THE EVALUATION OF THE CHANGE IN ATIKHISAR DAM WHICH PROVIDES WATER FOR THE URBAN PART OF CANAKKALE WITH LANDSAT ETM DATA AND PCI IMAGE PROCESSING SOFTWARE WITHIN 10 YEARS

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ABSTRACT

Çanakkale is placed in an area that has a strategically importance and divides the continents Asia and Europe and carries its own name in the NW of Turkey. Çanakkale has kept the quality of settlement field since 3000 B.C. The area of the province which has lands in both Europe and Asia and its coastline length is 671 km. There is a water famine in the region. Çanakkale city center surface area is placed with a size 928 km^2 and increased to 81,435. The most important source of water for Çanakkale is Atikhisar Dam and the water that Muslim hadjis brought for goodness.

The assurance of satellite images and geometrical corrections and the placement of the satellite images on the map coordinates have been made. In the screen of the satellite view, the airport, the crossroads, the Nara cape, the curling of Atikhisar Dam and Seddülbahir and Mehmetçik cape lighthouse were interpolated and placed on the UTM map coordinates by the help of checkpoints of geographical places. In the evaluation of the changing process of Atikhisar Dam within 10 years time, a comparison between the results of Landsat 5-7 LANDSAT 7 ETM+2001: Enhanced Thematic Mapper +: Panchromatic (0.520 - 0.900 µm, 15 m x 15 m pixel), Multispectral (µm, all 30 m x 30 m) pixel size, 60 m x 60 m, thermal band satellite views and real time values and using by PCI Geomatics Version 9.1 software RS programme.

Key words: GIS, Remote sensing applications.

INTRODUCTION

Canakkale is located between 40^o 08^1 north latitudes and 26^o 24^1 east longitudes; in an area that has a strategically importance and divides the continents Asia and Europe and carries its own name in the NW of Turkey, which was named HELLESPONTOS and DARDANEL in ancient ages, has kept the quality of settlement field since 3000 B.C. *(Anon 2)* The area of the province which has lands in both Europe and Asia, is 9737

km2, the length of the coastline is 671 km. As for its location, its climate shows the characteristics of both Mediterranean and Black sea.

The least rainy place in Canakkale is central and the neighborhood. The annual average of rainfall is 400-600mm, the annual average of rainfall in the coastal parts of Gelibolu and Biga is 600-800 mm, and the average rainfall in the mountains of Kaz whose average heights are 1000-1200 m, the average rainfall in the top points of mountains of Kaz is 1200-1500mm *(Canakkale City Annual, 1967, p. 58)*. The most amount of rainfall drops in winter. In summer, a dry climate is seen with high temperature, high evaporation and low rainfall. There have been some fluctuations in the annual amount of rainfall for several years.

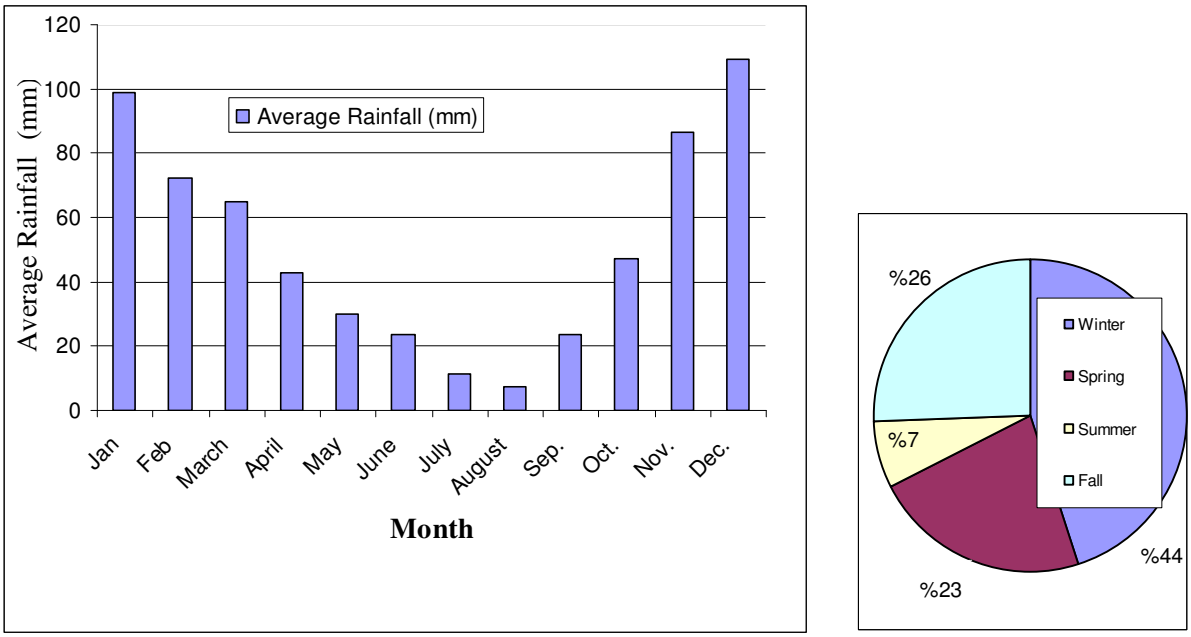

Figure 1: The Total amount of average rainfall of Canakkale *(DMI, 2002)*

WATER POTENTIALS IN PROVINCE

We can mention the Tuzla River, Menderes, Sarıçay and Kocabaş as Rivers in the city. These waters have irregular regime bloats out in spring rainfalls and autumn days. In different places in the borders of our city, there are underground waters whose depths vary between 5 and 10 meters. The transition climate of Mediterranean and Black sea is seen in Canakkale. It is hot and dry in summer, cold and rainy in winter. The average temperature of July and August varies between 25 and 35 degrees. Generally the Northeast wind and Southwest wind is dominant in Canakkale. If we evaluate the vegetation dependent on the climate, in spite of the wind comes from the sea and circulation, the abundance of olive trees in the coastal parts attract attention. There are evergreen trees such as bay and carob and also oaken, elm, plane trees, chestnut trees, fig trees, wild pear in the inner parts. There is bushes named lemur in various parts and there is thyme among these dominating the flora of the city.

The most important material that all of the living things need directly or indirectly in order to keep on living is water. As a result of urbanization, industrialization, and increasing population in the world, the interest to water is increasing rapidly.

Canakkale has approximately 5 dams in 28 lakes. These dams:

Atikhisar dam	:	2 109 ha
Gökçeada dam	:	485 ha
Tayfur dam	:	140 ha
Bayramiç dam	:	60 ha
Bakacak dam	:	674 ha

Canakkale city center take all water from Atikhisar dam. There is a 120.600 hectare land which is suitable to irrigate in Canakkale province. The 58.179 hectare (% 17.45) of the farmable land is being irrigated. The remaining 275.394 hectare (%82.55) land is used in dry conditions. Only the 58.179 hectare (%17.45) of the land that is used for agriculture is being irrigated. The remaining 275.394 hectare (%82.55) land is used for agricultural activities in dry conditions *(Anon 1, 3, 4, 7).*

Table 1: Compare of Water and Soil Conditions on Turkey and Canakkale

THE SURFACE AREA OF TURKIYE	779 500 km^2
The surface area of Canakkale	**9,737 km^2**
THE AGRICULTURE AREA OF TURKIYE	280 500 million ha
The Agriculture area of Canakkale	**353 381 ha**
THE IRRIGATABLE LAND OF TURKIYE	25,75 million ha
The irrigatable agriculture land of Canakkale	**214 409 ha (DSİ) 120.600 ha (IPKM)**
THE IRRIGATABLE LAND OF TURKIYE	8,50 million ha
The irrigatable land of Canakkale	**58,179 ha**
THE LAND OPENED TO IRRIGATION IN TURKIYE	4,543 million ha
The land opened to irrigation in Canakkale	**559 ha**
ANNUAL AVERAGE RAINFALL IN TURKIYE	642,6 mm
Annual average rainfall in Canakkale	**640 mm DSI, 617 mm Meteorology**
ANNUAL AVERAGE RAINFALL OF THE WORLD	1000 mm
THE ANNUAL SURFACE FLOW IN TURKIYE	186,05 km^3
The aboveground water in Canakkale	**2 305 hm^3 /year**
ANNUAL UNDERGROUND WATER RESERVE THAT CAN BE PUMPED IN TURKIYE	12,3 km^3
Underground water in Canakkale (total safe reserve in the city)	**480 hm^3 /year**
The Atikhisar Project of Canakkale	**23.7 hm^3**
Dam reservoir surfaces Atikhisar Dam	**2 109 ha**

(DSI, 1-7)

Atikhisar Dam and City Relations

Moreover, the drinking water of the city, whose population has reached 81 435 in 2001, is being supplied *(DIE, 2001, pp. 25-62).* Rapid urbanization that also affects Turkiye has started in 70's world-wide. Looking at the urbanization of the central Canakkale with the help of the population data taken from DIE; the surface area of the central has reached 928 km^2, the population has reached 81 435 and population growth rate has been % 33.92 since the establishment of the Turkish Republic. During the same period, while the population of Turkiye has increased five times, the population of Canakkale has increased two and a half times. Having revised the population movements of Canakkale generally, three different periods can be determined certainly. The first period is the years between 1927 and 1945. In this period, the population of Canakkale has increased rapidly. The second period is the population movements in the years between 1945 and 1950 when the population has decreased rapidly*. The last period is the time between 1950 and today. An area of 2 932 hectare lands is being watered in the plain of Canakkale by the help of Atikhisar project. But, apart from unconscious agricultural activities; one of the over pumping of water from underground is that loss of productivity and over saltiness is seen. Beside the risk of being arid, one of the most important problems resulting from wrong applications of agricultural irrigation is that the land is being infertile. Thus, the projects over the broad flow of waters which are devoted to being able to irrigate the lands, where dry agriculture is made, to prevent the loss of production and to have more and more products, gains attention. The dams and lakes that are opened to management and continuing projects have an important position in Canakkale as for managing the water sources.

Table 2: Features of Atikhisar Dam

FEATURES	ATIKHISAR DAM
River	Sariçay
Type	Filled land
Surface area	2.8 km^2
Height	33.2 m
Crepe length.	411.9m
Maximum Lake Volume	$24.9x10^6$
Filling Volume	2 218 000
Body Filling Volume	52.5 hm^3
Build Start-end Year	1963-1966
Begin to service year	1975

(Anon 5, 6, 8)

*The increase in the population between 1927 and 1945 results from the effects of the 1st and 2nd World War. As a conclusion of increasing the numbers of soldiers because of the security conditions, the population has increased.

REMOTE SENSING ESTABLISHMENTS

At first, definitions of classical and modern location *(Losch, 1956),* modeling that mentions physical earth shapes *(Stewart 1948)* have been carried out. Then, industrial, economical and social factors have taken place in the projects *(Lowry, 1964).* In the latest developments, there has been linear equations and quotient counting *(Pindyck and Rubinfeld 1991).* Modern studies in this subject have been made with Anys et al and Bannari et al (1994). The studies are being handled with 3 layers as spatial, material and equipment modeling. Positioning *(Murata, 1959)* is made by the help of urban economical development scales *(Hanink 1997)* and the layer of human activities *(Castells 1996).* What is important is to have satellite images belong to the area of study (*Abed J.* and *Kaysi I., 2003, p.992).*

Spatial resolution and real time measurements in distant perception give more realistic results about the near past *(Jackson, 1984).* For the future, it will give information about high resolution distant perception products *(Fritz, 1996).* Organic materials over the land play important role in the spectral resolution *(Dalal and Henry, 1986; Shonk et al., 1991).* Thus, multispectral images propose higher production in automatic classification *(Leone et al., 1995).* In view of the plant and the plant temperatures, the evaporation and perspiration can be taken into account at the same time. It is also possible to determine the existing water stress on the agricultural area *(Jackson et al., 1981),* maps of the missing nitrogen *(Blackmer et al., 1996),* and active photosynthesis radiation *(Pinter, 1993)* by the help of this method. Consequently, the physical materials such as soil, water and rock; vegetation and the sorts of them; organic materials; the evaporation, temperature and radiation that these materials spread, propose variety in the satellite images related to spectral resolution. As a result of this, people give more importance to the priority of the sensitiveness in image classifications. Urban areas are the most intense interaction places of these factors.

1- Material and Method

Firstly, UTM zone in which there is Turkiye was observed for PCI Geomatics Version 9.1 which is the shareware program of which we became licensed user in 2001 and the satellite images have been taken from:
"http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp" site. The technical detail of the satellite images are:

LANDSAT 7 ETM+2001

Enhanced Thematic Mapper +:

Panchromatic (0.520 - 0.900 µm, 15 m x 15 m pixel)

Multispectral (µm, all 30 m x 30 m pixel boyutu, 60 m x 60 m lik thermal band ex.):

.450 - .515 µm (blue)
.525 - .605 µm (green)

.630 - .690 µm (red)
.750 - .900 µm (NIR)
1.55 - 1.75 µm (SWIR 1)
10.40 - 12.50 µm (Thermal)
2.35 -3.09 µm (SWIR 2)

Swath width : 185 km

LANDSAT 5

Repetition time (the time needed to get images belongs to above-mentioned place from the same satellite): 16 days.

Only the spatial resolution of the satellite whose features are all the same is 120 and doesn't have panchromatic band. Image date: 21-07-1987 and average local time of the images: 07:33:00.0

The images obtained have been made usable by the help of the image processing shareware named PCI Geomatics Version 9.1 (50 West Wilmot Street, Richmond Hill-Ontario, Canada L4B 1M5). The images obtained have been compared and with the anticipated calculating technique, the prediction and evaluation made by Wiegend et al (1979) has become a reference and has made some proposals.

2- Atikhisar Geometrical Correction

When the satellite views were provided, there wasn't any coordinate information. Geometrical correction which is one of the most important applications aim at setting the satellite views on the map coordinates. The process applied is a good example of using the geographical information systems and distant perception technology together. Namely, the rough image of Canakkale taken from the satellite image in 1987 which doesn't include coordinate information, has been connected with a map of a scale of 1:25, 000, co-ordinated according to UTM co-ordinate system prepared by General Map Commandership. On the screen, by taking the airport, the intersection of the roads, the shore of the Nara cape, bends of the Atikhisar Dam, Mehmetcik and Seddülbahir lighthouses, the check points of the geographical places as a basis, interpolation has been made and the satellite image has been set to the UTM map co-ordinates. The first image has been a reference for co-ordinating the second satellite image. Co-ordinating is superior to real time DGPS application types. As it is known, the satellites used for this objective are geostationary satellites and the signals sent are weaker than GPS signals. The sensitiveness obtained when the satellite differential system was used, is almost half meter. This sensitiveness decreases with the receivers that are cheaper. In addition, the sensitiveness of the system is changing dependent upon the data type collected and the environment where the user studies. There are a lot of reference stations in this system. It can calculate the corrections like the main reference station. In this way, the loss of sensitiveness came into existence by going far away from the

main reference station disappears *(Mansfield, 1998).* It has a great contribution to integration to the geographical information systems *(Ilgar, 2003).* The coastal edge line and or dam bends, which are our reference points, can change according to the time and there can be a mistake but since there is not a location variation of the airport intersection and lighthouses, the study is accurate in a large scale.

Since the georeference of these images are taken, the subset of the place where the city locates is taken and the area in which we study has become subjective.

Phases of classifying the dam lakes:

In order to put forward the variation between the urban structure and the other structure, a classification has been carried out. Primarily, uneducated classification has been made.

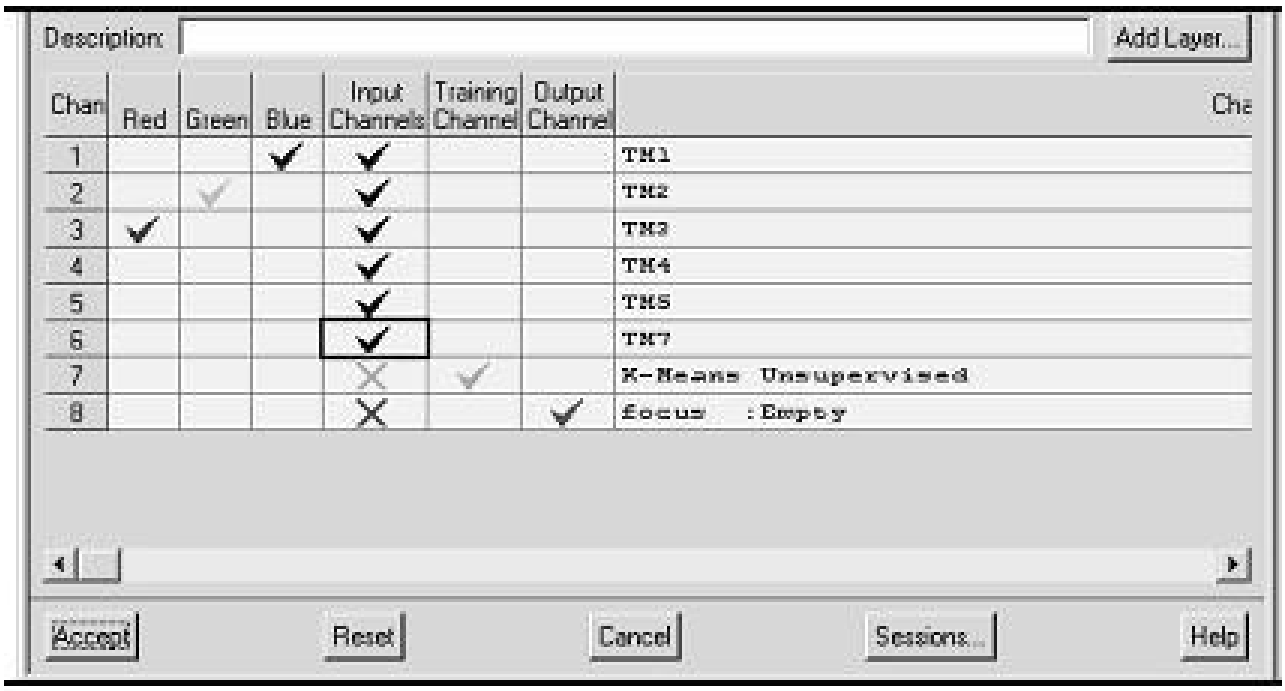

Figure 2: Uneducated Classification Table

Uneducated classification or grouping program, needles to any sample area input information, puts out the qualities which are aggregated in different groups to the class that represents that group in quality atmosphere, taking brightness values in different bands of the image to classify, or structure parameters formed with structure analysis, or quality information such as main components values obtained with the analysis of main components as a basis *(Muller, 1988).*

After this type of classification, educated classification has been made. The histogram of the urban area is materialized like this:

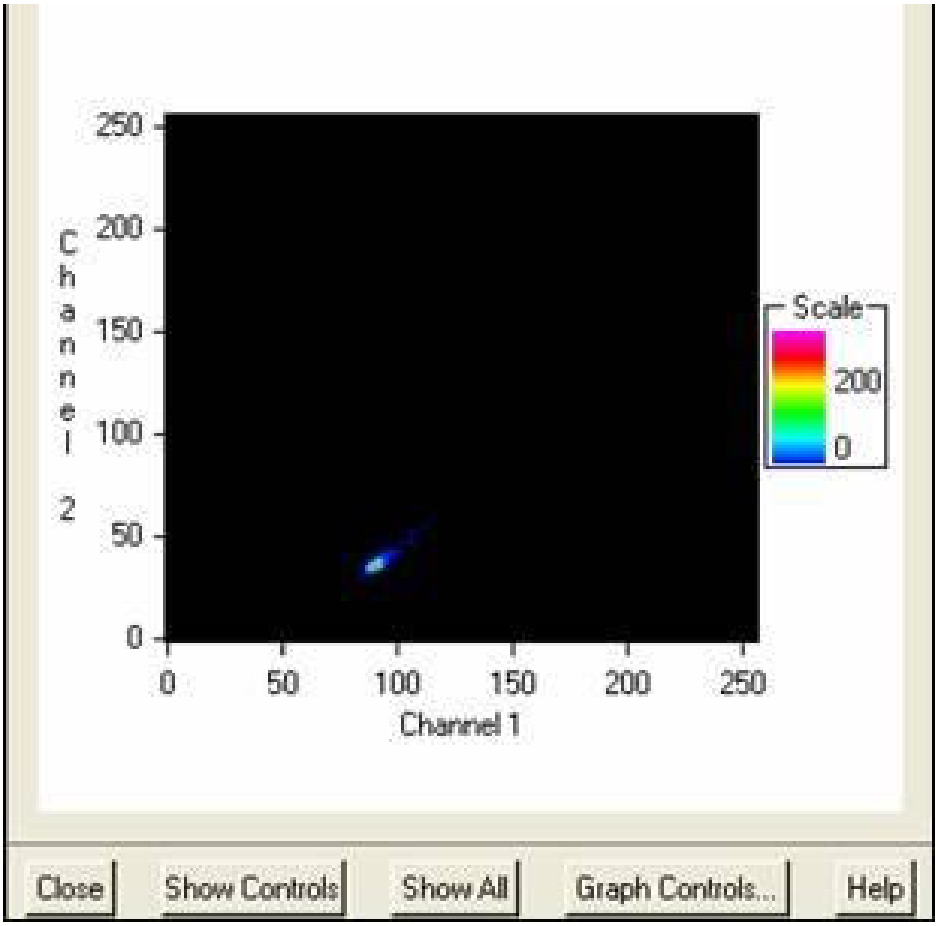

Figure 3: The Histogram of Educated Classification

The same process has been carried out on the image of 2001. As a result, the variation of the city between the two images according to the years has been tried to catch. By the help of the images whose georeferences are taken, quantitative values were obtained on urban areas. The varieties of sample land surface that seems similar, is given as input information to the educated classification program on the verge of representing different classes *(Pratt, 1978).*The image 1987 after these processes.

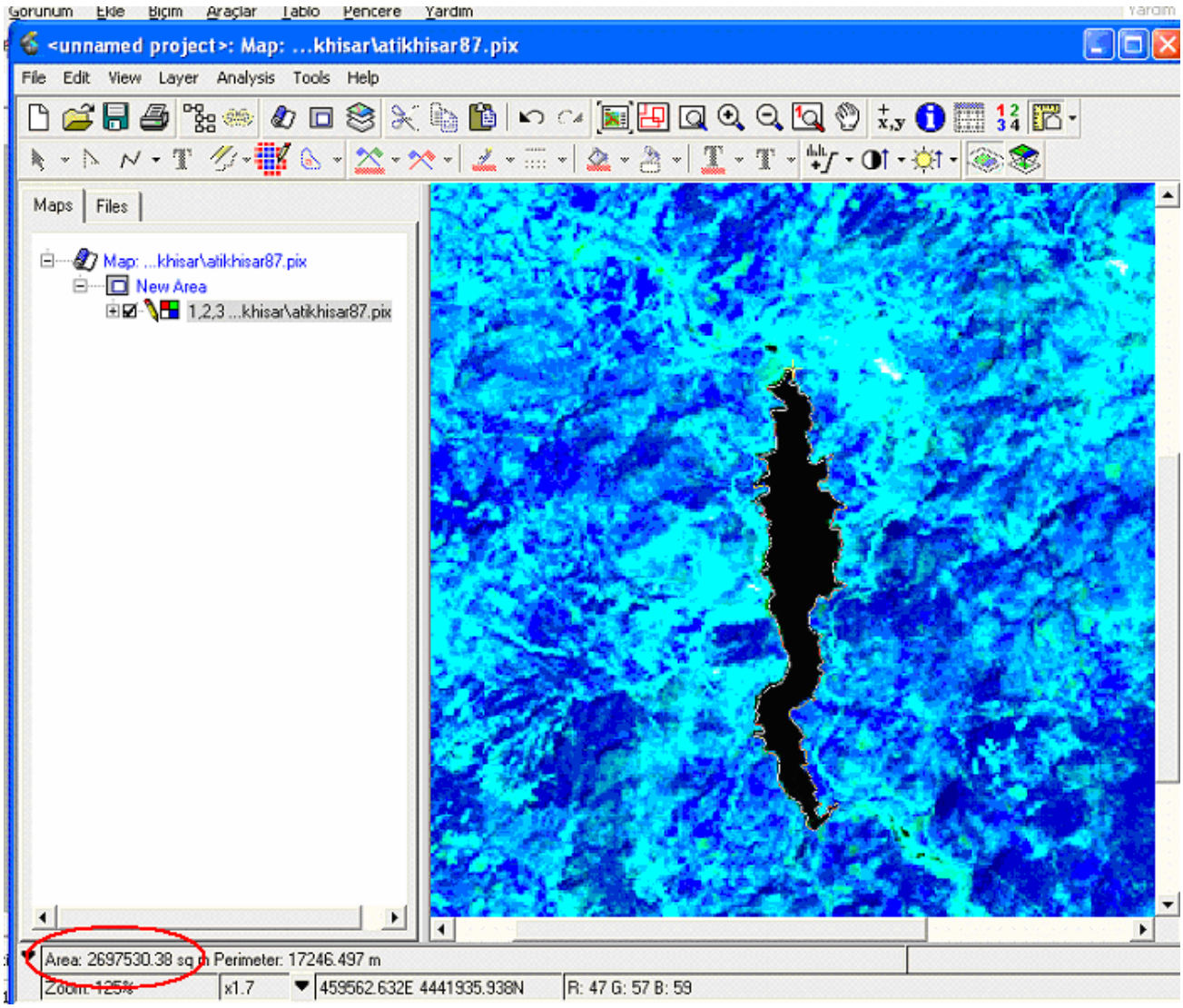

Figure 4: The Image of Polygon Values in 1987

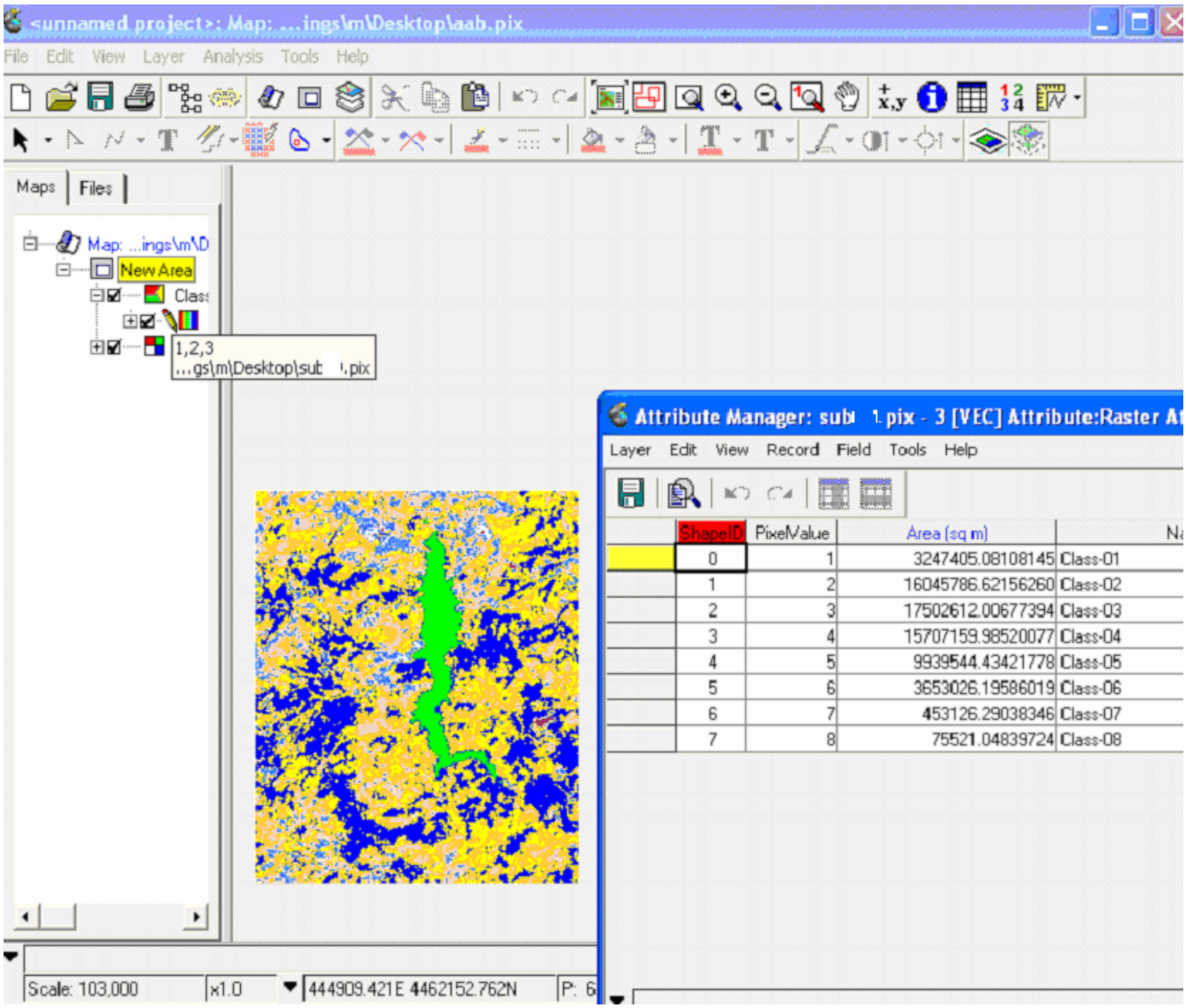

Figure 5: The Image of Polygon Values in 2001

CONCLUSION AND EVALUATION

In the light of the results, narrowing has been determined on the surface of Atikhisar Dam Lake. The population growth of % 33, 92 and the increasing surface area of 928 km^2 of Canakkale *(DIE, 2001. p.25-62)* can lead to the lack of water. After 1945's, the population growth speed of Canakkale has increased with a rate of % 62.5 and as a consequence of the stability of this increase, the urban developments in the central lead several problems. This situation has been the subject of many research and conferences *(Cullingworth, 1973, 1977; Alam and Alikhan 1994).* 3247405.08 sq m 1987, 2697530.38 sq m 2001.

After probable erosion, the bottom of the lake tends to be filled with sediment. This is reducing the quality of the drinking water. It will be helpful to revise the use of the lands regularly in the coastal parts.

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