

Water Risk Assessment and Spatial Analysis of Atikhisar Dam Using by GIS

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Abstract: In this study, the variations of water level of Atikhisar dam which provides water for most important city of Canakkale on Dardanelles. LANDSAT 5-7 satellite visions and topographic maps have been used in this research. As a result the area of the dam has been getting narrow quickly. The effect of this will reflect on the city and agricultural fields for future. Yet, in spite of %0 33 of population growth of Canakkale city, Atikhisar has a shore area water reserve that can be increased water reservoir capacity of Kilometer Square of 2697530.38 using by Landsat Enhanced Thematic Mapper +, Panchromatic (0.520 - 0.900 μm , 15 m x 15 m pixel) and PCI Geomatics Version 9.1 which is GIS software program. Despite the increase in population growth and agricultural areas of the water retention dam area was found to contraction. Reduce the amount of 928 km^2 .

Key words: Remote sensing • Water management • Dam reservoir • Sustainability • Canakkale

INTRODUCTION

Number of similar studies have been made using GIS. The study proposes a conceptual framework for site selection disposal of water treatment, urban planning residuals in developing countries using geographic information systems. For example Evaluation environmental studies [1]. Rural and Urban Planning study [2,3]. Hydrodynamic behavior analysis study [4]. Using RS and GIS data.

This study has been done Canakkale where was named Dardanelles in ancient time, 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 km^2 , 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. Atikhisar Dam take a place southern part (Fig. 1).



Fig. 1: The Map of Study Area

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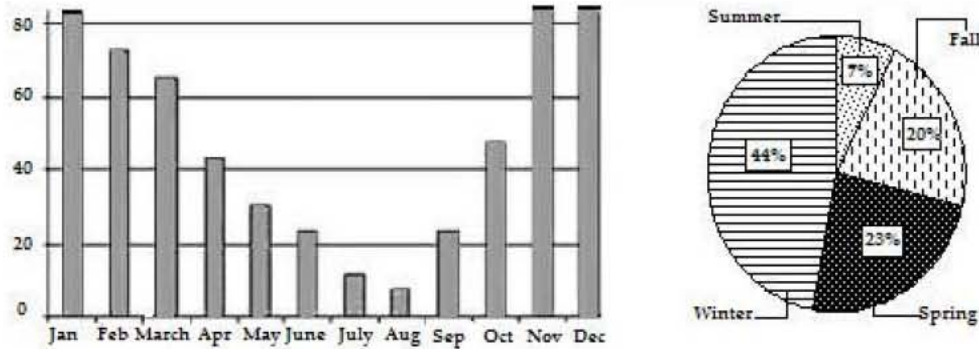


Fig. 2: The Total amount of average rainfall of Canakkale [5]

The annual average of rainfall is 400-600 mm, 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 1200-1500 mm. The most amount of rainfall drops in winter. In summer, a dry climate is seen with high temperature, high evaporation and low rainfall (Fig. 2). There have been some fluctuations in the annual amount of rainfall for several years.

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.

MATERIALS AND METHODS

Study Area: The study area in this project is located between 40°08' north latitudes and 26°24' 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 that 9.933 km² in 2005.

Data: UTM zone in which there is Turkey 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 [6]. The technical

details of the satellite images are: Landsat 7 ETM+2001, Enhanced Thematic Mapper+: Panchromatic (0.520-0.900 μm, 15 m x 15 m pixel) and Multispectral (μm, all 30 m x 30 m pixel size, 60 m x 60 m thermal band ex.) is below:

- .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

Dam Boundaries: At first, blue spaces were detected by using 1:2000 topographic maps and field study. The boundary of each dam was digitized in PCI Geomatics Version 9.1 applying satellite imagery, topographic maps and collected information. The proposed approach is superior to other vector map watermarking methods, since, it resolve the synchronization problem from the alternation of vertex coordinates [7].

The images obtained have been compared and with the anticipated calculating technique, the prediction and evaluation has become a reference and has made some proposals. At first, definitions of classical and modern location, modeling that mentions physical earth shapes [8] have been carried out. Then, industrial, economical and social factors have taken place in the projects [9]. In the latest developments, there has been linear equations and quotient counting [10]. Modern studies in this subject have been made with [11]. The studies are being handled with 3 layers as spatial, material and equipment modeling. Positioning [12] is made by the help of urban economical development scales [13] and the layer of human activities [14]. What is important is to have satellite images belong to the area of study [15].

Atikhisar Dam And City Relations: Moreover, the drinking water of the city, whose population has reached 81 435 in 2001, is being supplied [16]. Rapid urbanization that also affects Turkiye has started in 70's worldwide. 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 km², 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 rapidly¹. 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.

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

Table 1: Features of Atikhisar Dam (Anon 5, 6, 8)

Features	Atikhisar Dam
River	Sarıçay
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

Table 2: Definition of Atikhisar statistics for variance texture measures P-values

Band	Size	3 × 3			5 × 5			7 × 7		
		Mean	SD	P	Mean	SD	P	Mean	SD	P
Green	W	3.93	2.79	0.006	6.61	3.93	0.008	9.27	4.24	0.011
	T	9.11	5.39		14.62	8.96		18.40	11.00	
Red	W	3.24	1.91	0.008	5.78	3.40	0.010	8.25	4.53	0.010
	T	8.89	6.31		14.60	10.40		18.50	12.00	
NIR	W	65.00	63.80	0.250	106.00	108.00	0.240	137.00	129.00	0.24
	T	84.20	77.10		143.00	142.00		185.00	187.00	

¹The 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.

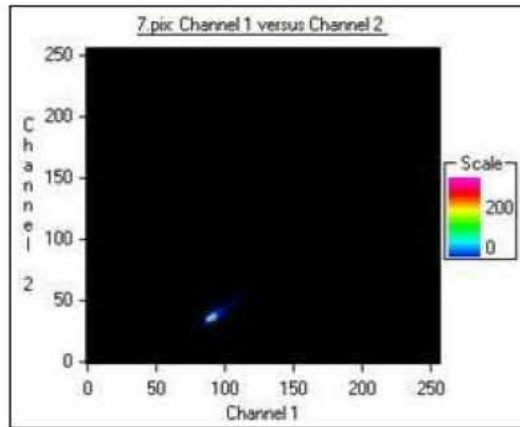


Fig. 3: The Histogram of Educated Classification

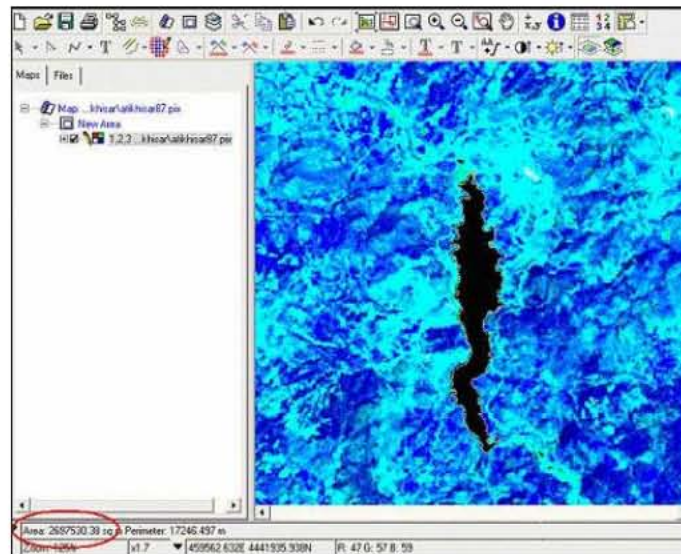


Fig. 4: The Image of Polygon Values in 1987

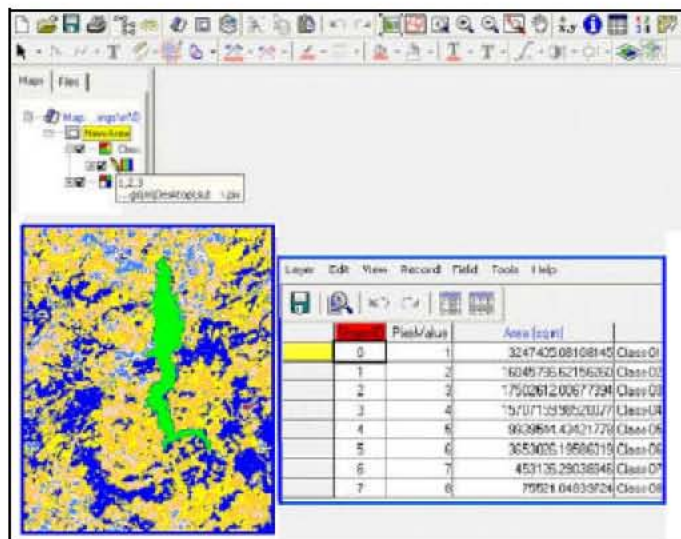


Fig. 5: The Image of Polygon Values in 2001

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 [17]. It has a great contribution to integration to the geographical information systems [18]. 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. 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. 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 [19].

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

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. The help of the images whose georeferences are taken obtained quantitative values 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 [20]. The image 1987 after these processes:

RESULTS AND DISCUSSION

Spatial resolution and real time measurements in distant perception give more realistic results about the near past [21]. Periphery of Atikhisar agriculture land has

pinus brutea pine forest. For the future, it will give information about high-resolution distant perception products [22] because of organic materials are added to dam. This contrition over the land play important role in the spectral resolution [23,24]. Thus, multispectral images propose higher production in automatic classification [25]. 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 [26], maps of the missing nitrogen [27] and active photosynthesis radiation [28] by effect to GIS studies. 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 the other result of this, sedimentation give more importance to the priority of the sensitiveness in water storage. Rough urban areas are the most intense interaction places of these restricted factors. 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, agriculture, global warming and increasing population in the area, the interest to water is increasing rapidly. Canakkale province has approximately 5 dams in 28 lakes. These are: Atikhisar Dam (2 109 ha), Gökçeada Dam (485 ha), Tayfur Dam (140 ha), Bayramiç Dam (60 ha), Bakacak Dam(674 ha).

Main province center which is Canakkale take all water from Atikhisar Dam. This dam has 120.600-hectare land, which is suitable to irrigate to downtown and urban. 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).

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 km² of Canakkale 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 research as 3247405.08 sq m 1987, 2697530.38 sq m in 2001. The 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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