Land Use/Cover Changes in North Eastern Greece from 1980 to 2000

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Abstract. Routes of transhumance movement as well as both summer and winter destinations are subjected to intense grazing that over the years may shape landscapes. The aim of this study was to investigate land use changes in Aspropotamos area, Trikala from 1985 to 2000 that serves as a summer destination of transhumance flocks. Changes in land cover were explored with the post classification comparison approach within a GIS environment. Two maps of 1985 and 2000 were used. The results of the current paper reveal a dramatic reduction of shrubland (up to 100%) followed by grazed open forest (17.61 %) and grasslands (13.77%), while the higher percentage of increase was recorded in the forest (32.7%) followed by agricultural land (24.88%). It seems that the declining trend of transhumance grazing in mountainous areas in Greece account for both changes in rangelands and forest areas. In conclusion, transhumance serves as a critical element towards maintaining ecosystem productivity to its recent historical equilibria.

Keywords: transhumance, lowland, highland, rangelands, succession.

1 Introduction

Transhumant livestock systems are common practices in many countries worldwide accompanied by vertical movement of the livestock (Aryan 2010, O'Flanagan et al. 2011). In this system, the livestock follows the same prescribed route from lowland to highlands every year, in order to exploit the seasonality of forage production and availability, due to different rangelands altitude, throughout the year. In addition in Greece, livestock movement is a common practice from antiquity (Hadjigeorgiou, 2011), although the last decades there is a reduction in this livestock movement. Nowadays, according to the Greek Payment and Control Agency for Guidance and Guarantee Community Aid (GPCAGGCA, 2011) there is only 1 million transhumant sheep and goats. However, Chatzimichali (2007) reported that around to 1960 in Greece there were about 2 millions transhumant small ruminants. This mobility decline of sheep and goats number has important ecological implications, as herders

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stopped utilize summer rangelands. Thus, rangelands go through a stage of plant succession towards climax, decrease their forage production and biodiversity, while leads to an increasing fire risk, and dynamic landscape changes (O'Flanagan et al., 2011, Oteros-Rozas *et al*., 2013).

Last years, herders and ecologists had a debate about the transhumance livestock systems. The first group pays attention to livestock production, whereas ecologists care about the ecosystems conservation and biodiversity maintenance in grazing lands (Ayan 2010). It is known that specific characteristics of the landscape as maquis, dehesas, montados (Gomez Sal and Lorente 2004) had been formed under grazing pressure and the transhumance has an important role in this landscape shaping (Gomez Sal 2000, Sklavou et al., 2014).

A common method for quantifying land cover changes is the comparison between two classified land cover maps (Foody, 2001, Fuller et al., 2003; Poyatos et al. 2003; Lu et al., 2004), namely post-classification comparison. However, the accuracy of the post-classification comparison is totally dependent on the accuracy of the initial classifications (Coppin et al. 2004).

The aim of this study was to investigate the land use changes in Aspropotamos area from 1985 to 2000.

2 Materials and Methods

The study was conducted in the enlarged community of Aspropotamos area in West part of Regional unit of Trikala (Fig 1) at an altitude above 700 m to 2379m. The most part of the study area were taken place among the mountains Lakmos, Athamanika and Koziakas. This survey has covered an area of 94.111 ha and its largest part is covered with grasslands, shrublands and forests and mainly used from transhumant livestock from May to October.

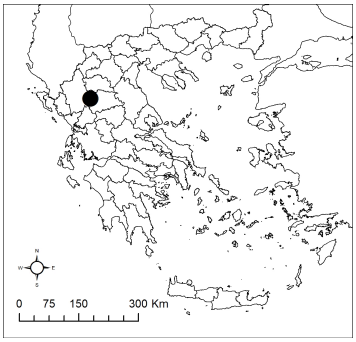

Fig. 1. The experimental area of Aspropotamos, Trikala.

For the land cover change detection, the post classification comparison approach was implemented, within a GIS environment. Two maps of 1985 and 2000 were used. For the land cover classification in 1985 a digital map of Forest Vegetation and Land Cover, by the former Ministry of Rural Development, was used. This was

based on an aerial photography survey around the year 1985 and is of 1:50,000 scale. The classes of this map were indicative of the classification scheme designed and they were merged to suit the purposes of our study.

The Corine Land Cover 2000 (CLC2000) vector map was used to provide land cover information for the year 2000. CLC2000 is based on classification and digitizing of features on satellite imagery, with 100 m positional accuracy and 25 ha minimum mapping, and is of original scale1: 100,000. 21 out of the 44 CLC classes were found in the study area, which were merged into the 5 classes of the classification scheme adopted in this study (Table 1).

Table 1. Classification scheme

Land use categories	Description
Grasslands	Areas dominated by herbaceous plants, with ground cover of woody vegetation < 10%
Shrublands	Areas dominated by evergreen woody shrubs with sclerophyllous leaves
Forest-rangeland	Areas dominate by herbaceous plants, with ground cover of woody vegetation between 10% - 40%
Forest	Areas with relative tree cover higher than 40%
Agricultural land	Fields with permanent or temporary crops
Other Areas	Areas with manmade features, including villages, rocks etc.

3 Results and Discussion

The land use/cover classification for the experimental area in 1985 and 2000 presented in Figure 1. Although the study period is only 15 years there are obviously differences in land use categories.

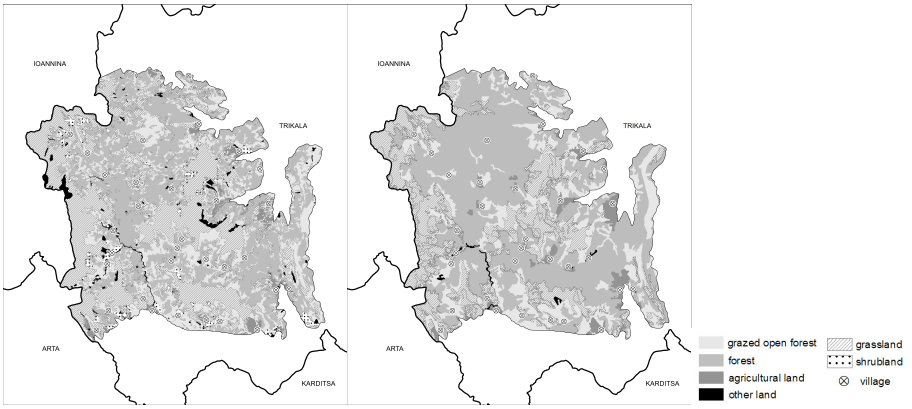

Fig. 2. The land use/land cover in experimental area of Aspropotamos in 1983 and 2000.

A decrease in rangelands (grasslands, shrublands, and grazed open forest) was detected during the study period. On the other hand, an increment of forests and agricultural lands in hectares were recorded (Table 2). Moreover, the higher percentage of reduction was recorded in shrublands (100%) following by grazed open forest (17.61 %) and grasslands (13.77%) while the higher percentage of increase was recorded in land use category of forest (32.7%) following by agricultural land (24.88) (Figure 3).

Table 2. Land uses (ha) in the study area during the period 1985-2000

Land uses	Years	
	1985	**2000**
Grassland	28,946	24,959
Shrubland	3,301	0
Grazed open forest	22,238	18,322
Forest	36,789	48,820
Agricultural land	2,815	3,516
Other land	2,021	494
Total	**96,111**	**96,111**

Moreover, the increment in agricultural land presented in the north east part of the experimental area (Table 2, Figure 2,3) as in this part there are many villages with agrarian societies. On the other hand, the above changes in rangelands and forest areas are expected as there is a decline trend of transhumance grazing in mountain areas in Greece (unpublished data) and other Mediterranean countries (Oteros-Rozas et al., 2013, Ainalis et al., 2015). Reduced transhumant livestock system may be due to various socio-economic factors that have significantly influenced the lifestyle of herders (Sklavou et al., 2014).

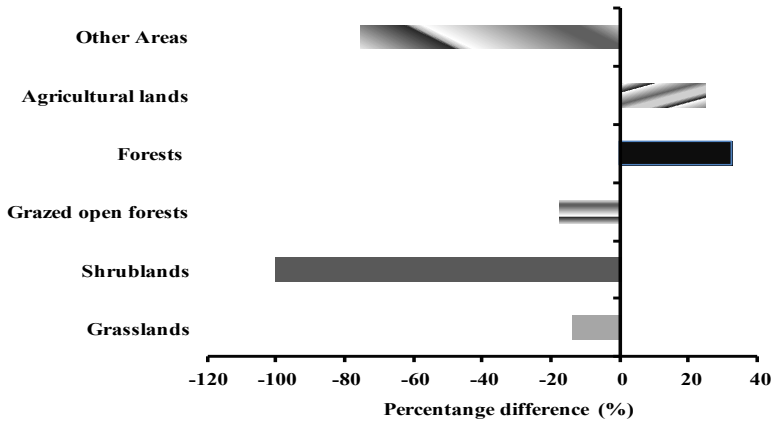

Fig. 3. Changes (%) of land use in Aspropotamos area during 1985 and 2000.

The abandoned of traditional livestock system has a significant influence in the landscape shaping in mountainous ecosystems and rural area (Hatfield and Davies 2006). Spatial pattern of grazing creates habitat heterogeneity in the landscape and influences species richness in different ways.The rangelands lost their biodiversity and presented more homogenous. Additionally, the decrease in shrublands and grazed open forest has as result their encroachment and reduction of the open patches (Figure 1) which are useful not only for the small ruminant feeding but there are habitats for wildlife animals (Olea and Mateo-Tomas, 2009).

4 Conclusions

It seems that is important to encourage the herders to keep alive the transhumance livestock system in order to benefit the ecosystem and maintain the landscape conservation. In Greece as a Mediterranean country with semi arid climate the maintenance of transhumance livestock system is critical element towards maintaining ecosystem productivity to its recent historical equilibria.

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