOLOGICAL INFRASTRUCTURE: AN EXAMINATION OF THREE CANADIAN CITIES.....	67
RICHARD PERRON AND ROB ZONNEVELD	
ROADS BELONG IN THE URBAN LANDSCAPE.....	93
THOMAS JUEL CLEMMENSEN	
EXTENDING THE ROLES OF ECOLOGICAL NETWORKS IN A SUSTAINABLE LANDSCAPE .....	113
MUHAMMAD FARID AZIZUL	
«MARGINAL» URBAN VEGETATION – THE CASE OF LISBON.....	135
S. MACHADO DOESBURG, P. FARINHA MARQUES	
THE ROLE OF NON-URBANIZED AREAS FOR DESIGNING AN URBAN GREEN INFRASTRUCTURE.....	157
RICCARDO PRIVITERA, FRANCESCO MARTINICO, DANIELE LA ROSA AND VIVIANA PAPPALARDO	
GREEN INFRASTRUCTURE IN THE CONTEXT OF RURAL SPACE RESTORATION AND DESIGN .....	187
ATTILA TÓTH AND L’UBICA FERIANCOVÁ	

THE POTENTIAL OF TOPKAPI PALACE TO CONTRIBUTE TO URBAN GREEN INFRASTRUCTURE PLANNING .....	213
PINAR KOYLU	
THROUGH THE HISTORICAL LANDSCAPE TO AN URBAN GREEN INFRASTRUCTURE: THEMES AND CONTEXT .....	231
MELTEM ERDEM KAYA AND MELIZ AKYOL	
GREEN INFRASTRUCTURE: CONDITION CHANGES IN SIX USA URBAN FORESTS.....	255
CHARLES A. WADE AND J. JAMES KIELBASO	

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## **THROUGH THE HISTORICAL LANDSCAPE TO AN URBAN GREEN INFRASTRUCTURE: THEMES AND CONTEXT**

**MELTEM ERDEM KAYA AND MELIZ AKYOL**

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### **Abstract**

Landscapes around the world have changed dramatically during the last five decades. While new functions, new forms of land usage and increased infrastructure dominate and trigger this change, places with a rich history have become more fragile than ever before. Within contemporary urban life, historic landscapes and associated land usage gain priority by their power to define and contribute to the sustainability of green infrastructure.

This research analyzes the green heritage of Istanbul to gain a better understanding of its potential to contribute to the development of the European side of Istanbul. Accordingly, three relevant typologies: historical parks and gardens, groves and cemeteries are analyzed to reveal the different themes and contexts they represent.

The research results show that historical landscapes can be managed through a systematic approach that underlies the integration of those landscapes into the surrounding environment by evaluating those places as a part of the green infrastructure of the city. These findings suggest that conservation strategies are an effective tool to control the change within those landscapes and should be re-considered, from the perspective of contemporary design approaches, to create a robust framework for the development of an integrated green infrastructure.

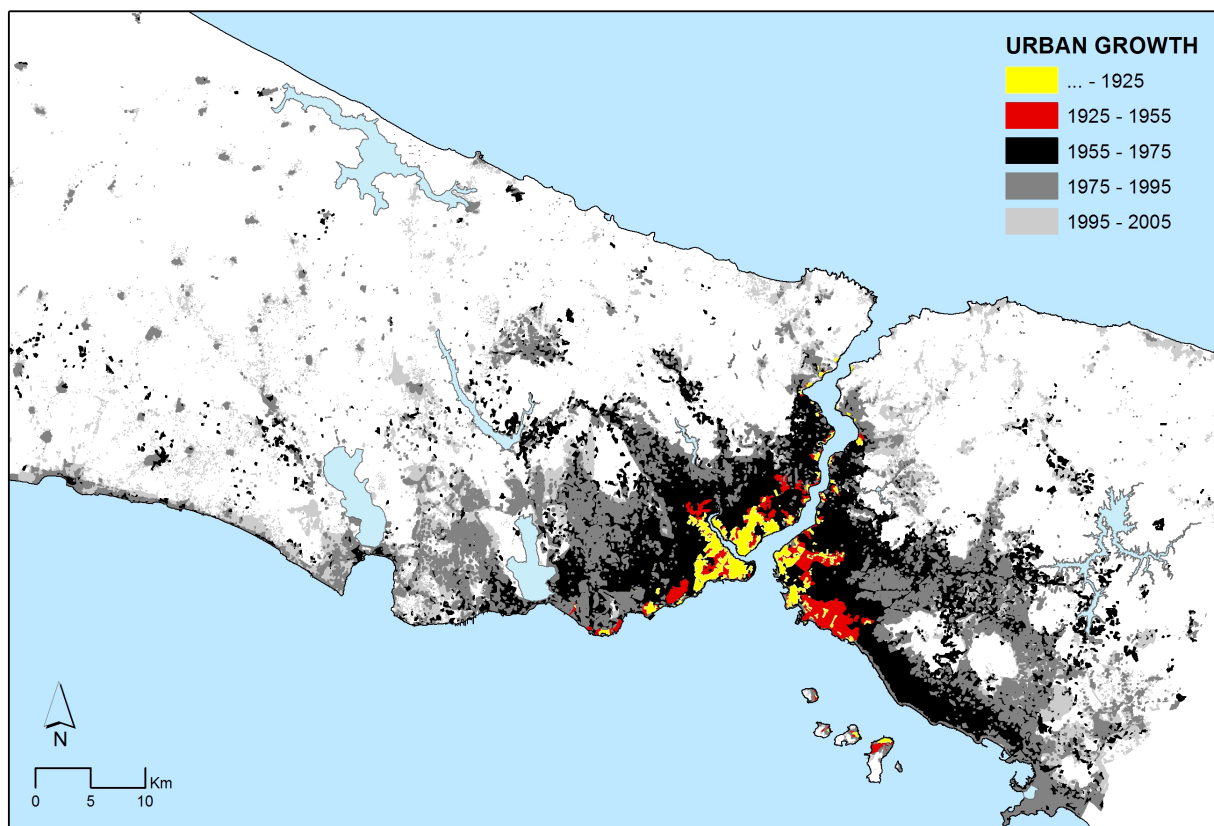
Key words:  
Green infrastructure, Historic  
Landscape, Istanbul, Landscape

## Introduction

Landscapes around the world have changed dramatically during the last 5 decades. While new functions, new forms of land usage and increased infrastructure dominate and trigger this change, places with a rich history have become more fragile than ever before. Urbanization processes and global population growth have led to an urgent call for sustainable planning and design practices to find viable ways to mitigate the negative impacts of development pressures.

Istanbul currently has a population of 14 million people and has been experiencing a dramatic urbanization process since the 1950's. Massive migration movements and the construction of the two bridges over the Bosphorus in 1973 and 1988 led urban growth expand through the east-west axis as well as through the north where the natural reserves are located. The pace and scale of spatial growth has become one of the major threats to the natural areas along the periphery of the city as well as to the green and open spaces within the city center (Kubat, et al., 2007). Figure 1 illustrates the spatial growth of the city according to different time periods. Another negative impact of the uncontrolled urbanization process can be found in the historic landscape of the city, which reflects different cultural interactions within the periods dating back to the Byzantine Period.

Figure 1  
Urban Growth of Istanbul according to different time periods (Kaya, 2013).



The unique and historic landscape of the city can be considered multi-layered and can be read in multiple ways. The historical background and ecology of a landscape appear to be the best ways to understand its diverse and dynamic structure. From an ecological viewpoint, historical landscapes and their components make a considerable contribution to the ecological structure of Istanbul. Once the historic capital, it is now an urban region and the problem of urban spread toward green areas at the periphery and urban intensification in the center has led to the loss of a considerable amount of green areas and ecological sustainability. As a result, the green areas in the center have become small patches in the form of urban parks. Within this dense built environment, large green areas are represented in the form of parks, groves, large gardens and cemeteries that have a historical background dating back to the 19<sup>th</sup> century. These urban green areas are a major component of the city's green network. Istanbul's rich historical heritage demands much more attention to be paid to these green areas for their potential in maintaining the ecological sustainability of the city.

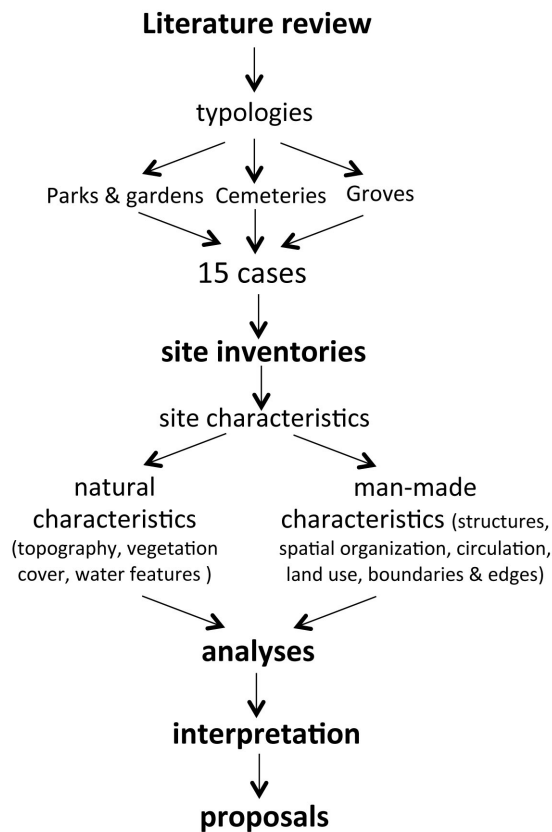
## Methodology

This paper aims to analyze the potential of the historical landscape of the European side of Istanbul, which can be referred to as green heritage; contributing to the city's green infrastructure by the provision of three relevant historical landscape typologies: (a) groves, (b) parks, and (c) gardens and cemeteries. The methodology of this research is based on a descriptive inventory, which evaluates landscapes by analyzing and describing their components (Arthur, et al., 1977). The inventory is based on three steps:

1. Literature review: includes the study of existing research and literature on the historical landscape of Istanbul and the definition of different typologies
2. Site inventories: includes field observations at the 15 selected sites and examination of high altitude images, topographical maps and photographs as a source for visual information to understand the site characteristics (natural and man-made)
3. Interpretation: includes interpretation of the data collected from the sites in order to develop proposals to evaluate green heritage as a part of the green infrastructure (figure 2)

15 different sites from the European side of Istanbul are selected according to their ability to reflect different spatial characteristics, different design approaches and their potential to reflect the historical landscape character of Istanbul.





Historical background and site characteristics such as natural characteristics (topography, vegetation cover, water features) and man-made characteristics (structures, spatial organization, circulation, land use, boundaries & edges) are evaluated as the main data set for the research. In this respect, each site is evaluated as a distinct landscape unit (figure 2).

Figure 2  
Methodology of the study.

According to preliminary site studies of the different typologies, a comparison chart is developed according to the size of the site, location, year of construction, management type, landscape components and vegetation type. The research, therefore, questions and investigates 3 central themes: (a) how and to which degree the historical landscape can contribute to the green infrastructure of the European side of Istanbul, (b) what the different contexts represented in those historical lands are, and finally (c) how history can be linked to the ecological structure as a green infrastructure.

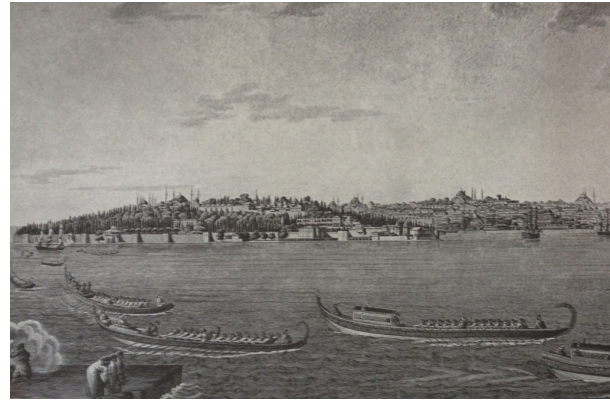
## Historical landscape and green infrastructure

The historical landscape of Istanbul can be considered in 3 distinct periods:

**Byzantine Period (300–1453 AD):** In this period Istanbul was a small citadel, which was surrounded by city walls. In common with all walled cities, there were also several villages and neighborhoods extending beyond the city walls. However, those were not able to integrate into the urban pattern. In this era, the northern part of the city was dominated by the Belgrade Forest, which is characterized by the dominance of the *Quercus* species (*Q. robur*, *Q. frainetto*, *Q. pertrea*) and also includes other species, such as *Fagus sativa*, *Carpinus betulus*, *Catanea sativa*, *Populus tremula*, *Corylus avellane*, *Acer campestre*, *Acer trautvetteri*, *Ulmus minor*, *Tilia argentea* (Yaltrık, Efe and Uzum, 1997). Only few settlements were seen along the Bosphorus. Thus, the general character reflected the dominance of natural and green areas. *Cupressus sempervirens* (Cyprus tree) could be seen in only few temple gardens in two fishing villages.

In the Byzantine period medical gardens had importance due to their function in producing medicine. Small house gardens were integral parts of the urban greenery. Those gardens, as the private spaces of families, were important for the production of vegetables and fruit. The size of the gardens of noble people was larger than the small house gardens. Besides vegetables and fruit, some horticultural species and flowers could be found in many gardens. Monasteries and churches had large gardens with a considerable amount of land (Yaltrık, Efe and Uzum, 1997).

**Ottoman Period (1453–1922):** When conquered in 1453, the city of Istanbul was almost demolished, which led to a new construction movement (Yıldızci, 1978). In this era, while the westward growth of the city was restricted by the city walls, the Golden Horn, and the Bosphorus shoreline at Galata, Üsküdar and adjacent areas, began to extend as new neighborhoods beyond the city walls. In Eyüp, inside the city walls, and at Üsküdar on the Anatolian side, new Turkish neighborhoods emerged. Although the city kept the physical structure, which had developed during the Byzantine period, its appearance quickly changed to that of a typical Islamic city during the rule of Fatih Sultan Mehmet, the seventh sultan of the Ottoman Empire. Trees started to be used as an integral part of greenery within the city. The physical structure, defined by trees raised between houses in the cities and villages of the Ottomans, was not typical for ancient settlements and was not seen in Istanbul before the Ottoman period. In addition to private residential gardens, the greenery penetrated the urban pattern in the form of gardens connected to public buildings, such as mosques, masjids and cemeteries (figure 3 and 4). The most remarkable features of this period are the Topkapi and Üsküdar palaces and their gardens. Those gardens are characterized by a symmetrical axial system similar to Baroque and Renaissance gardens (Yaltrık, Efe and Uzum, 1997).



After the establishment of Tokat garden as the first garden of Bosphorus, which was established in 1458, the number of gardens and open recreational areas along the Bosphorus increased (figure 4).

During the earthquake of 1509, a considerable amount of residential buildings were demolished, which led to the construction of new buildings (mostly one- or two-storey residential buildings). Most of these residential buildings had big gardens, which together with the natural water courses running through the city, contributed to the increase in the amount of green areas.

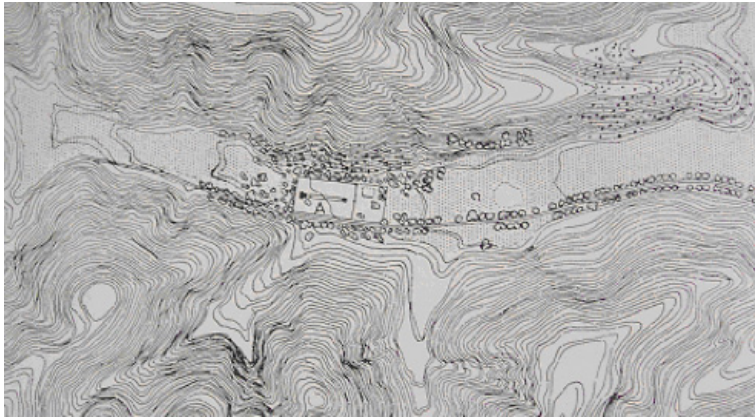
At the end of the 16<sup>th</sup> century there were 39 «hasbahçe» (private gardens of the sultans) inside and outside of the city. In this period, the only green areas within the Turkish neighborhoods were the gardens of the residential buildings. In addition to the groves, hasbahçes, trees planted around mosques, vegetable gardens, palace gardens and cemeteries, public squares and open recreational fields served as important green areas within the city (figure 1, 2 and 3) (Yalçırık, Efe and Uzum, 1997).

The Lale period, (1718–1730), led to another mood of life in which entertainment and joy became an integral part of daily life. This period exemplifies the first gardens designed under the influence of a more Western style, created for recreation (Yalçırık, Efe and Uzum, 1997). Sadabad in Kağıthane, Şerefabad in Üsküdar, Begıferah in Çengelköy, Emnabad in Fındıklı, Hüsrevabad in Kağıthane, Huyaunabad in between Ortaköy and Kuruçeşme, and Vezir garden in Topkapı Palace were the most important hasbahçes of this time.

In the 18<sup>th</sup> century the most important factor defining the macro-form of the city was the integration of the Golden Horn and the Bosphorus within the organic urban pattern. Although the city did not expand its boundaries considerably, as a result of this integration the citadel had lost its importance (Nazım Plan, 1995).

**Figure 3 (left)**  
An engraving by Melling picturing Constantinapolis (Yıldırım, 2008).

**Figure 4 (right)**  
Bosphorus, An engraving by Melling (Yıldırım, 2008).



The 19<sup>th</sup> century brought with it new development plans. The first plan was proposed by Helmuth von Moltke, a German staff officer seconded to the Ottoman army. This plan offered a new construction plan for residential buildings, squares and streets. According to the plan, residential buildings should be built in the style of masonry building. Large squares would be designed with specific geometrical forms and dimensions. Streets were classified into four distinct dimensions; 10 – 12 – 15 – 20 m. (Nazim Plan, 1995).

Figure 5  
Tokat Garden (Eldem, 1973).

Before the Republic, the most important changes in green area usage came with the Tanzimat of the 19<sup>th</sup> century. As part of a westernization process, recreational activities gained importance, and thus the public became more interested in outdoor activities. The surrounding area of the city was covered with vineyards, gardens, mulberries, plane trees and juglans trees; and within the city, vegetable gardens, meadows, riverside open spaces, hills, mulberry groves, shorelines, and open spaces near water resources became important recreational areas (Yaltrık, Efe and Uzum, 1997). Until mid-19<sup>th</sup> century, the public had used recreational open spaces, thus, there were only few parks established during the Ottoman Era (figure 5).

The first Istanbul public park was established in Sultanahmet in 1854. This park was named «Yeni Millet». Another park, established in the Ottoman Era, was Gülhane Park. Due to the expansion of the city boundaries in the second half of the 19<sup>th</sup> century, the amount of open spaces decreases. A change in lifestyle and the westernization effort of the government led to the emergence of Municipality Parks, which were designed and managed by the city municipal authority. The first of those parks was opened to the public in Büyük Çamlıca. At the end of the 19<sup>th</sup> century, Tepebaşı Municipality Garden, Taksim Municipality Garden, and Bakırköy Municipality Garden were also opened to the public (Yaltrık, Efe and Uzum, 1997).

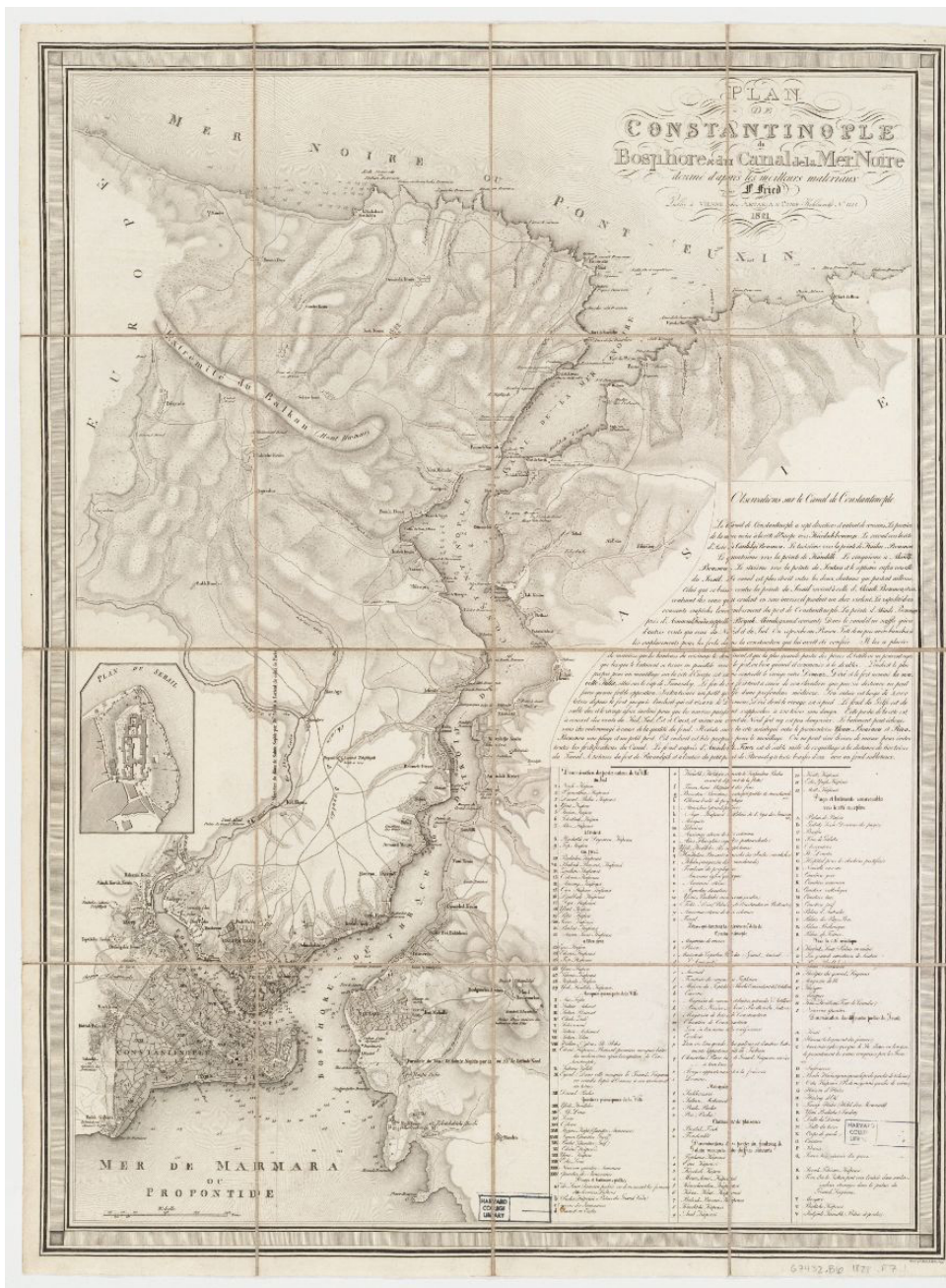


Figure 6  
Map of Bosphorus, 1821 (Fried, 1821).  
Harvard Hollis Archive:  
<http://ids.lib.harvard.edu/ids/view/7931999?width=912&height=1200&html=y>

**Republic Era (1923–):** The first park and green area planning of Istanbul began in 1932. Famous urban planners from Europe, such as Herman Elgotz from Germany, Alfred Agache and Jacques Henri Lambert from France, were invited to prepare a report for the city of Istanbul. Their report was important for the proposals for green areas (Çelik, 2005). Among those reports and works, Henri Prost's was remarkable. His plan offered sport fields, new thematic gardens such as botanical gardens and zoos, a new green barrier in front of the old city walls, beaches and archaeological parks while emphasizing the preservation of the green areas on the Anatolian side of the city. Thus, the first example of western style green area planning started with the Prost plan. The plan also included a large green corridor, beginning at Dolmabahçe Palace, passing through Harbiye Mektebi and finishing in Taksim Square (Nazım Plan, 1995).

Prost also proposed small allotment gardens, which could be attached to residential buildings and contribute to the income of families. This plan was revised by a team led by Prof. Kemal Ahmet Aru, and took into consideration the economic and historical structure of the city (figure 6, 7 and 8).

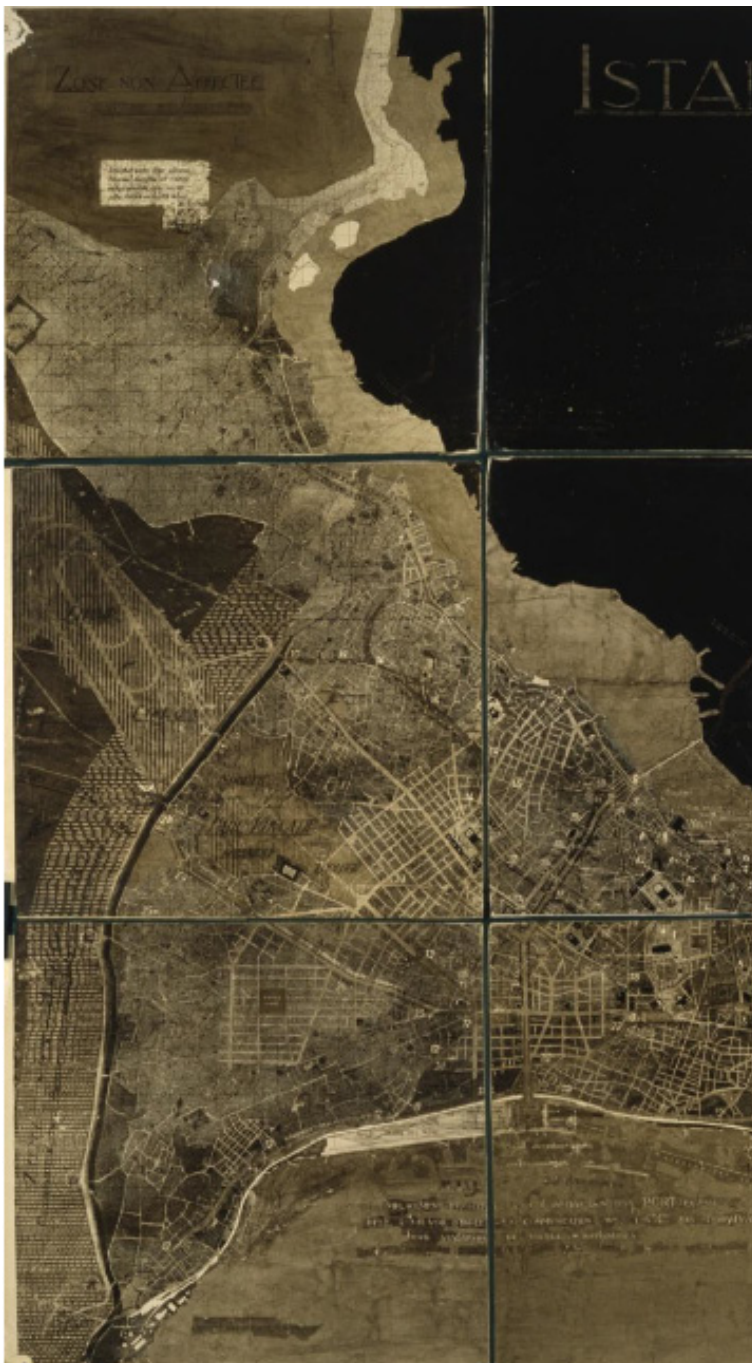
Between the 1950's and 60's Istanbul experienced massive migration from rural areas. This rapid rise in population and urban development formed a metropolis with a historical background (Bahtiyar, 1997). The first wave of migration settled along the Golden Horn and in the industrial areas around city walls. This was followed by other migration movements; the number of squatters and illegal construction greatly increased. In the 1950's, the boundaries of the city expanded through Yeşilköy in the west, Levent in the north, and Bostancı in the east. In 1957 the Directorate of Istanbul Zoning Plan Department was founded and started working in 1958. In 1958–60 the «Transition Period Development Plan» was prepared.

The plan emphasized the preservation of the existing large green areas and the implementation of four new parks (Büyük-Küçük Çamlıca, Kağıthane Park and Eyüp Manzumesi) and raised the need to organize the green areas near the city walls (Yıldızcı, 1978). The gaps in the existing planning process inspired the establishment of the Marmara Planning Organization in 1960. In the East Marmara Preliminary Report of 1962, future land requirements were evaluated in three groups: residential, industrial and green areas outside of the city. The green area requirements per person was defined as 20 m<sup>2</sup> and it was estimated that 10,000 ha of green area was needed for Istanbul.

In the Istanbul Development Planning Office Report of 1971, the entire Bosphorus was evaluated as an important part of urban history and defined as a recreation and natural preservation area. It was also stated

that Istanbul's historic structure which can be evaluated as a unique representation of the interaction of man and environment; a whole that must be protected with its topographic, natural and visual values. As part of this complex whole, historic groves, historic recreational areas, historic hills (and vistas), other natural elements that define the landscape (silhouette or skyline), cemeteries, castles, fortresses, summer palaces, religious and civic historic structures need to be protected (Yildizci, 1978).

**Figure 7**  
Istanbul European Side Master Plan at scale 1/5000, Old Istanbul, by Henri Prost, 1937 (Académie d'Architecture, 1960, in Bilsel, 2011).





In the Republic Era, squares, play grounds, school gardens and public parks started to be planned. However, illegal housing developments continued unabated during the 1960's, and another important factor that affected the spatial character of the city was the construction of high rise apartment buildings. Vacant areas and green areas, parks and play grounds were opened for construction and were used for apartment blocks (Nazım Plan, 1995).

In the 1970's, the concept of the summer house / second home developed. Prior to this date, summer places were restricted to the Yeşilköy neighbourhood in the west, Sarıyer and Büyükdere in the north, and Suadiye, Bostancı and the Princes' Islands in the east. Now places extended through Kumburgaz and Silivri in the west, Dragos and Bayramoğlu and Yalova and Çınarçık in the east and today the area is filled with summer housing complexes, motels and summer facilities that change the landscape character of the city's periphery (Nazım Plan, 1995).

**Figure 8**  
Istanbul European Side Master Plan – Principal roads indicated on a photograph at scale 1/2000, circa 1943, (Académie d'Architecture, 1960, in Bilsel, 2011).





## Green Infrastructure

According to the Natural England definition, a green infrastructure is ... a strategically planned and delivered network comprising the broadest range of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering those ecological services and quality of life benefits required by the communities it serves and needed to underpin sustainability. Its design and management should also respect and enhance the character and distinctiveness of an area with regard to habitats and landscape types. (Natural England, 2009).

The typology of green infrastructure is summarized in table 1.

Another definition of green infrastructure underlies the social aspect of the concept. Mell (2010) defines green infrastructure as «the resilient landscapes that support ecological, economy, and human interests by maintaining the integrity of, and promoting landscape connectivity, whilst enhancing the quality of life, place and the environment across different landscape boundaries.» (Mell, 2010, p. 255; Mell, 2013).

On the other hand, United States Environmental Protection Agency (EPA), recognize «green infrastructure» as a process, which supports sustainable communities. They define «green infrastructure» as a general process which includes the protection and improvement of habitats, energy, water, air, community, and much more. This strategy represents a valuable relation between land use planning and land conservation that works to protect natural ecosystems and services they provide.

Figure 9  
Study of a road network for the Old Istanbul Master Plan by Henri Prost. (Académie d'Architecture, 1960, in Bilsel, 2011).

Green infrastructure planning differs from open space planning by several key characteristics. First, green infrastructure planning considers the landscape context by not only focusing on site scale, but also by considering the strategic links of the sub-regional scale and beyond; second, green infrastructure planning considers private and public assets; and third, green infrastructure planning provides a multifunctional, connected network delivering ecosystem services (Natural England, 2009).

Istanbul's green infrastructure comprises natural landscape and man-made landscape features. Those features can be evaluated under two broad categories: natural vegetation pattern in the form of natural forests (Belgrade and Alemdağ forests), and scrubs (*Arbutus unedo*, *Laurus nobilis*, *Phillyrea latifolia*), and cultural vegetation patterns in the form of groves, parks and gardens (Yaltırık, Efe and Uzun, 1994). Historic landscapes in the context of a man-made landscape have the potential to contribute to the green infrastructure and the associated network within the city, through their different typologies and contexts. The Bosphorus, as the main artery of urban-blue infrastructure with the formation of natural bays, has always been an important attractor for settlement as well as an important infrastructure element for the distribution of green areas along the shoreline and hills.

The inherited characteristics of the historical patterns, boundaries, species combinations and spatial elements all define those special sites embedded in urban landscapes. However, since the middle of the 20<sup>th</sup> century, this unique landscape has been threatened by uncontrolled urban growth (Çelik, 2005). Decisions for intensification of the city center, as well as the spatial expansion of the city toward the periphery led to the loss of considerable amounts of green spaces and their connectivity. While the «natural character» of this landscape has been threatened by development pressures, the «man-made character» of the landscape in the form of parks, gardens, groves and cemeteries has experienced degradation and change.

**Table 1**  
**The typology of green infrastructure.**

Parks & Gardens	Urban parks, country and regional parks, formal gardens
Amenity Green space	Informal recreational spaces, housing green spaces, domestic gardens, village greens, urban commons, other incidental space, green roofs
Natural and semi-natural urban green spaces	Woodland and scrub, grassland (e.g. downland and meadow), heath or moor, wetlands, open and running water, wastelands and disturbed ground), bare rock habitats (e.g. cliffs and quarries)
Green corridors	Rivers and canals including their banks, road and rail corridors, cycling routes, pedestrian paths, and rights of way
Other	Allotments, community gardens, city farms, cemeteries and churchyards

## Typologies: Groves, parks and gardens, cemeteries

In this study we examine the historic landscape of the European side of Istanbul according to three distinct typologies: groves, parks and gardens and cemeteries. This study examines these different typologies according to the size of the site, location, year of construction, management type, landscape components and vegetation type. Following this we discuss ways to integrate these historic green areas into the urban pattern as part of a wider green infrastructure (figure 10). In total, 15 historic green areas were analyzed in the study;

- Parks and Gardens: Gülhane Park, Maçka Demokrasi Park, Kuruçeşme Park, Topkapı Palace Garden, Dolmabahçe Palace Garden, Yıldız Palace Garden, Sultanahmed Mosque Garden, Sultaniye Mosque Garden.
- Cemeteries: Eyüp Cemetery, Okmeydanı Cemetery.
- Groves: Naile Sultan Grove, Grove of the Australian Consulate, Emirgan Grove, Yıldız Grove, Ayşe Sultan Grove.

**Figure 10**  
A map showing green heritage along the European Side of Istanbul. 15 case studies was chosen in the categories palace-gardens, groves, parks and cemeteries.



These historic sites are selected according to their ability to represent the historic character of the landscape and their strategic location to contribute to the green network.

## Analysis

In this research different historic landscape typologies are analyzed according to natural landscape features (topography, vegetation, water surfaces) and man-made landscape features (structures, circulation, pools, boundaries and edges conditions).

According to the data analysis, historic parks and gardens, cemeteries and groves have different spatial features that contribute to the ecological quality of a green area. Those differences can be seen in both the natural features and man-made features. Parks, groves and cemeteries are mostly located in hilly areas, cover large tracts of land and often contribute to the silhouette effect when viewed from the Bosphorus. Gardens are located on flat land and are associated with buildings or structures and public parks. They usually include water features, which contribute to the ecological quality of the site by providing habitat for fauna and serve as a natural water reservoir, where any runoff is collected from the surrounding area. In formally designed gardens, however, water features are used in the form of channelled pools, which limit their capacity to collect external runoff water.

Whereas groves, cemeteries and parks have a landscape character defined by the spontaneous accumulation of mature vegetation patterns, historic gardens include the horticultural usage of plants in their formally designed parterres. With their mature vegetation patterns, which evolved through the historical development process, groves, parks and cemeteries make a considerable contribution to the ecological quality of the city. Those historic landscapes include both natural and exotic species. Groves mostly include exotic trees planted 150–200 years ago, which have adapted to the native environment and have become naturalized. Those groups include: *Pinus sp.*, *Pinus brutia*, *Cupressus sp.*, *Rhamnus alaternus*, *Taxus baccata*, *Robinia pseudoacacia*, *Fraxinus ornus*, and *Magnolia sp.*, *Acer campestre*, *Acer negundo*, *Acer pseudoplatanus*, *Aesculus hippocastanum*, *Cedrus atlantica*, *Cedrus deodora*, *Cedrus libani*, *Cercis siliquastrum*, *Cupressus sempervirens*, *Eriobotrya japonica*, *Fraxinus angustifolia*, *Laurus nobilis*, *Pinus halepensis*, *Pinus nigra*, *Pinus pinaster*, *Pinus pinea*, *Platanus x acerifolia*, *Salix babylonica*, *Syringa vulgaris*, *Tilia argentea*, *Viburnum tinus*. Cemeteries have a vegetation pattern and are dominated by *Cupressus sempervirens*.

Most of the gardens are surrounded by walls and are therefore separated from the surrounding environment and have a direct relationship with the building they are attached to. Some of them evolved as a court-

yard of a palace or were designed as an inner or outer garden of the palace. Some of the groves, located on private properties, are surrounded by walls for security reasons. The spatial organization of the historic gardens reflect a formal design language based on a symmetrical, axial system and represent a framed landscape mostly defined by parterres. Those gardens typically include water features in the form of a small pool or fountain as a focal object.

Groves have a system of pathways connected to an associated building. In groves surrounded by walls, those pathways form a loop system that is closed to the surrounding environment. Groves usually occupy land in conjunction with a building. Today some of the groves located on private property have lost their vegetation density and have been turned into the back gardens of residential housing complexes. Historic parks host different activities: playgrounds, thematic gardens, waterside sitting areas, resting areas, cafes, picnic areas etc. Therefore, the spatial organization of a park developed to respond to those different activity patterns. The circulation pattern includes pathways and vehicle entrance is restricted.


Actual usage of those historic landscapes changes over time and the historic parks in Istanbul now serve as a platform for public meetings, festivals and celebrations. Therefore, public parks are subject to cultural manipulation to attract visitors. Maintenance work such as trimming, new plantations, replacement of existing trees, irrigation, drainage, installation of lawn etc. appears to be one of the major threats to historic public parks. Exotic trees, such as palm species, are introduced to the sites and change their character and context. Due to private ownership, the sustainability and maintenance of those groves relies on private efforts.

The need for conservation approaches has become more apparent in the context of a contemporary metropolis that has a remarkable historic landscape. Therefore, historic character needs to be appreciated through proper management systems that pay attention to ecological integrity, sustainability and a site's unique history.

## Results from the inventory

Tables 2, 3 and 4 below present the data from the inventory of the 15 different locations, followed by an analysis and interpretation of the data. The table includes information on size of the site, location, date of implementation, management type, landscape elements and vegetation pattern. To reflect the different typologies, schematic drawings are provided to illustrate the size of the relevant sites and their landscape character as they refer to the constructed or organically evolved landscapes and edge conditions.

Table 2  
Typologies of Historic Landscapes – Groves.




	Naile Sultan Grove	Grove of Avusturya Consulate	Emirgan Grove	Yıldız Grove	Ayşe Sultan Grove
<b>Typology</b>	Grove	Grove	Grove	Grove	Grove
<b>Size</b>	4.9 ha.	5.5 ha.	47.2 ha.	46.7 ha.	6 ha.
<b>Location</b>	Kuruçeşme	Kuruçeşme	Emirgan	Beşiktaş	Bebek
<b>Date</b>		19th century	19th century		19th century
<b>Management</b>	Private	Private	Istanbul Metropolitan Municipality Parks and Gardens Directorate	Istanbul Metropolitan Municipality Parks and Gardens Directorate	Private
<b>Landscape Elements</b>	Inclined Topography Mixed group of deciduous conifers and shrubs Organic pattern of vegetation	Hilly topography, wandering pathways, cluster of conifers and deciduous tress.	Inclined topography, pathways, historic palaces, cafes, a historic barn, play grounds, landscape elements such as picnic tables, pergolas.	Mixed group of deciduous, coniferous and shrubs Pathways An artificial lake Hilly topography Organic pattern of vegetation Peripheral walls	Scattered pattern of vegetation Hilly topography
<b>Vegetation Pattern</b>	Pinus sp., Cedrus Atlantica, Tilia argentea, Acer sp., Aesculus hippocastanum, Cercis Rhamnus alaternus, Taxus siliquastrum, Cupressus semibaccata, Robinia pseudoacacia, Fraxinus ornus, and Magnolia atlantica, Taxus baccata, nolia sp.	Pinus sp., Cedrus Atlantica, Tilia argentea, Acer sp., Aesculus hippocastanum, Cercis Rhamnus alaternus, Taxus siliquastrum, Cupressus semibaccata, Robinia pseudoacacia, Fraxinus ornus, and Magnolia atlantica, Taxus baccata, nolia sp.	Acer campestre, Acer negundo, Acer pseudoplatanus, Aesculus hippocastanum, Cedrus atlantica, Cedrus deodora, Cedrus libani, Cercis siliquastrum, Cupressus sempervirens, Eriobotrya japonica, Fraxinus angustifolia, Laurus nobilis, Pinus halepensis, Pinus nigra, Pinus pinaster, Pinus pinea, Platanus x acerifolia, Quercus coccifera, Quercus dentata, Quercus robur, Salix babylonica, Syringa vulgaris, Tilia argentea, Viburnum tinus	The grove includes more than 120 species. Cedrus, Picea and Abies sp., Taxus, Cupressus, Pinus, Juniperus, Robinia pseudoacacia, Aesculus, Sophora, Acer, Fraxinus, Quercus, Ulmus, Pistacia, Liriodendron tulipifera, Koeleria paniculata, Feijoa sellowiana, Lagostromia indica.	The grove includes Pinus pinea, Cedrus atlantica, Cupressus sp., Cercis siliquastrum, Laurus nobilis, Fraxinus sp., Acer sp., Pistacia sp., Ulmus sp., Laurocerasus officinalis.

Table 3  
Typologies of Historic Landscapes – Palace Gardens and Mosque Gardens.



	Topkapı Palace	Dolmabahçe Palace	Yıldız Palace	Sultanahmet Mosque	Süleymaniye Mosque
<b>Typology</b>	Garden	Garden	Park and garden	Garden	Garden
<b>Size</b>	4.9 ha.	25 ha..	50 ha.		
<b>Location</b>	Sarayburnu	Beşiktaş	Beşiktaş	Eminönü	Süleymaniye
<b>Date</b>	15 th century	19th century	19th century	17th century	16th century
<b>Management</b>	Government	Government	Government	Government	Government
<b>Landscape Elements</b>	Inner gardens Courtyards Pathways Fountains Axial and linear path systems Planting fields defined by axes	Circular pool Surrounded by water Symetrical and axial garden layout Baraque style Series of planting beds Inner garden	Small ponds and streams Naturalistic landscape features Small bridges Wandering pathways Benches Small kiosks Formally designed small inner gardens	Garden surrounded by walls Peripheral garden Axial layout	Peripheral gardens Axial garden layout Surrounded by walls Pavilion Exotic species
<b>Vegetation Pattern</b>	Abies bornmülleriana, Acer negundo, Aesculus hippocastanum, Castanea sativa, Celtis australis, Cupressus sempervirens, Fraxinus angustifolia, Pinus pinea, Platanus acerifolia, Ulmus glabra, Magnolia grandiflora, Juniperus sabina, Buxus sempervirens, Taxus baccata	Tilia argentea, Acer sp., Aesculus hippocastanum, Cercis siliquastrum, Cupressus sempervirens, Pinus sp., Cedrus atlantica, Taxus baccata, Platanus sp., Abies bornmülleriana, Acer palmatum, Camelia japonica, Cedrus atlantica, Cryptomeria japonica, Fagus sylvatica, Liriodendron tulipifera	Acer negundo, Acer pseudoplatanus, Aesculus hippocastanum, Cedrus atlantica, Cedrus deodora, Cedrus libani, Cercis siliquastrum, Cupressus sempervirens, Eriobotrya japonica, Fraxinus angustifolia, Laurus nobilis, Pinus halepensis, Pinus nigra, Pinus pinaster, Pinus pinea, Platanus x acerifolia, Quercus coccifera, Quercus dentata, Quercus robur, Salic babylonica, Syringa vulgaris, Tilia argentea, Viburnum tinus, Ligustrum, Populus sp., Robinia sp., Sequa dendron	Acer negundo, Celtis siliquastrum, Chamacyparis lawsoniana, Pinus nigra, Platanus orientalis, Tilia argentea, Robinia pseudoacacia, Populus nigra, Laurus nobilis, Ficus carica, Cedrus deodora	Ailanthus sp., Biota orientalis, Laurus nobilis, Ilex aquifolium, Olea europea, Platanus acerifolia, Salix caprea, Ulmus glabra, Tilia agentea, Yucca filamentosa

Table 4  
Typologies of Historic Landscapes – Parks and Cemeteries.



	Gülhane Park	Kuruçeşme Park	Maçka Demokrasi Park	Eyüp Cemetery	Okmeydanı Cemetery
<b>Typology</b>	Park	Park	Park	Cemetery	Cemetery
<b>Size</b>	1 ha.	1 ha.	4-5 ha.	100 ha.	150 ha.
<b>Location</b>	Fatih	Beşiktaş	Maçka	Eyüp	Okmeydanı
<b>Date</b>	20 th century	20 th century	20th century	20th century	20th century
<b>Management</b>	Istanbul Metropolitan Municipality Parks and Gardens Directorate	Istanbul Metropolitan Municipality Parks and Gardens Directorate	Istanbul Metropolitan Municipality Parks and Gardens Directorate	Government	Government
<b>Landscape Elements</b>	The park includes seating areas, open theater, restaurants, play grounds, a small zoo, cafes, botanical park and a cistern with a small aquarium and historic statues from Roman period. Wandering pathways Composition of different trees and shrubs Exotic species	Wandering pathways Composition of different trees and shrubs Open theatre, Play grounds, Rock garden, Lawn, Cafes Water Garden	Park is located on slopes of a valley Pool, wandering pathways, Cafes, sport and play fields, pools, running pist, pathways, exhibition areas, sport club Dense vegetation pattern	Garden surrounded by walls Peripheral garden Axial layout	Dense vegetation pattern Pathways
<b>Vegetation Pattern</b>	<i>Celtis australis</i> , <i>Platanus occidentalis</i> , <i>Aesculus hippocastanum</i> , <i>Albizia julibrissin</i> , <i>Betula pendula</i> , <i>Cedrus deodora</i> , <i>Cedrus libani</i> , <i>Cupressus sempervirens</i> , <i>Pinus brutia</i> , <i>Pinus nigra</i> , <i>Pinus pinaster</i> , <i>Tilia argentea</i> , <i>Robinia pseudoacacia</i> , <i>Salix babylonica</i> , <i>Sophora japonica</i>	<i>Abelia grandiflora</i> , <i>Abies bornmuelleriana</i> , <i>Acer negundo</i> , <i>Aesculus hippocastanum</i> , <i>Albizia julibrissin</i> , <i>Acuba japonica</i> , <i>Betula sp.</i> , <i>Catalpa bignonioides</i> , <i>Cedrus atlantica</i> , <i>Cedrus deodora</i> , <i>Celtis australis</i> , <i>Cercis siliquastrum</i> , <i>Chamaecyparis lawsoniana</i> , <i>Cotoneaster horizontalis</i> , <i>Cotoneaster salicifolius</i> , <i>Crateagus oxycantha</i> , <i>Cupressus arizonica</i> , <i>Cupressus sempervirens</i> , <i>Eleagnus angustifolia</i> , <i>Euonymus japonicus</i> , <i>Fatsia japonica</i> , <i>Ficus carica</i> , <i>Juglans regia</i> , <i>Tilia argentea</i> , <i>Punica granatum</i> , <i>Prunus sp.</i>	<i>Abelia grandiflora</i> , <i>Abies bornmuelleriana</i> , <i>Acer negundo</i> , <i>Aesculus hippocastanum</i> , <i>Albizia julibrissin</i> , <i>Acuba japonica</i> , <i>Betula sp.</i> , <i>Catalpa bignonioides</i> , <i>Cedrus atlantica</i> , <i>Cedrus deodora</i> , <i>Celtis australis</i> , <i>Cercis siliquastrum</i> , <i>Chamaecyparis lawsoniana</i> , <i>Cotoneaster horizontalis</i> , <i>Cotoneaster salicifolius</i> , <i>Crateagus oxycantha</i> , <i>Cupressus arizonica</i> , <i>Cupressus sempervirens</i> , <i>Eleagnus angustifolia</i> , <i>Euonymus japonicus</i> , <i>Fatsia japonica</i> , <i>Ficus carica</i> , <i>Juglans regia</i> , <i>Lagerstromia indica</i> , <i>Laurocerasus officinalis</i> ,	<i>Cupressus sempervirens</i> , <i>Cupressus arizonica</i> , <i>Ailanthus sp.</i> , <i>Acer negundo</i> , <i>Celtis siliquastrum</i> , <i>Pinus nigra</i> , <i>Platanus orientalis</i> , <i>Tilia argentea</i> , <i>Robinia pseudoacacia</i> , <i>Populus nigra</i> , <i>Laurus nobilis</i> , <i>Ficus carica</i> , <i>Cedrus deodora</i>	<i>Ailanthus sp.</i> , <i>Cupressus sempervirens</i> , <i>Cupressus arizonica</i> , <i>Platanus acerifolia</i> , <i>Salix caprea</i> , <i>Acer sp.</i>

## Discussion and conclusions

As a metropolitan city, Istanbul has a unique historic urban landscape that has emerged through its unique historical development process. It has become increasingly important for historic cities to cope with various development pressures and their impact on the historic landscape. Green heritage contributes to this unique landscape and has the potential to sustain ecological integrity.

In this study we have examined three relevant historic landscape typologies for their potential to contribute to the development of green infrastructure for the European side of Istanbul. These landscape typologies are: parks & gardens, groves and cemeteries. Furthermore, this research has examined all three different typologies according to site characteristics, which are natural characteristics (topography, vegetation, water surfaces) and man-made characteristics (structures, circulation, landscape elements, etc.).



The research showed that the rapid urbanization process threatens the landscape and leads to the loss of green areas within the urban context. Protecting and connecting these historically and ecologically valuable green areas is vitally important for sustaining the green infrastructure of the city. According to the inventory studies and field observations, each typology has a different potential to contribute to the green infrastructure. Parks, groves and cemeteries have the potential to contribute to the emergence of a green network by providing mass and mature vegetation patterns, whereas palace gardens have less potential to sustain ecological value or to sustain the continuity of the green network due to their isolated structure as an inner garden. Indeed, these small scale sites are usually fragmented by massive structures such as walls and in the case of the palace, they are open to manipulation, for instance by introducing exotic and ornamental species that are preferred for their aesthetic appearance. Historic groves are a major component of the green infrastructure with their large scale and dense vegetation pattern. In addition to their importance for urban heritage, urban groves play a vital role in urban ecology because of their various functions such as controlling microclimatic effects, regulating air humidity, controlling surface runoff and erosion and reducing air pollution. Today, however, many groves are managed by private companies and are subject to manipulation. The groves, which are owned by the government still maintain their vegetation quality, whereas the groves, which are managed privately have lost their original vegetation pattern and density; consequently these sites opened for construction. A comparison of site scales shows that private groves usually occupy approximately 1–3 ha, whereas groves, which are owned by the government, occupy larger sites in the urban center.

Most of the historic groves and parks and gardens are declared as preservation sites by the Code of protection of cultural and natural properties. As defined by law, those sites are in need to be protected and sustained by proper maintenance and restoration work. However, today one of the major problems with these sites appears to be the lack of maintenance and improper restoration work.

It is clear that historic green areas are threatened by new interventions. The unique qualities of the city's past are being lost. In particular, the design approaches developed for the historic parks should correspond more precisely to the existing site characteristics by paying more attention to its historical identity. In this respect, conservation and well-balanced use of the site should be carefully defined in order to maintain a high degree of sustainability for future generations. Another important fact is that these sites are scattered within the urban pattern; we believe that if approached properly, these sites can contribute to the identity of a place by providing a reference to its past.

New design approaches can be developed to sustain and enforce this identity. Thematic green corridors (with historical references) may be promoted to connect those scattered green areas within the urban context. Small scale groves and parks can be considered as stepping stones that function as green stations of a wider green infrastructure. Attempts to prevent further fragmentation will contribute to the sustainability of this green network and provide the opportunity for circulation between areas. Integration of the historic landscape into the dynamics of the contemporary city by using the concept of green infrastructure is much more vital for cities that are experiencing a rapid urbanization process. Therefore, a well-organized management and monitoring system may sustain the existing historical character as well as promote sustainable development. These areas should be evaluated as being part of a wider environmental context, thus, the connection between those areas, as well as major green spots, should be reorganized by paying more attention to their connectivity.

Today, it becomes an imperative for cities, which have a historic urban landscape, to address the problems of urbanization and historical heritage. This research shows that history can be linked to ecology by evaluating the historically developed landscape as a part of the green infrastructure and strengthened with innovative design and planning approaches for future projects.

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- Académie d'Architecture, 1960. L'Œuvre de Henri Prost, Architecture et Urbanisme, L'Académie d'Architecture, Paris.
- Arslan, N., 1992. *Gravür ve Seyahatnamelerde İstanbul* (18. yüzyıl sonu ve 19. yüzyıl) (Istanbul in Engraves and Itinerary, end of 18<sup>th</sup> century and 19<sup>th</sup> century), Istanbul: Publication of Çelik Gülersoy Foundation İstanbul Library, Etude: I.
- Arthur, L.M., Daniel, T.C. and Boster, R.S., 1977. Scenic assessment: an overview. *Landscape Planning*, 4, pp. 109–129.
- Bahtiyar, S., 1997. A research on the topography of Istanbul.
- Bilsel, C., 2011. «Les Transformations d'Istanbul»: Henri Prost's planning of İstanbul (1936–1951). *AZ ITU Journal of Faculty of Architecture*, 8 (1), pp. 100–116.
- Çelik, A. 2005. *Yeşil kuşak kavramı ve İstanbul kent yeşil kuşak sistemi için öneriler*. (The concept of greenbelt and greenbelt proposals for Istanbul) Master Thesis. Bahcesehir University, Istanbul.
- Eldem, S.H., 1973. Türk Bahçeleri (Turkish Gardens). Ministry of Culture, Turkish art works:1.
- Environmental Protection Agency (EPA), Green Infrastructure, website [http://www.water.epa.gov/infrastructure/greeninfrastructure/gi\\_what.cfm](http://www.water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm). [Accessed 25 June 2013].
- Harvard Hollis Archive, <http://ids.lib.harvard.edu/ids/view/7931999?width=912&height=1200&html=y>
- İ.B.B. Nazım Plan Raporu, 1995. *1/50000 Ölçekli İstanbul Metropoliten Alan Alt Bölge Nazım Plan Raporu* (Istanbul Metropolitan subregion 1/5000 plan report). İstanbul.
- Kaya, H.S., 2013. İstanbul'da tarihi çeşmelerin acil durum su rezerv alanı olarak değerlendirilmesi (Evaluation of Historic Fountains as water reserves incase of emergency in Istanbul), The Annual Congress of The Foundation of Geographers of Turkey, 19–21 June 2013, Fatih University. İstanbul.
- Kubat, A.S., Kaya, H.S., Güler, G., Sarı, F. and Özer, Ö., 2007. The effects of proposed bridges on urban macroform of Istanbul: A Synthatic Evaluation. 6<sup>th</sup>. *International Space Syntax Symposium, ITU*. İstanbul.
- Mell, I.C., 2013. Can you tell a green field from a cold steel rail? Examining the «green» of Green Infrastructure development. *Local Environment: The International Journal of Justice and Sustainability*, 18 (2), pp. 152–166.
- Mell, I.C., 2010. *Green infrastructure: concepts, perceptions and its use in spatial planning*. Doctoral Thesis. Department of Architecture, Planning and Landscape, University of Newcastle.
- Natural England, 2009. Green Infrastructure Guidance, website <http://www.naturalengland.org.uk> [Accessed 25 June 2013].
- Yaltırık, F., Efe, A. and Uzun, A., 1997. Tarih Boyunca İstanbul'un Park, Bahçe ve Koruları Egzotik Ağaç ve Çallıları (Istanbul's park, garden and exotic trees and shrubs throughout history). İstanbul: İsfalt Publication, pp. 1–8, 15, 21–24.
- Yaltırık, F., Efe, A. and Uzun, A., 1994. The inventory of exotic tree and bush species of Istanbul's parks, gardens, groves. İstanbul: The scientific and technical research council of Turkey.
- Yıldızci, A.C., 1978. İstanbul'da Kent-sel Doku ile Yeşil Doku Arasındaki İlişkiler ve İstanbul Yeşil Alan Sistemi için Bir Öneri (The relation of urban pattern and green pattern in Istanbul and a proposal for green system for Istanbul). ITU Faculty of Architecture Press.
- Yıldırım, S.Ö., 2008. *Kentin Anlam Haritaları, Gravürlerde İstanbul, Kitabistanbul*. TC. Kültür ve Turizm Bakanlığı, Sertifika No: 1206-34-003145, ISBN 978-975-01266-04.



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