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Research Article

Investigation of Impact of Aslantaş Dam on Surrounding Environment Using Remote Sensing and GIS

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ABSTRACT

Dams have a great importance for its containing biological diversity and continuity of ecological balance. The number of dams in Turkey is quite a lot. Also, of a strategical important on international level. Aim of this study investigate the relationship between the emerging of Aslantaş Dam Reservoir consequential ecological diversity in and surrounding the reservoir. Agricultural activities, the destruction of the natural vegetation by human activities intensifies the wetland degradation. This research examines the effects of landuse/cover change on the Aslantaş Dam and its immediate surroundings through Remote Sensing (RS) and Geographic Information System (GIS) techniques. Results Aslantaş Dam to densely dense agricultural activities around it and unsustainable planning lead to very serious problems.

Keywords: Aslantaş dam; Remote sensing; Geographic information system; Wetlands

Introduction

Dams are one of the most important effects created on the hydrological regimes of rivers by the human [1]. The environmental results of dams are several and varied and includes direct impacts to the ecological and physic-chemical properties of rivers environment.

In the second half of the 20th century, the environmental pollution rised because of the accelerated growth rate of human population, causing more pollution of living resources. Resultly, ecosystem degradation has become a considerably serious subject. As a matter of fact, natural balance of wetland ecosystem pollution [2]. The wetland areas are heavily degraded and ecosystem drastically changes as a results of anthropogenic factors. For this reason, many international declarations and conventions have been made for wetlands. However, the humanity still continues to expose wetlands to the danger of extinction with unconscious practices [3].

The state of wetlands is no different in Turkey compared to the world. In Turkey, where a wetland area as large as the Marmara Sea lost its ecological and economic functions due to drying and pollution in the last 40 years, wrong management and use as well as influences of global climate change threaten the future of a wetland area of about 1.2 million ha. Some researchers claim that if wetlands continue to be "managed" in this manner, almost all of the wetlands in Turkey will be destroyed by 2030 (WWF, 2008: 9-12).

STUDY AREA

Karatepe-Aslantaş National Park is located at 30 km from north of Osmaniye and 22 km southeast of Kadirli. The protected area is located in the Kadirli and Düziçi districts of Osmaniye Province (Figure 1).

Karatepe-Aslantaş National Park was established on September 28, 1958 as the country's second protected area of this type after the discovery and excavations of important archaeological finds here.

The national park is located on a slightly rugged terrain between the foothills of south of Taurus Mountains, west of Amanos Mountains and north of Çukurova Delta. Elevation of the Karatepe-Aslantaş National Park area varies between 65-538 m (Figure 2).

Karatepe-Aslantaş National Park inhabits many typical vegetation species of the Mediterranean climate. The national park is partly on the banks of a reservoir formed by the Aslantaş Dam (Figure 3).

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Figure 1: Aslantaş Dam and surrounding area.

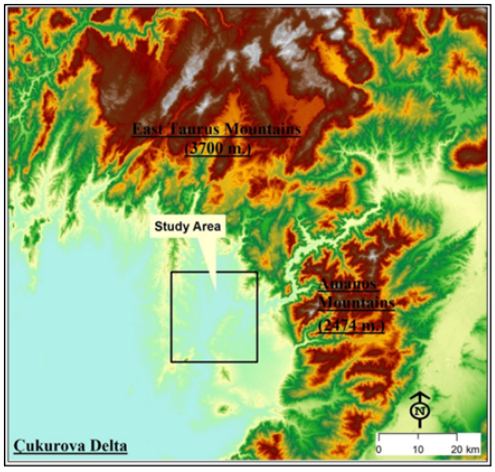

Figure 2: DEM of Aslantaş Dam and surrounding area.

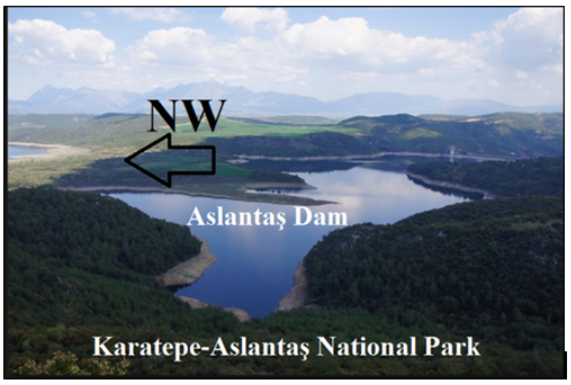

Figure 3: View of the Aslantaş Dam from the southwest.

DATA AND METHOD

Aim of this study investigate the relationship between the emerging of Aslantaş Dam Reservoir consequential ecological diversity in and surrounding the reservoir. In this context, the changes seen in natural landscape of the study area are addressed as three two stages: before construction of the dam reservoir and after formation of the dam reservoir. Thus, quantitative data were searched regarding transformation of the study area and it's near surrounding over time. Landsat TM and Landsat TIRS/OLI satellites images were used to reveal the change detection in the study area. On the purpose of identify the areal change of Aslantaş Dam Reservoir and its wetland as correctly as possible, the satellite images were taken from June and July, which is the driest period around the year (1987 and 2018). The Landsat TM images dated June 11, 1987 and Landsat 8 data 07 August 2018 were used in the study. The images used for the study were divided into 5 groups as; pasture, water, cropland, forest and settlement. Thus, the map showing the land use status of the Aslantaş Wetland in 1987 and 2018 was created (Figure 4).

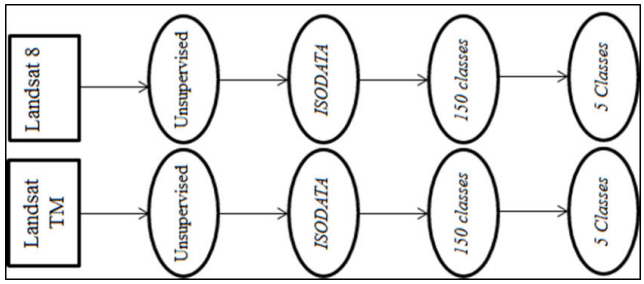

Figure 4: Flowchart of study.

Landsat data of 1987 and 2015 were obtained and geometric correction was applied. Geometrically corrected data were made suitable for processing. In the second stage, controlled classification was applied to Landsat OLI and TM data of 1987 and 2018 using the remote sensing software's. The image classified with the "IsoData method" consisted of 150 classes at first step. In the third stage, the land use map with 150 classes was reduced to 5 classes with the recode technique. IsoData method is used many studies [4-7].

The normalized difference vegetation index (NDVI) is calculated as the reflectance ratio from nearinfrared (NIR) and red channel (R) of satellite or airborne sensors. The NDVI was calculated with the following formula [8-13]:

NDVI=NIR - R/NIR +R

The NDVI is known to be well related to biophysical crop characteristics, such as absorption of photosynthetic active radiation and productivity [14-16].

RESULTS

This study aims to identify the development of water area, settlement, pasture, forest and cropland in terms of hectare (ha) presenting the effects of degradation on the land use in Aslantaş Dam and its immediate surroundings by use of the satellite images which belong to 1987-2018 periods (Figure 5).

According to the land use/land cover (LULC) images, important changes are observed last 31 years (1987-2018). Considering

approximately the last 31 years, while agricultural lands occupied the largest area with 14% in 1987 in today 29% The land classes covering the largest area in land cover map of 1987 is pasture areas. Today the share of pasture decreased to 41%. Pasture area covering % 8 area in the study area (Figures 6 and 7). Degradation of pasture areas negative affected biodiversity of Karatepe-Aslantaş National Park.

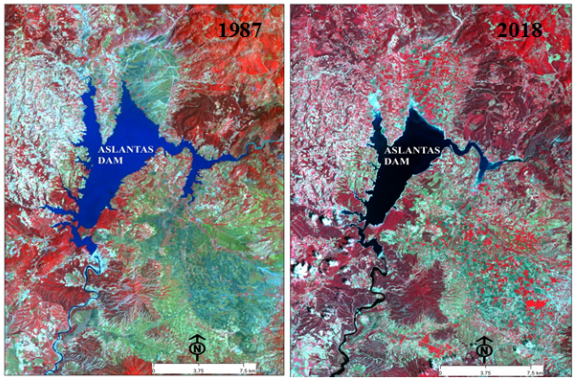

Figure 5: Landsat TM (1987) and Landsat 8 (2018) data.

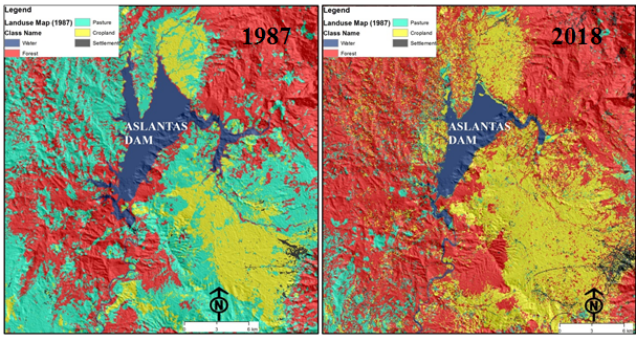

Figure 6: Landuse map of study area (1987-2018).

Construction of Aslantaş Dam in this region increased forest areas during 31 years (1987 to 2018). Forest areas increased while pasture areas decreased in 31 years. The reason of the increase of forest areas is the tree planting of the ministry of agriculture and forestry.

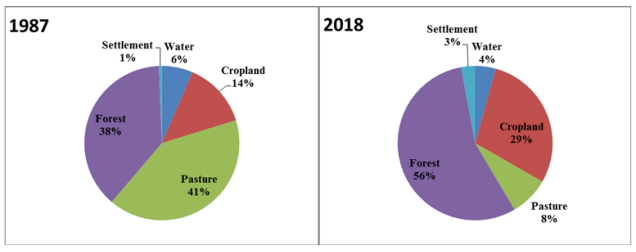

Figure 7: Graphic of Landuse classes (1987 and 2018).

1987 to 2018 increased forest and agricultural areas. However, pasture areas have decreased in last 31 years. With the increase of agricultural lands. Increased of cropland caused the eutrophication and siltation (Figure 8). The siltation is a major problem for many dams. Siltation in the dam lake caused even faster expansion of such reeds and swamps across wide areas. As a result, current dam of Aslantaş was formed.

Figure 8: Increased of cropland areas caused the eutrophication and siltation in Aslantaş Dam.

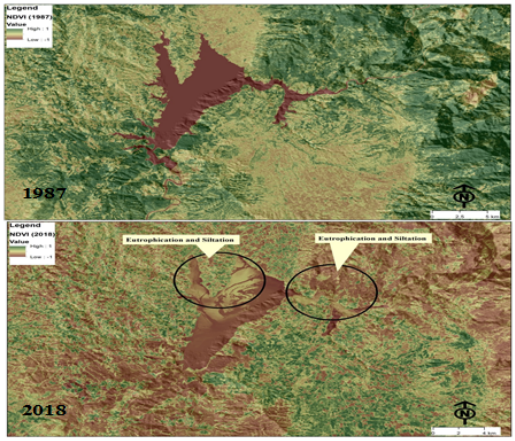

Figure 9: Siltation and eutrophication events intensive North and east side of Aslantaş Dam (1987 and 2018).

Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use. Eutrophication is a serious environmental problem since it results in a deterioration of water quality and is one of the major impediments to achieving the quality objectives established by the Water Framework Directive (http://www.eniscuola.net/en/2016/11/03/what-is-eutrophication-causes-effects-and-control/). Siltation and eutrophication events intensive North and east side of Aslantaş Dam. In this areas required step must be taken. Otherwise the wetland will disappear. On the other hand increased forest areas to prevent siltation but pasture areas decreased (Figure 9). Siltation or siltification is the pollution of water by particulate terrestrial clastic material, with a particle size dominated by silt

or clay. Construction on the land would cause siltation, pollution, and other degradation of the river. Salts, chemicals, and siltation could pollute the stream.

CONCLUSION

It was found in the study that changes took place in both land cover and land use in and around the study area between 1987 and 2018. According to LULC map, 33% of the pasture areas disappeared. Consequently, decreased biological diversity and increased siltation and eutrophication. In addition, formation of the dam reservoir significantly decreased the amount of water surface.

In today wetlands in the study area are not at stake. Permanent increase of fish farms and accumulation of fishmeal in the bottom of the dam might cause problems in the future primarily including water and sound pollution. Thus, the area should be monitored seriously. As a result, dams are harmful to the ecological diversity. However, they might have considerable benefits for the ecological environment provided that suitable physical conditions are available. Aslantaş Dam is an example for benefits of dams.

In conclusion, the proximity of the the Aslantaş Dam to densely agricultural activities around it and unsustainable planning lead to very serious problems. Measures taken in order to solve these problems create even more difficult problems instead of solving them.

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