Searching for Traces of Ecological Nodes in the Formation of Resilient

Coastal Areas: Gulf of Saros

Gildis Tachir[+] & Ahmed Alali[++] (Turkey)

Abstract

Building the resilience of a dynamic environment is a difficult task, but coastal areas shaped by natural formations have existing resilience points. This article attempts to find traces of elements that identify points of resilience. The method applied in this effort is the mapping method. In line with this method, it is aimed to investigate the traces of ecology nodes by overlapping the map information of the place with different elements with axonometric graphical expression. The Gulf of Saros, which is on the eastern coast of the Aegean Sea, was selected as the sample area of the study. The geographical environmental values of the Gulf of Saros were examined. As a limitation, the traces of the ecological node points of the Erikli district, which are areas with different environmental values in the Gulf of Saros, were researched, and other settlements were not evaluated within the scope of the study. In this direction, the protection, development and environmental sustainability of the traces of ecological nodes will increase the resilience of the coastal city against disasters that may occur.

Keywords: *Resilience, Ecological Node Points, Coastal City, Gulf of Saros, Turkey*

[+] Gildis Tachir, Assist. Prof., Architecture, Trakya University, Turkey. email: gildistachir@trakya.edu.tr.
[++] Ahmed Alali, M.A. Student, Architecture, Trakya University, Turkey. email: ahmedalali@trakya.edu.tr.

Received 1/8/24 – Revised 10/22/24 – Accepted 11/23/24

Introduction

Today, coastal city plans are insufficient due to negative climate effects. Resilient urban plans that can prevent the fragile structure of coastal cities and eliminate the dangers that may occur are needed. It is necessary to protect and develop the traces of ecological corridors in the formation of resilient urban planning.

In the formation of resilient city plans, there is a need for resilience management - known as resistant thinking - to manage systems against shocks that may occur (Walker and Salt, 2006; 2012). The idea of resilience is the creation of systems of staying within the existing ability of urban components, including stable and critical thresholds, being resistant to the risks that will occur, and adaptability and stability (Folke et al., 2010). At the same time, the idea of resilience includes understanding the harmony of the social and ecological systems used in the formation of the city plan (Walker and Salt, 2012) in the principle of sustainable working together and the resistance of the different components that make up the whole to work together in times of confusion and turmoil (Holling, 1973;1986).

The original environment that makes up the cities has natural, built and social environment components. The human perspective in nature and social-ecological systems is integrated systems (Berkes and Folke, 1998). In this sense, ecological resilience is directly related to human life, that is, to the sustainable city plan. In the sustainable urban planning, ecological node points that are part of ecological systems, ensuring the sustainability of these phenomena by preserving them are an important step in the formation of resilient urban plans.

Accordingly, in this study, the importance of coastal urban planning in ensuring its resilience in the urban plan was studied by searching for ecological traces. The Saros Gulf Erikli coastal area was determined as the sample area because the Erikli coastal settlement is a natural environment with unique environmental components. This natural environment is the intersection point of forest, sea and land. This intersection point has the ecological values of the rich potential provided by three different combinations (forest, sea and land). It is of vital importance to preserve the ecological values of coastal areas and transfer them to future generations. The total length of the Turkish coasts, including the Black Sea (1719 km), the Marmara Sea (1474 km), the Mediterranean Sea (2025 km) and the Aegean Sea (3265 km) coastal regions, is 8483 km (Simav and Seker, 2013). There are a total of 28 coastal settlements in these regions and the Erikli coastal settlement is an area with ecological values and a coastline on the Aegean Sea.

Methodology and Approach

The aim of this study is to search for traces of ecological node points in order to understand the environmental welfare and environmental authenticity impacts in coastal areas. The overlapping relationship between the concepts researched and the ecosystem, resilience and components of coastal, marine and forest areas was examined. Traces of ecological components of coastal areas were tried to be read by mapping method. The map information of the different plans was researched by finding them one-on-one in the area: they were provided by photographing the areas and making readings on the maps. The Gulf of Saros was selected as the sample area. The geographical environmental values of the Gulf of Saros were examined. As a limitation, the traces of the ecological node points of the Erikli district, which are areas with different environmental values in the Gulf of Saros, were researched; other settlements were not evaluated within the scope of the thesis. Infor-

mation on sample areas was obtained through field visits The current situation has been mapped by on-site observation. The indicators of the traces of the ecological node points created by the different plans were determined. In this direction, the necessary suggestions have been presented to protect, develop and ensure the environmental sustainability of the traces of ecological node points.

Literature Review: The Relationship Between the Concepts of Resilience and Ecology

Although the concepts of resilience and ecology are perceived as different concepts, it is seen that they have similar points when the literature researches are examined. The concept of resilience has different dimensions as social, economic, ecological and spatial resilience (Tümer Ergün, 2020). When looking at ecological resilience, it is understood that it is defined as designing margins that can meet minimum losses in crises in order to create the durability of the urban plan, providing the ability to maintain or transform the desired situation and ensuring the sustainability of the new system (Zurlini, et al., 2013; Sharifi and Yamagata, 2018). The concept of sustainability was emphasized in the report of the Brundtland Commission of the World Commission on Environment and Development in 1987 by preserving renewable resources and carrying them to the next generations (UN. Secretary General, 2000). It is emphasized that environmental protection is the main characteristics of sustainable development and states that there is a balanced approach among the environmental components. It is expected to develop strategies for the transportation axes, structures and city boundaries (sea, forest) that make up the urban fabric and to bring the sustainability perspective with it. It is understood that the authors who study sustainability argue that it is necessary to ensure the resilience of the factors that disrupt sustainability (Anderson, 2011).

Although the concept of resilience was first seen as an engineering and ecological term, resilience is seen as adapting to vulnerability and reducing losses (Chelleri, 2011). The concept of sustainability can be interpreted as ensuring the continuity of the existing one by preserving it. However, ecological approaches establish the link between the factors of sustainable development (Dudley et al. 2017). Ecological knowledge and studies are an important part in order of not breaking the durability of natural resources. In this sense, sustainability is not possible without ecology (Inogwabini, 2019). In parallel with these relationships, we can say that the concepts of resilience and ecology complement each other and have similar aspects.

The resilience of the cities of the future in the face of risks is important in the sustainability of the city. The resilient city plan is expected to measure how ecological systems can respond to fractures (Walker and Salt, 2012). It is the basic element of resilient cities to be able to recognize possible disruptions that cause crisis in the city and to be aware of how they can adopt their strategies and cope with these problems.

Resilience Approach into Coastal City Planning

The concept of city: It is defined as settlements where different civilizations and cultures can be read by where layering, built environment factors and natural environment components meet; the artificial environment dominates nature and a society consisting of different social layers lives in accordance with the laws of urban life (Ertürk and Tosun, 2009). Throughout history, cities have settled in suitable geographies and an urban pattern has

developed. In this direction, cities characterized by geographical effects have been formed. The definition of "coastal city" is formed. Accessibility to water has been important in history as well as today. Civilizations have developed in these settlements, for example: Egypt in the settlement of the Nile River, Mesopotamia in the settlement of the Tigris-Euphrates Rivers (Köroglu, 2018).

Coastal cities have been known as the settlements preferred by people as living spaces throughout history. The potentials provided by water have provided civilization to coastal cities. Coastal cities have socio-cultural and economic values in terms of the development of humanity (Dogan et al., 2005; Glaeser, 2008). It is seen that the unique coastal areas where soil and water meet have always been at the forefront throughout history. People first began to settle in coastal areas and established states and empires there, especially along the seashore or oceans to access water. People migrated from the plains surrounded by mountains to settle by the sea. While coastal cities are the starting point of people's production and trade, they are also places that increase people's curiosity to discover new places (Dogan et al., 2005; Glaeser, 2008). Throughout history, coastal cities, which are accepted as the points where civilizations have developed (Gaber and Özge. 2023), have become their own original and dynamic environments. A good understanding of the environmental compositions that make up the unique and dynamic nature of coastal cities and ensuring sustainability are important for the coastal city and its development (Pirenne, 2012).

Coastal cities are sensitive areas with their unique environmental characteristics. Rapid development on the coast, increasing settlement and unplanned development increase the pressures on the environment in coastal areas. This situation leads to many environmental problems in terms of the physical (natural and built) and social environment. Coastal cities are natural environments with natural, built and social environments (Aslanoglu 1998). These environmental formations contain ecological details. The combination of different ecological points constitutes the ecological node points.

Node point: Nodes are strategic places that visitors can enter; they are usually intersections of roads or natural formation clusters. Although theoretically they look like small points as in the plan of a city, they can actually be large areas or quite long linear lines, and even the intersection of ecological phenomena from a bird's eye view of the city. In fact, when the environment is looked at on a national or international level, it can become a holistic intersection point at the borders of the city (Lynch, 1964).

Intersection points (nodes): In the urban scale, urban or rural transportation axes intersect with each other at some points and form important junction areas called intersection points. These areas can be the frequently used edges (coastal-sea-forest) that make up the cities or squares as urban-scale meeting areas are examples of these. The intersection of ecological areas constitutes the node points. The node can sometimes be seen spatially seen as a line (Lynch, 1964), for example, the coastline of the city.

Edges: Edges are separating elements. They are located in a horizontal plane like roads, but in contrast to the unifying feature of roads, edges are used as separators. Examples of these are the coastal-forest and urban boundary, which are ecological boundaries (Lynch, 1964).

Considering the ecological boundaries of the coastal city, it is seen that the natural environment (forest area, seas), built environment (urban settlement) and social environment factors create them (Kıslalıoglu, and Berkes, 1993).

Establishing the resilience of ecological nodes in ensuring the sustainability of the city will reduce its vulnerability in the face of crises that the city may experience.

The concept of resilience is found in research areas in all disciplines. Global problems experienced around the world focus on the resilience approach in urban planning so that cities can increase their defense against a wide range of hazards (Sharifi and Yamagata, 2014; 2018).

Traces of Ecological Node Points - Erikli Coastal Settlement-Gulf of Saros/Turkey
Erikli coastal settlement: It is located 140 km from Edirne city center and 30 km from Kesan's city center. The Erikli settlement is located southwest of Kesan, on the shore of the Aegean Sea, the Gulf of Saros, on the Mecidiye-Erekli coastal road 22.55. The length of the coast is about 3 km. The population of the settlement is seen as 496 in 2022 (Çekmez, 2009); (Figure 1).

Figure 1. Location of Erikli coastal settlement (Google Maps, 2022).

Erikli is a coastal settlement based on agricultural activities. It developed in the 1970s when Kesan Municipality started to design restaurants and hotels in coastal areas. Considering the potentials of the Erikli coastal settlement, the fact that the Gulf of Saros is on a deepening slope, non-rocky coastal area, ecological values in the combination of forest, sea and land, clear water free from algae and harmful marine life, golden sand dunes, as well as a natural shelter for herons, pelicans and flamingos, and the presence of Lake Tuzla prepare a natural and original environment. The Erikli settlement is becoming an attrac-

tive point in the tourism industry with its potentials. In this direction, the area is a coastal settlement that stands out from the coastal settlements of the Gulf of Saros region by rapidly growing with the opening of municipal facilities, secondary residences, hotels and tourism facilities (Kocaman, 2011).

Erikli, the most important coastal settlement of the Gulf of Saros, is seen to have traces of ecological node points in the formation of natural potentials (Figure 2).

Figure 2. Node points of ecological traces of Erikli coastal settlement (www.ilcelerikoyleri.com; improved by Alali).

Ecological traces are sought by drawing the city boundary, transportation axes, coastline and urban texture traces of the Erikli settlement area in the plan plane. Ecological traces: The regions where the city intersects with the green, water and land parts were mapped and the contributions of the ecological values to the urban complex were questioned by overlapping the axonometric graphical expression of the drawings in the plan plane (Skyllstad, 2017). The aim of this technique is to determine the traces provided to the city by 3D (axonometric plane) of the existing ecological traces with 2D (plan plane). The forest boundary, urban texture, transportation axes and beach lines were examined in the planned city layers (. Ecological node traces when we look at the forest strip, those that appear as positive ecological node traces, the endemic vegetation that exists on the forest border are the existence of green areas. What appears to be negative are: the fact that urban expanse is based on the forest boundary: the fact that deforestation, uses forest lands as construction land, and the fact that the loss of forest lands causes local climate change. Considering the urban texture and transportation axis analysis, the positive ones in terms

of the traces of the ecological node points of the analysis are the accessibility of the settlement to water. The negative ones are: the expanse of the urban areas to the green area, not using the slope in the construction; material used in the construction of the coastal area; formation of temperature corridors in the urban texture; and transportation axes parallel to the coast. Considering the beach strip analysis, the positive ones in terms of the traces of the ecological nodes of the analysis are the public use of the coastal areas, the presence of the sea area, and the intensity of the use of the coastal area. The negative ones are the cleanliness of the coastal area. When we look at the overlap and intersection of all maps, the traces seen as positive are the endemic vegetation on the forest border, the presence of green areas, the water accessibility of the settlement, the public use of the coastal areas, the presence of the marine area, and the intensity of the use of the coastal area (Figure 3). In order for this study to occur, field studies, on-site observation, and mapping of the layers of urban components were analyzed.

When the observations made in the area, on-site detection and drawings in the axonometric plane are evaluated, it is understood that the Erikli coastal settlement is integrated with the forest area. There are secondary residences in the coastal settlement. Secondary residences close after the end of the tourism season and are not used until the next season. Buildings in this area are exposed to moisture that causes corrosion, spread of fungus and mold, and are also exposed to the effects of temperature fluctuations caused by climate change.

At the ecological junction where the forest, the coast and the residential area meet, the road forms a dividing line between the buildings and the sea, and the beach is narrow and almost absent (Figures 4 and 5). One of the risks the environment faces at this ecological juncture is the cutting down of trees that adversely affect the environment and the construction of new buildings, as it requires the flattening of the soil. The construction of new buildings also results in solid wastes that are environmentally difficult to recycle, as they consume large amounts of water and increase the need for sewage networks, as well as putting pressure on them to form a new road network. As well as the construction of new buildings, it generates the need for logging and soil levelling, which reduces vegetation, and this leads to an increase in greenhouse gases in the atmosphere and local climate change. This leads to environmental problems that negatively affect coasts and vegetation. For this reason, at this stage, environmental sustainability should be ensured by reducing the construction on the coast, protecting the vegetation, and keeping the coast clean from wastes. It is necessary to take correct measures to protect the buildings against corrosion and to use moisture and salinity resistant materials. Tourists and day visitors should be made aware of the importance of a clean environment and minimizing the harmful effects of pollution on the beach and urban area. For this reason, tourists should be made aware of the need to protect the environment, to throw out waste on designated areas and not to leave them on the beach (see table in figure 6).

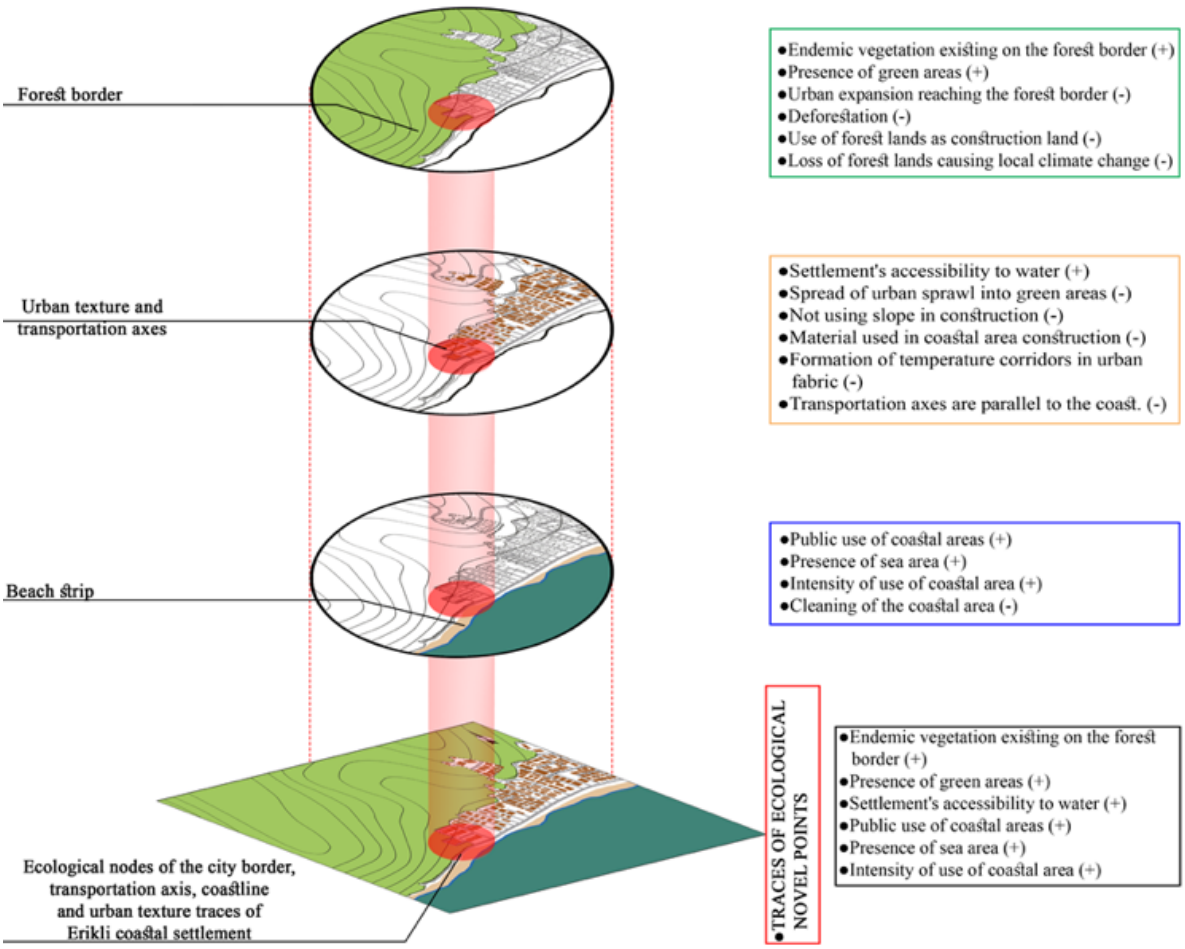

Figure 3. Axonometric drawing of the ecological nodes of the city boundary, transportation axis, coastline and urban pattern traces of the Erikli coastal settlement.

Figure 4. The meeting point of the city border and the forest and coastal border (Alali, 2024).

Figure 5. Wastes left in the area by visitors (Alali, 2024).

Current situation	Potential problems	Suggested solutions
▪ Availability of original vegetation ▪ Existence of construction in the coastal area ▪ Formation of thermal corridors created by climate change ▪ Unplanned coastal areas used for tourism purposes ▪ Sea water is pure and clean ▪ Environmental pollution	▪ Lack of sewerage network ▪ Environmental wastes created by new construction ▪ Unplanned construction ▪ Deforestation by logging ▪ Uncontrolled use of environmental plastics	• Ensuring and maintaining the sustainability of the traces of ecological node points ▪ Prevention of construction in the coastal area ▪ Vegetation protection ▪ Location-specific use of construction material ▪ Reduction of environmental waste

Figure 6. Table of the current state of the ecological node point, problems and proposed solutions.

Evaluation

In this study, the Erikli coastal settlements were examined as a sample area. Traces of the intersection points of the Erikli coastal settlement, the city border, the transportation axis, the coastline, the sea border and the ecological areas with the forest border were searched in the city plan. Inferences in this direction:

- The spread of the coastal settlement towards the forest should be stopped and the forest border should be protected as an ecological corridor.
- Urban texture should be well planned and site-specific construction should be allowed.
- Transportation axes should be developed in a way that will not harm ecological areas.

- Coastal areas should not be exposed to intensive uses and should be included in tourism planning by preserving it as an ecological environmental value.
- Temperature corridors should not be allowed in urban settlements and ecological traces should be protected.

The protection of the traces of ecological areas is an important point in ensuring the sustainability of the urban plan and the formation of a resilient urban texture.

Conclusion

Coastal areas are important strategic areas today as in history. The potentials and resource richness of coastal areas lead to the formation of dense settlements in these areas. Coastal areas play an important role in the economic, visual, functional and social development of the urban areas. In addition, coastal areas, which have become a point of attraction, cause rapid population growth. Uncontrolled increase in coastal areas damages coastal environmental values, destroys the natural environment, creates water and air pollution, ensures the extinction of plants and animals, and causes climate change problems. This situation emphasizes the necessity of ensuring the protection and sustainability of coastal areas.

The concept of ecology, which emerged as a branch of science that examines the relationships between the environment and its compositions, has begun to be questioned under the title of ecological architecture, including the discipline of architecture, which is known as the art of organizing the environment. Projects that adopt sustainable design approaches taking environmental values into account in coastal area planning are emerging. Ecological coastal urban planning is an integrated planning approach that aims to reduce the environmental footprint, uses renewable energy sources, and respects sustainable development and the environment. Environmental City respects the principles of sustainable development and environmental construction, combining working methods and sustainability of eco-friendly cities, social, environmental, economic and cultural dimensions of the creation of ecologically healthy cities, and creating a comprehensive vision of sustainability. This approach states that it is important to use the ecological node point to improve coastal areas and ensure their sustainability.

The importance of ecological elements in the evaluation of urbanization and the environmental effects of this urbanization in coastal areas is understood. The relationship of ecological environmental components with each other creates an ecological node point. It is important to find the traces of these nodes and to use the sustainability of these traces effectively in the coastal city plan. Because the sustainability of cities ensures the protection of environmental values, it is important to transfer the protected values to the next generations.

The holistic evaluation of the Saros Gulf and the Erikli coastal settlement in the combination of forest, land and sea, the protection of existing environmental values and planning in a sustainable plan vision are important in terms of ensuring the vitality of the area.

The study shows that the search for traces of ecological node points will provide viable options and create opportunities to raise awareness among investors, architects and plan-

ners as well as for those working in academics in the direction of protecting environmental values about the importance of improving and ensuring urban sustainability.

Acknowledgments

This manuscript was prepared from the unpublished master's thesis, titled "Searching for Traces of Ecological Node Points in Urban Coastal Areas: The Case of Saros Gulf" Ahmed Alalı Trakya University Institute of Natural and Applied Sciences Department of Architecture conducted by Assist. Prof. Dr. Gildis Tachir. This manuscript is original.

References

Alalı, Ahmed. "Kentsel Kıyı Alanların Ekolojik Dügüm Noktalarının Belirlenmesi: Saroz Körfezi Örnegi," Master's thesis, Trakya University, Institute of Science, Jan.2024.

Anderson, Cynthia. "Resilience in an Urban Social Space: A Case Study of Wenceslas Square." Master's thesis, Ohio State University, 2011. http://rave.ohiolink.edu/etdc/view?acc_num=osu1299638258.

Aslanoglu, Rana A. *Kent, Kimlik ve Küresellesme.* Bursa: Asa Kitabevi.1998.

Berkes, F., and Folke, C., Linking Social and Ecological Systems for Resilience and Sustainability. In *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* F. Berkes & C. Folke (eds.), New York, NY: Cambridge University Press, 1998.

Chelleri, Lorenzo. "From the Resilient City to Urban Resilience. A Review Essay on Understanding and Integrating the Resilience Perspective for Urban Systems | De la "ciutat resilient" a la resiliència urbana. Un estat de la qüestió sobre la comprensió i la integració de l. *Documents d'Analisi Geografica,* 58(2),(2011): 287–306, https://doi.org/10.5565/rev/dag.175.

Çekmez, N. "Kuzey Saroz Bölgesi'nin Ekonomik Kalkınmasında Ekoturizmden Yararlanma Olanakları." Master's thesis, Namık Kemal University, Institute of Science, Tekirdag, 2009.

Dogan, Ertugrul & Selim Burak, Ali Akkaya. *Türkiye Kıyıları (Tanımlama-Planlama-Kullanım)*. 1. Baskı, Istanbul: Beta Yayınevi, 2005.

Dudley, Nigel, Natasha Ali, Marianne Kettunen & Kathy MacKinnon. "Editorial Essay: Protected Areas and The Sustainable Development Goals." *Journal of Parks* 23(2), (2017):9–12.

Ertürk, Hasan, & Elif. Karakurt Tosun. "Küresellesme Sürecinde Kentlerde Mekânsal, Sosyal ve Kültürel Degisim: Bursa Örnegi." *Uludag Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi* 10(16),(2009): 37-53.

Folke, Carl. Carpenter, Stephen. Walker, Brian. Scheffer, Matren. Chapin, Terry, and Rockström, Johan. "Resilience Thinking: Integrating Resilience." *Adaptability and Transformability. Ecology and Society* 15(4), (2010). DOI: 10.5751/ES-03610-150420.

Gaber, Mustafa & Özge Özden. "Urban Growth and Its Environmental Impacts: Case of the Nile River, Egypt." *Journal of Urban Culture Research* 26 (2023):237-44. https://doi.org/10.14456/jucr.2023.14

Google Maps, 2022, www.google.saroz. (accessed February 17, 2024)

Glaeser, Edward L. *Cities, Agglomeration and Spatial Equilibrium.* OUP Oxford, 2008. ISBN: 9780199290444

Holling, Crowford. S. “Resilience and Stability of Ecological Systems.” *Annual Review of Ecology and Systematics* 4(1), 1–23, 1973. https://www.jstor.org/stable/2096802.

Holling, Crowford. S. "The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change." In *Sustainable Development of the Biosphere: Interactions between the World Economy and the Global Environment*,W. C. Clarkand & R. E. Munn (eds). Cambridge, UK: Cambridge University Press. 1986. 292–317.

Inogwabini, Bila-Isia. "Ecology and Sustainable Development." In *Encyclopedia of Sustainability in Higher Education,* Leal Filho W. (Editor). 2019. https://doi.org/10.1007/978-3-319-63951-2_422-1

Kıslalıoglu, Mine & Fikret Berkes. *Çevre ve Ekoloji*, Istanbul: Remzi kitabevi, 1993.137.

.

Kocaman, Sinan. “Edirne Ilinin Turizm Cografyası”. thesis PhD diss., Atatürk Üniversitesi/Sosyal Bilimler Enstitüsü, Erzurum, 2011.

Köroglu, K. “Eski Mezopotamya Tarihi Basangıcından Perslere Kadar.” *Istanbul: Iletisim Yayınları*, 1 (2018):15-16. ISBN-13: 978-975-05-0390-0, 12.

Lynch, Kevin. *The Image of the City.* MIT Press. 1964.

Pirenne, Henry. “Orta çag Kentleri, Çeviren: sadan Karadeniz,.” *Istanbul: Iletisim Yayınları.* 12. Baskı. 2012.

Simav, Özlem & Dursun Zafer Seker. “Kıyı Etkilenebilirlik Göstergesi ile Türkiye Kıyılari Risk Alanlarinin Tespiti.” 1 HGK. Harita Genel Komutanlıgı. Kartografya Dairesi. TMMOB Cografi Bilgi Sistemleri Kongresi Ankara, Türkiye, Kasım 11 -13, 2013.

Skyllstad, Kjell. “Mapping Urban Changes: Mapping the Past – Managing the Present.” *Journal of Urban Culture Research* 26 (2017):237-44. https://digital.car.chula.ac.th/jucr/vol15/iss1/10.

Sharifi, Ayyoob & Yoshiki Yamagata. “Resilient Urban Planning: Major Principles and Criteria.” *Energy Procedia* 61 (2014): 1491–1495. https://doi.org/10.1016/j.egypro.2014.12.154.

Sharifi, Ayyoob & Yoshiki Yamagata. “Resilience-Oriented Urban Planning.” Lecture Notes in Energy. 65(2018): 3–27. https://doi.org/10.1007/978-3-319-75798-8_1.

Tümer, Ergün. “A Research On Resilience of Urban Public Spaces: The Case of Güvenpark.” thesis PhD diss., The Graduate School of Natural and Applied Sciences of Middle East Technical University, 2020.

Walker, Brian, David Salt & Reid Walter. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington, DC: Island Press, 2006.

Walker, Brian & David Salt. *Resilience Practice: Building Capacity to Absorb Disturbance and Maintain Function*. Washington DC: Island Press, 2012.

UN. Secretary-General. *Report of the World Commission on Environment and Development*. 1–374, 2000.

Zurlini, Giovanni, Irene Petrosillo, Irene, Bruce K. Jones & Nicola Zaccarelli, Nicola. “Highlighting Order and Disorder in Social-Ecological Landscapes to Foster Adaptive Capacity and Sustainability.” *Landscape Ecology* 28(6): 2013, 1161–1173. https://doi.org/10.1007/s10980-012-9763-y.