

Spatial and Temporal Variation in Distribution of Pasture and Highlands: A Change Detection Analyses Based on Aerial Photographs

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Key words: Land-cover and land-use change; highlands and pastures, aerial photos

SUMMARY

The highlands and pastures in the Black Sea Region of Turkey and the lifestyle of its people have an important place in the rich cultural landscape of Turkey. Besides, pasture and highlands of the region have vital importance in the sustaining of stockbreeding and organic agriculture. However, in recent years due to migration of rural habitants of Turkish people to the cities, there have been observed substantial decrease in the workforce. Also, wrong agricultural politics have resulted in diminishing of livestock. In the region, some pastures have been turned into forest areas. The highlands have been used as a touristy area. Some new unlicensed constructions have sprung up centered around providing lodging and other basic needs for these highland visitors. The chance to experience the traditional highland culture and its pristine environment has drawn many people and new kind of 'Highland tourism' has enabled many of them to participate in this fascinating way of life.

This paper was basically focused on changes of pasture and highlands use in the Black Sea Region of Turkey. For this, aerial photos (black-white, scale 1/25.000, dating 1973; colour-infrared, scale 1/15.000, dating 2002) were used. The Change Detection extension in ARCVIEW3.2 was used to calculate areas of gains, losses and any change between 1973 and 2002 in each of the highland and pasture areas. According to result of investigations, it was seen that pastures have generally turned into forest areas and many unlicensed constructions have sprung up in the highlands. It was seen that there were a lot of road construction activities and damage of nature rather than necessary in the highlands.

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1. INTRODUCTION

Land-use/-cover changes are caused by human activities and natural ecological processes (Petit and Lambin, 2002). For a thorough understanding of these changes, long-term human-environment interactions need to be analyzed, based on the reconstruction of past land-use/-cover changes (Ramankutty and Foley, 1999). After 1990's, land use alterations from forests to other uses have occurred rapidly and widely in Turkey. Under current trend, the logged over forests will disappear in the near future. They functioned as the high biodiversity resources and huge carbon stocking pools, wild life habitat, and so on (Daisuka et al., 2001).

Together aerial photography, satellite remote sensing data form the base for land use mapping and change detection. With modern geographic information systems, flexible geographic databases can be created for land use issues. Remote sensing data and techniques and geographic information systems (GIS) provide efficient methods for analysis of land use issues and tools for land use planning and modeling (Pellikka et al., 2004).

There are no quantitative and objective data about the deforested area estimation and general trends of the land cover changes in the study area due to the lack of such investigations. The objective of this study is to assess the land cover change in distribution of pasture and highlands within a specific period of time by using aerial images.

2. THE LEGAL STATUS OF HIGHLANDS AND PASTURES

The legal status of highlands and pastures was first time determined by Land Law issued in 1858, in Ottoman time. According to these regulations, it was determined that water and grass resources of the pastures could only be used by the people of the village or villages that have a collective ownership status on the land. It was also indicated that these lands could not be traded, bought or sold (Yaçınalp, 2005). The status of the pastures had been determined with this law for many years. Recently, because of the popularity of "plateau tourism" new regulations for pastures and plateau are needed. In this respect, a new pasture law replaced the actual land law in 1998.

Today, highlands and pastures are such lands that are possessed and managed by the state in Turkey. Those who live in highlands have been taking advantage of water resources and grasses of highlands for a long period of time starting from an indefinite time according to their traditions formed in the course of time. There is no private ownership on these areas. Hence, it is not possible to register the high plateau on the land register. In the frame of some unwritten rules, who uses which part of the plateau is certain, and those who come from

outside of the community can not harbor in that part of the plateau without permission of community.

But nowadays, because of the popularity plateau gained in terms of tourism potential, plateau houses could be sold or rent without an official registration. This is done according to the pasture law that says pasturage and the harboring places for winter season can not be subject for private ownership, and they can not be utilized for different purposes other than their main functions, but their usage rights may be rented under the conditions defined in the regulations.

Also, in the cadastre law, in pastures and highlands, public real estates that are assigned to somebody or proved with documents or with statements of experts or witnesses that they have been being utilized by public for many years are restricted. Then, their surface areas are calculated, and they are given new parcel number after they are registered to the private registration. This restriction is not like real registration and the real estates determined in this way can not be subject of private ownership, given the regulations in the civil law

3. SPATIAL AND TEMPORAL VARIATION IN DISTRIBUTION OF PASTURE AND HIGHLANDS

Since the coastal area of black sea region followed by rough topographic structure of the land formed right after abruptly raising hills and lands that is proper for agriculture was dictated stock-breeding to be major activity in the region. The region has more than 200 highlands and 20 of them are used as tourism centers. The highlands starting after 1500 m height have very rich landscape properties and they are like natural arboretum. In this respect because highlands offer proper environments for stock breeding and wonderful climate conditions especially in the summer people tend to chose these places in recent years.

The fast industrialization after 1980s negatively affected the natural resources in the country. For example, the growth in the population destroyed many fertile agricultural lands in such a way that they can never be restored again by fostering unplanned urbanization and industrialization. In the past 20 years, the main natural resources affected in this way are the pastures and forests (Atasoy and Bıyık, 2005).

In their natural and traditional form, the highlands preferred in certain times of the year especially in the summer due to their cool climate, they are distant places mostly in the mountainous area, and they also consist of pastures used to graze live stock in the summer and to produce grasses for winter. Since these places have been opened to tourism recently, they have redesigned to reply the tourist expectations along with their traditional usage. This new approach for the highlands brought a lot of problems. How could the construction of new buildings be performed or guided/controlled without damaging natural environment (Var and Yalcinalp, 2005). The applications show that even the preservation of traditional architecture has become a serious problem because of increasing the value of real estates in highlands.

4. THE STUDY AREA

In the south part of Akçaabat district of Trabzon province, there is a highland called Işıklar. This highland covering a large area has 1550-1650 m of altitude and consists of four encampments. The surrounding of these encampments is covered by dense spruce trees and rich under forest vegetation. There are some empty places covered with mountain grasses in the forests used as pasturage (Figure 1). The encampment is settled in 24 km away from the Akçaabat province and there are some highland houses after 28 km. The encampments of the highland are called Engin oba, Uçpınar oba, Buyuk oba, and Liman oba. The highland also owns a very facilitated infrastructure such that it has asphalted road, electricity and telephone lines, drinking water network.

Kayabaşı National Park where Yayla Kent Tourist Facilities is established is also in the Işıklar highland. The Kayabaşı Highland Tourist Facility Project established on 32 500 square meters area mainly consists of bungalows that were built in the forest by using wood and stone only. The capacity of the facility is restricted for only 25 families, and there are also restaurant and a winter cafe in the facility. The transportation between the facility and the city is done via an asphalt road. The highland is also open to service with all its facilities in all seasons, whether summer or winter.

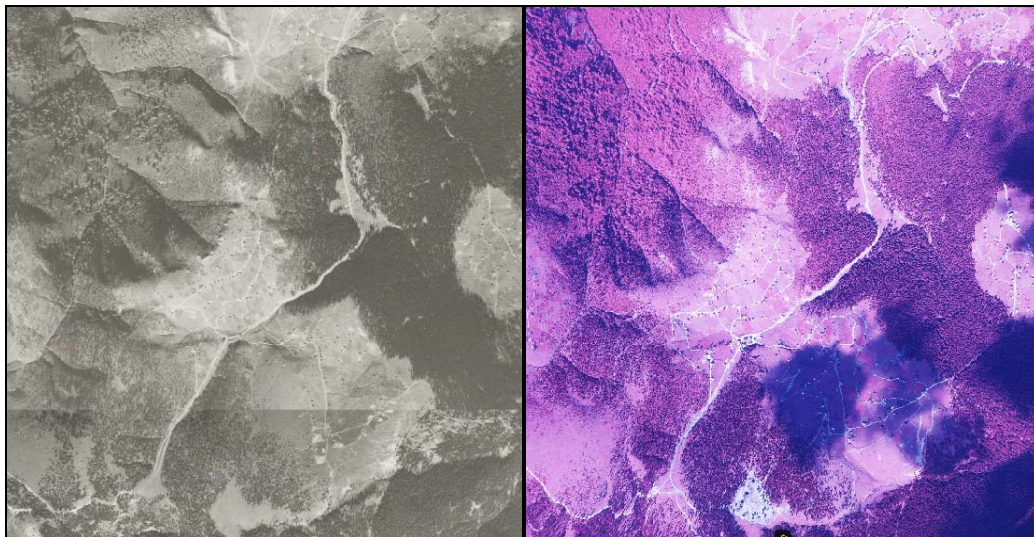


Figure 1. View of Işıklar highland between 1973–2002

5. A CHANGE DETECTION ANALYSIS BASED ON AERIAL PHOTOGRAPHS

The aerial photographs are used to determine the changes occurred in pastures and highlands in the course of time. The aerial photos taken on different dates were obtained from General Directorate of Forestry (OGM) in digital format. For this, two aerial photos were used: the first one is black-white, in scale of 1/25.000, and taken in 1973; the second one is color-infrared, in scale of 1/15.000, and taken in 2002. Also, numerical land models were produced

by using topographic maps that is in scale of 1/25000. In order to rectify the aerial photographs the coordinates of the check points were calculated with local measurement methods. ERMAPPER was used in rectification of the photos. ARCVIEW 3.2 was run to calculate areas of gains and losses and to determine changes between 1973 and 2002 in each of the highland and pasture areas.

The study of analysis was conducted in an area of 1000 hectare. The changes observed in 30 years were determined for four encampments and the pasture and forest areas they are settled. 329 houses built with wood and stone in the old traditional architectural style of the region that is proper for stock breeding were detected in four encampments in 1973 (Figure 2). These old houses were also in good harmony with natural properties of the region. The material required in building of the houses were mostly obtained from the nearest forest. The highland houses are spread out randomly all over the highland and pastures. But, if it is analyzed in details it can be seen that this randomness is a proper way of settling and functionality of the encampments. The relationship between the natural environment and these highland houses has never changed.



Figure 2. The old and new highland houses

554 highland houses is determined in 2002. The increase of the number of houses in 30 year was calculated as 68%. It was seen that most of the new houses are concrete. While some of the houses are built close to the forest, significant number of houses was replaced by the old ones, namely they were built in the same location by removing the old ones (Figure 3). Also the new houses are bigger than the old ones and they reflect the style of city houses. In fact, it was determined that while the total area of 329 houses in 1973 was 2.1 hectares, the total area of 554 houses in 2002 was calculated as 4.7 hectares (Table 1) and it is expected to growing faster nowadays. As seen while the number of houses was increased only 68%, the total area of the houses was increased almost 120%. The changes in architectural style of new houses was not in terms of proper for stock breeding. In the old style, there are generally two flats,

and the below one is used for stock breeding, while the above one built in a simple architecture is used for accommodation. On the other hand, the houses built in the past 30 years were generally built as summer cottage for living or resting in the summer (Figure 2). This result shows that the highlands are used for resting in the summer rather than stock breeding after all. Also, building the new houses in common pasture area shows that there is an on going construction, rather than planned construction activities.

Table 1. Spatial and Temporal Variation in Distribution of Pasture and Highlands

Temporal Variation	Forestry Area (hectar)	Pasture Area (h)	Building Number	Building Area (h)	Road (km)
1973	737.36	351.54	329	2.1	29.1
2002	757.01	331.84	554	4.5	38.9
Change	19.65	19.7	225	2.4	9.8

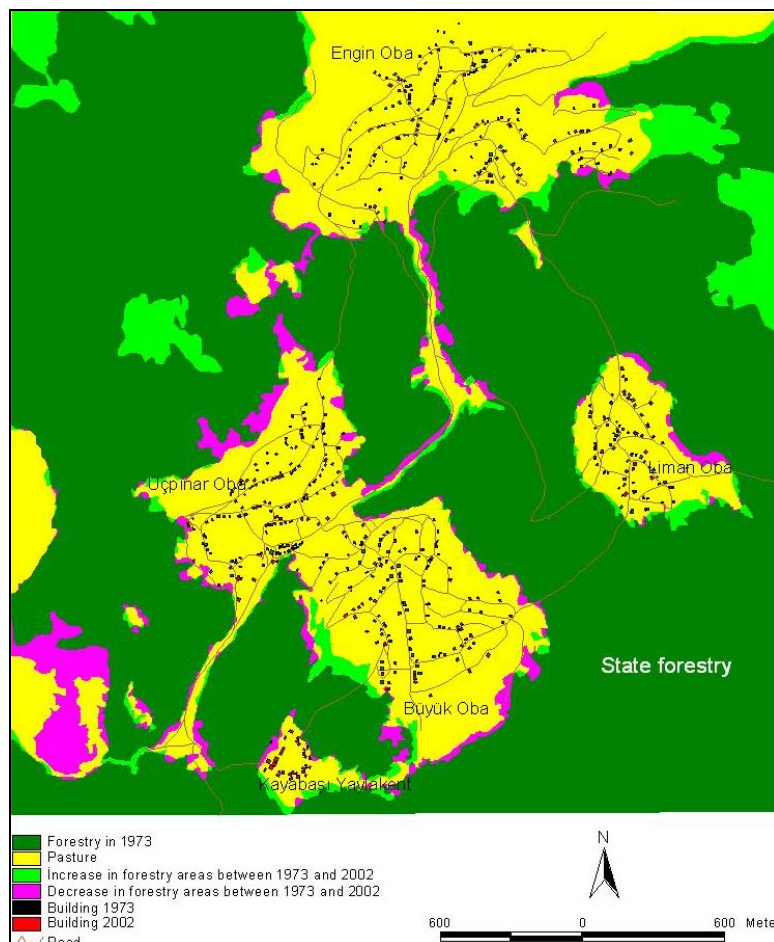


Figure 3. Changes occurred in the pastures and highlands

On the other hand, as a transportation infrastructure, the total km of the roads in encampments and forest was 29.1 km in 1973 (Table 1). While some parts of the road system was proper for vehicles, some parts were just footpaths. However in 2002, it is determined that the total km of the roads was 38.9 km. The additional roads are constructed as extensions of the old ones to reach the new houses, in the pasture area or near the state forests (Figure 4). In some places, the old footpaths are constructed to be proper for vehicle by widening them.

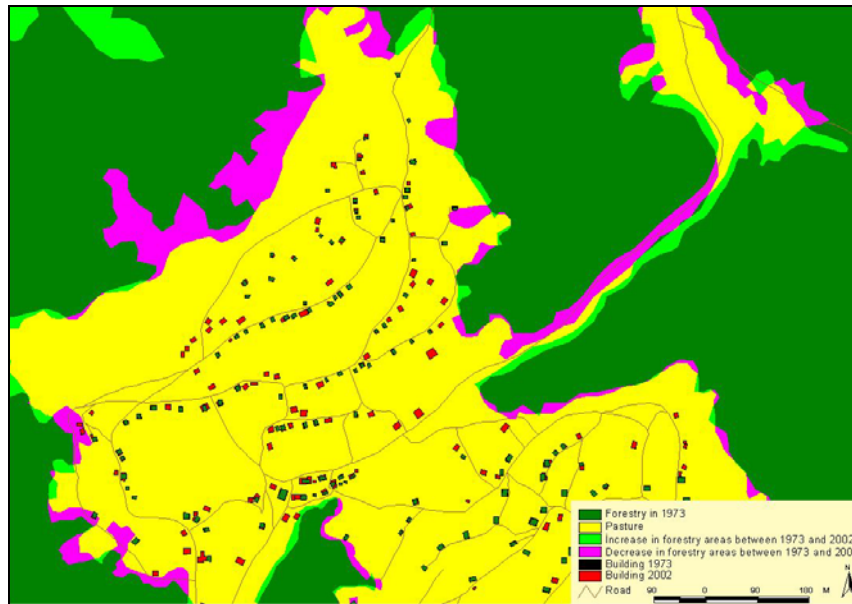


Figure 4. The location of the building and roads

Between 1973 and 2002, while the total area of forests is increased 20 hectares, it is determined that there is a same amount of decrease in the total areas of pastures (Figure 1, 3). In fact, there was decrease in some forest areas (37.6 hectares) while there is increase in other forests (56.8 hectares). The reason in the behind of increase of forest areas could be not using some places for stock breeding as much as they were used to. Because of heavy rainfall regime, the natural forestation and vegetation affect should also be considered in this increase. The rough topographic structure of the increased forest areas is also important in this respect. It is seen that the decreased forest areas are generally on the flat areas near the encampments. It was proven that some villagers or some neighbor's villagers removed the trees to produce fuel wood in these areas. Some forestation work was also determined on some parts of the encampment areas.

6. CONCLUSION

In the content of this evaluation done by using aerial photograph, it is determined that there is a significant increase (68%) in the number of houses built in the past 30 years in Isıklar Highland that is declared as a national park. While the old houses with their old traditional architectural style were seen in harmony with the natural environment, the new houses are completely concrete in structure. On the other hand, the new houses built in the encampments were determined not to be a part of a planning. This showed that the highlands, parts of wonder of the nature, are faced with an unplanned urbanization. As a consequence, the highlands declared as eco tourism places could face with the danger of loosing this property.

This study also shows that in recent years, the highlands are used, apart from their traditional usage which was mostly stock breeding, as summer resort by economically rich people. Since the infrastructure problems of highlands are solved they are opened to service all seasons, in 12 months of the year. Along with these opportunities created, to preserve the nature and ecological balance of highlands, the original architecture of the buildings should also be maintained and the construction activities should be controlled in a planned manner.

It can be concluded from this study that remotely sensed data like aerial images can be successfully used for monitoring and change detection. Land cover change or any other change can be detected using these photos for different dates and Geographic Information System (GIS).

REFERENCES

- Atasoy, M. And Bıyık, C., 2005. Mera ve Yaylaların Zamansal Değişiminin Tespitinde Dijital Fotogrametriden Yararlanma, Türkiye'de Arazi Toplulaştırması Sempozyumu, 15–16 Eylül 2005 Mevlana Kültür Merkezi, Konya.
- Daisuka, T., Tsuyoshi, K., Tatuya, S., and Haruwinote, S., 2001. Time series analysis of forest cover change and fragmentation in tropical lowland forest, Jambi, Sumatra, 22nd Asian Conference on Remote Sensing, 5-9 November, Singapore.
- Pellikka, P., Clark, B., Hurskainen, P, Keskinen, A., Lanne, M., Masalin, K., Nyman-Ghezelbash, P., and Sirviö, T., 2004. , Land use change monitoring applying Geographic Informatin Systems in the Taita Hills, Se-Kenya, 5th African Association of Remote Sensing of Environment Conference, 17-22 October, Nairobi, Kenya.
- Petit C.C. and Lambin E.F. 2002. Impact of data integration technique on historical landuse/land-cover change: Comparing historical maps with remote sensing data in the Belgian Ardennes. *Landscape Ecology* 17: 117–132.
- Ramankutty, N., and J.A. Foley (1999). Estimating historical changes in global land cover: croplands from 1700 to 1992. *Global Biogeochemical Cycles* 13(4), 997-1027.

Var, M. and Yalçınalp, E., 2005. Doğu Karadeniz Bölgesi'nde Yaylalara Yönelik Turistik Talebin Çevreye Etkileri Ve Çözüm Önerileri, 1. Çevre ve Ormancılık Şurası, 21–24 Mart 2005 Antalya.

Yalçınalp, E., Trabzon'da Bazı Turizm Merkezleri Ölçeğinde Yayla Turizminin Ekoturizm Kapsamında İncelenmesi, Yüksek Lisans Tezi, K.T.Ü F.B.E, 2005.

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BIOGRAPHICAL NOTES

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