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Estimation of land use and land cover changes in Konya Closed Basin

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Abstract

In this study, 28-year change of land cover in Konya Closed Basin between 1990-2018 was examined with CORINE data and mapped with geographic information systems. In addition, using the obtained data and linear regression method, predictions were made for the years 2024, 2030 and 2036. As a result of the study, it was seen that the biggest changes in the Konya Closed Basin were in the wetlands. In addition, artificial areas have also increased significantly. With the decrease in water areas, it has been seen that the basin may face drought problems in the future. As a result of the negative linear relationship in agricultural areas, it was observed that while the cultivated areas decreased, the uncultivated areas increased. On the other hand, there has been a slight decrease in forest areas.

1. Introduction

The land change of the world has been going on for centuries. It has always been a difficult issue for humanity to adapt. Science tried to understand and make sense of this land change, but these studies were very incomplete due to the inadequacy of technology.

CORINE (Coordination of Information on the Enviroment), is the land cover and usage data produced by computer aided visual interpretation method over satellite images according to the Land Use and Land Cover Use (LULC) Classification determined by the European Environment Agency. Launched in 1985, the project aimed to gather information for the European Union. In 1994, the European Environment Agency included the project in its program. The project, which covers an area of approximately 5.8 million km^2 and includes 39 countries, is responsible for collecting impartial information about the environment (LULC 2022).

When some important studies in the literature are examined Ateşoğlu (2016), 2006 CORINE data and the western Black Sea Region, Aegean coasts and Central Anatolian Google Earth data were compared and it was determined that the similarities were low. Başayiğit (2004), a land use map was created in the Isparta region by using the landsat data of the year 2000. Bayar and Karabacak (2017), using the 2000, 2006 and 2012 CORINE data, the land change of Ankara province was examined and predictions were made for 2030 according to the Puyravaud formula. Butner et al. (2004) described the methodology of CORINE databases. The results reveal significant land cover changes in some countries. Gençer and others (2015), Lake Eğirdir was compared using the Spot-4 satellite image and the CORINE 2006 map. It was concluded that the 2006 CORINE information should be updated for the whole of Turkey. Gezici and Maktav (2012), change analysis was made in Konya province by using landsat images of 1985, 2000 and 2011. The results obtained in this study showed that controlled and uncontrolled classification methods can be used effectively in the monitoring and management of the urbanization process. Özür and Ataol (2018) applied CORINE data in different parts of Turkey and emphasized the deficiencies of the project data in terms of resolution, accuracy, currency, and classification. Sarı and Özşahin (2016), within the scope of the study, the changes that took place in Tekirdağ province between 2000 and 2015 and the reasons for these changes were investigated. It has been determined that the most obvious change is in continuous city structures.

In this study, unlike the literature, LULC maps and change as well as future LULC situations were tried to be estimated.

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2. Method

In this study, satellite images and utilities were used to observe and analyze the changes in Konya Closed Basin in different years. CORINE land cover 1990 to 2018 maps were used. The workflow of this study is given in Figure 1.

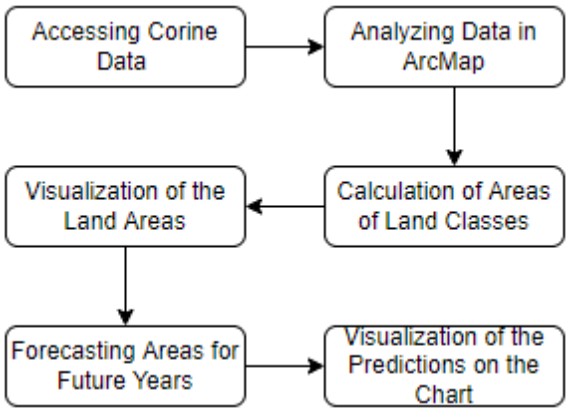

Figure 1. Work flow chart

2.1. Study area

Konya Closed Basin is located in the Central Anatolian borders of Turkey and covers 7% of the country with an area of approximately 5 million hectares (Özür and Ataol 2018). It is located between latitudes 36°51' N and 39°29' N, longitudes 31°36' and 34°52' E. The main river basins of Turkey are given in Figure 2 and the Location of Konya Closed Basin in Figure 3.

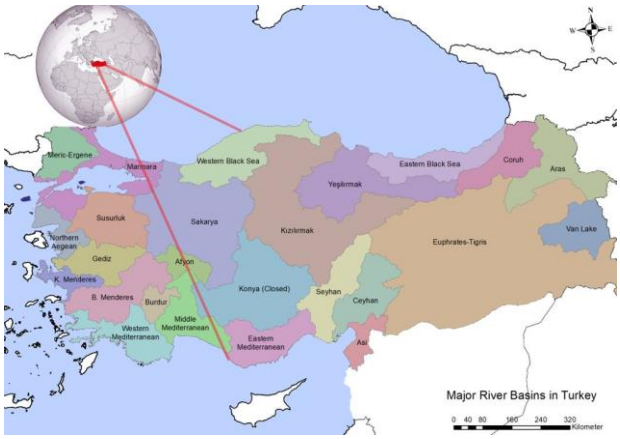

Figure 2. Major River Basins in Turkey

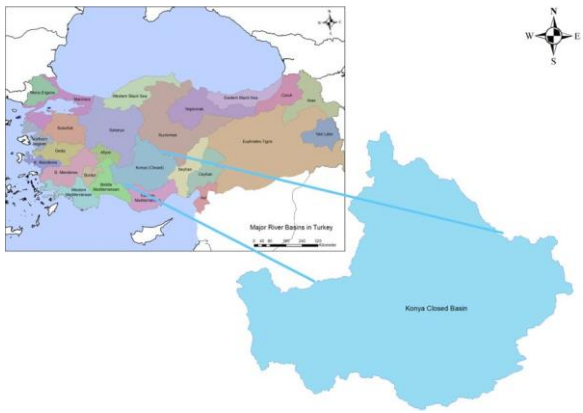

Figure 3. Konya Closed Basin

3. Results

The maps of Konya Closed Basin in different years were prepared in the ArcGIS program using CORINE data and their areas were calculated. The classification map of the Konya Closed Basin in 1990 is given in Figure 4.

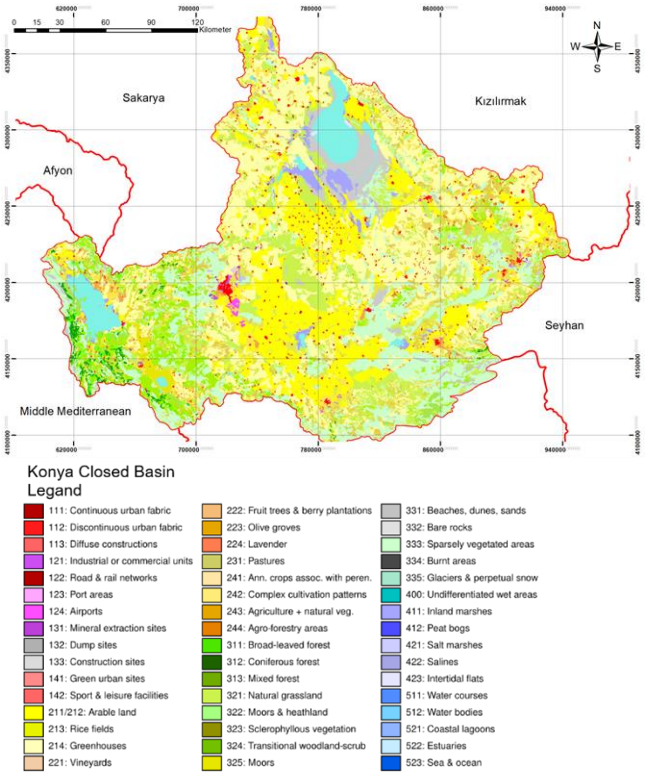

Figure 4. Classification of the year 1990

The classification map of the Konya Closed Basin in 2018 is given in Figure 5.

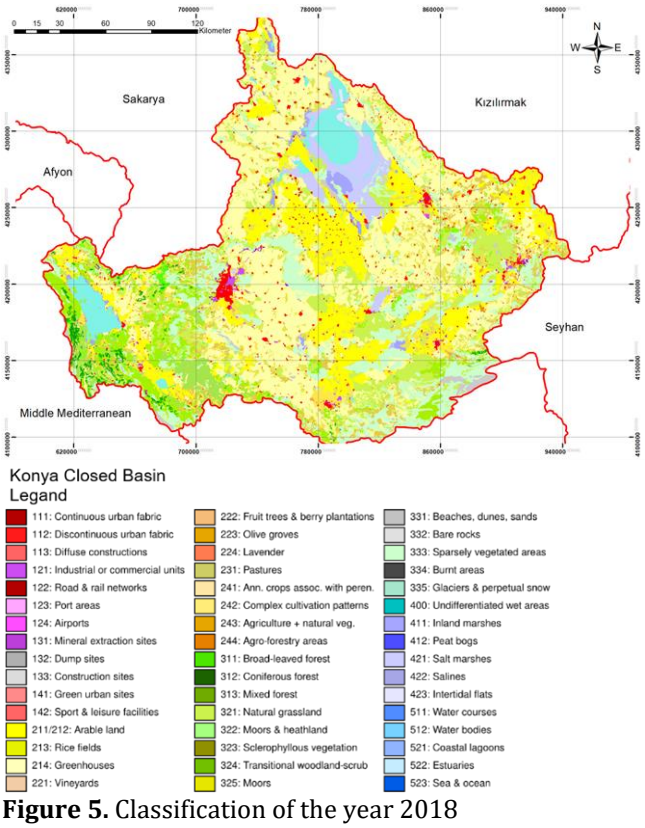

Figure 5. Classification of the year 2018

The areas are gathered under 5 general headings a is given in Table 1.

Table 1. CORINE Areas of Konya Closed Basin

Year	Artificial Surfaces (ha)	Agricultural Areas (ha)	Forest Areas(ha)
1990	81,230	2,779,074.42	1,866,756.45
2018	111,503.75	2,825,881.77	1,662,546.78
Year	**Wetlands(ha)**	**Water Bodies(ha)**	
1990	74,589.08	190,191.54	
2018	207,584.14	184,325.28	

Using the analysis, the areas that are likely to occur in the coming years were calculated with the linear regression method. The data obtained as a result of this method are given in table 2 for each title.

Table 2. Linear Regression Data

	R^2	Intersection Coefficient	Year Coefficient
Artificial Surfaces	0.9469	-1977327	1035,63
Agricultural Areas	0.7414	-1317939,7	2056,66
Forest Areas	0.7800	19261604,28	-8734,23
Wetlands	0.7229	-11545993	5833,92
Water Bodies	0.8380	571495.7	-191,98

The estimation of 2024, 2030 and 2036 using linear regression data is given in Table 3.

Table 3. Forecasts for the coming years

Year	Artificial Surfaces (ha)	Agricultural Areas (ha)	Forest Areas(ha)
2024	118,807.21	2,844,750.80	1,583,509.54
2030	125,021.05	2,857,090.79	1,531,104.12
2036	131,234.88	2,869,430.78	1,478,698.70
Year	**Wetlands(ha)**	**Water Bodies(ha)**	
2024	261,861.52	182,912.47	
2030	296,865.05	181,760.54	
2036	331,868.57	180,608.62	

Graphs were created for the found areas. These graphs are given in Figure 6, Figure 7, Figure 8, Figure 9, and Figure 10.

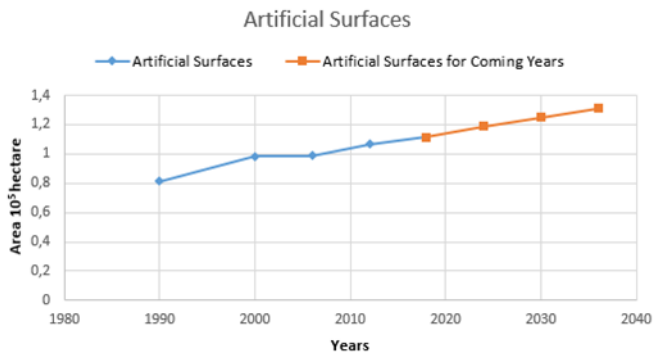

Figure 6. Artificial Surfaces of Konya Closed Basin

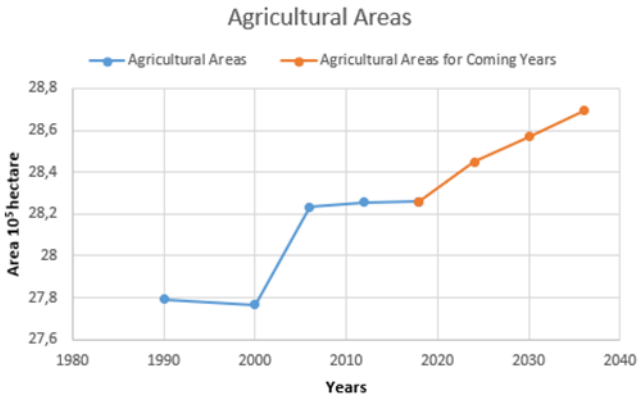

Figure 7. Agricultural Areas of Konya Closed Basin

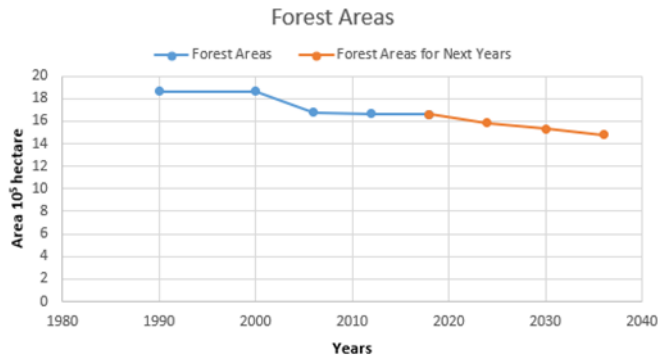

Figure 8. Forest Areas of Konya Closed Basin

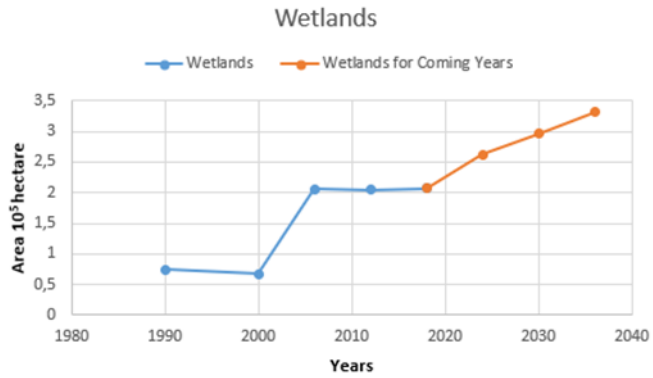

Figure 9. Wetlands of Konya Closed Basin

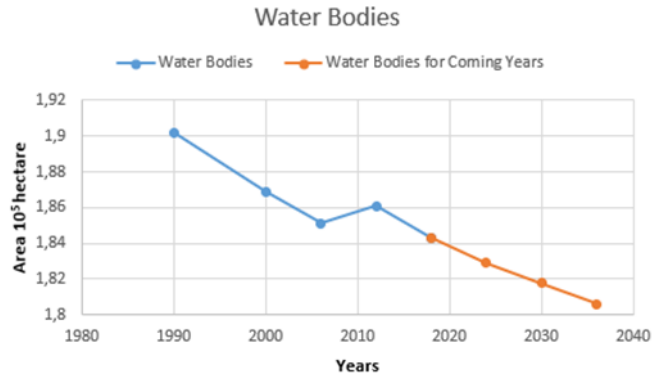

Figure 10. Water Bodies of Konya Closed Basin

4. Conclusion

As a result of this research, it was seen that artificial areas increased rapidly and these artificial areas were mostly formed as a result of the expansion of city centers. Artificial areas, which covered approximately 81

thousand 230 hectares and 1.63% of the total catchment area in 1990, reached 111 thousand 500 hectares in 2018. This area corresponds to 2.23% of the total basin. As a result of the calculations, if the increase continues at the same rate, it is predicted that there will be 131 thousand 234 hectares of artificial land in 2036. With this number, artificial areas will cover 2.63% of the total catchment area in 2036. In agricultural areas, reductions were observed in all areas except irrigated arable land. The biggest decrease is in rice fields, while there were 30 thousand 428 hectares of rice fields in 1990, this number was only 354 hectares in 2018. On the other hand, there is an increase of approximately 250 thousand hectares in 28 years in irrigated arable land. Agricultural lands, which covered 55.67% of the total basin with 2 million 779 thousand hectares in 1990, became 2 million 825 thousand hectares with an increase of 55 thousand hectares in 2018. In 2018, agricultural areas constitute 55.61% of the basin. It is predicted by the analysis that agricultural lands will reach 2 million 869 thousand hectares and 57.48% of the total basin area in 2036. A slight increase was observed in broad-leaved and coniferous forests in forest areas. Arid vegetation has increased from 39 thousand 333 hectares to 94 thousand 545 hectares in 28 years. On the other hand, natural grasslands, bare cliffs and sparse vegetation areas have experienced a great decline. While there was 1 million 866 thousand hectares of forest area in Konya Closed Basin in 1990, approximately 200 thousand hectares of forest were lost in 2018 and 1 million 662 thousand hectares of forest area remained. With this decrease, the forest areas that covered 37.40% of the total area in the basin in 1990 could have an area of 33.31% in 2018. As a result of the analyzes, it is predicted that forest areas will have 1 million 478 thousand hectares in 2036. This area will be equivalent to 29.62% of the total catchment area. With proper city planning, unplanned urbanization can be reduced and thus cities can be prevented from occupying forest areas. Wetlands have been the land cover in which the highest increase has been observed in this 28-year period. Particularly, the withdrawal of water bodies as a result of drought in the basin and leaving swamps as a result of these withdrawals have been effective in this area increase. Salt marshes, which were hardly observed in 1990, reached 151,901 hectares in 2018. The total wetlands in 1990 was 74 thousand 589 hectares. This area is equal to 1.49% of the area in the basin in 1990. In 2018, the wetlands was 207 thousand 584 hectares with an increase of approximately 3 times, which is equal to 4.16% of the total area. With the analyzes made, it has been seen that this area will reach 331 thousand 868 hectares in 2036. Under the conditions at that time, this number would be equivalent to 6.65% of the total area. Water bodies have decreased with the effect of drought and unconscious agriculture. While there were 190 thousand 191 hectares of water bodies in 1990, 184 thousand 235 hectares of water bodies remained in 2018. n this process, some lakes such as Lake Meke dried up and with the withdrawal of Tuz Gölü, large salt marshes were formed. While wetlands accounted for 3.81% of the total basin in 1990, it decreased to 3.69% in 2018. In line with the analyzes made, it has been predicted that the decrease in wetlands will continue steadily and 180 thousand 608 hectares of wetland will remain in 2036. This area will be equivalent to 3.62% of the total basin. Efforts should be made to prevent unconscious agricultural irrigation, and the drought that will occur due to global warming should not be fueled by incorrect irrigation. Farmers can be trained on this subject and the amount of water used in agricultural areas can be better controlled.

Acknowledgement

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References

Ateşoğlu A. (2016) Investigation of accuracy of CORINE 2006 land cover data used in watershed studies. *Journal of the Faculty of Forestry Istanbul University* 66(1), 173-183. (in Turkish)

Başayiğit, L. (2004). Producing of land use map according to the CORINE Land Use Classification System: Isparta Case, *Journal of Agricultural Sciences* 10 (4), 366-374. (in Turkish)

Bayar, R. & Karabacak, K. (2017). Land cover changes of Ankara Province (2000-2012). Journal Of Geographical Sciences, 15 (1), 59-76. (in Turkish)

Büttner, G., Feranec, J., Jaffrain, G., Mari, L., Maucha, G., & Soukup, T. (2004). The CORINE land cover 2000 project. *EARSeL eProceedings*, 3(3), 331-346.

Gençer, M., Başayiğit, L., & Akgül, M. (2015). CORINE land use classification of Eğirdir Lake protection zones. *Journal of Agricultural Sciences*, *21*(1), 26-38. (in Turkish)

Gezici, A., & Maktav, D. (2012). Land cover / use change detection assessment with the integration of remote sensing and GIS: Konya case study, *IV. Remote Sensing and Geographic Information Systems Symposium (UZAL-CBS 2012)*, 16-19 October 2012, Zonguldak (in Turkish)

LULC (2022), CORINE land cover, https://land.copernicus.eu/pan-european/corine-land-cover (Access date: 06.06.2022)

Özür, N. K. & Ataol, M. (2018). Using CORINE data in geography surveys. *International Geography Symposium on the 30th Anniversary of TUCAUM 3-6 Ekim 2018 /3-6 October 2018, Ankara* (in Turkish)

Özür, N. K. & Ataol, M. (2018). Assessment on the use of CORINE data in Turkey, *Journal of Institute of Social Sciences*, 9 (2), 110-130. (in Turkish)

Sarı, H. & Özşahin, E. (2016). Analysis of LULC (Landuse/Landcover) Characteristics of Tekirdag Province based on the CORINE System. *Alinteri Journal of Agriculture Science*, 30 (1), 13-26. (in Turkish)