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Temporal Change of Burdur Province Lakes Due to the Effect of Anthropogenic Pressure in the Last 43 Years (1975-2018)

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Abstract

Described as the world's natural richness museums, the wetlands are exposed to unrecoverable deep damages by the expansion of influence areas of agricultural and industrial activities. As a matter of fact, by mismanagement and misuse applications which have been followed, a wetland as large as three Van Lakes have lost its ecological and economical function for the last forty years due to reasons such as drying up, pollution etc. in Turkey. According to the Landsat satellite images obtained during the last 43 years, it was detected that lakes around Burdur Province was decreased. Hence, destruction of natural vegetation and significant pollution and contamination via fertilizers and chemcials used in agricultural lands, especially during the summer, are consequences of the Burdur Province Lakes. In consequence of the study, important changes have been found out in lakes at which are located the Burdur Province Lakes. According to the investigation results, 7 lakes located at the Burdur Province have narrowed distinctly in areal during the period of the recent 43 years. The eutrophication event an important threat of disappearing in 7 lakes of the Burdur Province. The most important narrowing have occured in Burdur and Acigöl Lakes.

Keywords: *Burdur Province, Lake, Temporal Change, Landsat, Wetland.*

Introduction

Lakes which are accepted as the Earth museums of natural wealth due to the biological diversity that they have; are the most important ecosystems of world with their natural functions and economical values (Arı and Derinöz, 2011). The lakes of Turkey which are the richest ecosystems of the Turkey are losing lands and undergoing damage because of drought, mistake agricultural policies and misuses of lands or planless in use.

In this study, lakes of Burdur Province was investigated by using remote sensing. Remote sensing provides important facilities for monitoring wetlands. Therefore, remote sensing methodology has been used in many previous studies (Gao et.al, 2012; Chawira et.al, 2013; Çelik and Gülersoy, 2013; Çelik et.al, 2013; Aslan et.al, 2016; Dörnhöfer and Oppelt, 2016; Luo et.al, 2016; Keys and Scott, 2018).

Burdur is in the west of Mediterranean Region of Turkey (Figure 1). Burdur and its surroundings have many lakes. The region where the burdur is located is called the lakes Region. Lakes Region is called, the province that comes to mind first is Burdur Province with its lakes having different natural beauties. Burdur province is located between 36 ° 53′ and 37 ° 50 53′ north latitudes and 29 ° 24′ and 30 ° 53′ east longitude.

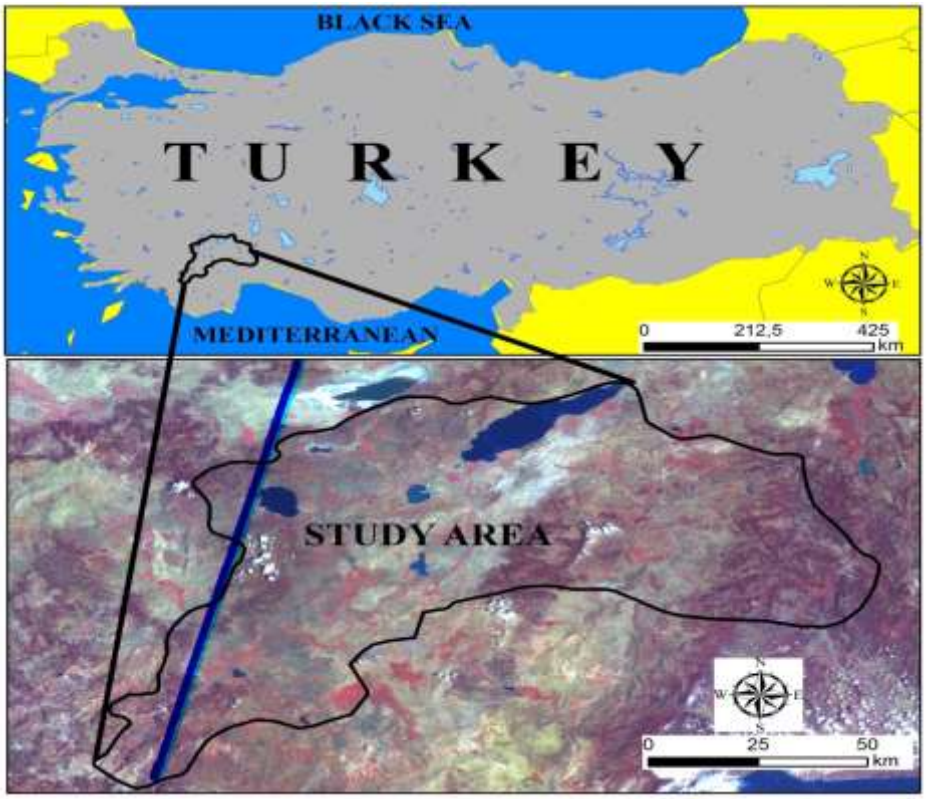

Figure 1. Location map of study area.

Data-Method

Remotely sensed data provides vital easiness and superiority on investigation and monitoring the changes in natural areas on the earth, water supplies and agricultural production processes. In this context, the wetlands changes between 1975-2018 in Burdur Province and surrounding area have been examined based on the benefits of remote sensing and the direction of change and its intensity have been analyzed.

In this research, a change of wetlands of Burdur Province and its relations with natural environment conditions in Burdur and its surrounding area have been investigated in the last 43 years period that is between 1975-2018 by using Erdas Imagine software. Accordingly, Landsat satellite pictures in 1975's and 2018's summer have been used. Landsat satellite data have been used (Table 1).

Table 1. Data used in the study

Sensor	Date
Landsat MSS	1975-06-16
Landsat TM	1986-07-06
Landsat OLI/TIRS	2018-08-22

Results

Described as the world's natural richness museums, the wetlands are exposed to unrecoverable deep damages by the expansion of influence areas of agricultural and industrial activities

Fundamental aim of this paper is change and problems of 7 lakes of Burdur Province which effecting as environmental problems. In this aim used Landsat MSS, TM and OLI/TIRS datas.

Burdur province one of the main fresh water reserves in the Lakes Region and Turkey. Important changes in the lakes of Burdur Province in recent years. Between 1975-1986 there is not much change in the area of lakes but in 1985 the changes increased (Table 2).

Table 2. Temporal changes of Lakes of Burdur Province in the last 43 years.

Lake	Total Area (1975)	Total Area (1986)	Total Area (2018)	Spatial Changing in the Lakes Area (1975-1986)	Spatial Changing in the Lakes Area (1986-2018)	Spatial Changing in the Lakes Area (1975-2018)
Burdur	220 km²	208 km²	130 km²	- 12 km²	-78 km²	-90 km²
Acıgöl	115 km²	112 km²	22,3 km²	-3 km²	-90 km²	-92,7 km²
Salda	47 km²	47 km²	44 km²	0 km²	-3 km²	-3 km²
Yarışlı	17 km²	17 km²	14,5 km²	0 km²	-2,5 km²	-2,5 km²
Akgöl	12 km²	7 km²	9 km²	-5 km²	+2 km²	-3 km²
Karataş*	9 km²	11 km²	4,8 km²	+2 km²	-6,2 km²	-4,2 km²
Gölhisar	4 km²	4 km²	2,3 km²	0 km²	-1,7 km²	-1,7 km²
Total	**424 km²**	**406 km²**	**226,9 km²**	**-18** km²	**-179,4** km²	**-197,1 km²**

* In 1982 the Karataş Lake was converted into a dam for agricultural irrigation

The increase occuring on the areas of irrigated farming caused Acigöl, Burdur and Karataş Lakes to narrow in areal, and stimulated increase of aquatic plants within the lakes. According to Landsat images 7 lakes of Burdur Province decreased in the last 43 years (Figure 2). It is a must to bring immediate solution to these problems in respect to sustainability of the wetlands.

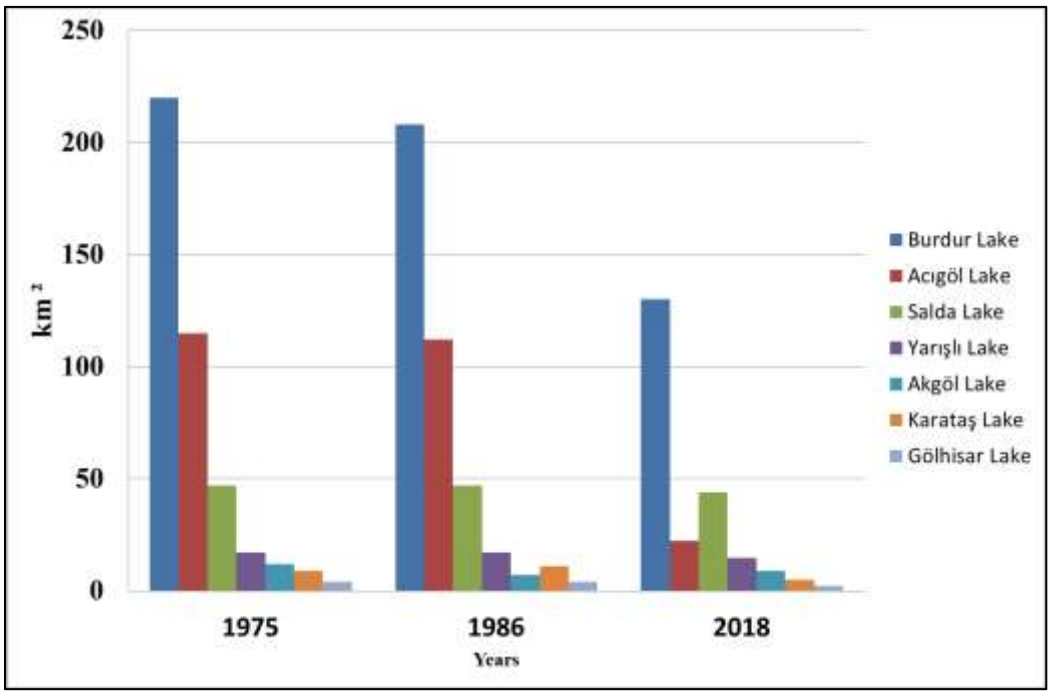

Figure 2. Temporal change of Burdur Province Lakes (1975-2018).

There are intensive agricultural activities in the northeast of Burdur Lake. So there are significant decreased in the north east of the lake (Figure 3). Burdur Lake decreased 90 km² in the last 43 years. This decreation is especially noteworthy after 1985 years. Burdur Lake between the years 1985-2018 there is 78 km of decreased.

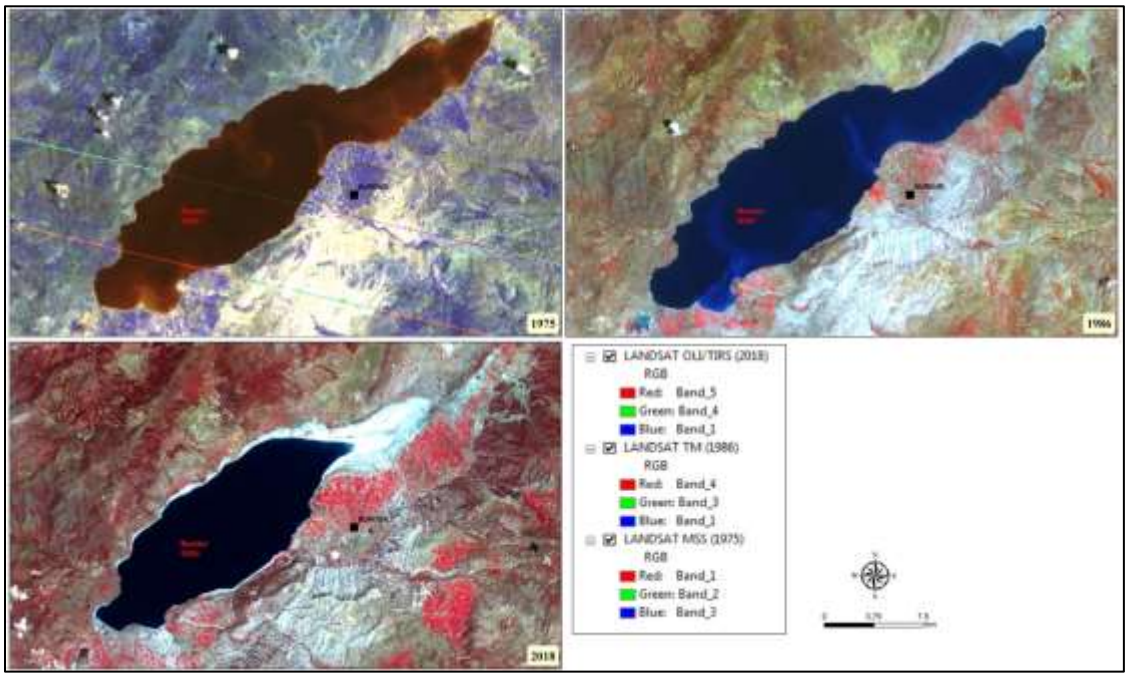

Figure 3. Landsat Sattelite Images of Burdur Lake (1975-1986 and 2018 years).

Maximum disappearance is in the Acıgöl Lake. Aquaculture fishing in the north of this lake (Figure 4). Acıgöl Lake disappeared 90 km² in the last 43 years. Acıgöl Lake covers an area of 22 km in today. This lake should be rehabilitated immediately. Otherwise it will disappear after a short time.

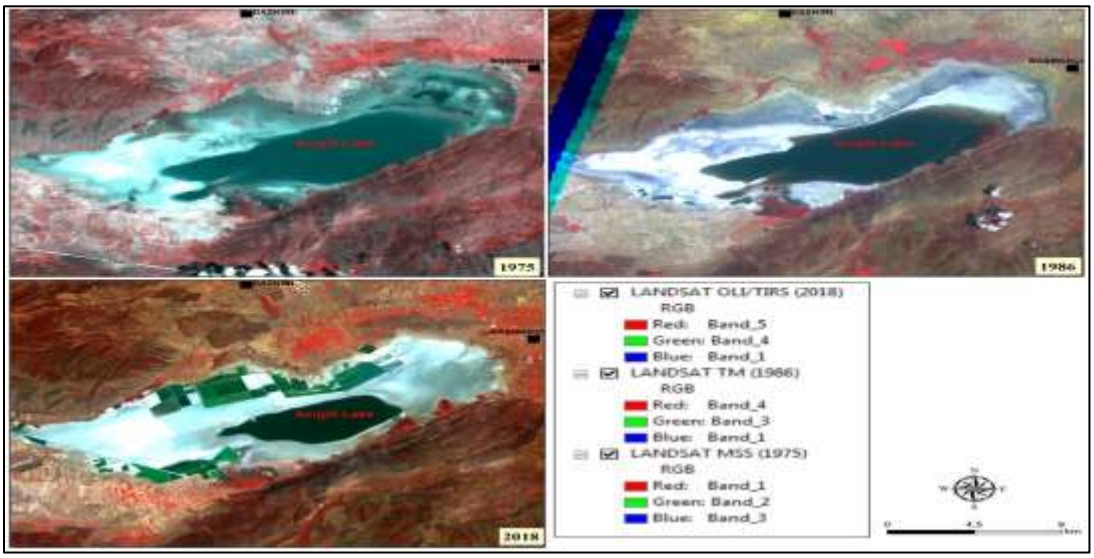

Figure 4. Landsat Sattelite Images of Acıgöl Lake (1975-1986 and 2018 years).

There is no significant decreation in the Salda Lake. Salda Lake disappeared only 3 km² in the last 43 years. Salda Lake narrowed by 1.41% between the 1975 to 2018 (Figure 5). Salda lake is well protected. Other lakes of Burdur Province must also be protected in this way.

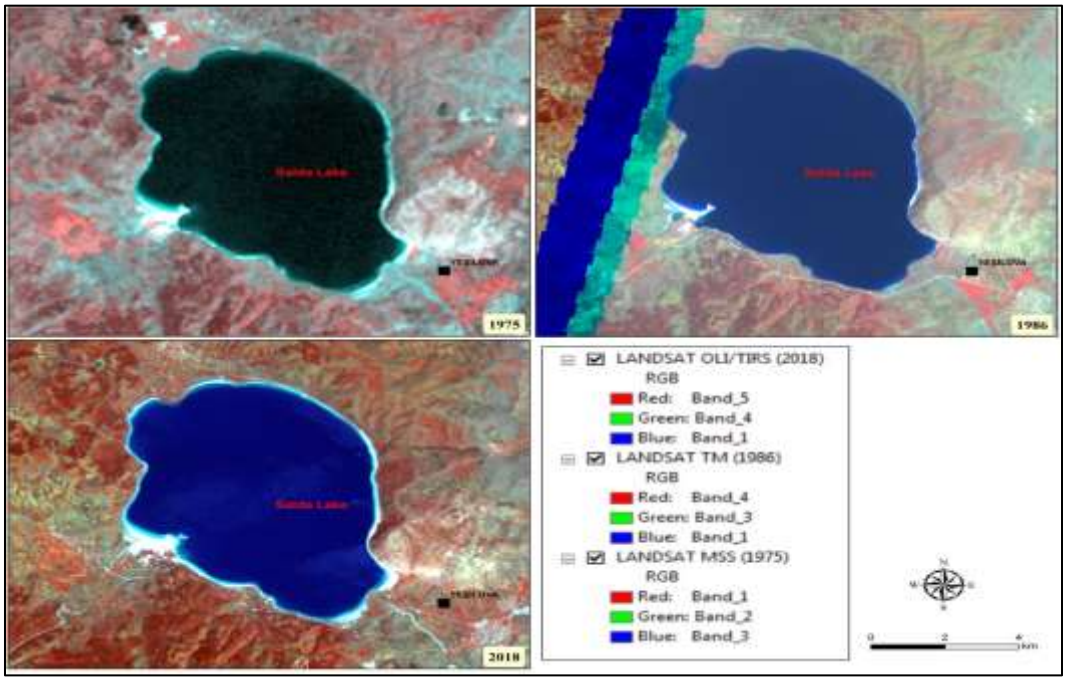

Figure 5. Landsat Sattelite Images of Salda Lake (1975-1986 and 2018 years).

Level change of Yarışlı Lake is dramatically. If it goes like this, it will be disappeare within 10 years. This lake should be protected as Salda Lake. Northwest of the agricultural areas disappearing the Yarışlı Lake. Not very decreased area of this lake but level change of Yarışlı Lake is dramatically (Figure 6).

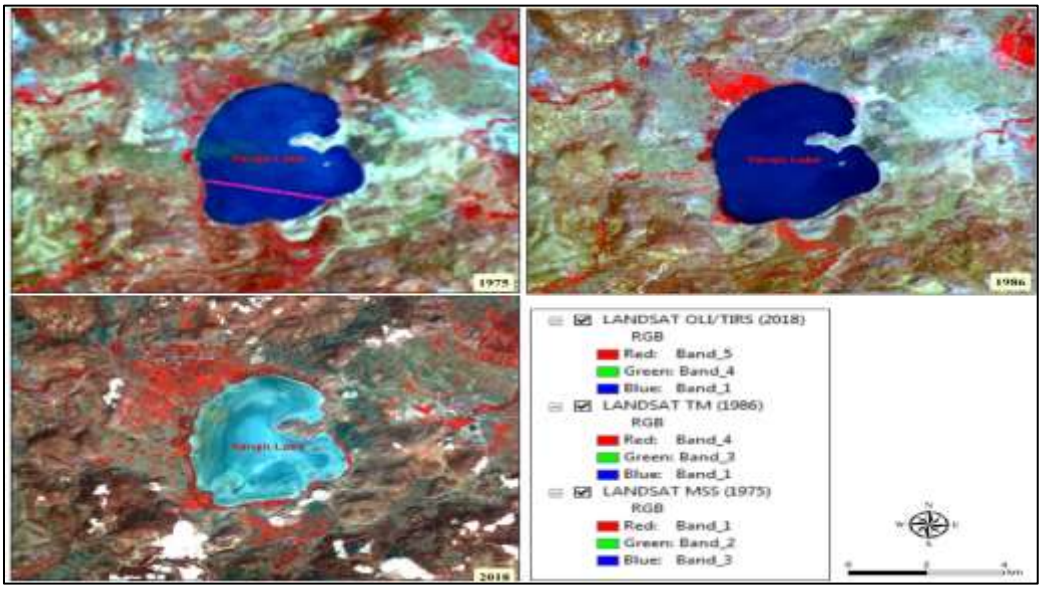

Figure 6. Landsat Sattelite Images of Yarışlı Lake (1975-1986 and 2018 years).

Level change of Akgöl Lake is dramatically. If it goes like this, it will be disappeare in a couple of years. This lake should be protected as Salda Lake. South of the agricultural areas disappeared the Akgöl Lake in the last 43 years (Figure 7).

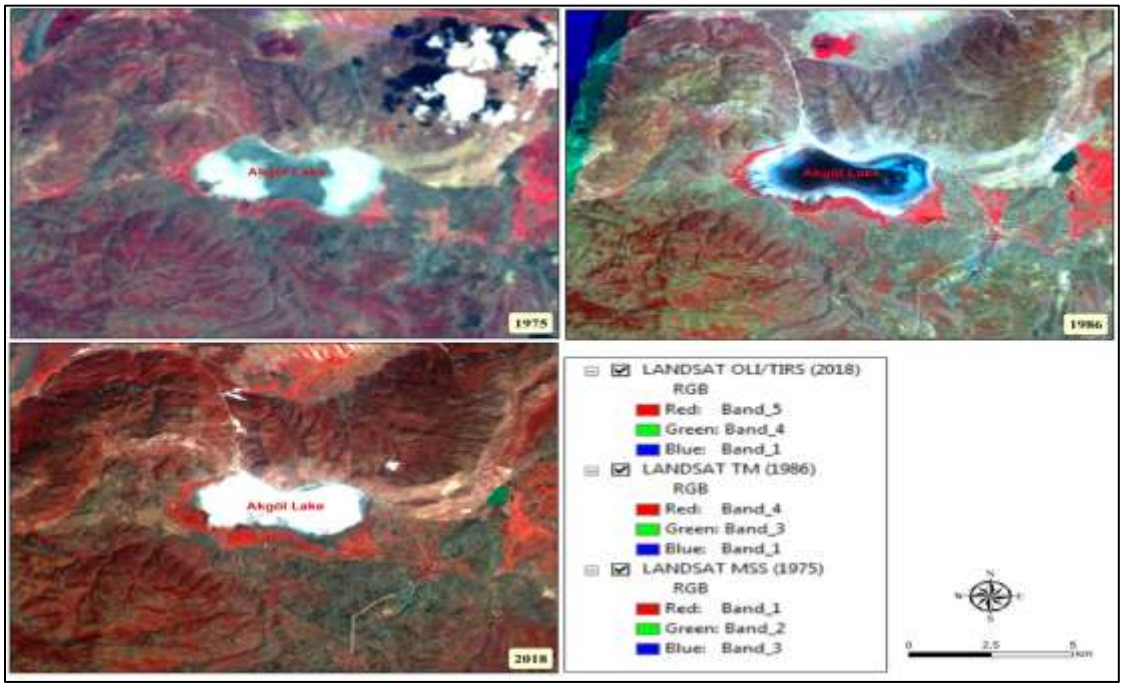

Figure 7. Landsat Sattelite Images of Akgöl Lake (1975-1986 and 2018 years).

There are intensive agricultural activities in the southwest of Karataş Lake. So there are significant decreased in the north east of the lake (Figure 8). Karataş Lake decreased % 37 in the last 43 years. This decreation is especially noteworthy after 1985 years. In 1982 the Karataş Lake was converted into a dam for agricultural irrigation (Çetin, 2009).

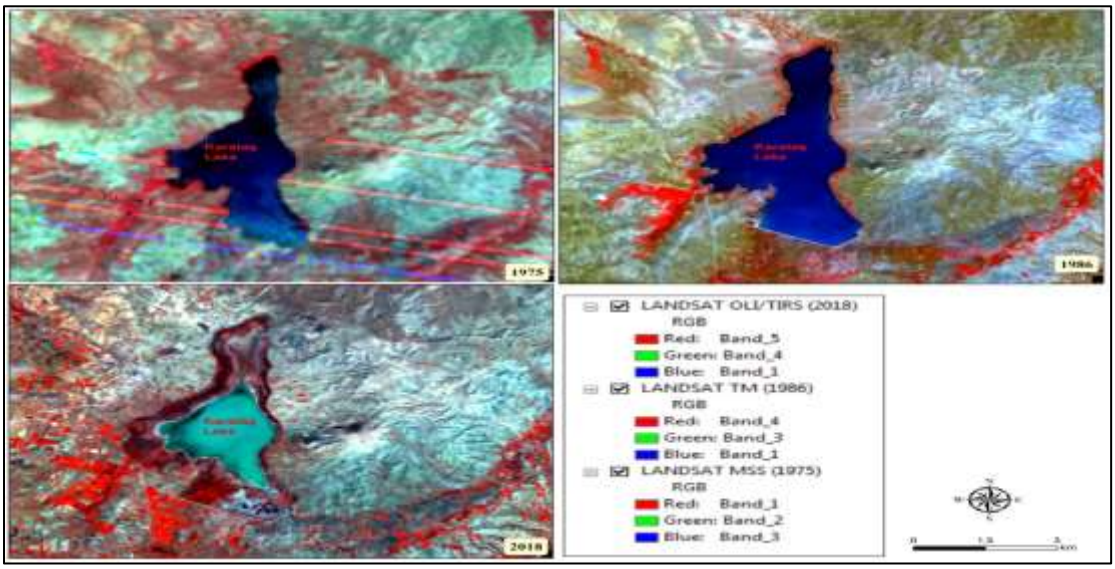

Figure 8. Landsat Sattelite Images of Karataş Lake (1975-1986 and 2018 years).

Landsat TM images were obtained in order to investigate change of land cover in the Gölhisar lake's immediate surroundings through the years of 1975-2018. According to this, areas of irrigated agriculture activity around the Gölhisar Lake showed an increase at the rate of 100% through the years of 1975-2018. The increase occuring on the areas of irrigated farming caused Gölhisar Lake to narrow in areal, and stimulated increase of aquatic plants within the lake (Figure 9).

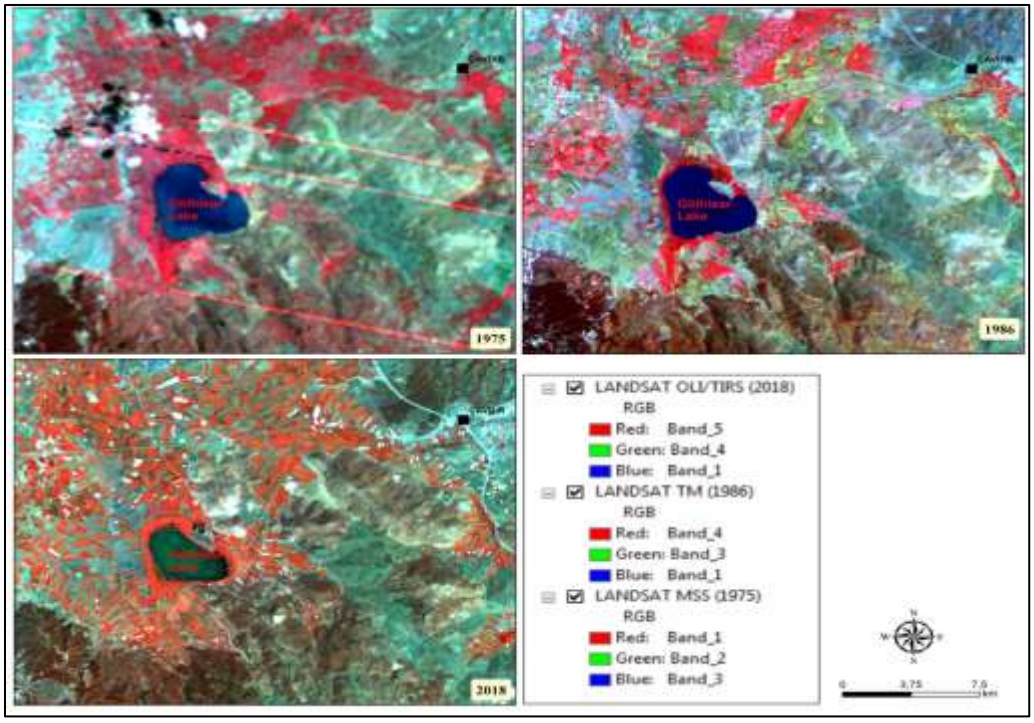

Figure 9. Landsat Sattelite Images of Gölhisar Lake (1975-1986 and 2018 years).

Conclusions

As a result of human activities, significant changes occur in the world in a short period of time. These changes need to be revealed in a short time. Remote sensing technology provides significant convenience in this regard. In this study, the important wetlands of Burdur Province that show a negative change using remote sensing technology have been investigated.

Lakes of Burdur Province, which is a karstic lakes, is mostly fed from the surrounding sources. However, the lake is dissapereance due to the irrigation farming pressure around these sources. More efficient irrigation technique should be used in Burdur Province. Otherwise lakes will continue to disappearing. Replacement of irrigation systems in the vicinity of Lakes of Burdur Province are required. A large number of boreholes are drilled without permission. Groundwater is consumed in an unsupervised manner by drilling wells drilled in almost every agricultural field. This issue should be controlled by the relevant institutions.

As a result, the negative impacts of the projects implemented on agricultural activities in the region have been largely ignored in lakes. According to the Landsat satellite images obtained during the last 43 years, it was detected that lakes around Burdur Province was decreased. Hence, destruction of natural vegetation and significant pollution and contamination via fertilizers and chemcials used in agricultural lands,

especially during the summer, are consequences of the Burdur Province Lakes. In consequence of the study, important changes have been found out in lakes at which are located the Burdur Province Lakes. According to the investigation results, 7 lakes located at the Burdur Province have narrowed distinctly in areal during the period of the recent 43 years. The eutrophication event an important threat of disappearing in 7 lakes of the Burdur Province. The most important narrowing have occured in Burdur and Acigöl Lakes.

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