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ECOSYSTEM PROBLEMS OF ELMALI DAM LAKE BASIN (ISTANBUL)

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ABSTRACT

The importance gained by human-induced ecosystem issues and the problems set forth has reached a large size. One of these areas is Elmal1 Dam Lake within the boundaries of the province of Istanbul. In this regard, in order to identify the problems in the study area and to determine measures to be taken towards the solution of problems, thesis work called Ecosystem Geography of Elmal1 Dam Lake Basin was performed. Within this scope, the atmosphere, hydrosphere, lithosphere and biosphere issues that constitute the earth systems are evaluated under separate headings. In the field of investigation, abiotic factors that shape ecosystem features as, atmospheric events and climate, atmospheric problems, atmospheric dirt, gases; rivers, lakes and their salinity, pH, total salt ratio, EC, temperature, evaporation residue, hardness, organic matter contents, chemical properties of water, physical properties of water, residual, color, turbidity, electrical conductivity, bacteria ratios and similar chemical features as well as hydrosphere elements; lithological properties; soil, rocks, landforms were evaluated. As biotic elements and factors, issues such as vegetation, human and human activities, land use features, microorganisms are discussed. The findings from these studies, views of the fields have been completed by putting forward solutions to prevent the future of the people and ecological environment to be imperiled.

KEYWORDS: *Elmal1, Istanbul, Basin, Ecosystem, Geography, Pollution*

1.INTRODUCTION

Today, the world population has reached 7.3 billion. The reasons such as very fast growth of the world population, which was 1 billion in early 1900s, excessive development of industry and technology, also failure in establishing or spreading environmental awareness adequately caused major disruption in the ecosystem. A deterioration in each part that constitutes the ground systems leads to chain disruptions also in other systems. For example, degradation in the atmosphere or breaking out of the normal affects the hydrosphere, lithosphere and biosphere. Watercourses, which are indispensable for human life and other living

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creatures, rank in the first place in degradation fields in the ecosystem. Besides, irresponsible contamination of potable water supplies prepares the ground for experiencing irreparable problems (Bayrak, 2013). Pressures on water sources increase because of human activities, such as urbanization in particular, population growth, rising life standards, increasing competition for water and pollution. Consequently, climatic variations and changes in natural conditions are further exacerbated (Şen, 2002).

It is determined that a large portion of the surface water sources is contaminated and many underground water sources are used excessively. If pollution and excessive use of water sources cannot be prevented, the idea that no good quality water source will be left to future generations is becoming increasingly stronger. These assessments demonstrate that clean water will be one of the most important problems that will occupy the agenda of the world in the next years. In addition, as the general amount of water sources is certain and limited, planning use of such limited sources against unlimited demands in the most rational way and offering for use are important practices. If we act with the awareness that the actual source of water resources is atmospheric vadose waters, in other words, precipitations, necessary precautions for collecting rainfalls that reaches the earth can be taken. If this important concept is ignored, the precipitations we mention as water resources cannot be exploited as desired. In this regard, local planning is of great importance. In regional planning, from where and how to provide all kinds of utility water should be planned and investments must be directed accordingly. Finding and protecting water sources for settlements and transferring them to the place of use have always been a vital issue (Wanielista et. all, 1997; Erlich, 1988).

The study area, Elmal1 Dam Basin, brings ease of settlement due to its effortless access; however, industrialization, wastes and misuse of the settlement environment cause ecologic degradation in the basin. Although our study area is required to be non-settlement areas, this region, where a very rapid population growth is being experienced, is becoming more polluted every day. However rapid population growth in the study area has caused a fast increase in distorted and unplanned settlement. Because of this situation, Elmal1 Basin has become a drinking water basin, which has the most built-up area and the highest population density when compared to the occupation areas among the dam basins in Istanbul. For example, even if it seems that the dam and surroundings are covered by forested land,especially Değirmendere coming from the south flows through entirely built-up areas. Again, rapidly growing population gathering areas such Çekmeköy, Çavuşbaş1 are born. The ongoing structuring trend in Çekmeköy has largely destroyed the feeding areas of Çekmeköy Creek that feeds the basin. Thus, the land use characteristics have changed and the forest cover has been replaced with human facilities. In result of this degradation, water being in the first place, the environment has been polluted and impairments in the ecosystem are in question (Var, 2008). Among the reasons of decrease in water quality in Elmal1 Dam Lake Basin (Istanbul), settlements and industries with inadequate or no treatment plants, unconsciously used agricultural fertilizer and pesticides, waste yards, road constructions and other public works can be listed. While these factors are causing erosion and consequently siltation in the basin, in other words, sedimentation and shoaling in the dam lake, high levels of suspended solids and therefore, low light transmittance and death of fish eggs and a decrease in fishery yields due to inorganic substances accumulating in the sediment on the one hand, they may lead to high ratios of dissolved organic matter accumulation, excessive development of phytoplankton as well as excessive increase in zooplankton on the other hand. After the eutrophication, water quality management in the dam becomes more difficult. Addressing the ecosystem elements such as water, soil, forest and vegetation as a whole and raising an environmental awareness that considers them also as an ecosystem beyond their socio-economic values are of great importance for the future of these resources and the living creatures in relation with them (Bayrak, 2013).

2. OBJECTIVES

The global climate systems have tended to change as time and space in their natural variability since formation of the atmosphere. Human activities have joined the natural variability components in the global climate systems for the first time after the industrial revolution in the mid-19th century and have begun to be effective. The radiation balance of the Earth has begun to deteriorate by significant increases in accumulation of the greenhouse gases released into the atmosphere due to various human effects, such as land use changes especially in the industrial revolution and destruction of forests. According to scientific research carried out, İstanbul and its surrounding are shown among risky locations in terms of potential effects of global climate

changes. As climate is the main factor that controls many cycles, changes in the climate bring alterations in cycles such as water, oxygen, carbon dioxide, sulfur and nitrogen. The major ones of these effects are the events such as destruction of the biosphere, migration of plants, heavy rains and floods, droughts and changes in underground water level (Bayrak, 2013).

Having correct and sufficient knowledge about deteriorations in the ecosystem and consequently occurring changes constitutes the first step of planning and basin management. Therefore, the purpose of this study is to identify the problems existing in the Elmal1 Basin and plan the solution of these problems. Differences between the precipitation and flow relations that change based on the seasons in a year are seen over the years. Consequently, for meeting the needs that change depending on time and amount, water management is of great importance. Therefore, changes in precipitation and flows need to be investigated. Knowing the trend in currents is of great importance in planning and operating water resources. Hydraulic information related to average and low currents is required in calculation of the dam and reservoir capacities and dam operation, while information on floods is needed in designing and operating flood structures and information of low currents is necessary in problems related to controlling water quality and water supply projects. Determination of such details can be counted among the purposes of the study. Identification of hydrographic characteristics and current water quality of Elmal1 dam Lake Basin, which is mostly used for drinking water, analysis of the basin and revealing existing risks to ensure sustainable use of the Dam Lake are other purposes.

Impacts of the ecosystem degradations due to the increase in population density, rapid destruction and misuse of natural resources are increasing in parallel day by day. Determination of what the people living in or affected by the basin need to do to fight against the problems that humans are mostly effective in occurrence of damages and reduce such damages can also be counted in the purposes. In accordance with this purpose, determination of hydrogeological, morphological, atmospheric, climatological, biological and ecological characteristics of the ecosystem, and putting forward their features constitute the scope (Bayrak, 2013).

3.METHODOLOGY

The study was prepared by the office and field work. Field studies include sampling and technical studies. Laboratory analysis of water samples taken was built. Writing and mapping process is under the office work. Mainly mapping is the determination of land cover and 1ts analysis. The classification of land cover pattern is viewed as one of the prerequisites for analysis. Thus, the initial focus of this study was on classifying mainly eight types of land cover patterns in the LandSat satellite image of 2012. The integration of grid cell information in the study area of interest in geographic information systems (GIS) with various environmental models has been fully implemented (Liang and Chen, 1995; Goodchild et al., 1996; Dikshit and Loucks, 1995, 1996).

Many shifting land cover patterns, driven by a diversity of social causes, result in land cover changes that affect physical geography, and other processes that, cumulatively, affect the global climate and biosphere (Hoşgören 2000, Riebsame et al., 1994). A primary component of mapping land cover is to develop a land use classification system. The supervised classification approach was applied in the land use pattern classification of this study. It needs to be carried out in sequence including satellite image mosaic, classification, and verification. Supervised image classification is a method in which the analyst defines training sites on the image that are representative of each desired land cover category. The delineation of training areas representative of a cover type is most effective when an image analyst has knowledge of the geography of a region and experience with the spectral properties of the cover classes (Skidmore, 1989). The image analyst then trains the software to recognize spectral values or signatures associated with the training sites. After the signatures for each land cover category have been defined, the software then uses those signatures to classify the remaining pixels (ERDAS, 1999; Jensen, 1996). Select and mosaic satellite image at first, an overlay is used when it is desirable for a block of content of a Landsat image and GIS themes of the study area to be shared with respect to the 35. Zone Universal Transverse Mercator (UTM) projection coordinates. The entire analysis for land cover identification and classification in the area was designed based on a practical scale GIS framework by using of Erdas Imagine image processing software called Erdas Imagine 9 version. Application of GPS helps verify the effectiveness of land cover classification based on LandSat satellite image (Ekinci and Ekinci, 2006).

4. GEOGRAPHICAL AREA

Elmal1 Dam Lake Basin, which is the study area, is located between 40° 59' - 41° 07' North latitudes and 29° 05' - 29° 11' East longitude and covers 1/25000 scale F 22 d3, F22 d4, G22 a1, G22 a2 topographical map sections (Figure 1). Geographically, Elmal1 Basin is in Kocaeli District of Çatalca-Kocaeli Section of Marmara Region. In terms of administrative units, it is completely within the boundaries of Beykoz District of Istanbul Province. Ömerli drinking water basin, Çekmeköy and Çavuşbaş1, and villages of Beykoz district are located in its east, south, and west and north, respectively. A large part of Elmal1 Basin is on the tributaries feeding Göksu Creek, which is one of the streams reaching the Bosphrous from east. The rivers in this region carry water to Elmal1 Dam Lake and together with their tributaries, these rivers drain Elmal1 Dam Lake Basin. Within this area, length of Elmal1 Basin in the North-South direction is 17 km and its width in East-West direction varies between 2.5 and 9.5. Its area is 51.01 km^2. Elmal1 Dam, which features as the smallest artificial dam lake with a lake area of 1.1 km^2 it covers and a water-holding capacity of 9.6 hm^3, has a catchment area of 83.4 km^2 (Bayrak, 2013).

5.RESULTS:

Elmal1 Dam Lake is the first water source of the Anatolian side of Istanbul. Elmal1 Dam Lake consists of 2 dam lakes. It is partially in harmony with the northwest-southeast oriented drainage structure that is dominant in the province Istanbul. Streams in the region transfer the waters that they carry through feeding tributaries such as Budakdere, Çavuşbaş1, and Karanl1kdere to Elmal1 Dam (II). In Elmal1 Basin, there are 11 streams feeding the reservoir. Among 11 streams in the entire basin, only 5 streams feed the reservoir in the study area. These are Budak Creek, Çekmekö Creek,Karaağaç Creek, De irmen Creek and Köprü Creek. Among these creeks, Baklac1k-Budak Creeks combine and directly flow to the reservoir (Tarkan, 2007). Çekmeköy Creek combines with Kemer Creek and flows to the Dam Lake by taking a new name as Karaağaç Değirmen Creek. With the combination of Çekmeköy and Köprü creeks coming from southeast with northwest orientation, De ğirmen Creek is formed. Kemer Creek located in the upstream of Köprü Creek extends to Kay1ş Mountain in the south. At the same time, there are small creeks with low flow rates that dry in summer in the region (Ýstanbul Bölge Müdürlüðü, 1978).

Water needs of the Anatolian Side of Ýstanbul were met by Elmal1 1 Dam, which was built by a French water company on Göksu Creek in 1891-1893. However, this dam made of soil has collapsed due to water pressure in 1916. In 1926, the landfill was repaired and the upstream surface was covered with concrete plates. In 1937, sand filters were added and the water was given to consumption by water filtration. In 1948, the dam was raised and took its current form. Construction of Elmal1 II Dam was started in 1952 and completed in 1955. Constructed by Établissements Billard and Etudes et Enteprises Companies, Elmal1 II Dam is concrete gravity-type with attenuated pillars. It is located in the upstream of the connection point of Budakdere and Çavuşbaş1 creeks that are tributaries of Göksu Creek in 4.5 km southeast of the Anatolian Fortress and 1.2 km away from Elmal1 I Dam. Basins are like a production center supplying water to their cities. The most important inputs in this production are precipitations such as rain, snow, etc. and the obtained product is the water accumulating in the dam lake. One of the main water sources that meet water needs of Istanbul is the Elmal1 Basin on the Anatolian side. Elmal1 Dam, which is one of the three dams on the Anatolian Side within the provincial boundaries of Istanbul, is established on the streams feeding Göksu Creek flowing to the Bosphorus. The dam lake is completely in Beykoz District of Istanbul. Featuring as the smallest artificial dam lake with a lake area of 1.1 km^2 it covers and water-holding capacity of 9.6 hm^3, Elmal1 Dam has a very small catchment area (83.4 km^2) compared to other dams of Istanbul. With an annual yield of 15 million m^3, though limited, it contributes to meeting water needs of the city. Elmal1 Dam, of which the catchment basin is generally forestry, has been the water source for the Anatolian Side of Istanbul for many years. The maximum reserve volume of the First Elmal1 Dam is 920,000 m^3. The maximum reserve volume of the Second Elmal1 Dam is 9,600,000 m^3. The daily water supply capacity of Elmal1 System, which supplies water to Üsküdar and Kad1köy districts by treating waters of both Elmal1 Dams, is 50,000 m^3. Elmal1 reservoir is still active and as of April 12, 2003, existing amount of water is 6,832 million m^3. Its annual yield is 15 million m^3. The dam meets 2.82% of the average clean water amount supplied to Ýstanbul. Water supply to the city from Elmal1 Dam is terminated as of September 21, 1993 because of some technical problems arising from extreme pollution, failure in operating the existing treatment plant and lack of care, and the facilities are completely abandoned from this date until May 1994. In May 1994, the research for gaining the waters in Elmal1 Dam to Istanbul by purifying has

started and in result of the studies, it is determined that 2-2.5 million m^3 of water corresponding to a 2-meter part of the lake level from the top can be utilized. Thereupon, requirement of Ozonation-Active carbon techniques that are used as the "Advanced Treatment" in the world is understood and put into practice, and as of September 6, 1994, a daily average of 40,000 m^3 of water began to be supplied to the city. After treating and transferring 2-2.5 million m^3 of water in usable parameters to the city, to clean the sediments accumulating on the dam base, carry out maintenance, repair of floodgates and complete the basin protection pump station and force main, supplying water from the Dam is terminated as of November 10, 1994, subsequently, the dam lake is emptied. Studies for removal of sediments on the dam base, cleaning of the dam base, repair and maintenance of floodgates and cleaning Budak and Çavuşbaşı streambeds were completed. In addition, opening of the Elmalı Basin Protection facilities, which was completed on December 4, 1994, was held and water supply to the city was initiated (Kaya, 2008).

Depending on the settlement in the basin, human and animal-driven pollution has been identified and Elmalı Dam was discharged and cleaned in 2002. On February 21, 2003, it was re-commissioned. The water supplied from Elmalı Dam is offered for needs of humans as drinking and utility water on the Asian side of the province of Istanbul. The first management plan of the Elmalı Embankment Protection Forest was made in 1971. This plan was issued as a permanent protection forest in accordance with the Ministerial decision no. 4/6403 dated October 28, 1958. Borders of the series are based on certain lines without destroying integrity of the portion allocated to protection. In this plan, general area is 9705.0 hectares. 8157.0 ha of the said plan area are defined as permanent protection area and 1458.0 ha are left outside the protection forest. In the data of this plan, 2085.0 ha are shown as a afforestation area and 3202.0 ha of an area of 3215.0 ha have been allocated to an area requiring afforestation as 2869.0 ha of scrubs and 326.0 ha of very degraded forests and given to afforestation (Demirtaş, 1995; Debik, 1995, Kambak, 1996; Demir, 1996; Aydın, 1996; Kerç, 1996; Gurbetoğlu, 1996; Kuvvet, 2004; Var, 2008; Kaya, 2008). Borders of the new plan unit were re-examined in result of the approval of the Ministry of Agriculture and Forestry no. 1 dated December 22, 1980 and those that are outside of the protection borders in its north, close to Beykoz District and in its south, again outside the protection area, are combined with the management plans of Beykoz District and Alemdağ District, respectively (Figure 2). Thus, area of the plan unit (Protection Forest) was calculated as 6.982.0 hectares. 4732.5 hectares of this general area are forestland and 2249.5 hectares are clearing. 996.5 ha of the forestland are the Red Pine class operation, 880 ha are the Black Pine class operation, 1,249.0 ha are the Maritime class operation and 1,607.0 the leafy tree class operation. The fields covered by trees in the area have been destroyed to a great extend for human settlement. This destruction goes just down to the lakeshores beyond the borders of the basin protection (http://www.iski.gov.tr.).

Illegal cutting for opening space, settlement and structuring are a lot in the area. Therefore, protection and sustainability of protecting the forest nature of these areas are required. Again, in the lake, which is a drinking water dam, animal watering and swimming in hot seasons are observed as a common culture. Therefore, efforts must be made to remove the settlement areas. Otherwise, it is very hard to apply protective measures(İSKİ., 2006)

By discharging used waters to the rivers, the organic substances being in the first place, various pollutants enter in the aquatic environment. During segregation of the organic substances, the ambient oxygen is consumed very quickly and the dissolved oxygen concentration is reduced. The biological life and ecologic system in the uncontaminated waterbed are also exposed to changes. Settleable substances, turbidity and low oxygen concentration change the normal living environment of plants and other aquatic creatures and very few fish species can survive in such an environment (Kaplan, 1989).

The most important factors in the pollution of lakes, which are one of the aquatic environments, are formed by the access of organic materials with high energy potential and phosphorus and carbon compounds in other forms that are carried by polluted rivers to the lakes (Demirtaş, 1995; Debik, 1995, Kambak, 1996; Demir, 1996; Aydın, 1996; Kerç, 1996; Gurbetoğlu, 1996; Kuvvet, 2004; Var, 2008; Kaya, 2008). The algae take carbon, phosphorus and carbonaceous compounds in their bodies by using the sunlight as a source of energy and make more high-energy molecules. They are used as food by algae and zooplanktons. These living creatures are bait for fish. In result of all these activities, carbon-rich wastes are formed. Because carbon, nitrogen and phosphorus entry to an unpolluted lake will be extremely limited, formation of algae in the water will be less. Such water sources can be used for various purposes.

6. SUGGESTIONS

In Elmal1 Basin, Çekmeköy and Çavuşbaş1, in the east Ömerli drinking water basin, Taşdelen, in the west Ümraniye, in the south Küçükbakkalköy, Kayışdağı and Ferhatpaşa settlements are located. Elmal1 Basin is well positioned for settlements in terms of its proximity to transportation connections by the TEM highway passing through, slightly inclined topography in parts and accessibility to the intensive labor in the city (Güney and Onay, 2006). However, industrial and residential areas that are concentrated due to ease of transportation pose a great threat to the basin (Gurbeto ğlu, 1996). Ring road connections of the 2nd Bosphorus Bridge pass from just north-west of Çavuşbaş1. Fatih Sultan Mehmet Bridge, its highways, ring roads and their connections form a strong transportation ring. Elmal1 Dam Lake Basin has no transportation problems. As Kavac1k is the last exit when passing to the Anatolian side from the European side through Fatih Sultan Mehmet Bridge and the first exit when passing to the European side from the Anatolian side, transportation is very easy. In addition, connections to Polenezköy, which is one of the important touristic and recreational places of Istanbul, and Çavuşbaş1 can be provided through Çekmeköy. In the study area, many asphalt, unpaved and gravel roads are available (Bayrak, 2013).

Elmal1 Basin is one of the basins, which is relatively small but provides drinking and utility water to Istanbul at law cost because of its proximity to the city. Residential areas such as Çavuşbaş1, Çekmeköy, Ümraniye, Sar1gazi, Maltepe and Alemdağ, especially industrial zones of Esenşehir and Dudullu in Ümraniye district and an important part of the surrounding housings are in the study area. According to the Landsat satellite image of 2012, the area classified as built-up in Elmal1 Basin is 40 km^2 (Figure 3). Destruction of the natural environment and dimensions of structuring in Çekmeköy and Çavuşbaş1 municipalities located in the forestry area in the north of TEM highway are increasing gradually (Figure 4). Urbanized areas are in Çavuşbaş1, Çekmeköy and Dudullu in the south of the basin. The northern and eastern sides of the basin are covered by woods and shrubbery, and there is a settlement unit scattered around here and surrounded by a farmland. Agricultural lands in small plots dealing with vegetable gardening in the creeks that feed the lake also attract the attention. The population growth of Çavuşbaş1 and Çekmeköy settlements in Elmal1 Basin between 1980 and 2013 is almost 15 times (İSKİ, 1990, 2005a; 2005b). According to the field observations, intensive structuring in Elmal1 Water Basin starts from Sultanbeyli in Ömerli Basin continues to the west with Yenidoğan, Samand1ra and Sar1gazi, which is in nature of a kind of spatial continuation of the structuring in the basin. It is even the locomotive of the growth in the surrounding areas with the concentrated industrial zones it hosts (Öztaş, 2006).

In the years with low precipitation, high flow rates and existence of another source effective on the precipitation or not must be brought on the agenda. As long as the physical properties of water catchment basins are interfered, yield of water is subject to changes. Irregular structuring has shown its impact on the basin. Elmal1 Dam Lake Basin is exhausted in terms of collecting healthy water. Because characteristics of the area that will collect water have been changed, yield of water is changing and bringing along pollution. Because Elmal1 Dam and Basin that meet water needs of a part of the Anatolian side of Istanbul are under the threat of urbanization, protection of the basin is of great importance. Elmal1 Dam Watershed has a very low capacity in comparison with other basins. However, it is crucial in terms of meeting the local demand in its surrounding. In Elmal1 (I and II) Basin, which ranks the last with 2.6% utilization share of Istanbul, it is determined that 61% of annual precipitation evaporates and 39% gets in the flow. Annually 15.3 million m^3 of water enter to Elmal1 Dam Lake and 5% of it evaporates. Although it was the only facility suppling water needs of the Anatolian side in the construction years of the dam, it is now faced with losing its characteristic as a drinking water dam (Kuvvet, 2004).

Some settlements in Elmal1 Basin are lacking necessary infrastructure services such as sewerage, waste treatment and disposal. Therefore, wastewater discharges and open waste dumping areas that are not complying with the health and environmental conditions cause pollution also in the dam. Surface waters are in the class of calcium bicarbonate (Ca-HCO_3) waters, while underground waters are in calcium bicarbonate (Ca-HCO_3) and sodium bicarbonate (Na-HCO_3) waters. According to pH values, waters are between 6 and 7.7. Again, the waters are classified as slightly acidic neutral waters. High amounts of phosphate in places in the content of waters shows possibility of contamination by chemicals such as detergent, etc. with an anthropogenic effect. The waters are at limit values of TSE, EPA, EC and WHO in terms of Chlorine (Cl), Lead (Pb), Nitrate ($NO3^-$) contents and exceed limit values of TSE, EPA, EC and WHO in terms of Sulfate (SO_4^{-2})

contents (Albay and Akçaalan, 2003). In addition, a high hydrogen sulfide effect in waters is concerned. This effect causes an annual corrosion between 2 and 80 mm on the concrete surface. Mechanical strength of the concrete suffering from corrosion decreases (Güvensel, 2006). Over time, holes are formed on the sewerage system (Örgün and U ğur, 1996). Wastewater leaks to the underground from worn regions. In the areas, where sewerage system is destroyed, underground and surface waters are under ecologic threats. Again, in the waters, Boron, Barium, Chromium, Manganese and Sulphur contents are high. This is caused by the new construction, plastic joinery workshops and excessive use of agricultural fertilizers in its surrounding. In some water locations, high iron, manganese and zinc contents are seen. The reason for this is again the steel factory and excessive use of agricultural fertilizers in its surrounding (Alt1nyurt, 2006; Debik, 1995).

In the basin, where an effective and rapid population growth is dominant, domestic wastewaters are seen as the most important reason of pollution of the reservoir. TEM highway passing through Elmal1 Basin creates an adverse impact on the basin (Erus, 1995). TEM highway passing through the basin and on the dam in Kavac1k and its ring roads are very busy. Roads with heavy traffic have an important place in pollutants (Orhon, 1991). Hazardous and harmful substances such as heavy metals in exhaust gases, machine oils, small particles of worn tires, asbestos dust from brake pads that contain carcinogenic substances and broken particles are carried to the reservoir by rainwater or air. In the soils close to the highway, heavy metal contamination is present (Gürevin et. all, 2006; Gürevin, 2004).

7. CONCLUSION

According to the water quality classes of the dam and streams of Elmal1 Basin, excluding Budakdere, water quality classes of other creeks pouring into the lake cannot meet criteria to be used as drinking water. Değirmendere can be qualified as the most polluted creek among the ones feeding the dam in the study area. The major cause of pollution is again wastewaters originating from settlements and pollution carried to the streams by rainwaters. However, although quality of waters feeding Elmal1 Dam is bad, it is seen that water accumulating in Elmal1 Dam Lake is usable. Due to presence of natural treatment plants in Elmal1 Basin, it can be said that there is not pollution that will pose a risk at dangerous levels in the underground waters and the water is useable in terms of the quality class. In surface waters on the other hand, because of rapid increase in settlements, industrial and illegal structuring in the region in recent years and particularly being a dynamic region in terms of industry, water quality in the basin must be monitored constantly. Precautions should be taken for not only domestic wastes but also leak of new wastes to the streams and Dam Lake from these regions, where industrial and commercial areas are increasing and pollutants show diversity, must be prevented.

Although prevention of incorrect structuring brought by the growing population in the settlements around the dam lake and restructuring of the sewerage system have been ensured by local governments in the last decade, unplanned structuring of previous years maintains its presence to a large extend. Well protection, maintenance and dissemination of forestlands and prevention of increases in quarries, gas stations and car wash and lubrication stations are required. Moreover, going towards works in nature of controlling, such as immediate collection of the wastes, reduction of animal breeding, disposal of animal manure out of the basin, taking measures to ensure pre-deposition of the pollutants entering in the basin or treatment plants and thus, reduction of pollution entry by coordinated works of the municipalities in the dam basin and the Metropolitan Municipality are mandatory in terms of sustainable environment understanding of the dam lake. The rapid urbanization over the last thirty years has brought along great changes in land use. Natural vegetation from the biosphere elements has been destroyed and these areas are zoned for construction. The rivers channeling in the slope direction on the topography are contaminated over time and these rivers have been taken into artificial channels in recent years. Therefore, in the study area, which is a fluvial morphogenetic region, erosion, carriage and collection activities of the rivers on the lithosphere have been reduced to a very low level and interrupted in terms of formation of the lithosphere. Yet, the transportation networks have led to the same result by interrupting these rivers. The onshore processes quickly distanced from the control of natural processes in a similar way. Furthermore_land use change has taken place in the direction of damage to the woods and caused increase in severity of erosion. Consequently, decreases in the reservoir capacity of the dam, quality of the accumulated water and water storage strength of the basin soils are concerned.

8.FIGURES, TABLES AND REFERENCES

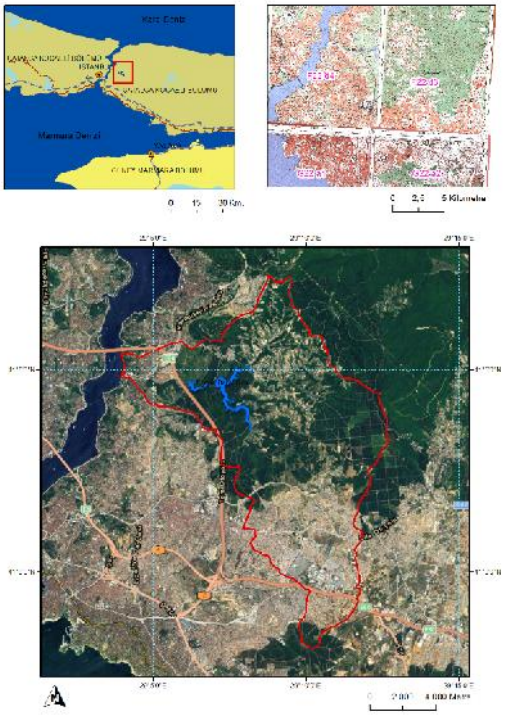

Figure 1: Location of Elmalý Dam Lake Basin

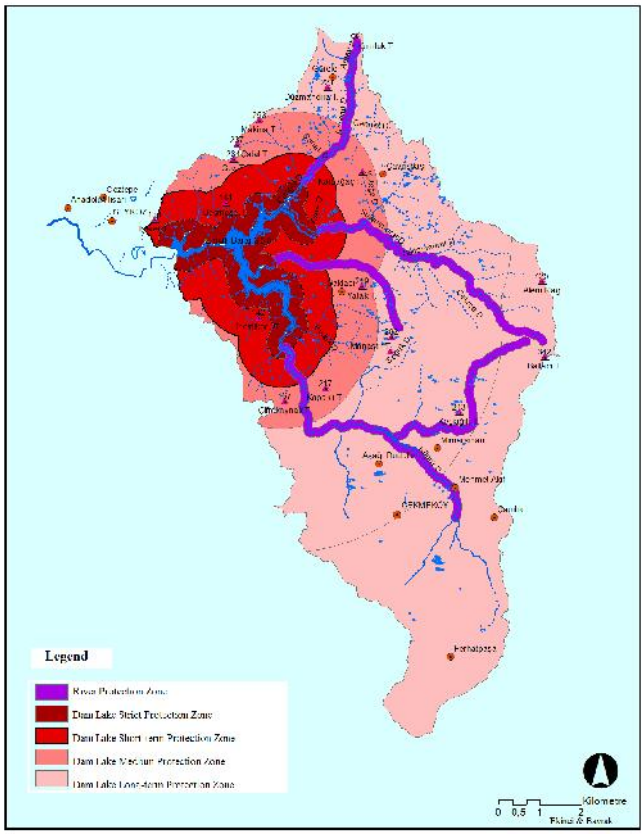

Figure 2: Map of Conservancy Zones of Elmalý Dam Lake Basin

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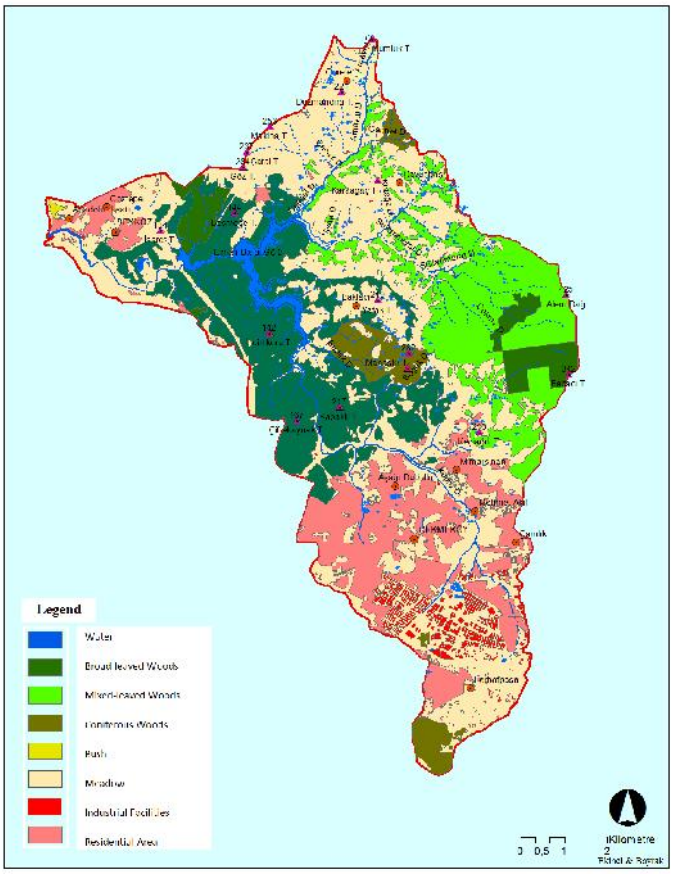

Figure 3: Map of Land Use Characteristics of Elmalı Dam Lake Basin

Figure 4: Forest Destruction in Elmalı Dam Lake Basin Protection Zone; A section from the structuring in Çavuşbaşı Settlement close to the dam lake

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