Title: Relationship Between the Landuse and Land Capability Classification in Adıyaman Province (TURKEY)

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Relationship Between the Landuse and Land Capability Classification in Adıyaman Province (TURKEY)

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Abstract: Remote Sensing and the Geographical Information Systems with their advantages of spatial, spectral and temporal availability and manipulation of data. In this study, the land cover changes of Adıyaman have been investigated between 1988 and 2018. This study analyses land-use/land-cover (LULC) changes in Adıyaman Province, Turkey. Landsat satellite images, which provide constant retrospective data, were used in our study to determine temporal and spatial change. The image classified with the “ISODATA method” consisted of 180 classes at first step. According to the findings Adıyaman city, rapidly growing like the other cities of Turkey, while covering an area of 500 km² in 1988, expanded to an area of 4600 km² in 2018.

Key words: Adıyaman, ISODATA, Landuse, Landsat. Land Capability.

1. Introduction

Today, the Earth’s land pattern can be examined by the detectors on satellite sensors periodically and the variations on these patterns can be detected in a short while. Monitoring of land cover changes and planning these lands effectively are the important issues for economic and ecological sustainability. The use and classification of land is significant for development plans. All human activities are related to the environment and lands (Tunç et.al, 2013; Ünal and Çelik, 2016). Relation between land use and land capability classes in Adıyaman were noted in the related literature, followed by Landsat satellite images and remote sensing methods were used to process using Geographical Information Systems (GIS) and Remote Sensing (RS) softwares for landuse mapping and overlay analysis. RS and the GIS with their advantages of spatial, spectral and temporal availability and manipulation of data covering large and inaccessible areas within a short time have become very handy tools in accessing, monitoring and conserving agricultural resources (Sener et al, 2005; Dewan and Yamaguchi, 2009; Çetinkaya et.al, 2017).

In this study, the land cover changes of Adıyaman have been investigated between 1988 and 2018 (for 30 years). The study area lies in the southeast of Turkey in the central Firat river region. The climate of Adiyaman is continental climate with hot, dry summers, and cold winters. Adiyaman, situated in the southeastern part of Turkey. At an altitude of 669 m., the land is mountainous, the extensions of the Taurus Mountains covering the northern side (Figure 1).
2. Data and Method

This study analyses land-use/land-cover (LULC) changes in Adıyaman Province, Turkey. Landsat satellite images, which provide constant retrospective data, were used in our study to determine temporal and spatial change. Landsat satellite data is commonly used in many fields related to geology, geography (Taş and Yakar, 2010) and land use (Hathout, 2002; Rogerson, 2002; Barsi et al., 2003; Rogan et al., 2003; Yuan et al., 2005; Campbell and Wynne, 2011; Çelik, 2012). Also satellite data have long been available and are useful for urban LULC mapping and change detection (Song et al., 2001; Stow and Chen, 2002).

Mapping LULC changes at regional scales is essential for a wide range of applications, including erosion risk mapping, land planning, global climate change etc. (Bahr, 2004; Coppin et al., 2004; Reis, 2008). Landsat satellite images were classified using unsupervised classification method (1988 and 2018). The change map was produced by pixel-to-pixel comparison of the classified images. This methodology used many studies (Alphan, 2003; Zhao et al., 2004; Phung et al., 2005; Zsuzsanna, 2005; Yıldırım and Kılıç, 2006; Wardlow and Egbert, 2008). Landsat OLI is satellite image which has a panchromatic band with a spatial resolution of 15 m, is obtained via remote sensing and frequently used in land use studies (Yang and Lo, 2002; Booth, 2009; Genç et al., 2010). Also, the Landsat TM data was used in order to create the land use map of 1990. Data processing control was performed using ISODATA method of classification and coding of the value of the land class algorithm remote sensing softwares. Our study consisted of 4 stages in general. In the first stage, Landsat data of 1988 and 2018 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 1988 and 2018 using the remote sensing softwares. The image classified with the “IsoData method” consisted of 180 classes at first step. In the third stage, the land use map
with 180 classes was reduced to 6 classes with the recode technique. Thus, the map showing the land use status of the Adıyaman in 1988 and 2018 was created.

The final stage, the accuracy of said land use maps were calculated. According to the results of the accuracy analysis, the kappa coefficient for the 2018 data was 0.91, whereas the coefficient for the 1988 data was 0.83.

3. Results

In the last three decades, the technologies and methods of remote sensing have evolved dramatically to include a suite of sensors operating at a wide range of imaging scales with potential interest and importance to planners and land managers (Rogan and Chen, 2004). The application of sustainable agricultural plans with the advancing technology led to changes in the way agricultural activities are performed. Dry farming products, which used to represent the agricultural character of the Southeastern Anatolia Region in 1980s, are replaced by irrigated farming products today, thanks to improvements introduced by the Southeastern Anatolia Project (Çelik and Gülersoy, 2018). Agricultural areas are denser on the brown soil and alluvial soil category. Pasture and Forest area denser on the Brown forest soil (Figure 2).

According to the land use maps, important changes are observed last 30 years. Considering approximately the last 30 years, whilst agricultural lands occupied the largest area with 48% in 1988 (Figure 3,4 and Table 1), Irrigated farming lands dominated the region by 2018 and today. The land class covering the largest area in land cover map of 1988 is farmland and pasture areas. Today the share of farmlands decreased to 33.8 %. Pasture area covering % 34.1 area in the study area. The pasture class largest area in the Adıyaman Province. However, a significant decrease is evident.
Figure 3. Landuse map of Adıyaman Province (Landsat TM, 1988).

Figure 4. Landuse map of Adıyaman Province (Landsat 8, 2018).
Table 1 shows the temporal change in land use in the Adıyaman Province between the years of 1988 and 2018. The table shows that forest and settlement areas expanded from 1988 to this day, whereas farming area and pastures narrowed. The highest increase occurred for the water and urban area, while the lowest narrowing occurred for farmland and pastures. According to results of 1988, the settlement area of 4,2 % increased to 8,1 % in 2018 data (Figure 5).

Figure 5. Temporal change of Adıyaman city last 30 years (1988-2018).

<table>
<thead>
<tr>
<th>Landuse Classes</th>
<th>1988 (%)</th>
<th>2018 (%)</th>
<th>Change(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmland</td>
<td>44,6</td>
<td>33,8</td>
<td>-10,8</td>
</tr>
<tr>
<td>Forest</td>
<td>11,5</td>
<td>14</td>
<td>2,5</td>
</tr>
<tr>
<td>Settlement</td>
<td>4,2</td>
<td>8,1</td>
<td>3,9</td>
</tr>
<tr>
<td>Water</td>
<td>3,5</td>
<td>10</td>
<td>6,5</td>
</tr>
<tr>
<td>Pasture</td>
<td>36,2</td>
<td>34,1</td>
<td>-2,1</td>
</tr>
</tbody>
</table>

Table 1. Landuse change (1988-2018).

The relationship between land cover in the Adıyaman Province and land capability categories was examined. It was determined whether the land use was sustainable, planned and suitable for its potential. Lands in category I, II and III cover a tight area of the study area. Lands in category VI, VII and VIII cover about 59 % of district’s surface area. In the Adıyaman Province, agricultural activities are mostly performed on lands in category I, II and III land capability classes. Agricultural activities are also performed on lands in category IV (Table 2 and Figure 6).
4. Conclusions

RS offers wide extend to determine landuse/landcover changes. It also provides important savings in the cost of monitoring. Provision of timely, consistent and reliable landuse/landcover (LULC) information helps in achieving sustainable development of urban and agricultural environments. This study examined the temporal change in relationships between land use and land use capability classes in the Adıyaman Province. About 40% of the lands in the study area are very fertile lands. Agricultural activities are performed on almost all of these lands. A great increase has been observed in irrigated farming lands as a result of irrigation via channels from the Atatürk Dam in particular. The results obtained from satellite data show that there has been a significant increase in irrigated farming lands especially last 10 years. Adıyaman Province receives sufficient sunlight. It is also irrigated via channels from the Atatürk Dam and groundwater in the area. Relevant bodies and experts must raise awareness in the region through education and training in order to increase yield and prevent desertification. In this context, farmers in this region with arid to semi-arid ecosystem must be informed and “land use plans” prepared with an interdisciplinary
approach must be implemented as soon as possible to prevent soil erosion and salinization.

References


