Land Use and Risks in Yalova After the Earthquake

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Abstract
The urbanization emerged with the industrial society transition from agricultural society, resulted in destruction of natural structure in consequence of the rise of structuring depend on population growth and efforts for constitution of settlement. Yalova is the province where sectors of tourism, industry and agricultural are developed because of its location and morphological characteristics. Yalova experienced the earthquake in 1999 disastrously and it was milestone for Yalova. After earthquake, Yalova was third province that had more loss of life and property. It was exposed to illegal housing due to the sustained migration, also lack of sanctions in the legislation, location of near the fault line and the density of residential in unsuitable geological areas increased the damage of city. Disaster areas were seen on the coastal and alluvion ground as a result of the earthquake. Today, it is observed that geological and ecological features of city are usually ignored in the proposal planning decisions and identities such as city of industry, agriculture, tourism for Yalova. The earthquake risk should not forget in planning studies. So, in this study change of land use and earthquake risk in the city are discussed.

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Deprem Sonrası Yalova’da Arazi Kullanımı ve Riskler

Özet
1. Introduction

Earthquake, regarded as a natural disaster, has affected the whole environment since the existence of life on earth and led countries and cities to be caught unprepared. Severe and more severe earthquakes can cause losses of life and property depending on the quality of structuring and land use conditions on settlement scale. With a growing world population and increasing urbanization, new research shows that populations are becoming more vulnerable to death and injury from large earthquakes in the past 50 years (Peek-Asa et.al, 2003). Variation in the number of deaths caused by earthquakes of different magnitudes can be attributed to building codes, location of victims, epicenter location, and other factors (Tanga et.al, 2017). In particular, wrong land use decisions have increased these losses. The costs caused by natural hazards are rapidly increasing in urban area, particularly in developing countries, where a number of megacities are growing (Li et.al, 2017). Cities in the developing world are facing increased risk of disasters and the potential of economic and human losses from natural hazards is being exacerbated by the rate of unplanned urban expansion and influenced by the quality of urban management (Tarhan et.al, 2016).

According to the Earthquake Result Report issued by Ministry of Public Works and Settlement (currently called as the Ministry of Environment And Urbanization) in 2004; "In Turkey where 93% of the territory and 98% of the population are affected by various earthquakes, social and economic losses caused by earthquake disaster require to take very serious measures. Because 182 disastrous earthquakes occurred and nearly 100.000 people lost their lives in Turkey between 1900 and 2003. In addition to the irreversible consequences of losses of life and property, losses of national wealth and losses of income in national product that constitute our macroeconomic losses also cause important threats for the future" (www.imo.org.tr). Therefore, in order to minimize the losses arising from earthquakes, it is very important to take various measures at every stage from country scale to urban and building scale.

After Izmit Gulf and Düzce earthquakes that occurred in Marmara Region in Turkey in 1999 and caused damages in many cities, and the rules, standards, laws and regulations have been set to minimize the hazards caused by earthquake and other natural disasters and to include what to do after these disasters. In addition to legislative regulations such as Compulsory Earthquake Insurance No. 587, Decree Law on Building Inspection No. 595 ad Decree Law No. 601 which regulates competent engineering concept, various measures have been tried to be taken by different legislations such as the Regulation for Buildings to be Built in the Earthquake Regions in 2007 and the Law on Conversion of the Areas Under the Disaster Risk in 2012 in order to reduce the risk of earthquake.

Yalova selected as the study area is a province with the smallest surface area of Marmara Region in Turkey and it is located in the first-degree earthquake zone. The city which experienced the earthquake in 1999 disastrously, face with the risk of future earthquake emphasized by many researchers.

Yalova is bordered by the Sea of Marmara in the north. This border has led to the fact that the western coasts of the settlement have natural beaches in some places
and these areas are used as a summer resort. When it was a district of Istanbul in 1930, it became province in 1995 and started to be attractive for investors. Yalova has six districts as Çınarcık, Altınova, Çiftlikköy, Armutlu, Termal, and Central District. Being renowned for its hot springs, the city is a settlement which mainly tourism in the west, industry in the east, and agricultural sectors in the south develop.

Yalova has advantages as being neighborhood with Istanbul, Kocaeli and Bursa; whereas, it has disadvantages as being in development pressure of Istanbul, the effects of industry in Istanbul and Kocaeli, and locating in interaction area for major projects and investments in the region. This situation brings economic return but affects negatively the conservation-use balance in spatial development. The city has been exposed to the increase in population and it has had an irregular development because of incorrect planning decisions. This lead to housing of unsafe areas in terms of ground conditions as well as destroying of agricultural lands, irrigation areas, coasts, and forests in Yalova,

The major earthquake occurring in Marmara Region in 1999 was milestone for Yalova as was for whole region. Effects of uncontrolled development appeared with the major earthquake. As a result the earthquake, Yalova was third province where the most losses of life and property were experienced. Even though today identities such as city of industry, agriculture, and tourism are attributed to Yalova, geological, topographic, and ecological features of the city have been usually ignored in the proposal planning decisions. When planning and land use decisions of Yalova that is located in the first-degree earthquake zone and faces with earthquake risk are evaluated, it is seen that it has significant risks. The study discusses the spatial distribution of plan decisions prepared for a city that carries such a risk after the earthquake disaster.

2. Results and discussion

Yalova is the province that is located in Marmara Region in Turkey and has the smallest surface with an area of 847 km². Yalova is bordered by Marmara Sea and Istanbul in the west and north, Kocaeli in the east, and Bursa in the south (Figure 1).
It has a feature as being the transition point between three major cities. Except for plains on the east coasts, it has a mountainous terrain whose altitude rises towards west and south. Yalova, located within the circle of the North Anatolian Fault line, is located in the 1st degree earthquake zone (Figure 2).

Population in the center of Yalova was 2635 in 1935 and followed a stable trend until 1955 and after this year, the population started to increase (Taner, 1997). The population of the city center start to exceed the population of villages in Yalova in 1975. Location of Yalova between Kocaeli-Istanbul-Bursa, development of thermal spring and summer tourism in the region, and facilities brought by marine transport have lead to development and changing of the province and also the increase of population.

The Marmara Sea coastal strip of the city is a natural beach. Yalova was a touristic suburban and rich neighborhood of Istanbul and was dependent to Istanbul (Bahadır, 2007). Once it became province in 1995, its growth rate increased significantly in terms of urbanization such as education, health, and housing and the city has become a center of attraction (Güner, 2006). The population growth rate of the city increased approximately double between 1990 and 1997 and while general population was 113,417 in 1990, it increased to 163,916 in a seven-year period (www.yeniumitilkyardim.com).

A 7.4-magnitude earthquake occurred as a result of breaking of the North Anatolian Fault Line in Marmara Region in 1999. With this earthquake, many buildings demolished and deaths occurred in the city. According to the data, 2,496 people lost their life (DPT Müsteşarlığı, 1999) and many people left from the city in
the earthquake. However, fear of earthquake and its psychological effects on people who left from the city have decreased and migrant population began to come back to city as a result of revival of the construction sector for decreasing effect of earthquake in a short time, relatively positive impact of tourism, construction of permanent housing, and renovation of damaged buildings. The population of Yalova, which was 168,593 in 2000, reached to 241,665 in 2016 (TUİK, 2014).

The economy of Yalova is based on industry, agriculture, and tourism (Figure 3). Shipyards are located in the east of the province and Yalova is ranked as the second in Turkey in terms of the number of shipyards. This situation makes important contributions to the economy of the province.

**Figure 3. Tourism, Industry, and Agricultural Areas in Yalova**

![Tourism, Industry, and Agricultural Areas in Yalova](image)

Reference: www.alasayvan.net

60% of total area in Yalova comprises of forests, sea and geothermal water resources and 25% comprises of agricultural lands and the tourism potential has come to the forefront in Yalova. Tourism activities begin to be intensive in April and September (TUİK, 2013). In Yalova, summer tourism is important and there are intensive summer sites on the coastline of Çiftlikköy and Çınarcık in particular. Also, hot springs in Termal and Armutlu are among sources of income in tourism. Coastal line, the Delmece Plateau, Erikli and Suduşen waterfalls, and hot springs are important areas in terms of tourism incomes of the province (MARKA, 2010). Agricultural production areas are intensive in the district of Çiftlikköy.

In the light of all of these results, identity of Yalova as industry in the east and tourism in the west has advantages and disadvantages of being located in the middle of three large cities. It is seen that it is under pressure of development and the influence of decentralization of industry in Istanbul, is affected by great projects as Gulf Crossing Bridge and Connecting Highway Project, and remains under pressures of industry in Kocaeli with other great investments. These pressures make the city attractive for the population, increase the areas of
settlement, and cause to expand the spreading areas towards the areas which are not suitable for the construction.

2.1. Planned development of Yalova

Yalova is a very quiet district in 1930 (Figure 4). The first development plan of Yalova was designed in 1938 upon request of Atatürk. In the plan, its city center was divided into three regions and there were suggestions for villa-style house with garden at coastal line in addition to the planning of Cumhuriyet Square (Oran,1938). When development plan of Yalova was being designed, social principles that will provide the development of the city for 50 years had been tried to be applied (http://forum.memurlar.net).

![Figure 4. Yalova in 1930 and 2016](image)


Studies conducted in Termal have an important place in the development activities after the Declaration of Republic. It is known that Termal district occurred by an earthquake in the year of 1200 B.C (Yalova Belediyesi, 2014) and Thermal hot springs have been defined as power and energy baths since 6th century and have an important place throughout history. They got damaged during the First World War and began to be used again with the Republican Era. While the construction of a hot spring was considered, Turkey's first Living Tree Museum was made by bringing rare species of plants and trees from different countries (http://forum.memurlar.net).

On April 7, 1938 the map of the zone of hot springs was confirmed and construction was limited in the area adjacent to the zone and 500 m away from the border (http://forum.memurlar.net). A road was planned as continuation of road with plane trees in front of Dolmabahçe Palace (Istanbul) and it was considered as a follow-up of the road in Yalova for people left from Dolmabahçe Palace (Istanbul) by the ferry. This road (Çınarlı Hıyaban Road) had a length of 12.350 m and a width of 10 m starting from Yalova port side, continuing throughout Street Gazipaşa, and ending in front of the hot spring in Termal (http://forum.memurlar.net).
In 1939 Yalova had three neighborhoods consisting of 461 houses [24,25]. Yalova was located in the 1st degree earthquake zone and it was shown as “The region will undergo a major damage” on the map of earthquake that became effective in 1945 for the first time in Turkey by Council of Ministers’ Decision (http://farkyalovada.com). According to this, “Construction Regulation for Earthquake Resistant Construction Conditions” was determined in Yalova in 1947 and the buildings were built within the framework of this regulation. In the early 1950s, settlement was expanded an area of approximately 91.5 hectares and towards the late 1950s it was expanded west side of Stream Safran composing of houses with gardens in Bahçelievler neighborhood (Kazel, 2014).

In Bahçelievler neighborhood, quaternary and alluvial areas and Yalakdere Formation were observed intensely. “Quaternary units consist of marine sediment deposits and sediments deposited in coastal and river environments. Yalakdere Formation has locally landslide and was affected by active tectonism” (www.yalovakentmuzesi.gov.tr). The Yalakdere Formation and quaternary and alluvial areas are not suitable for settlement because of their features (Figure 5).

**Figure 5:** Geological map of Yalova

Reference: modulplanlama.com.tr

In 1960s, Yalova was one of residential areas preferred by American troops because of proximity to the military air field in Karamürsel used as one of USA military training station. This situation brought boom to city and economy and first reinforced concrete buildings were began to be built upon request of American troops (Özkaynak vd.,2004). Partially concrete and duplex houses and partially small prefabricated buildings were built upon understanding that Yalova was in the earthquake zone after ground surveys by USA engineers (http://farkyalovada.com).

Within the scope of Preliminary Report of Eastern Marmara Region, in 1963 Yalova was a part of the first regional plan but this plan wasn’t brought to the resulted level (www.spo.org.tr). In the Yalova Development Plan of 1968 prepared by the Bank of Provinces and Yalova Municipality, whole area was in the first-degree earthquake zone, a river was present in the west at that time, and sloping spaces were existing in the south, all of which were important thresholds (Figure 6). It was decided to construct single-storey structures preserving traditional urban fabric on front side of planning area and four-storey buildings in the city center.
But, sloping areas and side of streams were permitted for two-storey buildings due to lack of proper settlement area (İlknur, 2000).

**Figure 6:** The boundaries limit the city in 1960s and the growth directions of Yalova

In 1970s multi-storey building was allowed by amendments of plans. Multi-storey buildings started to be built on sides of streams and coastal band and floor number was increased from 4 to 6 in the city center (İlknur, 2000). In addition, in this period industry developed and the world’s largest acrylic fiber manufacturer operating under a single roof began operations on the coast in 1972 (Özkaynak vd., 2004).

In 1980s, growth direction of residential area was on west-east and it enlarged in the north-south direction on valley and ridges between valleys (Kazel, 2014). Also in this period, the settlement became attraction point for Arabs and tourism and boarding houses developed. In 1986, Arab entrepreneurs from Kuwait and Saudi Arabia preferred the coasts of Yalova and Gökçedere because of thermal potential (Tercan, 2001). Arab tourists have provided economic input by renting and purchasing house, participating in hotel constructions, benefiting from accommodation facilities and other commercial activities.

Upper scaled Plan for Çınarcık-Yalova-Karamürsel (1/25.000) was prepared in 1982 and its aim was to examine uncontrolled construction on coastal axis of Çınarcık-Yalova-Karamürsel in the context of protection-usage balance and to establish a connection with Topçular Port Side, a regional transport network. In this plan, areas for tourism, tourism and second homes, excursion tourism, and camping were planned on the coastal band and hazardous areas geologically were determined (Tercan, 2001).

The private sector was encouraged to enter construction sector by enacting Mass Housing Law in 1984 in Turkey and large-scale summer housing projects began to develop in Yalova (Özkaynak vd., 2004). Because of employment opportunities in the construction sector, intensive migration from the Southeastern Anatolia Region to Turkey after the 1980s and also Yalova’s being a center of attraction, Yalova...
started to take rapid migration after 1985 (Özkaynak vd.,2004). While population of city center was 40,292 in 1980, it reached to 72,824 in 1990 (Taner,1997).

In 1986 new works for development plan for Yalova started. The planning area covered city center of Yalova and surrounding area of village status at that time (Yalova Belediyesi,1997). Hacı Mehmet Plain, which is a wooded area and has a ground formed by the alluvial, was opened for construction with new development plan, became attractive and was turned into an area for construction of five-storey luxurious blocks (http://t24.com.tr). Also, thanks to this plan, agricultural areas and geologically hazardous areas at south of Yalova-Bursa highway were opened for settlement and areas for tourism, tourism and second homes, excursion tourism and camping in previous plan were transformed to residential areas (Terçan,2001). By planning studies in 1991, all sloping area in the city center was included in development plan (Yalova Belediyesi,1997). Parceling plan scaled 1/1000 was made in Neighborhoods of Bağlarbaşı, Fevziçakmak, Mustafa Kemalpaşa and İsmetpaşa and conditions as two-storied building and medium density were accepted as in geological survey confirmed in 1988 (Yalova Belediyesi,1997).

Generally in these periods, in Yalova settlements were gathered on the coast as small units and settlements developed in areas with little slope depend on coastal tourism. It was seen that agricultural lands were large in rural areas and forests and maquis shrubland were not damaged (Bahadır, 2007) (Figure 7). Yalova started to develop as a result of being a province, was taken into priority status in incentive and development, and was encouraged for other investments, mainly industrial investments (Bahadır, 2007). Over time, the construction started on the coast started to expand towards the inland (Figure 8). The decisions on use for tourism and industry on the coasts accelerated the spread of the settlement in this direction. It is understood that land use in Yalova spread at a great speed in the 7-year period between 1992 and 1999.

![Figure 7: Land use in Yalova between 1992 and 1999](image)

References: Bahadır, 2007

After 1995 urban development has shifted towards the south since Marmara Sea is a natural border in the north. Migration from other provinces to Yalova, which was having a rapid industrialization, realized until 1999 and the urban area spread. Çınarcık, Çiflikköy, and Altınova districts located on the coast of Marmara Sea and central district of Yalova began to develop and residential areas increased in here (Bahadır, 2007). As a result of increasing urban population, residential and industrial areas increased at axis of east-west on the coast. Also, Development Plan of Fill Area for Ferry Port in Çınarcık (Yalova) approved in 1996 is one sample of interventions at coastal area and this situation accelerated the deterioration
period of ecological structure of the coasts. Construction of buildings without obeying the Coastal Code, the establishment of industrial facilities on the coast, and the release of wastes into the sea (Bahadır, 2007) have great shares in this process.

Settlements in Yalova are situated particularly in plateaus, hillsides, and plains. Especially the city center is located on alluvial ground where the rivers reach the sea. This area is exposed to both the mass movements and floods (Bahadır, 2007). This area is unfavorable for settlement due to problem of liquefaction of ground. Additionally, 1st and 2nd-class agricultural lands, which are fertile and easy to irrigate, are used for settlement area. Armutlu, Altınova, and Çiftlikköy districts as well as central district of Yalova are located on 1st-class agricultural lands.

It was seen in the analysis of risk areas in terms of ground prepared within the scope of Yalova Environmental Master Plan in 2007 that settlement areas were in geologically dangerous or loose ground and also the city's development direction was in massive erosion areas (Figure 8).

![Figure 8: Maps for Analysis of Risk Areas in Terms of Ground](http://modulplanlama.com.tr)

Improvement of build-and-sell contracting in parallel to need of housing led to housing with poor quality equipment and materials (Güner, 2006). Improper changes for projects were made in many buildings during usage, also checks and maintenance of carrier systems were not made (Güner, 2006). Accounts of licensed structures such as ground, concrete, and iron according to the Regulation for Buildings to be Built in Disaster Regions were made on lower standards (Güner, 2006). All of them had a negative effect on results of earthquake.

### 2.2. Earthquake of 1999 and its effects in Yalova

In the region the North Anatolian Fault extends along the south of Marmara Sea, seismic activity is very high and ground conditions are unfavorable. In 1999 earthquake having a magnitude of 7.4 affected Yalova as all Marmara Region and caused major damages in urban areas, which were not built in sound and suitable ground, and thousands of people lost their lives. Between 17 August - 4 October 1999, about 2000 aftershocks ranging from 2 to 5.8 was recorded (Demirtaş, 1999). The ground investigations made in the region revealed that the ability of compactibility of the ground layer was very high and in some regions ground showed potential of liquefaction (http://sufizmveinsan.com). During
earthquake, there was extreme devastation in many settlements especially near the fault fracture and on the water saturated alluvion ground such as Adapazari, İzmit, Gölcük, Yalova, and Akyazı (http://sufizmveinsan.com).

Great loss of life and property was experienced because of improper land use, unplanned urbanization, and failure to build earthquake-resistant houses in areas with disaster risk. The earthquake showed consequences of settlement inappropriate for ecological structure and affecting negatively ecological structure. As a result of the earthquake, in Yalova 9123 buildings were heavy damaged or destroyed, 45% of total housing stock were affected, and 28,422 dwellings and workplaces in the city were damaged in varying degrees (Table 1).

**Table 1:** Manpower Loss and Building Damage because of earthquake in 1999³ (DPT Müsteşarlığı, 1999)

<table>
<thead>
<tr>
<th>Damage Type</th>
<th>Yalova</th>
<th>General Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead</td>
<td>2.496</td>
<td>15.226</td>
</tr>
<tr>
<td>Wounded</td>
<td>4.472</td>
<td>23.983</td>
</tr>
<tr>
<td>Heavy damaged or destroyed</td>
<td>9.123</td>
<td>27.634</td>
</tr>
<tr>
<td>dwelling-workplace</td>
<td></td>
<td>27.428</td>
</tr>
<tr>
<td>Middle damaged</td>
<td>7.997</td>
<td></td>
</tr>
<tr>
<td>dwelling-workplace</td>
<td></td>
<td>11.302</td>
</tr>
<tr>
<td>Less damaged</td>
<td>11.302</td>
<td>31.379</td>
</tr>
<tr>
<td>dwelling-workplace</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference: T.C. Başbakanlık Devlet Planlama Teşkilati Müsteşarlığı, 1999

The greatest devastation occurred in Hacı Mehmet Plain and Bahçelievler neighborhood in the city center of Yalova and marine resorts in districts of Çiftlikköy and Çınarcık (Figure 9).

**Figure 9:** Street Malazgirt (1999)

Reference: http://farkyalovada.com/tr

Until recently, the city had not experienced earthquake at this magnitude and was caught unprepared from many directions, thus, it had huge losses. The lack of a disaster management plan in the city, insufficient risk-focused decisions in planning, neglecting of sustainability in implementation of plans, the lack of consciousness and education on disaster in community and local governments, and the failure of completely implementation of laws and regulations increased the destruction as a result of the earthquake. Also, the fact that gathering and living spaces were not determined during or after the disaster in the studies before the earthquake caused unhealthy conditions.

³ According to data disclosed by Prime Ministry Crisis Center on 07.09.1999.
Researches conducted in Yalova after earthquake stated that factors causing damage on buildings were settlement on unstable ground, failure of correctly designing foundation carrying the structure and being proper for characteristic of ground, mistakes in selection and usage of building materials, mistakes in combination of building element, design errors, and renovations on structure later (http://benkoltd.com). The inadequacy of control mechanism that inspects them increased the number of damages. Destruction increased due to structuring on coastal and landfills. The industrialization on the eastern coast of the city in urban development aspects and the increasing number of industrial facilities caused problems during the earthquake. During the earthquake, the tanks of the AKSA Factory located in Taşköprü were damaged and hazardous chemicals leaked into the air, soil, and sea and damaged the environment. The industrial production partially or completely stops. The city's economy is experiencing a shortterm crisis” (www.wcdrr.org).

As a result of the earthquake, economical structure was affected negatively because of reasons such as the costs for construction and repairing of housing, losses in production facilities and infrastructure, and loss in added-value (National Income). It was determined that 3.793 of 7.468 workplaces were damaged. Operating loss arising from the earthquake in the manufacturing industry was 78% (Güner, 2006). Income from tourism and summer house vacationers decreased to 15% from 77% because of the earthquake. 4 of 50 sites and two large hotels on the coastal area were destroyed. Total number of tourists, which was 48.811 before the earthquake, decreased to 25.802 in 1999 (Güner, 2006).

2.3. Development of Yalova after the earthquake

Even though some measures were taken after the earthquake, residential areas have continued to increase and structuring on the coastal area in the north has begun to enlarge towards southward, which caused to increase pressure further on forests and agricultural areas. 1st-class agricultural lands and a part of flat areas for agriculture were opened to settlement with the planning studies. Forest and scrub areas have decreased day by day as a result of transformation of forests into agricultural land. After the earthquake, the forests has decreased at the rate of 1/3 compared to 1992 (Bahadır, 2007) (Figure 10).

Figure 10: Land use in Yalova in 2001

Urban density was decreased partly by the Revision Development Plans realized in 2001 (Yalova Valiliği Yalova Çevre ve Şehircilik İl Müdürlüğü, 2011). Yalova’s eastern coast was opened to industry according to Environmental Master Plan approved in 2007. Industry has been located on eastern due to proximity to the industrial axis in Kocaeli and existence of the highway providing the connection between Istanbul, Kocaeli and Bursa. Also areas of industry and trade are expected to increase in this region by Gulf (Körfez) Bridge of which construction was completed in 2016. Its west part is intended to be used for tourism due to existence of forest and sea (Figure 11).

Figure 11: Today's Land use in Yalova

According to results of the geological survey report, construction in residential areas was limited to 2nd floor after the earthquake. Construction in the central business fields and commercial areas was proposed as 4th floor (Yalova Valiliği Yalova Çevre ve Şehircilik İl Müdürlüğü, 2011). In subsequent planning studies, the number of floors was increased to 4th floor for housing too due to increasing of population and demand. One of residential areas where these applications were implemented was Hacı Mehmet Plain that had most deaths and damaged buildings as a result of the earthquake. Because Hacı Mehmet Plain has clay in ground, it was not allowed for construction in the past, but in 2004 Housing Development Administration of Turkey (TOKİ) was granted permission for housing in this region, so settlement in plain started again. Housing Development Administration of Turkey made its own development plan in this region in 2006 and began to build 4-storey houses and completed the construction of 1152 houses in 2008 (http://t24.com.tr), (Figure 12).
Planning decisions to double density of housing in Hacı Mehmet Plain became definite by being approved by Yalova Municipal Council and Provincial General Council of Yalova in 2011 (www.wcdrr.org). Location of Hacı Mehmet Plain on marsh sediments and passing of the fault line through this region showed that area at risk was occurred again (Figure 13) (Kendir, 2010).

Figure 13: The relationship between damaged structures and fault line in Yalova

33 of development plans made in between 2000-2014 after the earthquake are related to coastal areas (http://dergi.aljazeera.com.tr). Intervention on coastal areas has been realized by these plans mainly based on fill area, shipyard and port side. According to the current development plan (Yalova Revised Implementation Plan dated 09/10/2013), it is observed that while hmax is 13.00 and floor area ratio is 1,50 in conditions of construction of Housing Development Administration of Turkey (TOKİ), building coverage ratio (taks) is 0,40, floor area ratio is 1,20.
and buildings should be detached and 3rd floors for the surrounding residential areas.

At the present time, existing buildings have generally 4 storeys in the city center of Yalova and Bahçelevler, Rüstempaşa, Süleymanbey, and Fevziçakmak neighborhoods. There are 5-6-7 storey buildings at parcels fronting Fatih, Cumhuriyet, and Istanbul Streets and other main roads and also 10-storey blocks opposite to the ferry port in neighborhood of Süleymanbey (Kendir, 2010). Planning studies between 1995 and 1999 have been effective on occurrence of these densities.

Population has been continuing to increase due to reasons such as proximity of three major cities, natural beauties, and values of economic, social and cultural. It is estimated that the population will be 241,081 in 2023 and about 320,000 in 2025 (TUİK, 2014).

Through projects shaping the future of Yalova prepared by the East Marmara Development Agency taking opinions from various institutions and organizations, it is aimed that 7% of Yalova is settlement band, 33% is agricultural band and 60% is forests in total area. In this regard bands in which forest and agricultural areas are protected are recommended. Also Environmental Master Plan seems to support these scenarios. Different identities are attributed to east and west of Yalova by new projects developed in parallel with Environmental Master Plan (Figure 14).

**Figure 14**: Identities Proposed for Yalova

![Figure 14: Identities Proposed for Yalova](image)

**Reference**: Doğu Marmara Kalkınma Ajansı (2015)

Identities proposed for Yalova are important in terms of economic development of the city and developments such as tourism, agriculture, and industry are directed. It is important to develop in Yalova having thermal springs in terms of health tourism, however it is possible that especially the increase in accommodations can damage the natural structure against excess tourism demand. It is estimated that the proposal development focuses having characteristics of accelerating urban growth would increase population and develop industry and service sectors (Figure 15). It is clear that especially by Gulf (Körfez) Transition, changes in the
east part of the city would affect economy and ecology and would be contrary to principles of good governance of ecological capacity.

**Figure 15:** Development Focuses of Yalova

Urban transformation projects in Yalova are being developed as is throughout Turkey. Urban Transformation and Development Area has been determined in 13 regions located in various places in Yalova and sent to Ministry of Environment and Urbanization.

One of important guiding plans for Yalova is 1/25.000 scale Environmental Master Plan accepted and effectuated by Yalova Municipal Council and Provincial General Council on 08.06.2007 and amended in various dates. Through this plan prepared by considering the national and regional importance and location of Yalova for the year of 2025, it is aimed to determine development goals by ensuring the protection-usage balance and create a livable environment by protecting the ecological balance in accordance with sectoral development goals within the framework of the principles planning (Figure 16).

**Figure 16:** Environmental Master Plan of Yalova

According to plan, the expansion direction of the city is mainly towards Kocaeli. Shipyards and Gulf Transition Project located in this route have effects on direction of development. Project of Gulf Transition and Highway providing the connection between Istanbul-Kocaeli and Bursa has been involved in the Environmental Master Plan. Passing of this transport axis through agricultural and forest areas would increase the construction in this region and points out that areas with
ecological importance would disappear (Figure 17). Also, in the plan it is intended to establish a satellite town in Kirazli. Population-increasing suggestions have been developed with various functions by ignoring the fact that Yalova is in the first degree earthquake zone in other developed projects as well as the Environmental Plan.

Figure 17: Gulf (Körfez) Transition and Highway Route

When the risk areas in terms of ground in Figure 8 are compared with the proposal projects, it is seen that the constructions have been continuing to be built on geologically objectionable areas in some places.

One of the projects carried out in Yalova as a complemental part of planning process is “Green-Blue Road” and the other one is "Model Forest" (Erbay,2012). The Green-Blue Road is a sustainable regional development project intending to contribute to economic growth and employment especially in the tourism and other related sectors by revealing the cultural and natural values of Yalova (Erbay,2012). The concept of Model Forest targets the harmonization and reconciliation between sustainability of forests and people’s social, economical and cultural development (ogm.gov.tr).

Other important plan for Yalova is İzmit Gulf (Kocaeli - Yalova) Integrated Coastal Zone Plan approved in November 2014. The basic principles of plan are that; in the overall plan, basing on harmonization principle for cross-sectoral policy and sustainable use of coastal resources, determining the carrying capacity of coastal and sea environment and ensuring the realization of development in accordance with this capacity, providing the systematical controlling of pollution and production of clean waste by using waste management cycles, the improvement of environmental quality in urban areas (http://www.csb.gov.tr). They seem as supporting the protection of ecology.

Also, East Marmara Regional Plan was prepared by East Marmara Development Agency (MARKA) and covered years were determined as 2010-2013 in such way to be compatible with "National Development Plan" (MARKA,2010). By East Marmara Regional Plan, elimination of damage occurring due to the earthquake, balancing of the migration, land use planning taking into account risk of earthquake in residential area and controlling the urban growth by protecting the
environmental values are targeted in the region of Kocaeli-Sakarya-Yalova (Taştakin, 2007).

Today, planning works continue and Master and Implementation Plan works of which the primary objective is to solve the transportation problems. According to the Regulation for Buildings to be Built in the Earthquake Regions, urban transformation studies have started in some regions of the city and it has to be concluded in a short time. The pressure on agriculture and forest areas has continued as a result of structuring due to the increase of population. Partial participation is provided in accordance with sustainability-oriented planning studies and Projects are being carried out in cooperation with the community, local government and non-governmental organizations and these studies need to be continued.

3. Conclusion and suggestions

Pressure on agricultural and forest areas is increasing because the development direction is towards inner part of the city from the coasts in Yalova that was the second city having the highest annual population growth rate of 38.5% in 2012-2013 according to the data of Turkish Statistical Institute. Sea of Marmara and Mountains Samanlı are important altitude areas of the city and restrict the development directions of the city. Thus, in these areas transformation is inevitable. In many places, agricultural areas are opened to settlement and space are being tried to open for agricultural activities by cutting of trees in forests.

It is possible to meet a risk of severe earthquake again in Yalova experiencing a major earthquake because it is in the first-degree earthquake zone. This reality shouldn't be forget when decisions about Yalova are made. Compared to before the earthquake, decisions are taken more deliberate in studies after the earthquake.

It is seen that although sustainability, ecological and cultural protection is based on all plans developed for Yalova, applications have characteristics of increasing construction and environmental problems by attracting population. Even though mainly industrial uses, shipyards and Gulf (Körfez) Bridge developed in the east of Yalova are important in terms of employment, there are negative effects on the natural structure especially at the coasts. Anthropogenic environmental problems such as water, air, soil and noise pollution increase.

It is seen that especially industry and residential areas are planned on alluvion ground on the decisions of Environmental Master Plana and are risky for settlement. The proximity of industrial and shipyards areas to the coast and agricultural areas is another problem.

Despite the debates and objections, the construction in Hacı Mehmet Plain in the city center was began by Housing Development Administration of Turkey (TOKİ) and has increased gradually and today it has become one of regions with the highest real estate value.

The west of the city has been promoted for tourism but uncontrolled tourism can create problems. Hotels have increased in the area close to the protected area in
Termal and it is seen that the district having a high landscape value cannot protected exactly.

Because of its proximity to the metropolitan cities such as Istanbul, Kocaeli and Bursa, intense entry and exit of vehicles in the city by road and sea transportation and transportation routes passing from areas where agricultural areas are intensive affect the ecological structure and also create a potential to ensure that investments are intense in these regions by setting the real estate market.

Varying population caused by seasonal migration (internal tourism and labor) change the existing texture of city in terms of both urbanism and social aspect. Because it is the smallest province in Turkey in terms of surface area, inadequacy for residential area has appeared and the settlement pressure also increases with very high land prices.

The decisions of site selection made under the influence of land ownership and other factors accelerate the construction on unsuitable ground, agriculture, forest and coastal areas. Disaster areas were seen on the coastal and alluvion ground as a result of the earthquake.

Sustainability of Yalova is important in terms of city’s future. Because, sustainability has the ultimate aim of developing strong communities and creating places that are enjoyable and safe to live in over time (Saunders et.al.,2015). The transport and technical infrastructure of the settlement, topographic, geological, hydrological, and soil characteristics, climate and vegetation, the physical condition of the buildings, the quantitative and qualitative characteristics constitute the components of the physical environment (Kadıoğlu,2008).

An accurate planning is needed for making Yalova having earthquake risk sustainable, livable and accessible. This situation will reveal the necessity of taking some precautions without forgetting the earthquake risk of Yalova province. Moreover;

- Long-term planning, investment, and enforcement of mitigating or preventive measures, such as landuse and other zoning and building codes should be developed (Tarhan et.al, 2016).
- In the Development Plans prepared in Turkey, the development policies are produced, areas having disaster risks at the national level should be given special attention and it must be an approach that does not encourage development in these areas (Tezer et.al.,2008).
- Existing plans should be updated and developed, residential and industry-dominated construction in coastal areas that are risky areas should be controlled.
- By transportation plans, an efficient transport network considering the ecology should be established.
- It is suggested that geological dangerous areas should be evaluated as recreation areas instead of construction. Settlements should be selected on the grounds which are appropriate for soil survey and for which potential risks are taken into account.
• Urban transformation projects should be accelerated for constructions in risk areas and areas with appropriate ground survey which social, cultural and economic characteristics are in the foreground for those living in these regions should be planned as new settlements.

• The inspection mechanism should be made healthier in order to prevent unauthorized inspection and illegal construction.

• Social, cultural and historical value and also economic and technical criteria of the construction should be taken into account while deciding between demolition and reconstruction and strengthening after the earthquake (Ilki et.al, 2008).

• The applicability of plans should be provided within the framework of planning decisions protecting natural and historical structure.

• Decisions within protection-use balance that prevent pressure on forest and agricultural areas should be made.

• Efforts should be made minimizing the environmental risks depend on population growth and wrong construction areas.

• A culture and incentives that lead to the acceptance of responsibility by communities including private sector and civil organizations, for planning and cooperation in preparation, response and recovery should be established (Tarhan et.al, 2016).

In conclusion, Yalova is located on earthquake region, so functions and identities attributed to the city should not exceed the carrying capacity. The development of protection-use policies providing economy-ecology balance and protecting natural and cultural values, is important for future of the province.

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