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Land cover changes evaluation of Tirana region

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Abstract

For a long time, people have not seen the necessity of measuring the contribution of nature to public health. Increased stress and sedentary lifestyle, levels of cardiovascular disease, diabetes and respiratory diseases, have raised the interest for scientific studies on the relationship between health and nature. The purpose of this study is to analyze the land cover of Tirana Prefecture and its compound categories: agricultural area, artificial surface, forests and semi-natural areas. The main groups of data used in this study are: Maps of land cover for 2006 and 2012; Tirana and its administrative units' population according to census of 2011; the digital map of the territorial division of the Republic of Albania of 2015. The goal is to create the main independent variables that can link health data with land cover data. For this purpose, GIS techniques were used. Analysis was performed for all public administrative units of Tirana Prefecture. From land cover analysis for 2006 and 2012 resulted that public administration units Tiranë, Kavajë, Paskuqan, Kamëz, Kashar, Farkë, Krrabë, Rrogozhinë, Bërxullë have lower agricultural area for capita (2,700-1,200,000 m^2/1000 inhabitant). The biggest changes in forest surface (decrease of more than 600 m^2/1000 inhabitants), during the period 2006 to 2012 have occurred in public administration units of Farkë, Kashar, Paskuqan, Synej, Lekaj, Pezë, Tiranë, Golem, Gosë. These results will be used to study the relationship between nature and public health. They could be used also to orient public policies.

Keywords: Land cover, digital map, GIS, public administration unit.

Introduction

Landscape-based change and trends assessments have been conducted on ecosystem productivity [10; 11; 14] and land cover [6]. Landscape indicators and models can be used to identify and prioritize areas for conservation [15]. For example, land cover and other biophysical data, combined with rule based habitat models, have been used to prioritize areas for conservation [4, 13]. Different publications show that the urban green spaces, parks and urban forests can help reduce heat and improve air quality. Infants and children breaths twice as much air as an adult, this means they are more exposed to local air pollutants during a period when their lungs are going through vulnerable stages of development [12].

Some reviews have assessed a range of evidence to understand the benefits and value of urban trees, urban parks and the overall effectiveness of green space to reduce heat, ozone and ultraviolet (UV) radiation in urban areas [2, 8, 12]. Plants and trees have a different capacity to capture and to filter air pollution, improve air circulation and decrease ambient temperatures. For a long time, people have not seen the need to measure the contribution of nature in health. Increased stress and sedentary lifestyle, levels of cardiovascular disease, diabetes and respiratory diseases, have raised interest for scientific studies on the relationship between health and nature. Normal logic suggests that natural environments could help to combat the health crisis, by supporting active life and free stress. Land use and land cover are two separate terminologies which are often used interchangeably [6]. A definition from the INSPIRE Directive [7] explains that land cover represents the physical and biological cover of the Earth's surface including classes as build-up areas, forests, agricultural areas, wetlands, (semi-)natural areas, water bodies [3]. Land use represents the present and future planned human activities on a territory [5, 7], characterized as residential, industrial, commercial, agricultural, forestry and leisure. Land

cover represents an important factor for physical geographical studies and analysis to environmental and spatial planning. Land cover is a dynamic variable that reflects changes in regional environments and it is necessary to be updated frequently. CORINE Land Cover (Coordination of Information on the Environment) is a project coordinated by European Environment Agency. Land cover contains 51 classifications while this paper describes three major categories. Tirana Prefecture has a varied land cover composition including densely artificial areas, agricultural areas, forest and semi natural areas. The goal of this research is to create the main independent variables that can link health data with land cover data. For this purpose, GIS intersection techniques were used.

Materials and methods

The main groups of data used are: Land cover for years 2006 and 2012 issued by the National Environment Agency of Albania, number of population from census in 2011, the digital map of the territorial division of Albania provided by the Ministry of Local government in 2015. Analysis was perform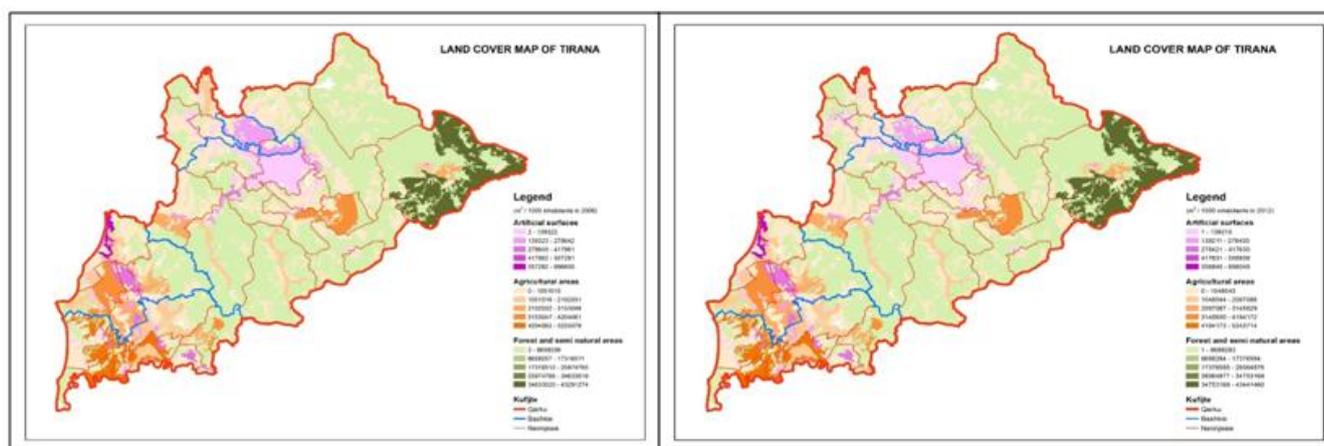ed up to the public administration units in Tirana Prefecture, which includes five municipalities and 29 public administration units.

This paper describes three major categories of land cover: a. Artificial surfaces, b. Agricultural areas and c. Forest and semi natural areas.

Results and discussion

Land cover maps of 2006 and 2012 were used to calculate three major categories for new public administration units created in 2015, in relation to their population in 2011 census. Figure 1 shows the distribution of artificial surface, agriculture surface, and forest and semi natural areas in Tirana Prefecture for years 2006 and 2012.

The land cover categories are divided in five classes from lowest to highest values. Figure 1 shows that the majority artificial surface and agricultural areas are located in the middle and west side of Tirana Prefecture, while forest and semi natural areas are mainly located in northeast and east part of Tirana Prefecture. For better identification of changes between 2006 and 2012 maps each of above mentioned categories are analyzed separately.

Figure 1: Land cover maps of Tirana Prefecture for 2006 and 2012 calculated for 29 public administration units in relation of their population.
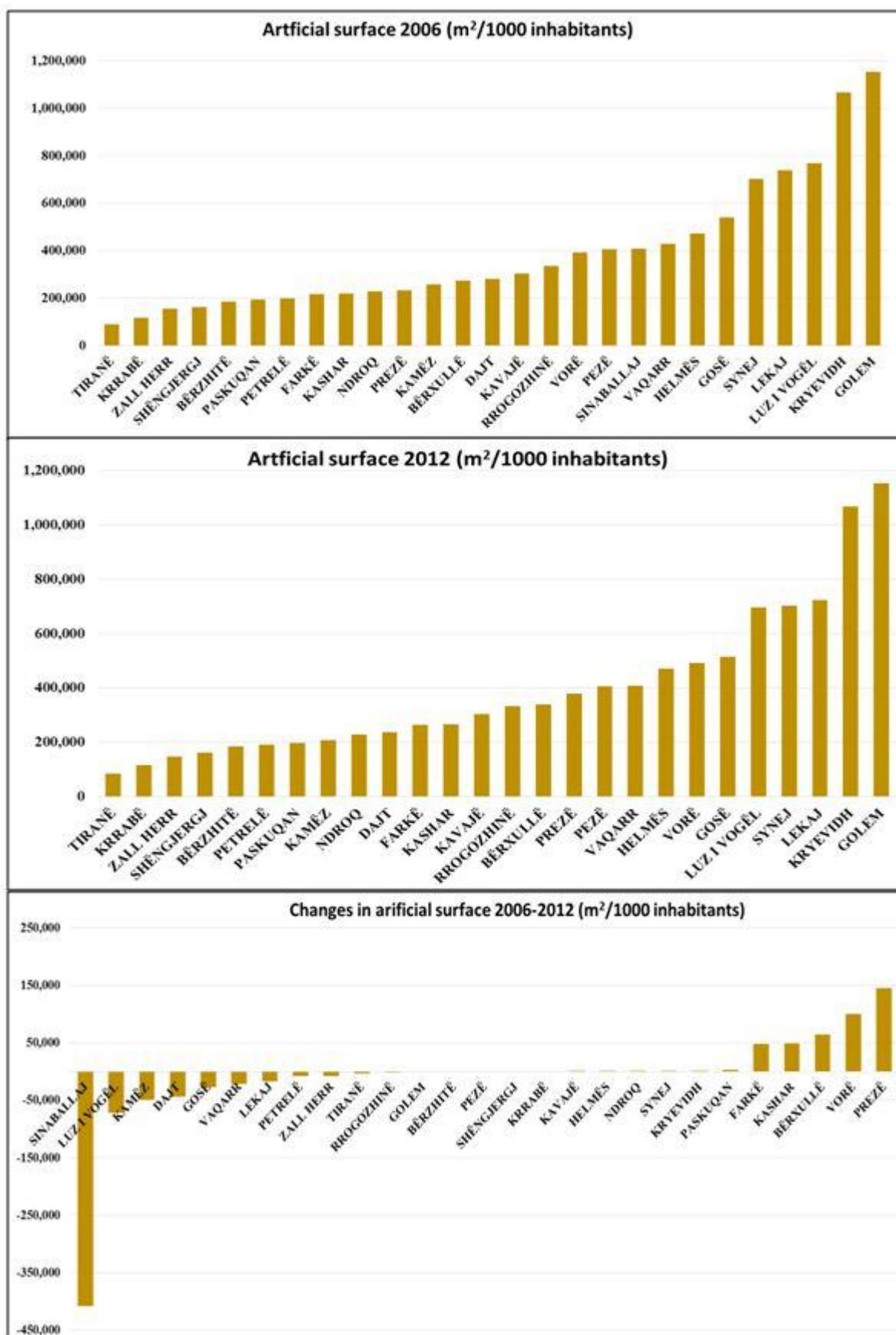
Figure 2 Values of artificial surface for all public adminitration units of Tirana Prefecture for years 2006, 2012 and changes between 2006 and 2012.

Figure 2 describes the quantity of artificial surface for Tirana Prefecture for 2006 and 2012, and changes during this period. All values are calculated per 1000 inhabitants. The three groups of public administration units, based on the average values of artificial areas for the period 2006 and 2012 are:

Group A, with artificial surface between 85,000 - 230,000 m^2/1000 inhabitants, composed by: Tiranë, Krrabë, Zall Herr, Shëngjergj, Bërzhitë, Paskuqan, Petrelë.

Group B, with artificial surface between 230,000 - 410,000 m^2/1000 inhabitants: Ndroq, Farkë, Kashar , Prezë, Kamëz, Bërxullë, Dajt, Kavajë, Rrogozhinë, Vorë, Pezë.

Group C, with artificial surface between 410,000 - 1,200,000 m^2/1000 inhabitants: Sinaballaj, Vaqarr, Helmës, Gosë, Synej, Lekaj, Luz i Vogël, Kryevidh, Golem.

The last part of figure 2 shows changes in artificial areas land cover categories from 2006 to 2012. In this case three different groups were indentified:

Group A, with significant decrease of artificial areas from -400,000 to -7,000 m^2/1000 inhabitants: Sinaballaj, Luz i Vogël, Kamëz, Dajt, Gosë, Vaqarr, Lekaj, Petrelë, Zall Herr.

Group B, with small changes of artificial areas from -7,000 to 1 m^2/1000 inhabitants: Tiranë, Rrogozhinë, Golem, Bërzhitë, Pezë, Shëngjergj, Krrabë, Kavajë, Helmës.

Group C, with increase of artificial areas from 1 to 145,000 m^2/1000 inhabitants: Ndroq, Synej, Kryevidh, Paskuqan, Farkë, Kashar, Bërxullë, Vorë, Prezë.

Figure 3 describes the value of agriculture surface for Tirana Prefecture for 2006 and 2012, and changes during those years, for all public administrations units. All values are calculated per 1000 inhabitants. The first part of figure 3 shows the agriculture surface values for 2006 and the middle part shows values for 2012. Three groups of public administration units, based on the average values of agriculture surface for period 2006 and 2012 are:

Group A, with agricultural surface between 2,700 - 1,200,000 m^2/1000 inhabitants: Tiranë, Kavajë, Paskuqan, Kamëz, Kashar, Farkë, Krrabë, Rrogozhinë, Bërxullë,.

Group B, with agricultural surface between 1,200,000- 6,100,000 m^2/1000 inhabitants: Dajt, Vorë, Vaqarr, Pezë, Zall Herr, Prezë, Bërzhitë, Luz i Vogël, Golem, Baldushk.

Group C, with agricultural surface between 6,100,000- 13,300,000 m^2/1000 inhabitants: Synej, Lekaj, Petrelë, Shëngjergj, Ndroq, Gosë, Zall-bastar, Helmës, Kryevidh, Sinaballaj   .

The third part of figure 3, describes the changes from 2006 to 2012. As well in this case three different groups were identifed:

Group A, with significant decrease of agriculture areas from -260,000 to -11,000 m^2/1000 inhabitants is composed by the following public administrative units: Zall-bastar, Prezë, Vorë, Bërxullë, Zall Herr, Kashar, Dajt, Lekaj, Bërzhitë.

Group B, with small changes of agriculture areas from -11,000 to7,000 m^2/1000 inhabitantse: Rrogozhinë, Paskuqan, Petrelë, Shëngjergj, Ndroq, Kavajë, Krrabë, Baldushk, Pezë, Tiranë.

Group C with increase of agriculture areas from 7,000 to 290,000 m^2/1000 inhabitants: Vaqarr, Golem, Synej, Farkë, Kryevidh, Helmës, Gosë, Kamëz, Luz i Vogël, Sinaballaj.

Figure 4 describes the average values for forest and semi natural areas, for 2006 and 2012. In this case the respective groups of public administration units are:

Group A, with Forest and semi natural areas from 1,900 to 1,200,000 m^2/1000 inhabitants: Tiranë, Kamëz, Paskuqan, Luz i Vogël, Bërxullë, Farkë, Kashar, Rrogozhinë, Synej.

Group B, with Forest and semi natural areas from 1,200,000 to 3,800,000 m^2/1000 inhabitants: Vorë, Golem, Kryevidh, Prezë, Zall Herr, Gosë, Vaqarr, Dajt, Lekaj.

Group C, with Forest and semi natural areas from 3,800,000 to 86,800,000 m^2/1000 inhabitants: Ndroq, Petrelë, Krrabë, Bërzhitë, Helmës, Pezë, Baldushk, Sinaballaj, Zall-bastar, Shëngjergj.
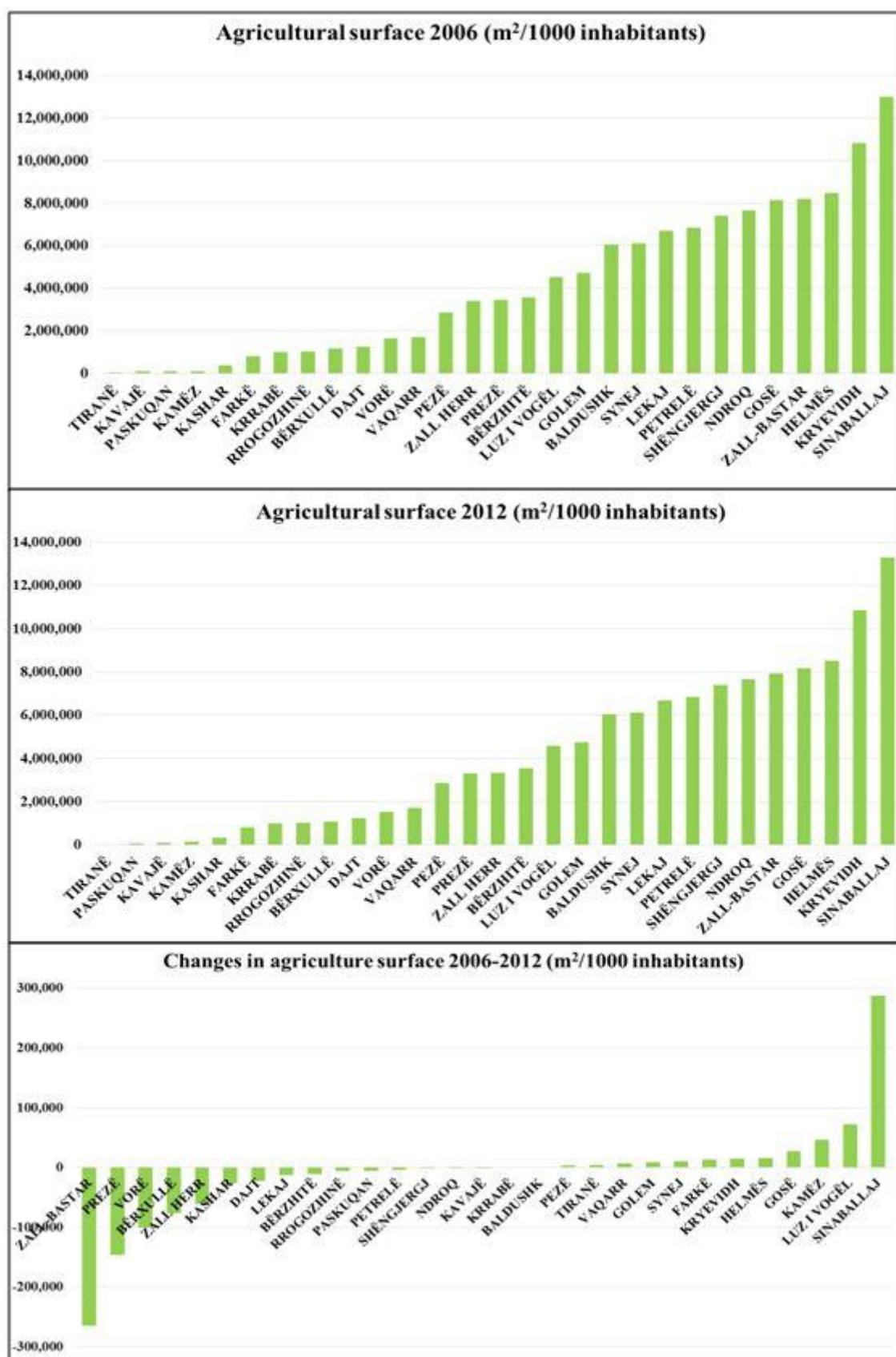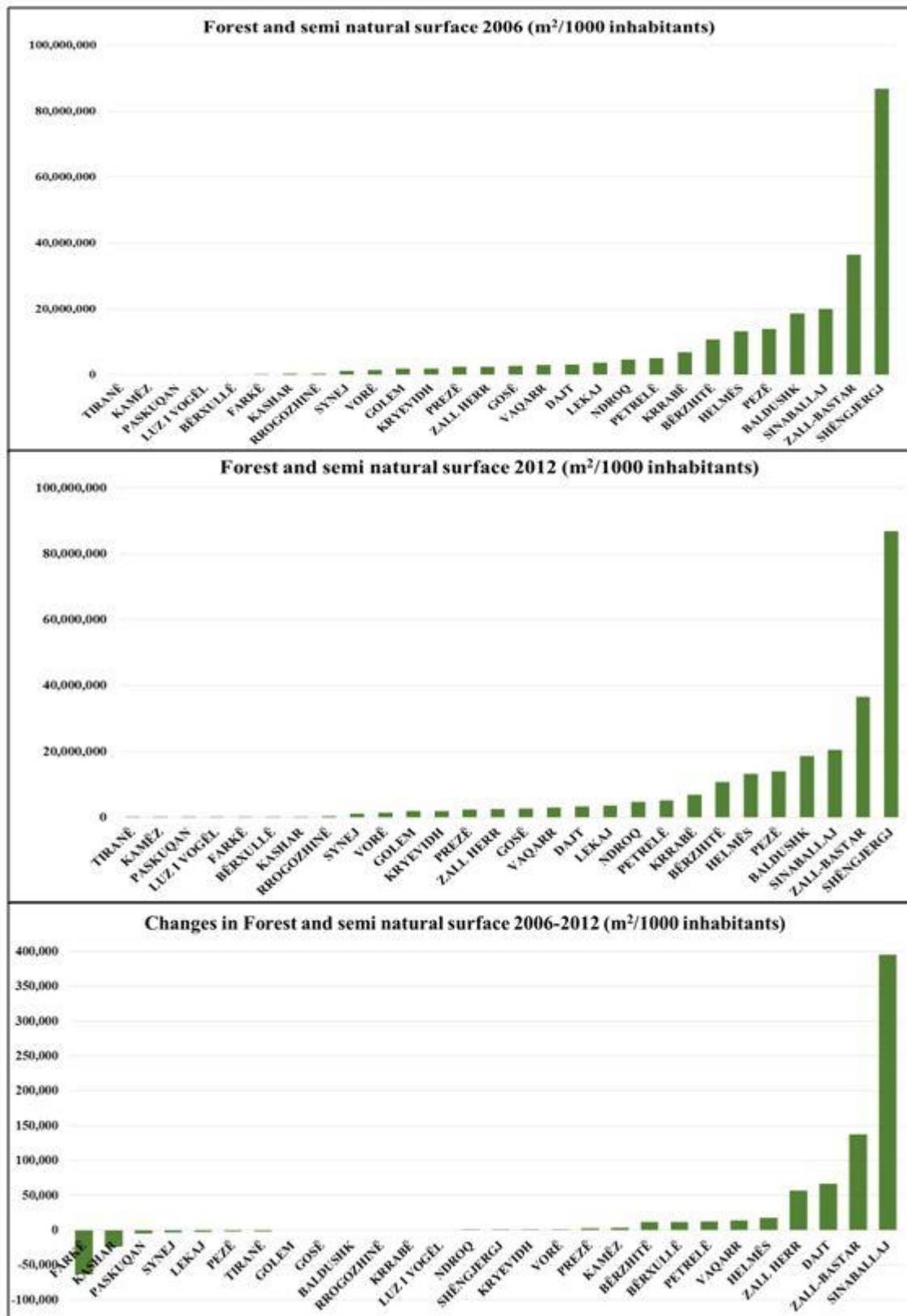
Figure 3 Values of agriculture surface for all public administrations of Tirana Prefecture for years 2006, 2012, and changes between 2006 and 2012

Figure 4 Values of forest and semi natural surface for all public administrations of Tirana Prefecture for years 2006, 2012, and changes between 2006 and 2012.

The third part of figure 4, describes the changes from 2006 to 2012 in forest and semi natural areas, and three different groups in this case are:

Group A, with significant decrease of forest and semi natural areas from -63,000 to -600 m²/1000 inhabitants: Farkë, Kashar, Paskuqan, Synej, Lekaj, Pezë, Tiranë, Golem, Gosë.

Group B, with small changes of forest and semi natural areas from -600 to 3,000 m²/1000 inhabitants: Baldushk, Rrogozhinë, Krrabë, Luz i Vogël, Ndroq, Shëngjergj, Kryevidh, Vorë, Prezë,

Group C, with increase of semi natural areas from 3,000 to 140,000 m²/1000 inhabitants:

Kamëz, Bërzhitë, Bërxullë, Petrelë, Vaqarr, Helmës, Zall Herr, Dajt, Zall-bastar, Sinaballaj.

Conclusion

Tirana Prefecture has high variability of land cover. In this paper, three major categories of Land cover, artificial areas, agricultural areas, forest and semi natural areas are described. The goal of this research was to create the main independent variables that can link health data with land cover data.These indicators will be used in future research to identify any relationship between health indicators and land cover data.

GIS techniques are important technologies for analysis and quantification of spatial phenomena which is not possible through conventional mapping method.

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