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USE OF LAND SURFACE TEMPERATURE (LST) DATA IN THE DETERMINATION OF HIGH AREAS OF FOREST FIRE RISK IN ERDEMLI DISTRICT

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Abstract

In Turkey, forest fires are often occurring due to anthropogenic effect and natural conditions. The Mediterranean region is the beginning of the regions where the forest fire case is frequently experienced in Turkey. One of the natural causes of fires occurring in this area is the overheating of the ground surface, depending on the high temperatures. In this study, the last period of the forest fires in the Erdemli district were analyzed and the average ground surface temperature during the months of these fires will be examined. In this context, we have used MOD11A2 satellite data for 4 months between June and September, which is the most heated period of Erdemli District during the year. In this way, areas where the risk of forest fire in the field of study were set up. The results are seen that a large portion of the recent forest fires coincide with the months of August and September. These months are also the hottest periods, according to the results obtained from LST data. As a result, this study shows that the risk of forest fire using LST data can be determined by the remote sensing methodology of high areas.

Keywords: Forest Fire, MODIS, Remote Sensing, LST.

1. INTRODUCTION

Forests with a rich biodiversity should be kept in order to maintain ecological stability. One of the most important issues for the administration of forest areas is the dangers that arise from natural causes such as fire. Fires occurring in forest areas also threaten human life while destroying ecological wealth (Kerry and Ostrovsky, 2003; Özkan, 2010).

This requires the creation of forest fire risk maps. During the creation of forest fire risk maps, satellite imagery constitutes a very important data source (Karabulut, 2013; Matin et.al., 2017; Nogueira et. al., 2017).[1]

The wildfire occurs due to two basic dynamics:

1) Natural factors

2) Human factor

The factors of proximity to road and settlement are important for the risk map of a human-induced wildfire. In the natural forest fire, the temperature situation of vegetation and ground surface is prominent.

Erdemli the natural beauties are a sophisticated rich Mediterranean coast. Erdemli surrounded Mezitli in the east, Silifke in the west, Karaman and Konya in the north, and the Mediterranean in the south (Figure 1).

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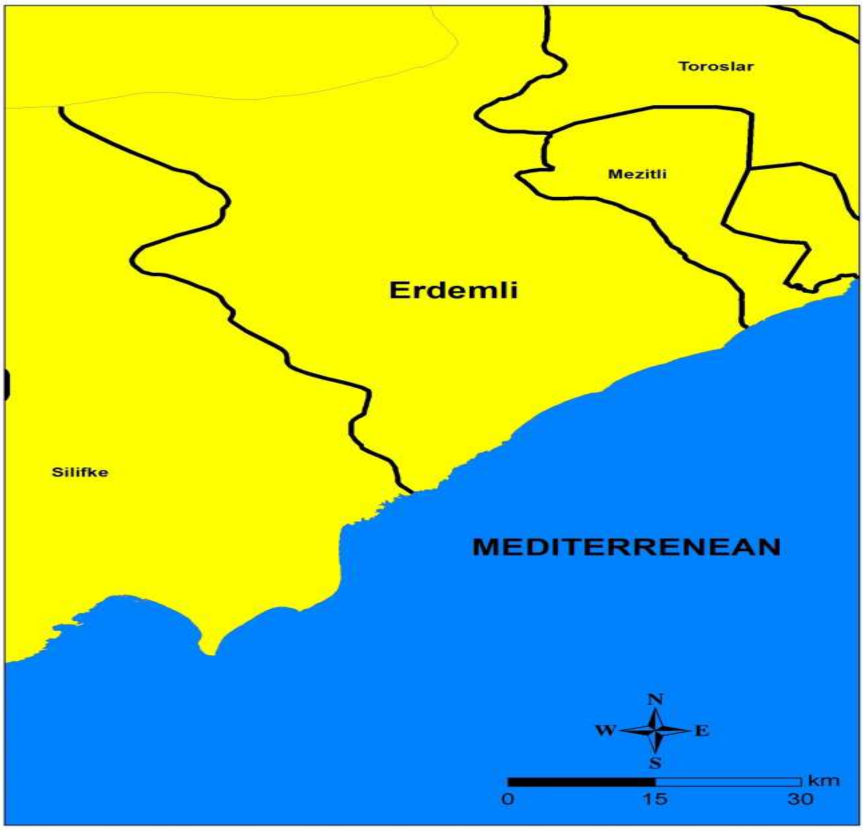

Figure 1. Location map of Erdemli.

2. DATA AND METHOD

As is known, the topography shapes in Turkey are changing at a short distance. Accordingly, the climate parameters such as temperature, precipitation and humidity differ at a short distance (Atalay, 2006; Atalay, 2015). Therefore, new methods are becoming important to obtain information and data about the important climate parameters such as temperature. One of these methods is remote sensing (Çelik, 2017).

In this study, the Land Surface Temperature (LST) model was used. Split-Window (SW) model used for the creation of LST data (Sobrino et al., 1996; Liu et.al., 2017). The SW algorithm used to obtain LST data is calculated by the following formula steps:

$$T_s = T_i + c_1(T_i - T_j) + c_2(T_i - T_j)^2 + c_0 + [(c]_3 + c_4 W)(1 - \varepsilon) + (c_5 + c_6 W)\Delta\varepsilon$$

$$e(LST) = \sqrt{\delta_{alg}^2 + \delta_{alg}^2} + \delta_{alg}^2 + \delta_{alg}^2$$

In this formula, the i and J are the temperature values in Kelvin. The brightness temperature of the Ti and Tj (brightness temperature) is the difference of each pixel in the return of the Rays from δε(emissivity difference). The W value obtained in the formulation of δε= (Ei − εj) is the water condition in the atmosphere (the amount of water in grams in the area of cm^3). The formula C0 − c6 gives the SW coefficient.

You need to download the error coefficient of the LST data obtained with the SW algorithm. Otherwise, especially in the semi-arid regions, the error rates resulting from aerosols and atmospheric effects are increasing. Sensitivity analysis was performed to improve the reliability of LST data. Sensitivity Analysis 2. The formula is calculated by step (Munoz and Sobrino, 2008; Kotchi et. al., 2017).

4. To reduce the error rate of brightness reflected from the object on the surface. The formulation used in the step. Finally, sensitivity analysis to reduce the uncertainty in the amount of water vapor in the CM area in the atmosphere, i.e. the amount of water vapor in the atmosphere to be able to obtain a clearer 5. The formulation used in the step.

$$T_s = T_i + c_1(T_i - T_j) + c_2(T_i - T_j)^2 + c_0 + (c_3 + c_4 W)(1 - \varepsilon) + (c_5 + c_6 W)\Delta\varepsilon \quad (1)$$

$$e(\mathrm{LST}) = \sqrt{\delta_{\mathrm{alg}}^2 + \delta_{\mathrm{NE}\Delta T}^2 + \delta_{\varepsilon}^2 + \delta_W^2} \quad (2)$$

$$\delta_{\mathrm{NE}\Delta T} = \sqrt{\left(\frac{\partial T_s}{\partial T_i}\right)^2 e^2(T_i) + \left(\frac{\partial T_s}{\partial T_j}\right)^2 e^2(T_j)} \quad (3)$$

$$\delta_{\varepsilon} = \sqrt{\left(\frac{\partial T_s}{\partial \varepsilon_i}\right)^2 e^2(\varepsilon_i) + \left(\frac{\partial T_s}{\partial \varepsilon_j}\right)^2 e^2(\varepsilon_j)} \quad (4)$$

$$\delta_W = \left(\frac{\partial T_s}{\partial W}\right) e(W) \quad (5)$$

3. FINDINGS

Findings are common in the Red pine forest areas in the Erdemli region (Fig. 2). The occurrence of wildfire can cause significant damage in these areas. Due to the overheating of the Earth's surface, the red pine forest areas are facing a natural fire hazard.

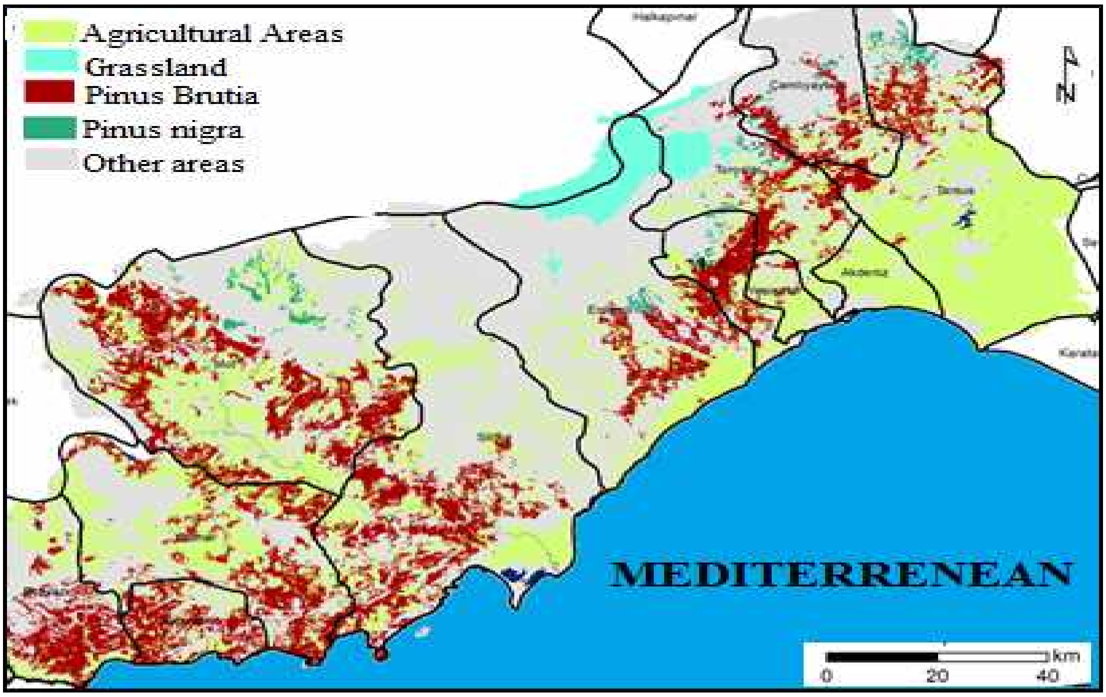

Figure 2. Forest map of Mersin Provence.

As the hottest period in both Erdemli and Mersin, the months of July and August attract attention. A forest fire is frequently occurring in July and August in the west and northeast of the Erdemli region **(Fig. 3).**

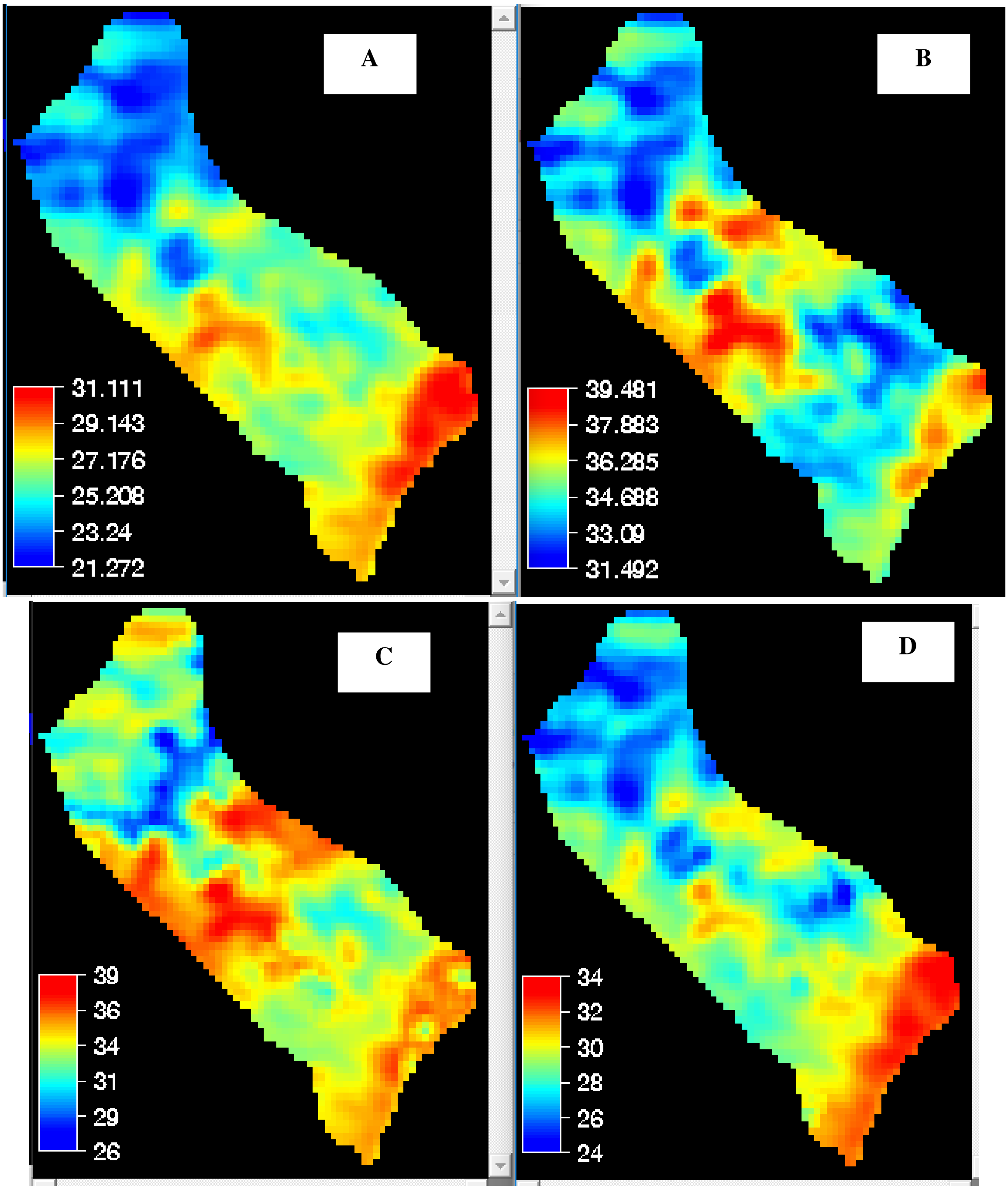

Figure 3. LST maps of Erdemli (a: june, b: july, c: august, d: September).

LST images obtained by thermal infrared remote sensing can be evaluated quickly and effectively for different objects on the earth by the mean of physical, environmental and climatic characteristics (Li et. Al., 2013; Küçükönder et.al., 2014).

Table 1. Maximum, minimum and mean of LST of Erdemli

June			
	Minimum	Maximum	Mean
Erdemli	20,777	31,768	26,068
Mersin	17,6797	45,9317	35,101
July			
	Minimum	Maximum	Mean
Erdemli	31,006	40,302	35,035
Mersin	14,5443	47,5862	36,4008
August			
	Minimum	Maximum	Mean
Erdemli	26,112	38,745	33,631
Mersin	8,4946	39,7492	27,9849
September			
	Minimum	Maximum	Mean
Erdemli	20,866	34,519	28,602
Mersin	2,0417	40,0722	30,4476

In the west of Erdemli, the Kayaali Valley and its environs are the high risk of forest fire **(Fig. 4).**

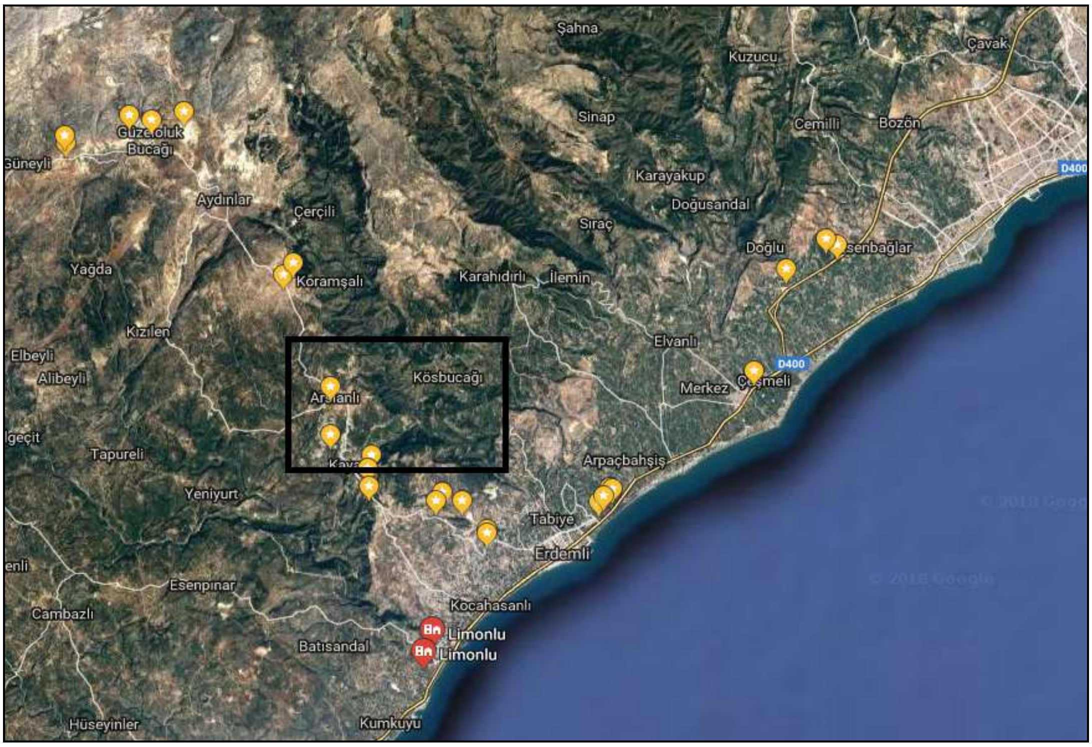

Figure 4. Kayaali Valley and surroundings.

4. CONCLUSIONS

The use of LST data is an effective parameter for the detection of forest fire risk. This parameter should be used in the forest fire risk maps. In July, Erdemli is the most heated month of the ground surface. As a matter of fact, forest fires occur frequently in this period. For this period, the relevant institutions in Erdemli must take particular precautions. Because the highest temperatures in July in Erdemli district can find 40 °C.

Forest fire risk maps should be created that include more comprehensive parameters for all of Turkey. Thus, the impact of disaster will be minimized. Another statement used to determine the risk zones of fire; LST data obtained and processed by the remote sensing method must be included in the fire parameters such as the distance from the forest types, slope, Baku, road and settlement.

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