Chapter 9

Revealing Landscape Planning Strategies for Disaster-Prone Coastal Urban Environments: The Case of Istanbul Megacity

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Additional information is available at the end of the chapter

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Abstract

Regarding the challenges of the twenty-first century, this study aims to explore the role of landscape architecture within the multidisciplinary setting of the studies on coastal disasters. Thus, it focuses on Istanbul, which deserves being one of the most well-known coastal megacities of the world, not only due to its long history dating back to 6700 BC but also due its unique coastal configuration. This ever-expanding but disaster-prone megacity stands on two peninsulas belonging to different continents, holds the only strait connecting the Black Sea to the other seas, and accommodates 12 lakes with more than 100 streams. These coastal features promote the vulnerability of the megacity to a wide range of natural and man-made disasters, such as earthquake, tsunami, flood, sea level rise, and salinization. The evaluation process of this study benefits from the GIS and comprises five major phases: examining the urban-landscape change, defining the major coastal disasters, identifying the disaster-prone environments, and defining multilayered landscape planning strategies. This study develops landscape planning strategies for disaster-prone coastal urban environments by deriving from the complex dynamics of the Istanbul megacity. This study is an attempt to further disaster-sensitive landscape studies in the belief that not only Istanbul but also the other coastal megacities will benefit from them.

Keywords: landscape planning, coastal megacities, disaster-prone urban environments, GIS, Istanbul

1. Introduction

The twenty-first century brings about chaotic environmental issues that are likely to be challenging and need innovative strategies. With a population of 15 million, Istanbul is one of the most well-known coastal megacities of the world, due to its history dating back to 6700 BC and its unique coastal configuration. This ever-expanding but disaster-prone megacity stands on two peninsulas belonging to different continents, holds the only strait connecting the Black Sea to the world. Due to its coastal identity, this megacity is open to a wide range of natural and man-made disasters, such as earthquake, tsunami, flood, sea level rise, and salinization.

ADRC [1] defines disaster as a severe disruption of the function of a community leading extensive human, material, economic, and environmental failures which exceeds the ability of the pertinent community to get over through its own resources.

In the case of at-risk megacity of Istanbul, limited open space, increasing number of people, gigantic urban infrastructure, old urban fabric, official plans' incapability to catch the rapid change of the city, urban expansion to the drinking water basins, buried urban streams, and instantly decided megaprojects are the significant internal features that are increasing the vulnerability of the city.

In 1999, a major earthquake struck the Istanbul surrounding area and acted as a turning point for the country as it revealed that not only the megacity but the whole country is unprepared for the disasters. Several credible academic and governmental studies have been conducted since 1999 but more or less with a focus on the earthquake.

However, in the case of Istanbul where even the environmental plans cannot easily keep up with the increasing population and rapid spatial development, which are rendering them unable to protect their validity, it is a hard challenge to implement a sustainable disaster management system.

Cities rely on the functionality of their infrastructures. In case of a disaster, this functional network itself can already turn into a dominant component of urban vulnerability [2]. The existence of an expanding urban population and density already brings about an exponentially increased complexity within the urban infrastructure [3]. Megacities are characteristic of the complexity of their infrastructures. Thus, they are open to drastically severe multihazards, which are defined by the UNISDR Terminology [4] as the context capturing interrelated simultaneous, cascading, or cumulative hazard events.

The reason for the concerns in Istanbul is not only the vulnerability of the urban infrastructure but the existence of unique cultural heritages representing the synthesis of western and eastern cultures. Cultural accumulation of the city has a densely knitted spatial pattern with its natural coastal formations especially along the strait of Bosphorus, which is binding the Black Sea to the Sea of Marmara, the Golden Horn standing in the oldest part of the megacity, and the opening to the Sea of Marmara [5].

Figure 1 represents the location and the 10 coastline types of the megacity that are defined within this study due to their natural and cultural characteristics, while **Figure 2** illustrates

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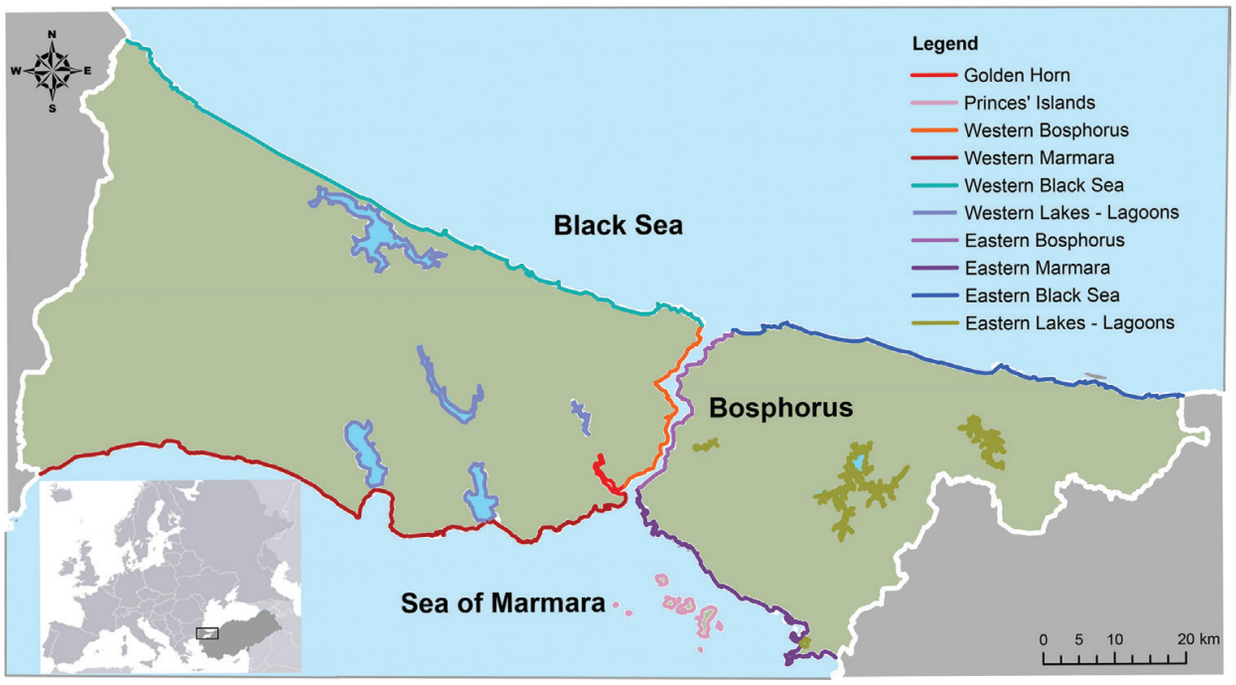

Figure 1. Location of the megacity and its coastline types due to natural and cultural characteristics.

Figure 2. Images from the Golden Horn and Bosphorus, respectively [6].

the images pertinent to the two of the cultural coastal areas of Istanbul such as Golden Horn and Bosphorus Strait.

As a discipline, dealing with multiscale studies pertinent with open spaces, landscape architecture executes landscape analysis, planning, designing, and management for the benefit of built and natural environments. Its ability to conduct multiscale studies makes the profession of landscape architecture competent to take part in multidisciplinary studies.

Disaster management involving two major components, which are risk management and crisis management, stands on a multidisciplinary structure. Thus, this study examines the role of landscape architecture within this setting. Landscape planning can undertake several roles in the phases of disaster management as mitigation to preparedness before the disaster and

response to recovery after the disaster. However, an insufficient number of studies have analyzed the management of disaster types as a whole from natural to man-made ones from the scope of landscape planning.

According to UNISDR Terminology [4], resilience is the capacity of a system or a community exposed to hazards to withstand, absorb, accommodate, adapt to, transform, and overcome from the effects of a hazard or a multihazard in a timely and effective manner, including through the preservation and restoration of its critical infrastructures and functions through risk management.

Besides the many other landscape strategies, this study interrogates the interplay between resiliency and green infrastructure with a focus on disaster-prone coastal urban environments. According to Hagerman [7], green infrastructure refers to the existence of an interconnected system composed of soil, water, air, fauna, and flora. Thus, it forms the basis of a healthy ecosystem, which forwards the services to mankind. Schiappacasse and Müller [8] and EEA-Green Infrastructure [9] defined the integration of green infrastructure planning into spatial planning system as a source of urban and regional resilience. Thus, it highlights that multilayered system of the green infrastructure is the best fit with the disaster-prone areas requiring resilience.

This study reveals the current and projected disasters/hazards pertinent with the megacity like earthquake, sea level rise, and coastal megaprojects. Earthquake emerges to be the most notable and widely examined current hazard of Istanbul. Erdik and Durukal [10] remarked that Istanbul will face a major earthquake while this area has an annual probability of approximately 2%, one of the highest in the world. As Altan and Kemper [11] identified, the North Anatolian Fault, which is standing 50 km away from the city center and passing through the Sea of Marmara, is one of the largest and most active tectonic fault lines in the world. The most recent major earthquake in the region generated by this fault brought about a massive destruction with its measure of 7.4 on Richter scale.

Sea level rise appears to be a serious hazard within the projected ones. By discussing the potential vulnerability of the countries to climate change, GCP [12] figured out that among 116 countries, Turkey gets intermediate rating within the Likert scale of 5. Turkey holds a coastline with a length of 8333 km [13]. Regarding this coastal character, 40% of the population of Turkey lives in coastal areas below 5 m altitude (as a general measure to compare all countries), which may be at risk due to the sea level rise in the course of global warming [12].

Turkey has a diverse coastal pattern due to a variety of geomorphologic and socioeconomic attributes. This diversity brings about a need for site-specific studies on different coastal regions of Turkey in order to capture a further understanding of the climate-induced impacts on the coastal environments [14, 15].

Different than the other coastal cities of Turkey, Istanbul welcomes drastic coastal megaprojects such as turning western peninsula of Istanbul into an island through the opening of a canal binding Marmara Sea to the Black Sea. Megaprojects have mega-impacts on the environment. Impacts of such projects may be regarded as adverse or good due to the level of working with nature rather than in opposition to it.

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The megacity of Istanbul might capture a priority through the site-specific hazard-based further studies regarding its strategic financial and cultural importance but also its specific location in between two inner seas as the Black Sea and Sea of Marmara. Thus, this study attempts to identify the significant coastal disaster types and the disaster-prone environments at the megacity to develop the multilayered landscape planning strategies that will work both before and after the emergence of the disasters.

2. Materials and methods

In order to reveal the power of landscape planning in disaster mitigation, this study utilized GIS technology by means of the Arc GIS 10.0 software to examine the interplay between the identified disaster types within this research and the coastal landscapes for revealing the planning strategies for the disaster-prone landscapes of Istanbul. The 1:5000 scale digital base map files in dwg format were obtained from the Istanbul Metropolitan Municipality's Directorate of Cartography.

Controlling and updating of the dwg files for such a rapidly changing city are done by benefiting from the current aerial photographs available from the online city map service of the Istanbul Metropolitan Municipality [16].

Within this study, GIS-based data were registered to Universal Transverse Mercator 3 Degree coordinate system with European Datum 1950. JICA and IMM [17] forwarded the basic disaster mitigation plan of the megacity refer to this registration, as the central meridian of 30° east is close to Istanbul. Further information on coastal disasters and disaster management was gathered from the literature during the development of the method of this study. **Figure 3** illustrates the evaluation process used in this study for developing landscape planning strategies for the disaster-prone coastal urban environments of the Istanbul megacity.

This study involves a four-phased evaluation process. Istanbul is a dynamic and ever-expanding coastal megacity welcoming a significant number of megaprojects altering the coastlines [18]. Thus, the evaluation process starts with the classification of the coastlines of Istanbul and figuring out their spatial interplay with the urban macroform.

In the case of Istanbul, urban development throughout the centuries indicates a strong dependency on the coastal areas. In the last decades, this development has turned into a mega-urbanization holding huge and rapid spatial alterations. Thus, the coastal risks are increased. Within the second phase of the evaluation process, the most significant coastal disasters are identified and then classified as natural or man-made and current or projected.

Identification of the disaster-prone environments holds the third phase of the study and interrogates the interplays between the urban pattern-dynamics and the disaster types. The disasters are handled as earthquake, flood, tsunami, sea level rise, megaprojects, salinization, and terrorist attacks. In the case of Istanbul, vulnerable water basins, lakes, and lagoons appear to be important as they are under the impacts of rapid urban development, megaprojects,

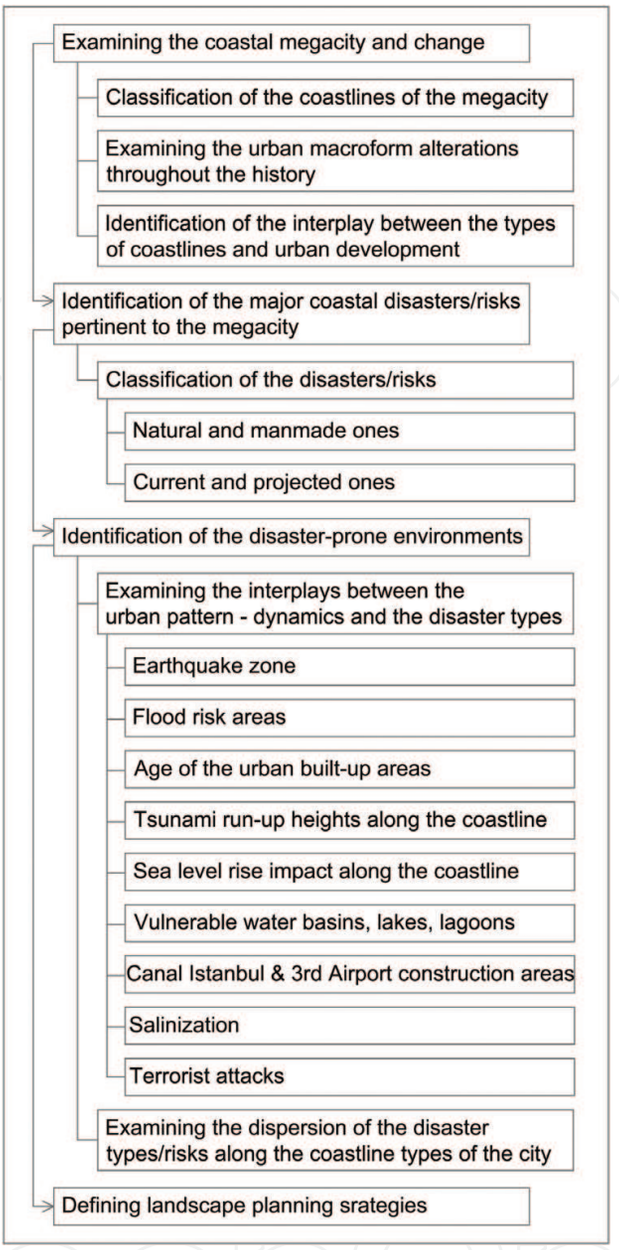

Figure 3. Evaluation process of this study and its phases.

salinization, and sea level rise. Istanbul examines huge amount of coastal megaprojects [18, 19]. This study focuses on one of them, which is an integrated project of Canal Istanbul and third Airport. This project is a significant one as it aims to turn western peninsula of Istanbul into an island. The third phase ends by the dispersion of the disaster types with varying levels along the coastlines.

The final phase of the evaluation process promotes the citywide spatial findings by developing the landscape planning strategies for the disaster-prone coastal urban environments.

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3. Results and discussion

Each landscape generates a unique signature on the Earth [20]. The urban development of Istanbul represents a template how a city can interact with a grift coastal land involving peninsulas, islands, gulfs, straits, and bays throughout the centuries. Spatial development of the megacity from Byzantium period to today holds the initial stage of the evaluation process of this study to understand the interaction of the city with the ongoing environmental dynamics.

This study benefits from three main sources such as 1/100.000 Environment Plan of Istanbul [21], online land cover data of European Environment Agency [22], and the aerial photographs available from the Istanbul Metropolitan Municipality [16] to reveal the spatiotemporal changes within the urban macroform from Byzantium period to today.

Figure 4 illustrates that old settlement areas of Istanbul take place along the waterfronts and within the surrounding area of the coastal historical hub of the city. This hub represents the intersection area of three water bodies, which are Golden Horn, Bosphorus, and the Marmara Sea.

There are several critiques about the spatial development of the city happened under the impact of the nonpermanent processes declared by the administrative units and the international diffusion on the planning ideas especially after the second half of the 1950s [23]. The 1950s were also a significant turning point for the megacity as it has begun to gain economic dominance within the country, which brings about a rural migration increasing with an accelerated ratio [24]. Linear development approach of the city along the coastal areas altered

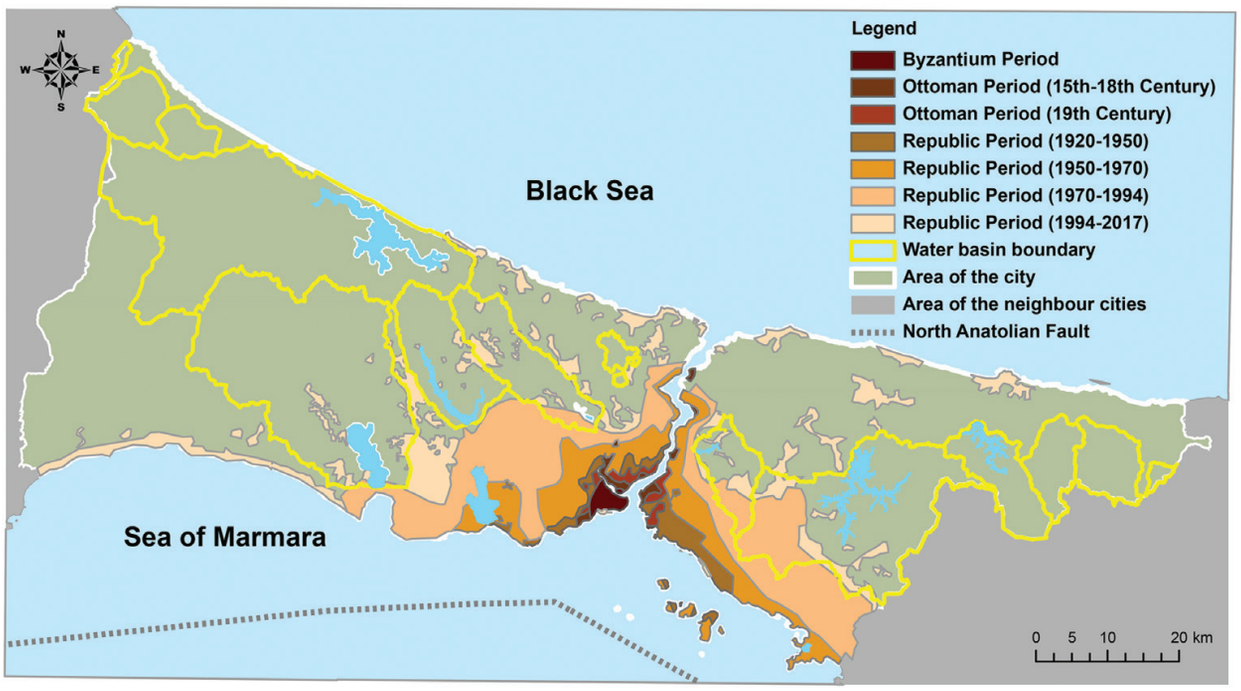

Figure 4. Altering urban macroform and its interplay with the water basins.

drastically within the 1970s (**Figure 4**). Throughout the decades, the built-up spaces expanded to the water basins due to the combination of legal, illegal, and informal residential areas occurred at the urban–rural fringe.

Today, urban sprawl is concerned to be a problem as the ecologically important and protected areas of Istanbul even in the transfrontier scale exist in the northern part of the megacity. As an indicator for both the ecologically important and sensitive areas, this study handles the water basins. To explore the interplay between the urban macroform and water basins of Istanbul, boundaries of water basins are obtained as jpg files from the online city map service of the Istanbul Metropolitan Municipality and then rectified and adapted to the GIS studies.

Western peninsula of the megacity is more abundant than the eastern one about the water bodies involving lakes and lagoons. Expansion of the built-up areas of the eastern peninsula to the water basin is larger than the development within the western one. These spatial expansions are, to some extent, the results of the approval-, amendment-, and implementation-based problems within the official urban plans.

Urban macroform development represents the age, and the network of the urban building pattern and its potential interact with the disasters as in the case of earthquake, flood, and terrorist attacks.

North Anatolian Fault passing through the Sea of Marmara is a major hazard for the megacity. According to the official map of the dispersion of earthquake zones in Istanbul [25], within the total five level of earthquake zones of Turkey, the megacity captures the highest four levels. Dispersion of the zones reveals a concern to the southern districts that involve the old coastal settlements (**Figure 5**).

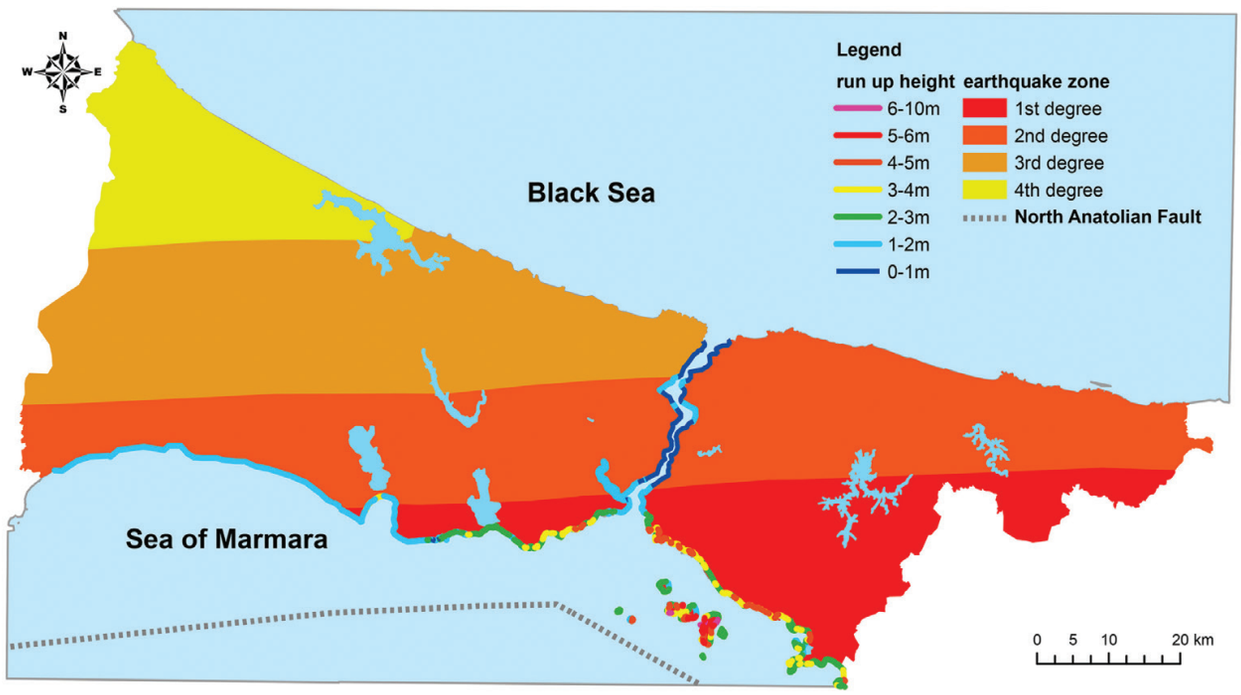

Figure 5. Dispersion of the earthquake zones and tsunami run-up heights in Istanbul (adapted from [25, 26]).

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Old development areas of megacity represent the dense built-up spaces involving narrow roads within a mazy road network. Such a pattern with an attached building collapse potential brings about a chaotic evacuation road network and an insufficient amount of open spaces for the evacuation areas. Thus, earthquake and accompanying secondary disasters can easily create cascading infrastructure failures within the old urban setting.

OYO International [26] examines the interplay between the earthquake and secondary hazards. Hence, the GIS-based maps generated within this study benefitted from it for the spatial dispersion of the tsunami run-up heights reaching 10 m as the highest (**Figure 5**).

Alpar et al. [27] forwarded the fact of near-field tsunami for Istanbul. Thus, they highlighted that it is rather problematic to estimate a near-field tsunami impact on the islands and southern coastal districts of Istanbul due to the nonexhaustive historical documents, the longtime interval between the devastating earthquakes, and the limited distance between the fault and coastline.

In the case of Istanbul, fragmented open space network appears to be important for the disaster management. Turer Baskaya [5] highlighted the issue that open reserve areas should not be used at least for the major evacuation facilities as their future concerns a big question mark in such a rapidly changing megacity.

Due to the high land prices and limited empty area for development within the inner city, there are some instant transformation projects and pertinent implementations ongoing from varying scales. Today, amendment plans are the reality of the megacity, which is a tool for the planning system authorities to catch the rapid spatial change. Thus, new constructions may easily occur on the green fields, which had been available for the evacuation areas.

An evacuation system should not rely on the reserve open areas/green fields at least for the major facilities but prefer already designed open spaces, semipublic open spaces of administrative, educational, healthcare, and religious buildings or protected lands for the evacuation hubs [5].

A continuous green connection between the coastline and interior lands is vital for the disaster-prone coastal cities. Green represents here not only planted public areas but also semipublic areas, pedestrianized streets or multifunctional land uses involving plenty of pervious surfaces and let semipublic-public accesses. In this study, human and ecosystem friendly corridors with varying ratios in between capture the meaning of green connectivity.

Coastal megacities are considered to be disadvantaged regarding sea-borne risks. However, due to the existence of their public gates to the sea in case of a disaster like earthquake, they can rely on sea transportation and stay in access to urban, national, or even international traffic.

This study highlights the current and projected hazards as in the case of instantly decided megaprojects. Megaprojects [19] remarked that in between the years of 1998 and 2017, a total of 120 megaprojects (completed or continuing) have taken place in Istanbul. This amount raises a question about the feasibility and sustainability of the projects. This study handles one megaproject as a sample to interrogate their interplay with the environmental dynamics, which is the combined projects of Canal Istanbul, surrounding development areas, and the third airport. Besides, this combined project is not taking place in the official environment plan of Istanbul dated 2009.

The draft plans of the Canal Istanbul forward the pertinent sizes as 25 m depth, 200 m width, and 42 km length [28]. Kundak and Baypinar [29] compared the main artificial canals in the world, Bosphorus Strait and Canal Istanbul. They indicated that these artificial ones acting as the megaprojects of their period were built to gain substantial benefits like shortening the sea navigation distance, diminishing the risks pertinent to the duration of the journey together with the severe environmental conditions. However, in the case of the Bosphorus Strait and Canal Istanbul, there is neither a shorter nor longer one to attach the Black Sea to the Sea of Marmara; therefore, the duration of the cruise does not change.

Touching the equilibrium between different seas should regard cautiousness. Besides many others, this study highlights a credible 2015 dated report of World Wildlife Fund (WWF), which is prepared by 21 scholars with a title of "either canal or Istanbul" in Turkish. Physical (e.g., temperature), chemical (e.g., salinity), and biological (e.g., chlorophyll concentration) differences between the Mediterranean Sea and the Black Sea are in the balance by means of the Istanbul and Canakkale straits together with the Marmara Sea. The Black Sea and Mediterranean waters with different intensities (temperature, salinity) are divided into two layers with an obvious interface. The top and bottom layer waters flowing in opposite directions to each other join with each other by the effect of shear stress and turbulence along the distance, providing water, heat, and matter exchange between them. Mixing mechanisms and two water bodies arising from different seas are undergoing rapid change along their way, especially in the shallow Istanbul and Dardanelles Straits. Thus, any intervention to this system should require well analyzing supported by the reliable data [30].

According to Saydam [31], this canal will have an impact on the lower waters of the Marmara Sea approaching the Bosphorus to reach the Black Sea by such a short period that it can be expressed in months. Therefore, this project may lead to even the end of the life in the Marmara Sea.

Figures 6 and **7** illustrate the route of the canal, location of the airport at the north, and the new development areas surrounding the watercourse. These construction areas with an area of 38,500 ha announced through the 13.08.2012 dated [32] decree of the council of ministers.

The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats (TEMA) highlights that the proposed construction areas are located in the ecologically important internationally protected areas. It forwards the adverse impacts of the third Bridge, third Airport, and Canal Istanbul combined projects on the forest ecosystem and endemic species, flora and fauna richness, fertile lands, currents and marine ecosystem, local climate and climate change, bird migration routes, freshwater resources, urban development, and transportation system [33].

These projects will change the urban development pattern and generate a massive amount of settlement areas in the northern part of the western peninsula. These projects will turn the already existing built-up space of the western peninsula into an island and welcome more population to the city (**Figure 6**).

Flooding is natural but turns into a disaster in case the built-up spaces are developed in the flood-prone areas without enough regard to natural dynamics [34]. Istanbul is rich about its urban streams, which are generating a water network both hidden "within" and "under"

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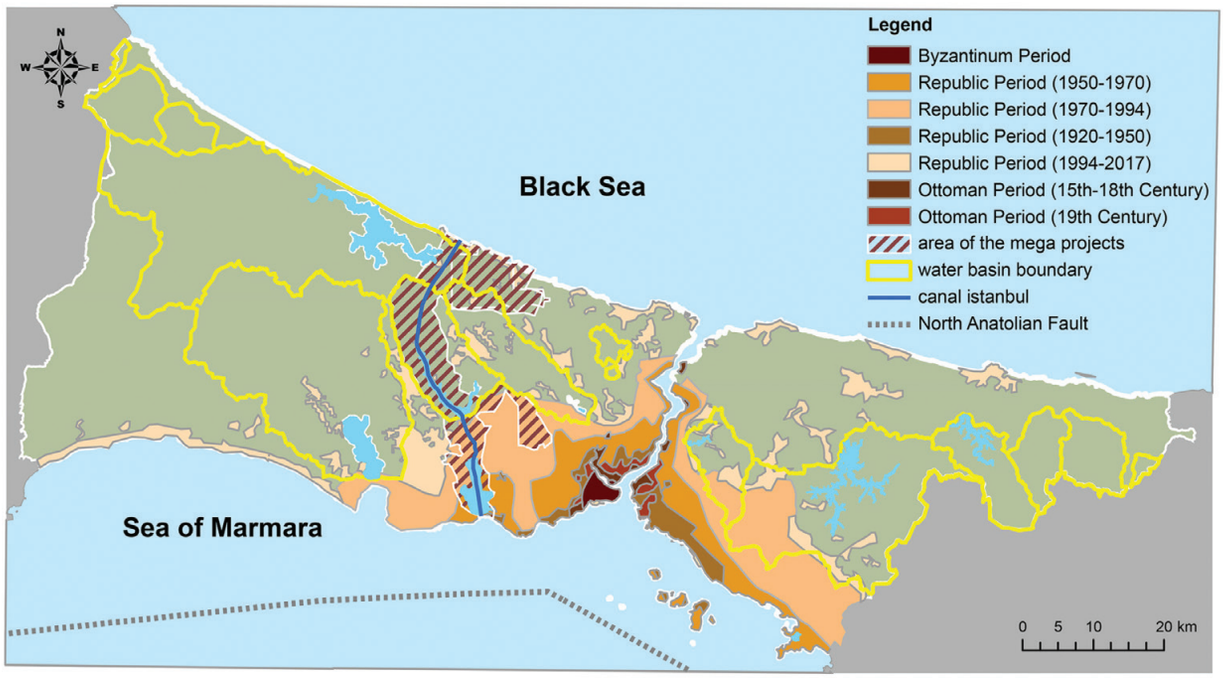

Figure 6. Interplay between the urban development, water basins, and the megaprojects of Canal Istanbul and third airport.

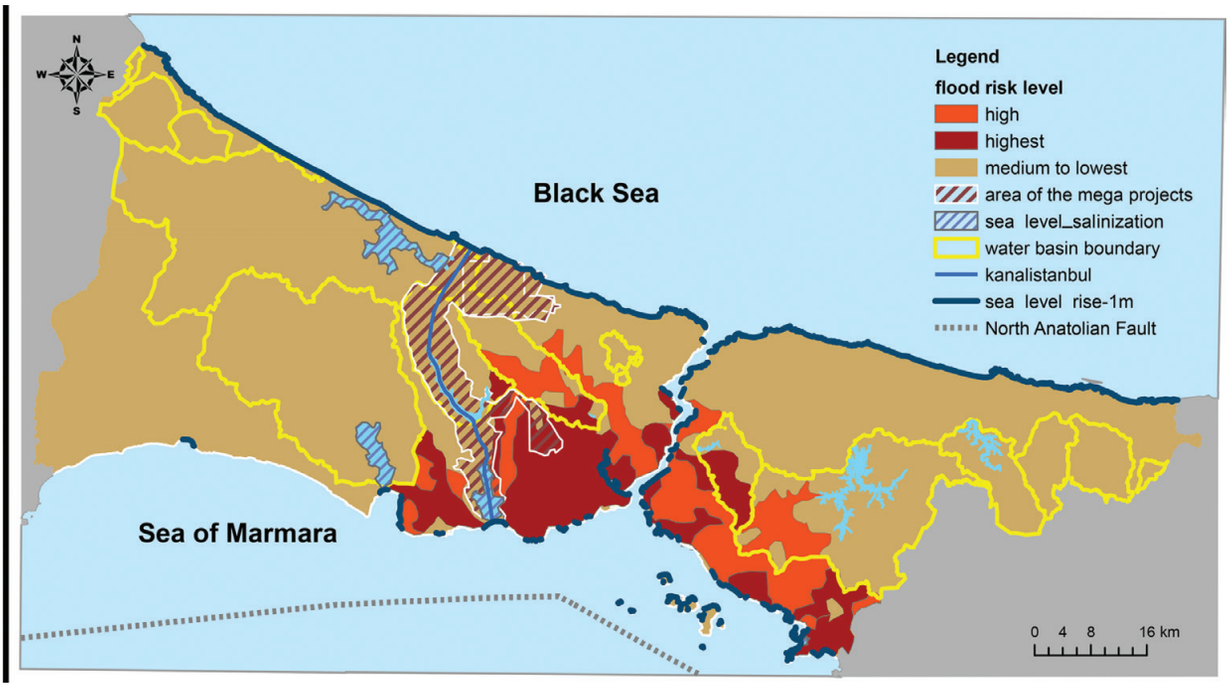

Figure 7. Cascading hazards of flood, sea level rise, salinization, and the megaprojects of the Canal Istanbul and third airport.

the current built-up spaces. Turer Baskaya and Ayatac [35] figured out the historical urban streams of the megacity regarding their interplay with the surrounding built-up spaces. With a focus on eight of the major historical urban streams, it highlights that the role of stream ecosystems in urban planning has been disregarded especially after the mid 1970s, which has

brought about cascading environmental problems. The flood also appears to be a gradually increasing problem within the densely populated areas standing on old urban infrastructures.

Ozacar [36] interrogated the impacts of urbanization on flood and soil erosion hazards in Istanbul and forwarded a scored watershed map representing the distribution of the floods from 1997 to 2010 (**Figure 7**). Flood risk areas holding the levels of the highest and high are standing in the urban development areas. Scarcity of the pervious surfaces and the buried urban streams are the features of daily landscapes of Istanbul, which promote the flood risk. Development areas of the western peninsula examine a higher flood risk level, which will grow even more by the construction of the megaprojects of Canal Istanbul and the third airport.

Resilient landscape planning and designing can forward a systems-based approach to give an adapted new way of life to the people living in flood-prone areas [37]. Even in the world cities, there are implementations of such resilient studies which prove that regarding the unique natural features it owns, Istanbul can benefit from this systems-based approach. However, Istanbul should first figure out how the megaprojects can be sensitive to environmental-natural dynamics.

Intervention to degraded landscapes is an initial integral to the systems-based approach regarding the megacity of Istanbul. Industrial facilities and brownfields within the expanding development areas and buried urban streams existing even in the most densely settled areas might be the subject of landscape intervention studies. Regarding the mosaic of the diverse landscape features, combined intervention techniques of reclamation, rehabilitation, naturalization, and enhancement should be developed through a multiscale perspective.

Today, salinization is not a robust current hazard, but Canal Istanbul Project will increase it and promote it probably to the priority level. **Figure 6** represents the megaproject and the sea level rise impacts on the water bodies. Western peninsula will lose a great amount of water sources.

One of the significant potential impacts of the accelerated sea level rise on Istanbul is saltwater intrusion as two of the big lagoons, one lake as a drinking water supply and the historical estuary of Golden Horn are in great vulnerability [14, 38]. Another concern about the city is the impact of the sea level rise on the spatial matrix of the cultural heritages, which extends along the strait of Bosphorus and the northern centrum of Marmara Sea (**Figure 7**).

Rural migration and the seasonal demographic change due to the high tourism capacity compose the chaotic demographic pattern of the megacity. This demographic profile together with a mazy pattern of the built-up spaces generates prone areas to man-made disasters. Within the last 15 years, 13 terrorist attacks occurred there, while all of them were in the western peninsula (**Figure 8**).

Historical squares and cultural heritages surrounding areas appear to be attack-prone due to the incredibly high amount of mobile people, narrow roads within a mazy road network, and blocked views within the built-up space configurations.

For the enhancement of attack-prone existing spatial configurations, diverse issues should be taken into consideration ranging from enlightenment techniques to the design of transportation

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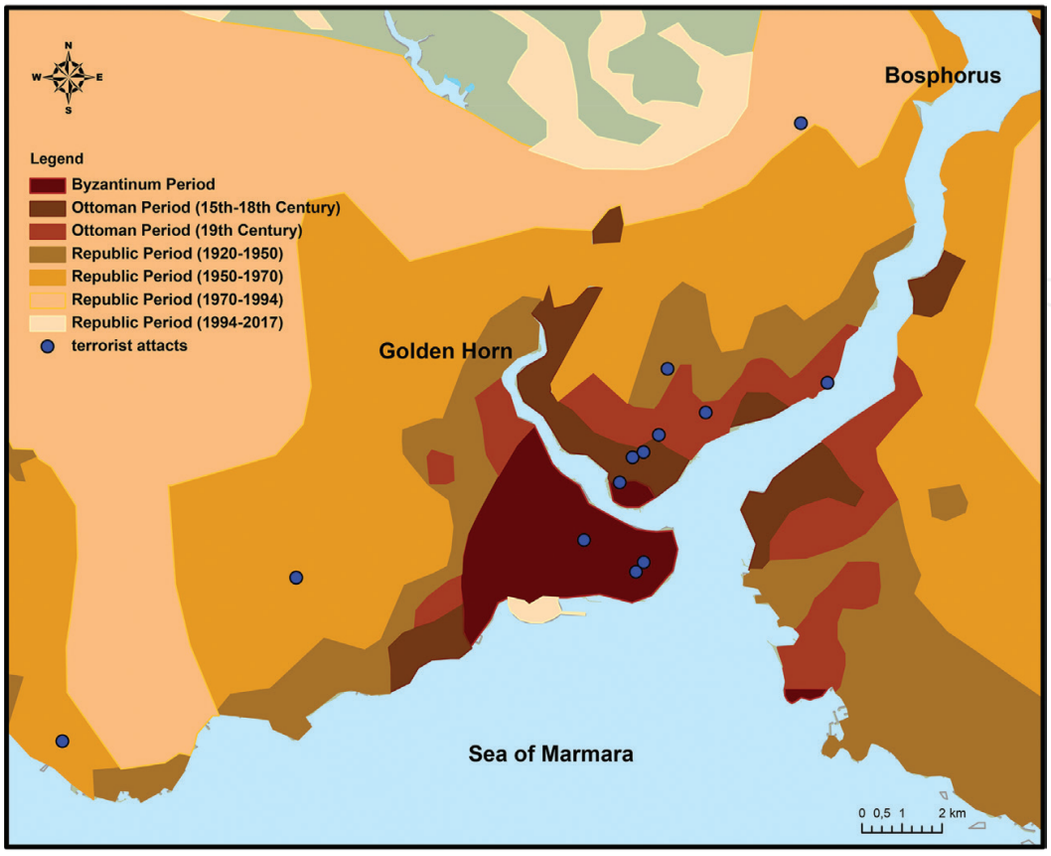

Figure 8. Dispersion of the terrorist attacks within the last 15 years.

nodes and urban vantage point calculations to the assessment of mobility modes of the pedestrians within the pedestrianized areas. Thus, multiscale and multidisciplinary studies are necessary for the new multilayered understanding of the public spaces of the twenty-first century.

Dynamics altering the urbanized areas differ throughout the decades by the proportional changes and technical promotions of the already existing dynamics and the emerging new ones together with the redefined interplays between them. This brings about a necessity of ever up-to-date planning and design approaches and techniques.

Based on the GIS-based findings of this study, **Table 1** indicates the hazards distribution along the coastlines regarding their levels. Gray-colored ones in the table represent the levels that will increase following the establishment of the megaproject. Planning strategies should be developed according to not only the hazards' but also the coastlines' characteristics.

Insufficient amount of open spaces brings about the strategy of generating hybrid and transformable landscapes to provide efficient usage of the available open spaces in the disaster-prone cities. Turer Baskaya [5] defined the concept of disaster-sensitive hybrid spaces. In case of a disaster, open spaces of daily life instantly may transform into hybrid spaces for the emergency evacuation. Hybrid open spaces hold varying public to semipublic open spaces and strategically important buildings/facilities to bind them to each other to enlarge the capacity of services. Thus, both the internal and external spaces of these facilities turn into

	Flood	Earthquake	Tsunami	Sea level rise (projected)	Salinization (projected)	Terrorist attacks	Old built-up space
Golden Horn	+++	++	++	++++	—	++	++++
Princes' Islands	++	++++	++++	+++	—	—	++
Western Bosphorus	++	++	+	+	—	+	+++
(Urbanized areas of) Western Marmara	++++	++++	++	++	—	+	+++
Western Black Sea	+	+	Not available	++++	—	—	—
Western Lakes & Lagoons	+	++	+	—	++++	—	—
Eastern Bosphorus	++	++	+	+++	—	—	+++
Eastern Marmara	++	++++	+++	+++	—	—	++
Eastern Black Sea	+	++	Not available	++++	—	—	—
Eastern Lakes & Lagoons	+	+++	—	—	+	—	—

Hazard levels (++++: very high, +++: high, ++: medium, +: low, −: in between non to very low).
Hazard levels that will increase after the implementation of the megaproject.

Table 1. Dispersion of the hazard types along the coastline types of the megacity of Istanbul.

new components of the emergency response [5]. Besides increasing the capacity, letting citizens perceive and get aware of the defined elements of the disaster management is essential.

When we handle the disaster-prone urban environments through human scale, benefiting from landscape mental map arrives. Sulsters [39] states that every person deals with his unique city experience and a mental map as the byproduct of this experience. These maps are involving not only the direct experiences but also the perceptional ones attached to their fund of life.

In this study, application of mental mapping in urban legibility studies appears to be important to estimate the behaviors of victims of the disasters in case of an emergency. Revealing the way they are going to act, the landmarks they are going to use for the orientation, and places they will select for their evacuations are essential for disaster-sensitive spatial designs and even for placing awareness raising features within these places. Awareness raising through the spatial design of daily landscapes stands as a successful mitigation tool.

Figure 9 illustrates the urban dynamics and characteristics of the disaster-prone megacity of Istanbul and proposes landscape strategies and their interplay with the hazard types as a summary of the so far discussed findings of this study. As a rapidly altering megacity open to massive coastal changes, Istanbul is a demanding case study but capable of forwarding varying strategies.

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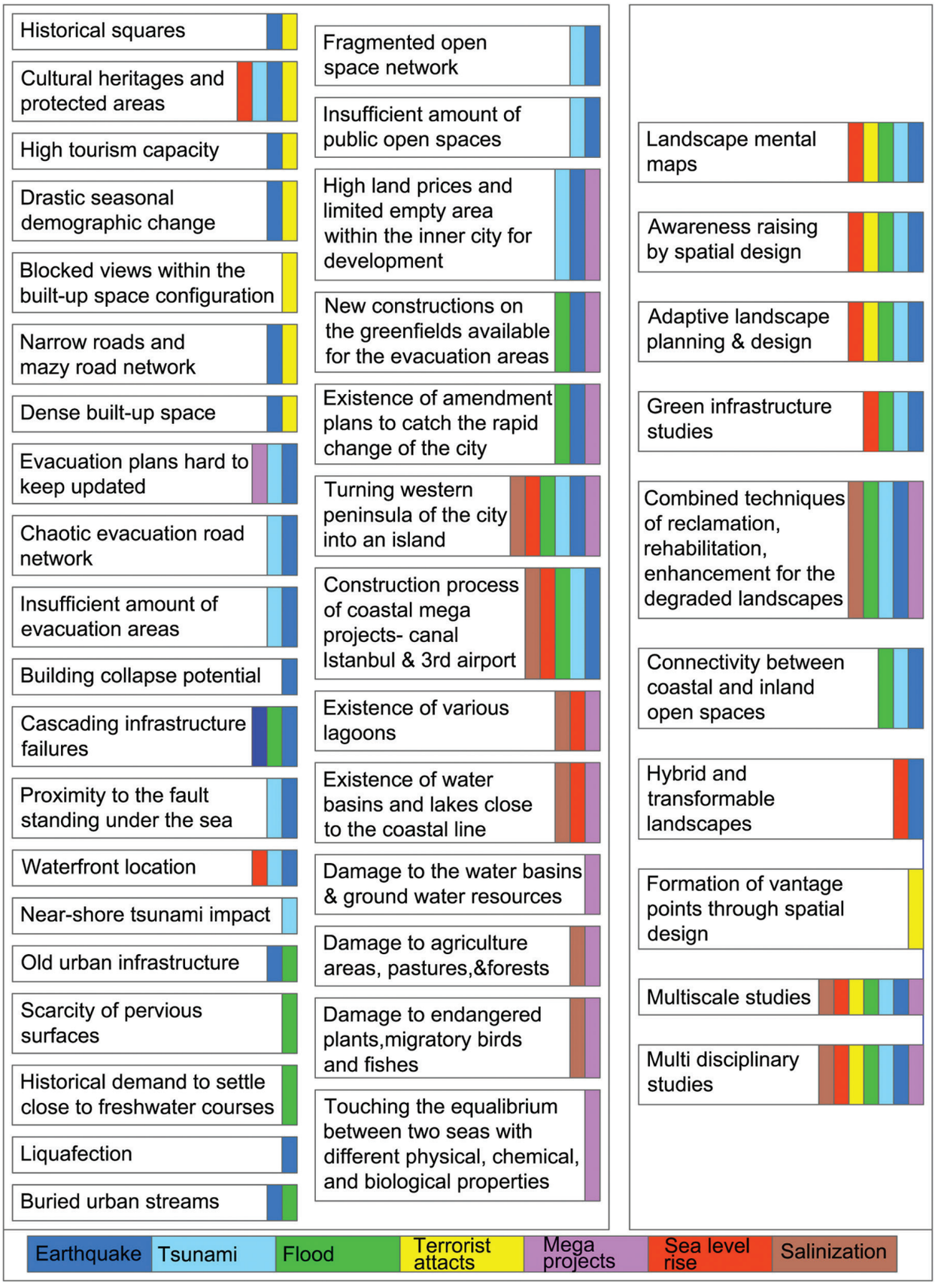

Figure 9. Interplay between the urban pattern-dynamics, disaster types, and landscape strategies.

4. Conclusion

Istanbul is worldwide known coastal megacity having mega-impacts on the natural and cultural environment. This megacity captures a unique coastal location, which has promoted it as a cultural bridge and a world scale financial node inviting more or less inevitably mega coastal projects to itself. However, this coastal identity also renders it as one of the most hazard-prone settlements of the world.

IFRC [40] highlighted the mighty transaction between hazard, vulnerability, and risk. When the vulnerability of the community and the adverse impacts of the risk cannot be decreased, risk management fails, and hazards turn into disasters.

This study handles the coastal megacity of Istanbul and interrogates its chaotic characteristics and dynamics to reveal the power of multilayered and multiscale landscape strategies for preventing the hazards turning into disasters. These landscape strategies are adaptable to other hazard-prone coastal cities and take the initial steps for further studies to handle a disaster-free future.

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References

[1] ADRC. Asian Risk Reduction Center. Some Definitions and Concepts [Internet]. 2017. Available from: http://www.adrc.asia/publications/LWR/LWR…/definitions.pdf [Accessed: 2017-07-10]

[2] Wenzel F, Bendimerad F, Sinha R. Megacities—Megarisks. Natural Hazards. 2007;**42**:481-491. DOI: 10.1007/s11069-006-9073-2

[3] Jha AK, Miner TW, Stanton-Geddes Z. Building Urban Resilience Principles, Tools, and Practice. Washington, DC: World Bank; 2013. DOI: 10.1596/978-0-8213-8865-5

[4] UNISDR Terminology on Disaster Risk Reduction [Internet]. United Nations Office for Risk Reduction; 2017. [Cited 2017 August 10]. Available from: http://www.unisdr.org/we/inform/terminology

[5] Turer Baskaya FA. Disaster sensitive landscape planning for the coastal megacity of Istanbul. Journal of Coastal Conservation – Planning and Management. 2015;**19**:729-742. DOI: 10.1007/s11852-014-0365-5

[6] Eurosoft. Licence Free Istanbul Photographs [Cd]. Istanbul: Eurosoft Software Distribution Firm; 2005

[7] Hagerman C. Green infrastructure, In: Cohen N, Robbins P, editors. Green Cities- An A-to- Z Guide. The SAGE reference series on green society. United States of America: Sage Publications, Inc.; 2011. p. 223-229. http://dx.doi.org/10.4135/9781412973816

[8] Schiappacasse P, Müller B. Planning green infrastructure as a source of urban and regional resilience—Towards institutional challenges. Urbani Izziv. 2015;**26**:13-24. DOI: 10.5379/urbani-izziv-en-2015-26-supplement-001

[9] EEA. Green infrastructure and territorial cohesion. The concept of green infrastructure and its integration into policies using monitoring systems. European Environment Agency EEA Technical Report No. 18/2011. 2011. ISBN 978-92-9213-242-2. ISSN 1725- 2237. Copenhagen, Denmark: Publication Office of the European Union; 2011. DOI: 10.2800/88266

[10] Erdik M, Durukal E. Earthquake risk and its mitigation in Istanbul. Natural Hazards. 2008;**44**:181-197. DOI: 10.1007/s11069-007-9110-9

[11] Altan O, Kemper G. Spatial information for disaster management using examples from Istanbul. In: Konecny M, Zlatanova S, Bandrova TL, editors. Geographic Information and Cartography for Risk and Crisis Management Towards Better Solutions, Lecture Notes in Geoinformation and Cartography. Berlin, Heidelberg: Springer; 2010. pp. 23-37. DOI: 10.1007/978-3-642-03442-8

[12] GCP—Global Credit Portal. Climate Change Is A Global Mega-Trend For Sovereingn Risk. [Internet] 2014. [Cited 2017 July 12]. Available from: https://www.globalcreditportal.com/ratingsdirect/renderArticle.do?articleId=1318252&SctArtId=236925&from=CM&nsl_code=LIME&sourceObjectId=8606813&sourceRevId=1&fee_ind=N&exp_date=20240514-20:34:43

[13] Celik K. Importance of coastline planning in coastal areas. Journal of Global Engineering Studies. 2015;**2**(1):36-43

[14] Karaca M, Nicholls RJ. Potential implications of accelerated sea-level rise for Turkey. Journal of Coastal Research. 2008;**24**(2):288-298. DOI: 10.2112/07A-0003.1

[15] Avsar NV, Kutoglu SH, Erol B, Shuanggen J. Coastal risk analysis of the Black Sea under the sea level rise. In: FIG Working Week 2015—From the Wisdom of the Ages to the

Challenges of the Modern World [Internet]; 2015 May 17-21; Sofia, Bulgaria. [Cited 2017 June 02]. Available from: https://www.fig.net/resources/proceedings/fig_proceedings/fig2015/papers/ts05a/TS05A_avsar_kutoglu_et_al_7725.pdf

[16] Online city map service of Istanbul Metropolitan Municipality. [Internet] 2015. Available from: http://sehirrehberi.ibb.gov.tr [Accessed: 2017 May 15]

[17] JICA and IMM. The Study on a Disaster Prevention/Mitigation Basic Plan in Istanbul including Seismic Microzonation in the Republic of Turkey Final Report [Internet]. Japan International Cooperation Agency and Istanbul Metropolitan Municipality (JICA-IMM); 2002 [Cited 2014 March 15]. Available from: http://www.ibb.gov.tr/tr-TR/SubSites/DepremSite/PublishingImages/JICA_ENG.pdf

[18] Turer Baskaya FA, Tekeli E. Coastline changes and Istanbul coastal landscape. In. Ozhan E, editors. MEDCOAST 2015—The Twelfth International Conference on the Mediterranean Coastal Environment; 2015 November 6-10; Varna, Bulgaria. Dalyan, Turkey: MEDCOAST; 2015. 1:171-182. ISBN: 978-605-85652-4-1

[19] Mega Projects of Istanbul. [Internet] 2017. [Cited 2017 August 10]. Available from: https://megaprojeleristanbul.com/

[20] Jones G. Foreword. In: Dramstadt WE, Olson JD, Forman RTT, editors. Landscape Ecology Principles in Landscape Architecture and Land-Use Planning. Harvard University, Graduate School of Design, USA: Island Press; 1996. p. 5

[21] 1/100.000 Environment Plan of Istanbul, Part III. [Internet] 2009. [Cited 2014 December 10]. Available from: http://www.planlama.org/images/stories/dokuman/istanbul_cdp/3-b_il_butunu_aras_bulgulari.pdf

[22] 'Coordination of information on the environment'—CORINE online land cover data of European Environment Agency [Internet]. Turkish Republic the Ministry of Forestry and Water Management. 2012. [Cited 2017 March 10]. Available from: http://corine.ormansu.gov.tr/corine

[23] Ayatac H. The international diffusion of planning ideas: The case of Istanbul, Turkey. Journal of Planning History. 2007;**6**(2):114-134

[24] Kundak S, Turkoglu H. Assessment of seismic risk in Istanbul. In: Proceedings of the 45th European Congress of the European Regional Science Association Land Use and Water Management in a Sustainable Network Society; 2005 August 23-27; Amsterdam, Netherlands. [Internet] [Cited 2014 November 07]. Available from: http://www-sre.wuwien.ac.at/ersa/ersaconfs/ersa05/papers/408.pdf

[25] Map for the Earthquake Zones of Istanbul. Republic of Turkey Prime Ministry Disaster and Emergency Management Authority. [Internet] 1996. [Cited 2017 May 15] Available from: http://www.deprem.gov.tr/depbolge/istanbul.gif

[26] OYO International Geological. Geotechnical study report according to the construction plans as a result of settlement purposed microzonation works—Production of

microzonation report and maps European side (South) to Istanbul Metropolitan Municipality. Final Report. OYO International Corporation. [Internet] 2007. [Cited 2014 March 15]. Available from: http://www.ibb.gov.tr/trTR/SubSites/EarthquakeSiteEn/Pages/MicrozonationProjectEuropeanSideSouth.aspx

[27] Alpar B, Gazioglu C, Altinok Y, Yucel ZY, Dengiz S. Tsunami hazard assessment in Istanbul using by high resolution satellite data (ikonos) and DTM. In: Altan O, editor. Proceedings of the XXth Congress of the ISPRS; 2004 July 12-23; Istanbul. 2004. [Cited 2013 November 21]. Available from: http://www.isprs.org/proceedings/XXXV/congress/comm7/papers/137.pdf

[28] Mega Projects—Canal Istanbul [Internet]. New Istanbul Project; 2017 [Cited 2017 August 10]. Available from: https://dosya.megaprojeleristanbul.com/yn-ist/yn-ist.01.jpg

[29] Kundak S, Baypinar MB. The crazy project—Canal Istanbul. TeMA Journal of Land Use, Mobility and Environment. 2011;**4**(3):53-63 [Internet] [Cited 2016 March 05]. Available from: http://www.tema.unina.it/index.php/tema/article/download/465/621

[30] WWF Report on Canal Istanbul, Either Canal or Istanbul (in Turkish) [Internet]. 2015 [Cited 2017 August 10]. Available from: http://www.wwf.org.tr/?4480

[31] Saydam AC. Why the Crazy Project can not be? (in Turkish) [Internet]. 2011 [Cited 2017 June 10]. Available from: http://www.havadantozdan.com/cilgin-proje-neden-olmaz/

[32] 13.08.2012 dated Official Gazette declaring a decree of the council of ministers with the number of 2012/3573, and the title of "Decision on the Authorization of the Ministry of Environment and Urbanization within the Scope of Project Implementations to be Conducted in Some Areas in Istanbul Province" (in Turkish). 2012

[33] Zeren Gulersoy N, Yazici Gokmen E. Conclusion and evaluation. In: Gulersoy NZ, Erdemli Mutlu O, Yazici Gokmen E, editors. Three projects that will affect the future of Istanbul—3rd Bridge, 3rd Airport, Canal Istanbul—TEMA Expert Opinions. (in Turkish). Istanbul: TEMA; 2014. pp. 148-159

[34] Watson D, Adams M. Design for Flooding—Architecture, Landscape, and Urban Design for Resilience to Climate Change. USA: John Wiley and Sons; 2010

[35] Turer Baskaya FA, Ayatac H. Developing Landscape Planning Strategies for the Historical Urban Steams—Case of Istanbul. Research Project with Project Number 38165 (Continuing). Istanbul: Istanbul Technical University; 2017

[36] Ozacar BG. Impacts of urbanization on flood and soil erosion hazards in Istanbul Turkey [PhD Dissertation]. School of Geography and Development, The University of Arizona; 2013. ProQuest/UMI. UMI Number: 3603219

[37] Resilient Design: Flooding. ASLA—American Society of Landscape Architects. [Internet] 2017. [Cited 2017 September 10]. Available from: https://www.asla.org/flooding.aspx

[38] Interactive Flood Map: Water Level Elevation Map. 2012. [Cited 2017 July 02]. Available from: http://www.floodmap.net/

[39] Sulsters WA. Mental mapping, viewing the urban landscapes of the mind. In: Proceedings of the International Conference "Doing, Thinking, Feeling Home: The Mental Geography of Residential Environment"; 2005 October 14-15; Delft, Netherlands. Netherlands: Delft University of Technology; 2005. Conference paper 1. [Internet] [Cited 2017 July 10]. Available from: https://repository.tudelft.nl/islandora/object/uuid%3Afc71de16-b485-4888-b6fe-a9d2771d9e4a?collection=research

[40] IFRC. What is a Disaster? International Federation of Red Cross and Red Crescent Societies. [Internet] n.d. [Cited 2017 August 10]. Available from: http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/