

## Nature based zoning for the coastal area of Bursa

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### Abstract:

Man's demands on Turkey's coastline are increasing and this is common to coastal areas world-wide. This is because of population growth and economic development. Transport, industrial, housing, energy production and infrastructure development and tourism are transforming Turkey's coastal areas. Yet still these coastal areas are treated as if they are an unlimited resource. The answer is to plan development in relation to the coastal landscape's capacity, based on careful understanding of its character and the area's natural resources. Planning based on sustaining ecological integrity is a priority. This study proposes planning policies which identify different categories of zones and interaction between sub-zones. These will help define densities and location of sustainable land use development and management. In this way there can be a balance of conservation and development. The study focuses on the city of Bursa in the Sea of Marmara region because it can contribute to implementation of the 1/100000 Bursa Environmental Plan and because Bursa is the fourth largest metropolitan area of Turkey. As a result of this study the basic principles of planning and management are determined for ensuring the sustainability, and use types and densities of the region.

**Keywords:** *The balance of conservation and development, land use management, environmental management, coastal zones of interaction, sustainable landscape planning, Integrated Coastal Zone Management.*

### 1. Introduction

A "coastal land core area" includes beaches, dunes, coastal marshes, intertidal areas and rock platforms and is defined as the most sensitive environmental area (Sustainable Planning Branch New Brunswick Department of the Environment and Local Government 2002). The dunes and salt marshes act as barrier zones to protect the area from the impact of wind and waves and reduce the risk for public safety. Coastal salt marshes are the eco-systems that supports fishery, and purifies the water. These wetlands are protected by Ramsar Convention<sup>1</sup>. Developments in these zones damage the ecosystems and water quality.

The coastal zone is an area where terrestrial and marine ecosystems

interact with each other. They are some of the most sensitive ecosystems in environmental terms. They serve as natural buffers to reduce the impact of storm surges and flooding and dissipate the energy of wind and waves with dunes, barrier islands, salt marshes and beaches. These features also provide habitats for terrestrial and marine flora and fauna including endangered species. Therefore, a great number of environmental goods and services have been supplied by coastal areas through the transfer of matter, energy and living organisms between terrestrial and aquatic systems (Reid and Trexler, 1989; Reid and Trexler, 1991; FAO, 1998). However, coastal areas are not only of ecological importance, but also favorable for urbanization. Coastal areas are attractive recreation and tourism related development, because of its attraction as a landscape: paradoxically that very development can destroy the landscape. Beautiful views are destroyed.

Coastal areas have been attractive areas for many societies. In our century, the coastal zones have become even more important economically and socially. However, coastal areas are also under threat because of natural causes, anthropogenic actions (Charlier, Meyer, 1992). People often prefer coastal locations for settlements because they provide ease of coastal sea transport, they can host mixed economic activities such as industry, shipping and tourism as well as traditional resource-based economic activities like aquaculture, fishing, forestry and agriculture. They produce seafood (Burke, Kura, Kassem, Revenga, Spalding, et al. 2001). Coastal ecosystems are regions of bio-diversity and biological productivity with the ease of accessibility which makes them a centre of human activity. Natural resources have enabled economic and social development and played an important role relative to other areas. Human society prefers coastal zones for living also for its recreational potential and tourism. Tourism, which is the major income in coastal zone, is under threat because of coastal treat (Charlier, Meyer, 1992). Beaches are under threat of climate change based sea level rise and erosion (Phillips, Jones, 2006). The need to preserve these resources is vital for the sustainability of the region and the economy (Phillips, Jones, 2006).

At present, more than 50% of the world's population lives within 200 km from the coast (Kullenburg, 2001) and it is also predicted that by 2025 the world's population will be 8.5 billion and of this 75% will be living in coastal areas (Olsen et al., 1997; Small and Nicholls, 2003). Globally, the number of people living in the coastal zones increased from 2 billion in 1990 to 2.2 billion in 1995 - 39 percent of the world's population (Burke, Kura, Kassem, et al. 2001). The consequence of the increasing population and economic activities within and around coastal areas tend to increase the demand for employment, housing, energy, water and other goods and services (FAO, 1998). In this way, natural coastlines are transformed by housing, services, recreational and transport development, which leads to the degradation of biodiversity and natural habitats (UNEPA, 2005). Especially in developing countries, these areas are open to damage due to uncontrolled growth. Coasts face many environmental challenges from human settlement.

The rate of ecosystem change is directly proportional to population growth rates. As population grows in a coastal-area, so does the pressure on the ecosystem through the conversion of habitat, pollution and exploitation of coastal-based resources (Burke, Kura, Kassem, et al. 2001). According to UNEP, "it is estimated that almost 50 per cent of the world's coasts are threatened by development-related activities" (UNEP, UN-HABITAT, 2005).

<sup>1</sup> *The Convention on Wetlands (Ramsar, Iran, 1971) -- called the "Ramsar Convention" -- is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories.*

[http://www.ramsar.org/cda/en/ramsar-about-about-ramsar/main/ramsar/1-36%5E7687\\_4000\\_0\\_](http://www.ramsar.org/cda/en/ramsar-about-about-ramsar/main/ramsar/1-36%5E7687_4000_0_)

Pollution of coastal zones causes many problems such as damaged mangroves, coral reefs, seagrass beds, with consequent coastal erosion and consequent exposure to hurricanes, (including loss of lives) and loss of seafood resources (UNEP, UN-HABITAT, 2005). The pressure on coastal areas is not due just the number of inhabitants; pollution to rivers and water sources also affects the coastal habitats. As a result of the high pressures on coastal ecosystems and the services, the priority for reevaluation the different activities is increasing. The integration of a sustainability base, landscape resource evaluation into the planning process is for future coastal planning and managements.

A review of specific cases shows that urbanization in general and specific land uses like recreation (tourism) and industry are dominant triggers for coastal system deterioration (Hinrichsen, 1990; Burak et al., 2004). Coastal areas, with their rich and diverse ecosystems, are today under pressure from these uses. One attempt to minimize the impact of development in coastal areas is Integrated Coastal Zone Management (ICZM), which can be defined as 'continuous and dynamic processes by which decisions are taken for the sustainable use, development and protection of coastal and marine resources' (Cisin-Sain and Knecht, 2001; Pourebrahimet all, 2011). The 1993 World Coastal Conference defined Integrated Coastal Zone Management to involve a comprehensive assessment, setting of objectives, planning and management of coastal areas and resources, taking into account traditional culture and historical perspectives, and conflicting interests and uses. It aims to protect and assist decision making in relation to the natural, cultural, ecological and economic resources of coastal areas. In other words, ICZM is a tool that regulates the overlapping authorities, settles the disputes between users of coastal areas and provides a balance between environmental health and economic development. ICZM embraces coordination between municipal authorities and society, science and management, and sectorial and public interests. This management tool can play a significant role to achieving the environmental, economic, social and cultural objectives for the sustainable management of coastal zones.

Since the Industrial Revolution, the pollution has increased world-wide. One major consequence has been climate change, leading to sea level rise and serious impacts on coastal land. According to the Sustainable Planning Branch New Brunswick Department of the Environment and Local Government (2002), the best way to preserve the coastal zones is by limiting pollution which contributes to climate change. Such restrictions should be part of a package which should include coastal area management. The rationale is on the basis of the good of the environmental, public safety and economy. These topics are also current for Turkey.

In this study, Bursa is studied for two reasons. Firstly, because it is one of the most densely populated and economically viable urban-regions in the Sea of Marmara area; secondly, the Greater Metropolitan Municipality and the Special Provincial Administration of Bursa have been preparing the *Bursa 1/100.000 Environmental Plan (Bursa Çevre Düzeni Planı)* since 2011 and this study aims to contribute to this planning process in respect of the main principles of land use and protection of the coastal zone.

Consequently planning for new development and growth and the direction of growth demands to reflect existing resource constraints is critical to avoid irreparable damage to the natural environment. Thus, the coastal areas and

the urban fringe areas are primary areas of concern. Protection of the characteristic features of the area, parallel with land-use planning is urgently required. Consequently, this study aims to define the zones and sub-zones of influences and interaction precisely, as well as defining the main principles for land-use, protection and enhancement. For this purpose, the data concerning the basic components of natural structure, the environment and the environmental issues are initially organized, then analyzed through the use of Geographic Information Systems (GIS) and interpreted. Use of GIS provides the opportunity to manage large amounts of spatially related information and the ability to integrate multiple layers of information (Pourebrahim et al., 2011). The pressure on life-support systems and the earthquake and landslide risks of high seismicity constitutes the basis for the interpretation. And especial emphasis is put on land use planning and environmental management of agriculture, industry, services, transport and logistics. The study concludes by proposing land-use measures and protection guidelines for the coastal zone and the areas of influence by reference to the characteristic zoning and sub-zoning.

## **2. An overview to Bursa and coastal settlements**

Turkey, with its abundance of varied resources along its lengthy coastline, is bounded by three major seas: The Black Sea in the North, the Aegean Sea in the West and the Mediterranean Sea in the South. In addition in North Western Turkey, there is the largely land-locked the Sea of Marmara. Coastal urbanization in Turkey follows the pattern of urbanization in developing countries with coastline. In Turkey, the majority of the population and the economic activities are located in coastal areas, and coastline of the Sea of Marmara is the major attraction for both human settlement and related economic activity. Istanbul is the largest metropolitan region in Turkey and is one of Europe's four megacities with a population of over ten million; and Bursa as the fourth largest metropolitan area of Turkey are the major settlements surrounding the Marmara Sea. The Marmara Region with a population of nearly 22 million (21,887,360 in 2010) has 30% of the total population of Turkey in 8.6% of the country's area (Figure 1).

### **2.1 Coastal districts of Bursa; Gemlik, Mudanya, Karacabey**

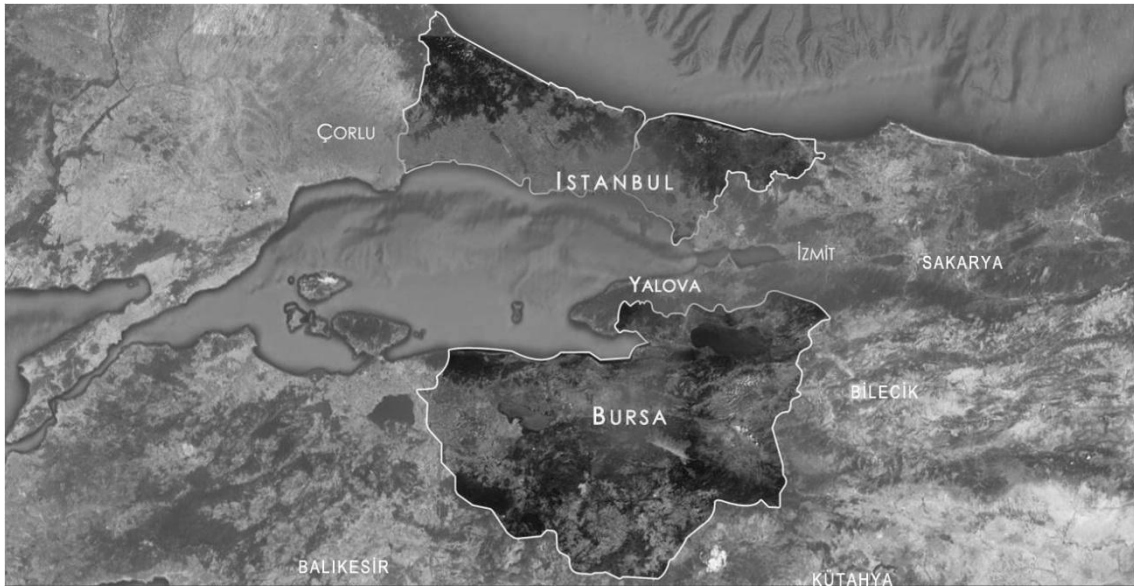
Bursa is in the Southern part of the Marmara Sea Region. To the North is Yalova; Kocaeli and Sakarya are to the Northeast; Bilecik is to the East, and Kütahya and Balıkesir to the South (Figure 2). Bursa is one of the most important industrial cities of Turkey with the second-largest exports after



**Figure 1.** Location of the Marmara region in Turkey.

Istanbul. Bursa is one of the strategic urban-regional agglomerations in terms of economy, population, culture, nature and the development along the coastline of the Sea of Marmara. Today, Bursa is adversely affected by ill-advised use of land and resources as part of a process of uncontrolled urban growth. Therefore, planning is on the agenda in order to meet the social, economic and recreational demands of the growing population of the metropolitan area itself, and also of visitors whether for tourism, commerce, cultural, administration or scientific purposes.

The Sea of Marmara Coastal Zone, within the boundaries of the Bursa metropolitan area, is a priority area with its characteristic features of topography, vegetation, wetlands and crops such as olive groves. The relationship between the terrestrial and aquatic ecosystems; in terms of economy, urban development, population and administration is built upon the three coastal districts of Gemlik, Mudanya and Karacabey (Figure 3).



**Figure 2.** Location of Bursa.



**Figure 3.** Location of Gemlik, Mudanya and Karacabey in coastal zone of Marmara Sea.

### 2.1.1 Gemlik

Located on the coast of the Gulf of Gemlik, Gemlik district is surrounded by mountains, and only partially open to the Marmara Sea on Western parts of the district. On the East of this closed basin, the district of Orhangazi is located, and on the West Mudanya bounds Gemlik. The economy of the district is primarily agricultural, with olive cultivation especially important. In addition to agriculture, there is also considerable industry. The district hosts five major industrial facilities and nearly hundred industrial facilities of various scales (Gemlik Municipality Website, 2012). In addition, the Gempport, located within the district of Gemlik, provides an important hub for import and export for Bursa as well as other industrial districts in the region (Gempport Website, 2012). The Gemlik is also an important passenger port. Furthermore, Gemlik is a centre for tourism. Within this context, the vibrancy of agriculture, industry, tourism and services sectors attracts immigration, and the population is increasing.

The economic dynamism of the district, inevitably, leads growth. However, as being surrounded by mountains on the three sides and developed on the alluvial soil, the district carries high risk of earthquake. Thus, urban growth should be carefully planned.

### 2.1.2 Mudanya

Located in the vicinity of Organized Industrial District<sup>2</sup> of Bursa, Mudanya is one of the most important industrial centres within the region. The district is also an important port for sea-borne exports and imports, and passenger transport. Along with being an important port, Mudanya is also an important transport hub in terms of railway and highway transport. The Bursa-Mudanya railway line, built in the Ottoman times, is a node of international and trans-continental transfers of industrial and agricultural goods for the region. As freight transport from Mudanya port has grown, especially in recent years so traffic has increased on the Bursa-Mudanya line (Dostoğlu, N. et al, 2007). Additionally, tourism is another economically significant sector and leads to an increase in the summer population of the district.

The coastline of the district is 42 kilometres, long and the coastline of the district centre is approximately 10 kilometres. The coastal land uses consist of residential, summer housing, commercial, industrial, transport and recreational uses, along with the long and wide natural sandy beaches of Zeytinbaşı and Yeniköy.

Mudanya is a linear settlement along the coast, 400-500 m wide, because the steep slopes of the mountains to the south limit development. The topography and limited area for developed on the West has led to growth to the East, towards Güzelyalı. The urbanization is characterized by the construction activity concentrated on Güzelyalı. However, it is not possible to define the urbanization trends as planned and controlled.

Similar to Gemlik, Mudanya is also at high risk of earthquakes, due to being located on the Northern Anatolian Fault; therefore uncontrolled development of concern should be halted, and future development should be properly planned to be earthquake resistant and avoid landslide areas.

### 2.1.3 Karacabey

Karacabey district is at the crossroads of the Bursa- Çanakkale, Bursa – Balıkesir axes and İzmir. The economy is composed of industry, agriculture,

<sup>2</sup> Organized Industrial Zones are areas with necessary infrastructure dedicated to industry. The aim of these Zones is to ensure that industrial activities are carried out in appropriate places; to act as guides towards urbanization; to prevent environmental problems; to benefit from information and informatics technologies; and to enable manufacturing industries to locate and develop according to a pre-defined plan. There are 107 OIZs in Turkey, with their site selection, their expropriation, and their infrastructure completed.

<http://www.yoikk.gov.tr/dosya/up/eng/OIZ-son.pdf>

commerce, transport and service sectors. However, the area is not as developed as Gemlik and Mudanya. In the Southern and Northern parts of Karacabey, there is industry particularly food industry. In the 1990s and the 2000s, as a consequence of developments in the field of agro-industry, the district experienced rapid increase in population and this continues (Karacabey Municipality Website, 2012).

In contrast to Mudanya and Gemlik, Karacabey has mainly developed away from the shore. In Karacabey, there are cliffs and small bay formations along the coastline, especially between Malkara and Kurşunlu, while to the south the Karadağ Mountains lie parallel to the sea. To the East of Yeniköy, there is also a small delta plain formed where the River Kocadere meets the sea. Within this delta plain, on both sides of the river, there are two lagoons called ArapÇiftliği and Dalyan (Karacabey Municipality Website, 2012).

Unlike Gemlik and Mudanya, the district of Karacabey is less affected by the urbanization influence of the Bursa metropolitan area and maintains its natural character. As explained above, this is due to the fact that the coastal areas, located within this district, are limited by the topography. However, the pollution by residential and industrial waste of the River Nilüfer contaminates the groundwater of the delta area.

The pollution, and the land use changes caused by population growth in the coastal zones in Marmara are the major problems, they significantly alter the coastal ecosystems.

### **3. Datas and method**

To promote the sustainable use of coastal zone resources and to lessen human pressure on coastal systems requires ecological planning. This addresses ecosystems. Firstly needs to understand the relationships between social, economical and environmental systems. This study aims to define the zones and sub-zones of influences and interaction in the Bursa Coastal Zone, as well as defining the main principles for land-use, protection and enhancement. For this purpose, the data concerning the basic components of natural structure and the environment are based on the data-sets of the 1/100.000 scale Bursa Environmental Plan. Then has followed analytical researches of the geology, geomorphology, hydrology, hydrogeology, forestry, ecology, soils, land use, climate and environmental issues, consultants' reports, researches on the natural structure of Bursa and strategic plans at the provincial and regional levels. All these datasets have then been analyzed using Geographic Information Systems (GIS) which provide the opportunity to manage large amounts of spatially related information and the ability to integrate multiple layers of information (Pourebrahim et al, 2011). Lastly the information has been interpreted. The study concludes by proposing land-use measures and protection guidelines for the coastal zone and the areas of influence by reference to the characteristic zoning and sub-zoning.

This study follows four sequential steps.

- First, all data sets of natural resource components have been evaluated. Subsequently, contour mapping, and maps of geomorphology and quantitative hydrogeology, water sources, landslide and, high potential of liquefaction areas, forest areas, presence of

forest, soil and land use, protected plain areas have been studied, overlain and interpreted.

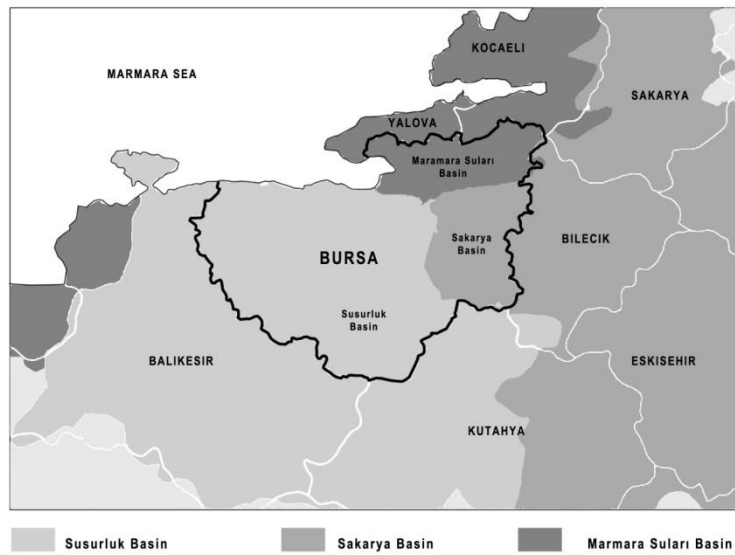
- Second, the borders of the Bursa Marmara Coastal Zone have been determined by utilizing the map of surface water basins and topography map.
- Third, natural structural properties and interactions within the coastal area have been defined, and
- Fourth, land use and possible development areas have been defined and evaluated.

#### 4. Evaluation

This method addresses regional scale, sub-regional scale and the specific site scale (Marmara coastal area of Bursa) according to the natural thresholds.

The city of Bursa is located in three different surface water basins, which are identified by topographic thresholds. These basins are the Susurluk Basin, the Sakarya Basin and the Marmara Suları Basin (Figure 4). These basins form different zones of interaction. These zones include other subsidiary catchment areas. Bursa consists of seven sub-water catchment areas according to the topographical thresholds (Figure 5). These sub-regions are Karacabey-Mudanya-Gemlik Sub-Region, Gemlik Kuzey Sub-Region, İznik Sub-Region, Nilüfer Sub-Region, Uludağ Sub-Region, Yenişehir-İnegöl Sub-Region, Büyükorhan-Harmancık Sub-Region.

Following the determination of water catchment boundaries within which the natural interactions are mostly encountered; the contours, geomorphology, agricultural land classification, quantitative hydrogeology, water source, landslide and high risk liquefaction areas maps, produced under the 1/100.000 scale Bursa Environmental Plan, are evaluated (Figure 6-10).

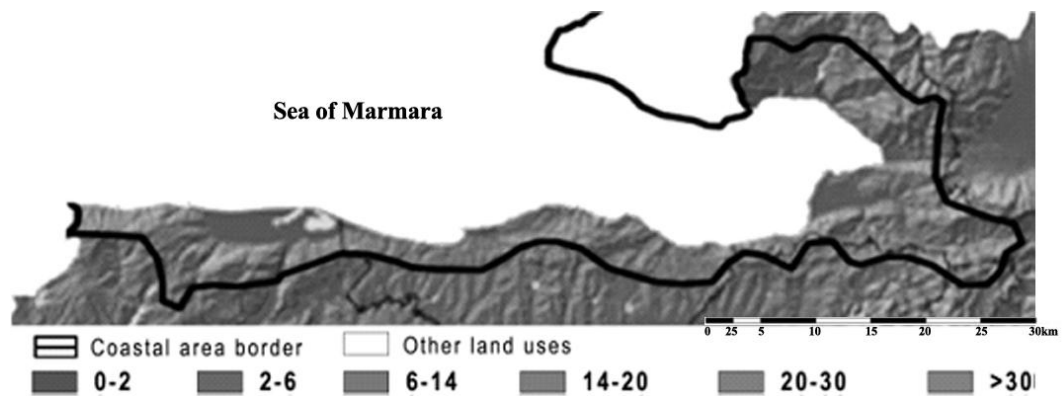


**Figure 4.** Surface water basin system in the Bursa area.

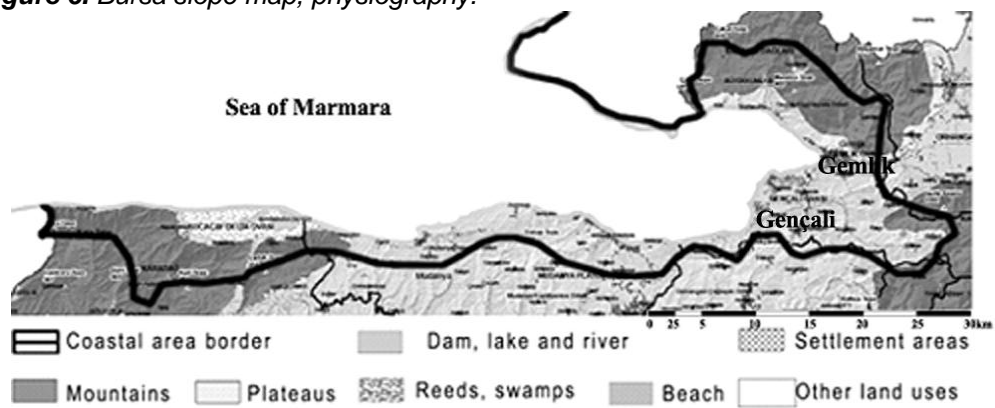


**Figure 5.** Evaluation of sub water catchment areas of Bursa.

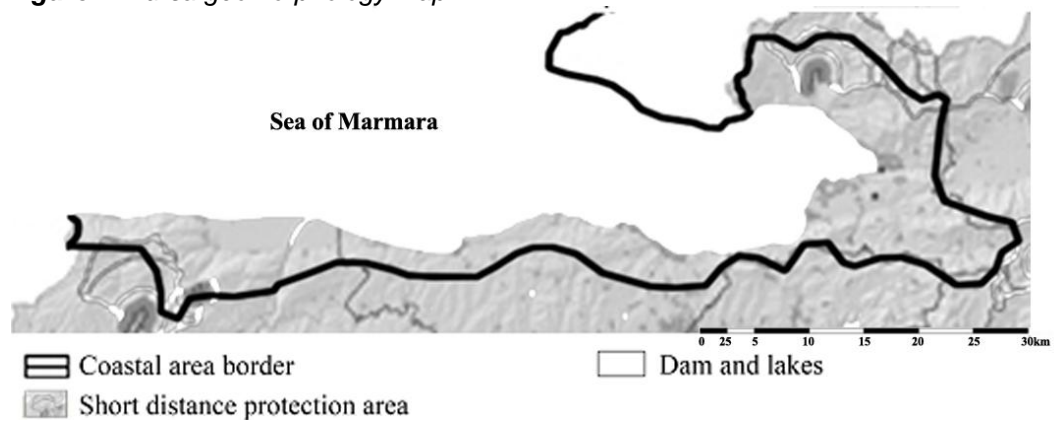




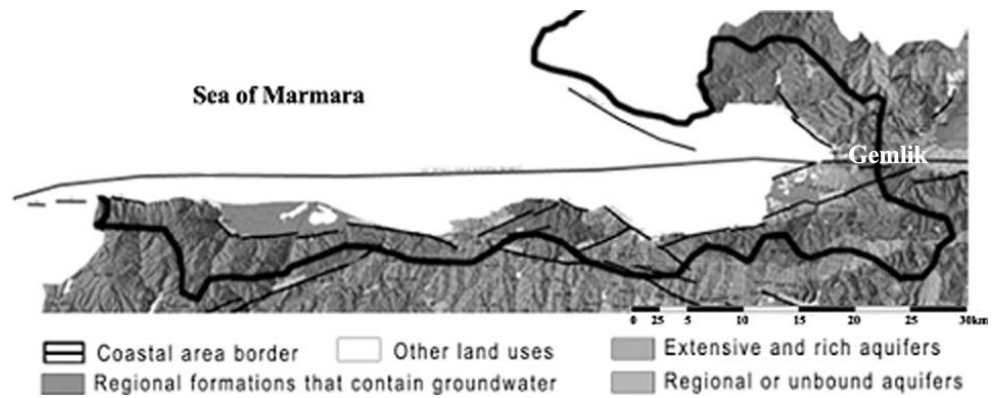
**Figure 6.** Bursa slope map, physiography.



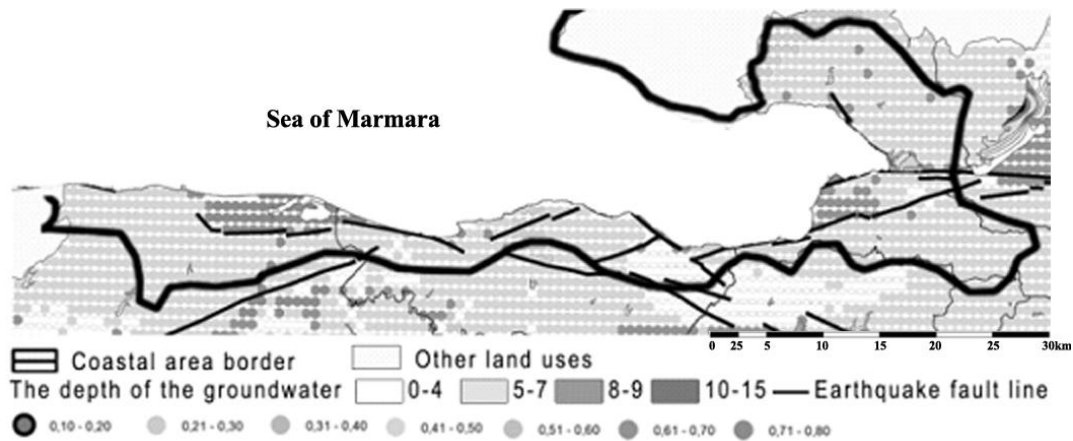
**Figure 7.** Bursa geomorphology map.



**Figure 8.** Bursa watersource map.



**Figure 9.** Bursa quantitative hydrogeology map.



**Figure 10.** Bursa high risk of liquefaction areas map.

#### **4.1 Multilayered ecosystem model**

The topography is very varied, with hills and flat plains (Figure 6). Within the Coastal Zone, the areas where the Port of Gemlik and the Delta of Kocaçay are located appear in the 0-2° slope group. The other important area of consideration, also included within this relatively flat, low slope group, is the narrow coastal strip between the delta of Kocaçay and Zeytinbağı.

The Plateau of Mudanya (Figure 7), located along the coastline between the mass of Karadağ in the West and the elevations of mountains in the East, constitutes the dominant feature of the coast-line. Despite being smaller, the lowland plains are as important topographically. These plains are located in the delta of Kocaçay and Gemlik (the plains of Gemlik and Gençali).

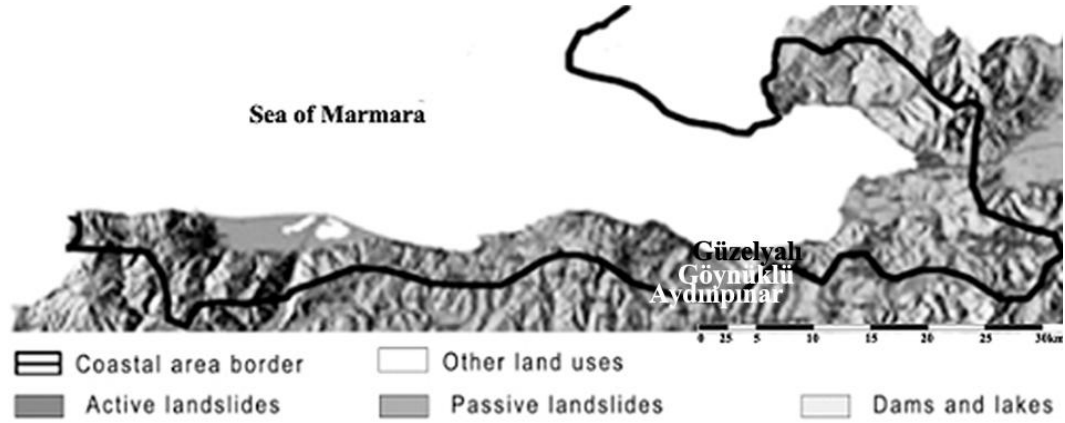
The area is rich in water resources. The two drinking water dams and water collection basins, which are located in Kocaçay and Karadağ Creek, are the main surface water resources in the area (Figure 8). In addition, there are two geothermal resource areas within the boundaries of Gemlik district.

The groundwater map (Figure 9) indicates regional formations that contain groundwater and formations that do not contain groundwater. There are also a limited number of regional or independent aquifers. Furthermore, the two important focal points, in terms of groundwater, that reveal the characteristics of extensive and rich aquifers are located in the Delta of Kocaçay and Gemlik.

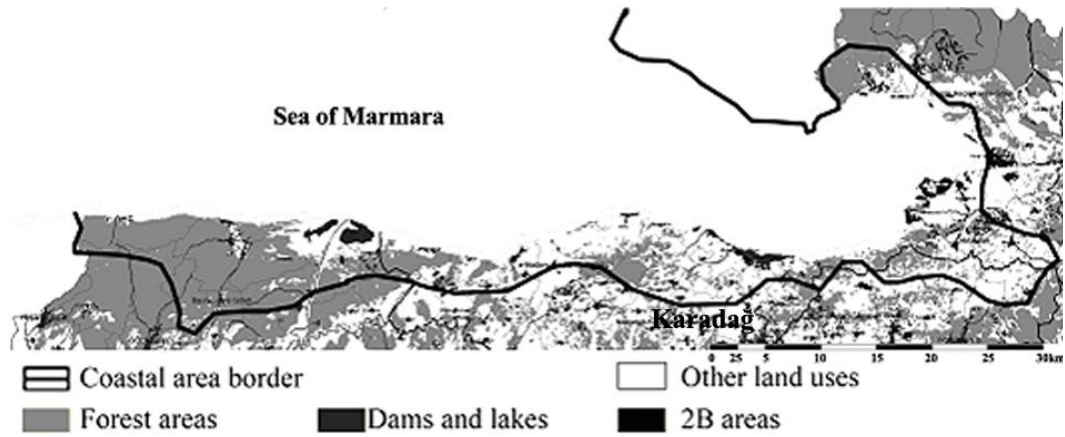
Within the zone of influence of the Northern Anatolian Fault, there is a high risk of liquefaction especially in alluvial soils. The coastal zone risk of liquefaction map (Figure 10) shows that the potential risk areas are concentrated along Kocaçay Creek and Gemlik. Additionally, the evidence from the landslide map of the coastal area (Figure 11) shows that there are no active landslide areas in the area; however, within the territories of Göynüklü and Aydınpinar, located in the South of Güzelyalı, passive landslide areas are encountered.

There is a strong and continuous forest on the Samanlık and Karadağ Mountains, and forest areas also exist all along the coast albeit partial and fragmented (Figure 12). Taking the land use capability (Figure 13) and the agricultural uses (Figure 14) of the coastal zone into consideration, parts of Bayramdere, Zeytinbağı and Gençali are classified as

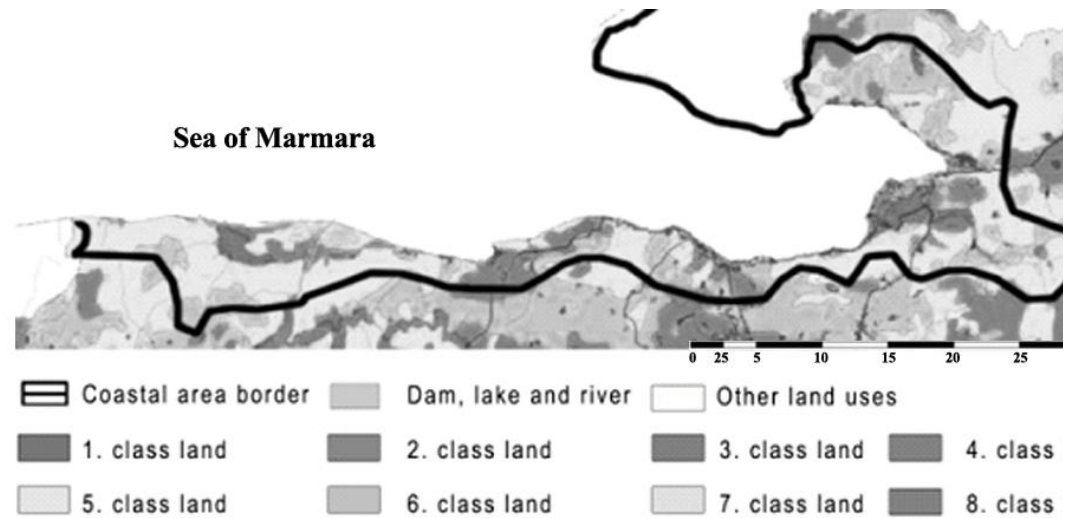
first class lands; while, except for the forest and urban areas, most of the coastal zone is agricultural land. The cultivated agricultural fields are mostly olive groves and are located within Gemlik and Mudanya.



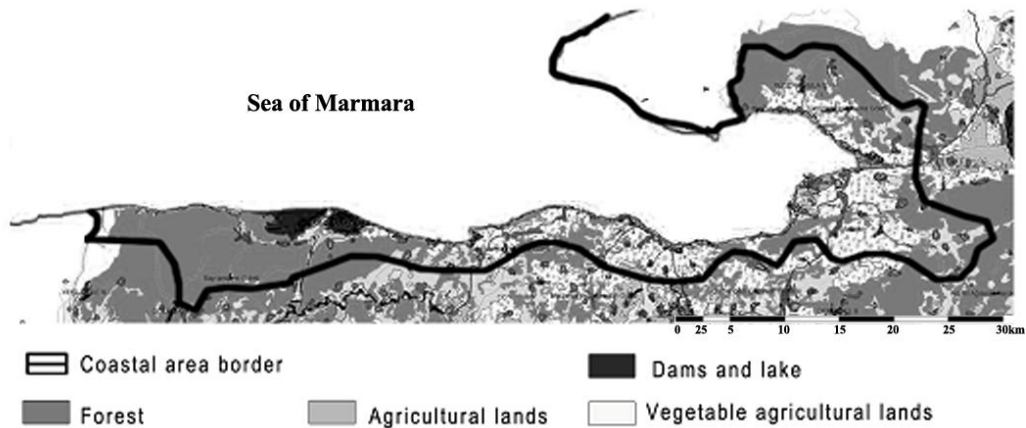
**Figure 11.** Bursa landslide map.



**Figure 12.** Bursa forest area map.



**Figure 13.** Bursa land capability classification.



**Figure 14.** Bursa agricultural lands.

## 5. Findings

The coastal zones of interaction, are broadly defined by reference to natural thresholds or administrative boundaries, and should be defined more specifically. In the case of Bursa, this more specific definition can be realized within the frame of two main zones and their sub-zones. The reason behind this zoning and sub-zoning is to advance the degree of interposition in terms of land use patterns and natural protection as well as stating the degree to which urbanization has penetrated to the balance of use and protection of natural assets, regardless of the administrative boundaries, and contrary to the benefits of enhancement of natural resources.

The first zone can be defined as '**the primarily urbanized area**'. The sub-zones in this zone are the coastal Gemlik, coastal Mudanya sub-zones and the agricultural buffer sub-zone. The main characteristics of the primarily urbanized area are shaped by the influence of the urbanization of Bursa.

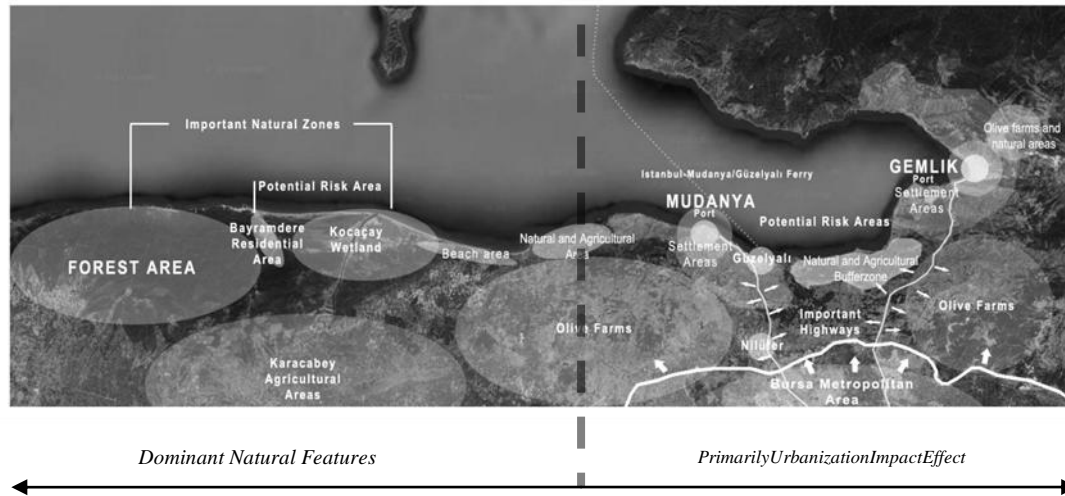
Historically, the urbanization of the Bursa Metropolitan region, along with the development of industry, transportation, infrastructure and the logistics in the area, have directly influenced the urbanization dynamics of Gemlik and Mudanya. Therefore, uncontrolled urbanization have led to the excessive use of the natural resources and put pressure on the coastal ecosystem of Gemlik and Mudanya as well as the third sub-zone of coastal agricultural fields. This constitutes a matter of intervention as the agricultural buffer zone which forms an ecological corridor between two rapidly developing zones and an ecosystem of fertile lands for cultivation.

The second zone consists of the areas that are relatively less affected by the pressures of urbanization of the Bursa metropolitan area. Unlike the primarily urbanization impact zone, the existence of strong natural thresholds shielded the area from the strong influence of urbanization. Therefore the zone is characterized by the dominance of natural assets and can be named as '**natural cultural landscape**'. This zone hosts an important wetland ecosystem, forests, dunes, beaches, fertile soil resources, thus agricultural areas. This zone embodies the sub-zones of agricultural and natural sub-zone (neighbour to Mudanya sub-zone of the strong urbanization impact zone), the beach and summer houses area (right next to the agricultural and natural sub-zone), Kocaçay wetland and its vicinity, Bayramdere residential axis, and lastly the forest area located at the administrative boundaries of Bursa and the city of Balıkesir (Figure 15).

The dominant natural features zone, the pressure of Mudanya's development towards the Karacabey axis requires consideration of these two sub-zones inter-rationally. In addition to this, Bayramdere is a focal point of attention in the zone. Bayramdere is located between the forest areas and the Kocaçay sub-zones and is subject to both residential and summer housing development and the use of pesticides for agricultural purposes in the area.

Another concern is the environmental management and protection. In the coastal zone of Bursa, urban environmental management should be applied to reduce the impact of human especially in Gemlik and Mudanya. With this way, reduce of urban extension and marine pollution on natural-cultural landscapes will be possible.

In Bursa coastal area, within the scope of protection, sensitive ecosystems (wetland, sand dunes), forests, and life support systems such as soil and water sources are the main issues to focus on. In this context, forest, agricultural lands, dunes, wetland and natural system interactions should be conserved. The areas exist in natural-cultural landscape zone and Bursa coastal area. In this area to provide the conservation, the natural border of surface drainage water connected to surface water should be considered. The integrity is seen in the clusters in Figure 16. With this approach, life support systems can be conserved considering the direct and indirect



**Figure 15.** Bursa coastal interaction zones and sub-zones.



**Figure 16.** Sub-zones in Bursa coastal area.

interactions. So, the interaction of two main zones in the east-west direction with north-south direction can be considered in the coastal area of Bursa.

## 6. Conclusion

First strategic approach of 1/100000 Bursa Environmental Plan is sustainability. However, there is a need of sub-zoning study, based on natural integrity, in order to reflect the environmental, economic and social dimension of sustainability, considering current and potential land use in Bursa coastal area. The study is based on this purpose. The sub-zoning is purposed by considering the natural integrity, to remove the gap between planning approach and current trend and to provide the sustainability. The main theme of the purpose is to define the living area in a manageable scale. In this way, Karacabey-Mudanya-Gemlik Sub-Region, an urbanized area along the coast with different natural and cultural landscape features which is one of the seven sub-regions defined to contribute the 1/100000 Bursa Environmental Plan, is divided into 10 sub regions. With this classification, it is indented to define type and density of the development without damaging the ecological integrity to ensure the sustainability of each sub-zone.

Hence, it is necessary to develop **inter-relational criteria for**,

- 1) The protection and use balance of the zones and sub-zones, scientific and technical studies to define the carrying capacity and natural fragility within the border.
- 2) Providing the scientific research integrity as much as ecological integrity in sub-scale studies and encouraging the multi-disciplinary studies
- 3) Assessment for the environmental impacts of the possible development trends of the existing uses and possible potential uses, examination of national, regional and local development decisions in detail in the zone. Definition of development decisions and the preventions.
- 4) Preparing and dissemination the environmental action plans specific for each zone, in this way ensuring the sustainability of functions, and sustainable use of areas.
- 5) The governance, ensuring the management of sub zones in the main coastal zone under the main principles of **sustainability** and a **holistic approach**.

With this study, zoning proposal based on nature will contribute on defining the success criteria for sustainable development, visibility of the success and providing the sustainability. In the study area, start of the ICZM and take advantage of the world's experience will be guide to provide the sustainability of planning studies of Bursa coastal area in every scale.

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### **Bursa kıyı bölgesinde doğa temelli kuşaklama**

Kıyı alanları, dünya üzerindeki en hassas ekosistemlerden biri olup, hem karasal hem denizsel flora ve faunayı barındıran doğal tampon alanlardır. Ekolojik öneminin yanı sıra, kentsel gelişime paralel olarak rekreasyon ve turizm açısından da çekici arazilerdir. Ekonomik ve sosyal açıdan gelişime açık olan bu alanlar, maalesef ki günümüzde antropolojik etkenler yüzünden doğal kaynakları büyük tehdit altında kalmıştır. Dünya genelinde kıyı alanlarında yaşayan nüfus giderek artmaktadır; nitekim gelecek on yıl içerisinde nüfusun yaklaşık dörtte üçünün kıyı alanlarında yaşayacağı öngörülmektedir. Bu bölgelerdeki artan nüfus, konut, enerji, su ve diğer hizmet ihtiyaçlarını da beraberinde getirmektedir. Bu bağlamda dönüşen doğal kıyı alanları, biyolojik çeşitliliğin ve doğal yaşam alanlarının bozulması ile yüz yüze kalmaktadır.

Tüm dünyada olduğu gibi, Türkiye'nin kıyı alanları üzerinde de nüfus artışı ve ekonomik gelişime bağlı olarak her geçen gün talep artmaktadır. Ulaşım, endüstri, yerleşim, enerji üretimi, altyapı gelişimi ve turizm Türkiye'nin kıyı alanlarını

değiştirmektedir ve bu alanlar tükenmez kaynaklar gibi ele alınmaktadır. Ancak doğru olan, kıyı peyzajının karakterini ve kapasitesini anlayarak doğal kaynakları koruma üzerine plan geliştirmektir. Planlama süresince, ekolojik bütünlüğün sürdürülebilmesi temel amaçtır. Bu çalışmada sürdürülebilir arazi kullanımı geliştirilmesi ve yönetimi için yoğunlukların ve konumların belirlenmesi doğrultusunda farklı kategorilerde kıyı ve etkileşim alanı içerisinde bulunan alt bölgelerin tanımlandığı planlama ilkeleri önerilmiş, koruma ve geliştirme arasında denge kurulması hedeflenmiştir. Çalışma kapsamında Bursa iki amaçla ele alınmıştır. Öncelikle Marmara Kıyı Bölgesi'ndeki en yoğun nüfuslu ve ekonomik açıdan gelişmiş kentsel bölgelerden biridir. Diğer neden, Bursa Büyükşehir Belediyesi ve Bursa İl Özel İdaresi 2011 yılından beri Bursa Çevre Düzeni Planı'nı hazırlamaktadır. Bu çalışmanın verileri ile planlama sürecine arazi kullanımı ve kıyı alanının korunması adına planlama sürecine katkıda bulunmak hedeflenmiştir.

Türkiye'nin 4. büyük metropolü olan Bursa büyümenin etkisi ile hatalı alan ve kaynak kullanımının giderek arttığı bir il konumundadır. Bursa'da giderek artan nüfusun, ayrıca Bursa'yı turistik, ticari, bilimsel vb. farklı amaçlarla ziyaret eden kesimlerin sosyal, ekonomik, rekreasyonel ihtiyaçlarının karşılanması amacıyla çok yönlü kullanımlar gündeme gelmektedir. Söz konusu kullanımlar ve potansiyel kullanım eğilimlerinin öngörülmesi ve talebin kaynak kısıtları doğrultusunda yönlendirilmesi geri dönüşü olmayan girişimlerin engellenmesi açısından büyük önem taşımaktadır. Bu kapsamda, Bursa için halihazırda son derece önemli bir kullanım alanı olan ve eğilimlerin yoğun baskısı altında kalan Marmara Denizi kıyıları ve etkileşim zonları öncelikli alanlar arasında yer almaktadır.

Bursa İli'nin Marmara Denizi kıyıları topografik özellikleri, doğal bitki örtüsü, sulak alanları, yörenin karakteristik özelliği haline gelen zeytin gibi özel ürün arazileri ile özgün bir yapı sergilemektedir. Ancak, alanın özgün yapısının korunması ve kullanımların da bu doğrultuda yönlendirilmesi aciliyet arz etmektedir.

Yürütülen çalışmada kıyı kesiminin özgün yapısının korunması ve kullanımında öncelikle etki ve etkileşim sınırlarının tanımlanması ve bu sınırlar içerisinde dikkate alınması gereken temel ilkelerin saptanması amaçlanmıştır. Amaç doğrultusunda, temel doğal yapı bileşenleri ile çevre sorunlarına ilişkin veri ve bilgiler derlenerek Coğrafi Bilgi Sistemleri temelinde analizler ile yorumlanmıştır. Yorumlamalarda yaşam destek sistemlerinin üzerinde oluşan baskılar ile deprenselliğin yüksek olduğu bu bölgede olası riskler etkin yönlendiriciler olmuştur. Bursa kıyı kesiminin tarım, sanayi, hizmetler, ulaşım, lojistik gibi sektörelbazlı önemi de göz önünde bulundurularak arazi kullanım ve çevre yönetimi kapsamında değerlendirmelerde bulunulmuştur. Çalışma sonucunda sürdürülebilirliği sağlamak açısından bölgenin kullanım çeşitliliği ve yoğunlukları planlama ve yönetim konusunda temel ilkeler belirlenmiştir. Kıyı alanları ve etkileşim alanlarının karakteristik zonlarını temel alarak bu alanlar için arazi kullanım önlemleri ve koruma ilkeleri belirlenmiştir.