MODELING OF LAND USE THROUGH LAND INFORMATION SYSTEM TO VILLAGE LEVEL IN ALBANIA

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Abstract: *The main objective of this paper has been the use of GIS technology to assisting local Government on the sustainable management of land resources. The study not only provided the basic spatial database in communal level, but also evaluated the soil and land suitability, land use, land use changes and agricultural land urbanization. The land information database is established for Kryevidh commune (Tirana District). During the land data collection and its processing are found out the most important soil characteristics and qualities, as well as is accomplished the agricultural land suitability assessment classified in four suitable classes (S1-S4) and one non suitable (N). About 52.8% of Kryevidh commune is occupied with N class the other is occupied with S1, S2, S3 and S4, respectively 5%, 11.4%, 16.5% and 14.3%. Based in the land use information before and post 1991 it is analyzed changes of land use in communal level. The main changes have been occurred on agriculture land. In this class transformations from agriculture to non agriculture are observed. Also, changes are observed within agriculture land where 293 ha or 9.9% of suitable land is fallow. The data shows that 147 ha (14%) of suitable land for agriculture is occupied with the new buildings. There are derived the maps for land suitability, land use for 1991 and 2009, as well as land use changes. The results of this study suggested that urgent measures are needed to protect agriculture land from further urbanisation.*

Key words: *GIS, Land use, land use change, land suitability*

INTRODUCTION

The agriculture land in Albania occupies only 24% of the total land area, so the pressure in this area is increased enough the last years. After 1991 many changes occurred in Albania and that the economic system changed from being a central organised one into a market-oriented one. Fast transition from 550 large farming cooperatives, to some 450 000 small private farms was occurred. This type of change and massive demographic movement has had a tremendous impact on land use. Also, lack of land use policy sound has resulted in widespread land degradation and chaotic development causing the loss of the best quality land to non-agriculture uses. The conversion of agricultural land in non-agricultural use (buildings, roads, etc) is obviously increased in all the country, especially in arable land. However, it is difficult to get the data for the area of agricultural land converted in urban land. It is a necessity the assessment of the actual state of the land use in order to plan the measures able to prevent any negative effects that could occur from the different uses. Also, with GIS tools will integrate diverse geospatial data, such as topographic, hydrographic, land and soil suitability, land cover/use and others in GIS database and their joint analysis increases the quantity as well as quality of derived information. The use of technologies such as GIS will also enable us the analysis of trends, such as trends in land degradation, land use change, and urbanization of agriculture land. This will be a powerful tool to get solution of problems and building of a land use planning in commune level.

MATERIAL AND METHODS

The cadastral information of the Immovable Property Registration System in Albania is digitally entered into the geographic database and it is used for the collection of land information in parcel level. The land use for the 2009 is derived from the orthophoto and verification on terrain. The topographic maps of scale 1:10,000, land parcel and commune boundary, and the cadastral book were used as the primary natural database for the commune. In addition the thematic maps for land use before 1991 (scale 1:5000) were digitised and entered into the database as well. ArcGis 9.2.modules ArcTools and ArcMap were used for the joining of the map sheets and their corresponding layers and creation of different maps. The land suitability assessment is based on the analysis of a number of *climate, site and soil characteristics* matched against the requirements of that land use (Albania-Land Use Policy Project 2003). It has been consisted in the collection of land and soil information in semi detail level through the soil augering and describing (grid system), determination of soil types, opening and describing the soil profiles and land suitability assessment classification. Soil augering is carried out in the terrain with slope up to 25 %, and grill system in distance 300 m to each other (i.e. a 9.0 ha survey intensity). The detail information collected during field survey has been used to determine the soil types. There are taken into consideration the land form (flat, terraces, plain, valley, foot of slope etc.), the deep, the soil drainage class, as well as the classes of topsoil texture and subsoil texture. There are determined the number of profiles, one representative profile for each soil type. The profiles are described and there are taken the samples for each layer. The samples are analysed for organic matter content, soil pH, available phosphorous, cation exchange capacity, exchangeable potassium, exchangeable sodium percent, electrical conductivity, calcium and magnesium, texture as well.

Land suitability assessment take into consideration the exchangeable sodium percent, electrical conductivity, texture, cation exchange capacity, fertility, topsoil and subsoil structures, slope, flood risk, soil depth, topsoil stone content, topsoil and subsoil texture, soil drainage, total available water (TAW), actual erosion and erosion risk. For the soil fertility have been considered organic matter, soil pH, available phosphorous, exchangeable potassium, calcium and magnesium, as well as the Ca:Mg and K:Mg ratios.

The land use information is collected according to land use legend. The land is classified in four main categories on the base of function: agricultural, forestry and pastures, nonagricultural and others and land use categories are distinguished in classes and subclasses by the activity criteria. All the information is collected in parcel level based in cadastral information. In the geo-database two land-use data sets have been included describing land uses in 1991 and in 2009. The land use change analyses have been made using the Land Use Information System Methodology and Land Use Changes Analyses methodology of LUPP2 (Jansen L. 2003. Land-use changes have been analyzed at the level of the spatial extent (i.e. in Ha) of the area that suffered changes. It has been collected the information for *the buildings* built before and post 1991. A spatial association between the parcels and buildings provides information for the zones occupied with buildings.

ANALYSES AND RESULTS

The study has been carried out to the area of about 6321.4 ha in Kryevidh commune. The soil information has been collected through the 282 total auger bores.

In this commune five soil types were found out. Each soil type has been characterised by the detailed description and analysis of representative soil profile pits (FAO 1990). The agricultural land suitability assessment classified in four suitable classes (S1-S4) and one non suitable (N).

Land suitability for each soil and land survey is determinate by asking the GIS to

display all sites having particular combination (s) of parameters. Based in soil data collection and through GIS application have been derived the map for land suitability (Figure 1).

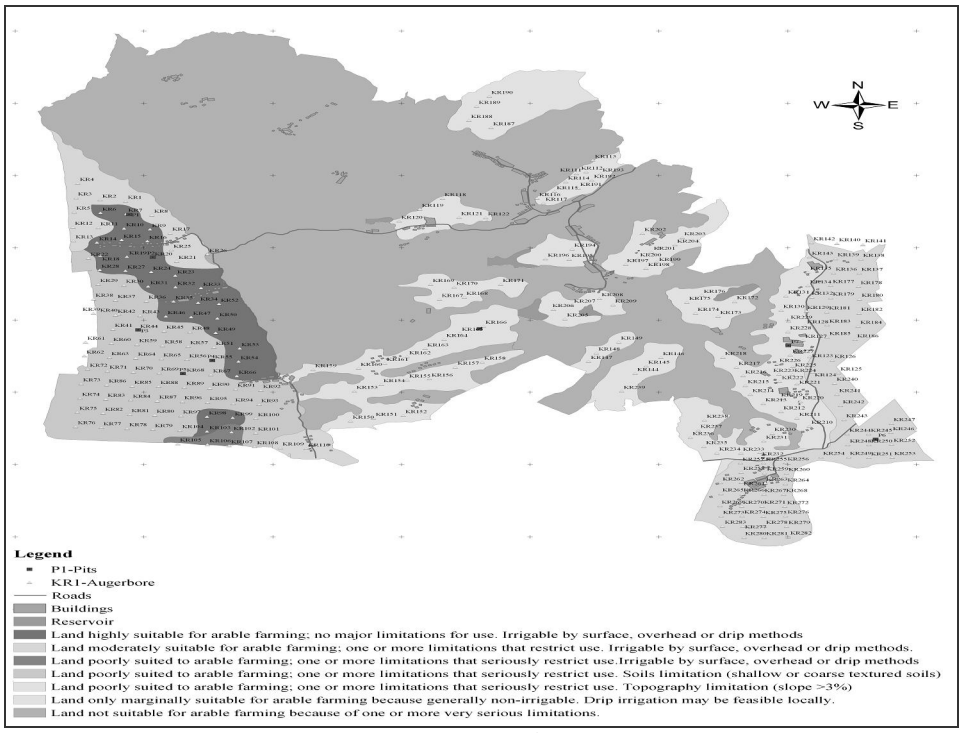

Figure 1. Land Suitability Map of Kryevidh Commune

The agricultural land has been classified in S1, S2, S3 and S4 classes, respectively 5%, 11.4%, 16.5% and 14.3%. Classes N occupy 52.8% of Kryevidh commune. The analyses of the data for land use shows that land use changes are different within commune. The figure 2 and 3 present the land use in 1991 and 2009 respectively, as well as the land use changes of Kryevidh commune in Figure 4.

The intensity of changes in the period mid 1990s-2009 is high (Figure 4). Arable land is converted into Fallow, Non-Agriculture, Meadow or Forest.

The trends found in this commune are:

- Land-use changes in sloping areas where Arable land are lost to Fallow or Pasture Land-uses, and
- An increase of urbanised areas at the cost of Agriculture Land-uses mainly in flat plain.

The data collection for the buildings built before and post 1991 in Kryevidh commune shows the trends of this phenomenon. A GIS application has been developed based in the zoning of land suitability classes and the extension of buildings in agricultural land, which demonstrates that the most part of new buildings is built in the most suitable agricultural land of commune. The data showed that 14% of class S1 and S2 are urbanised, while in the land of class N the urbanization is too little. Also undesired uses of land were observed on hilly area. Cultivation with arable crops on very steeply area creates opportunity of soil erosion.

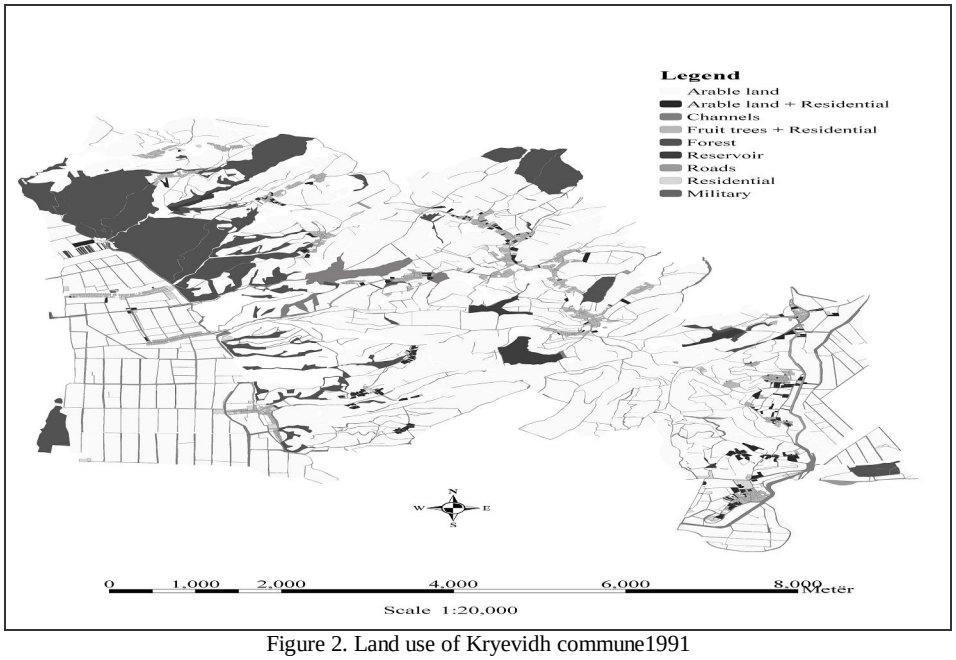

Figure 2. Land use of Kryevidh commune1991

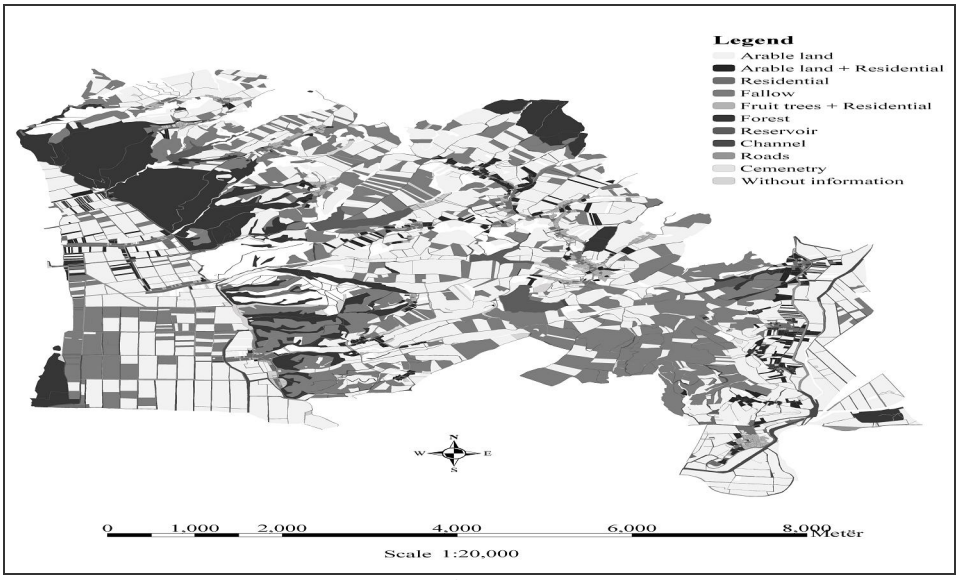

Figure 3. Land use of Kryevidh commune 2009

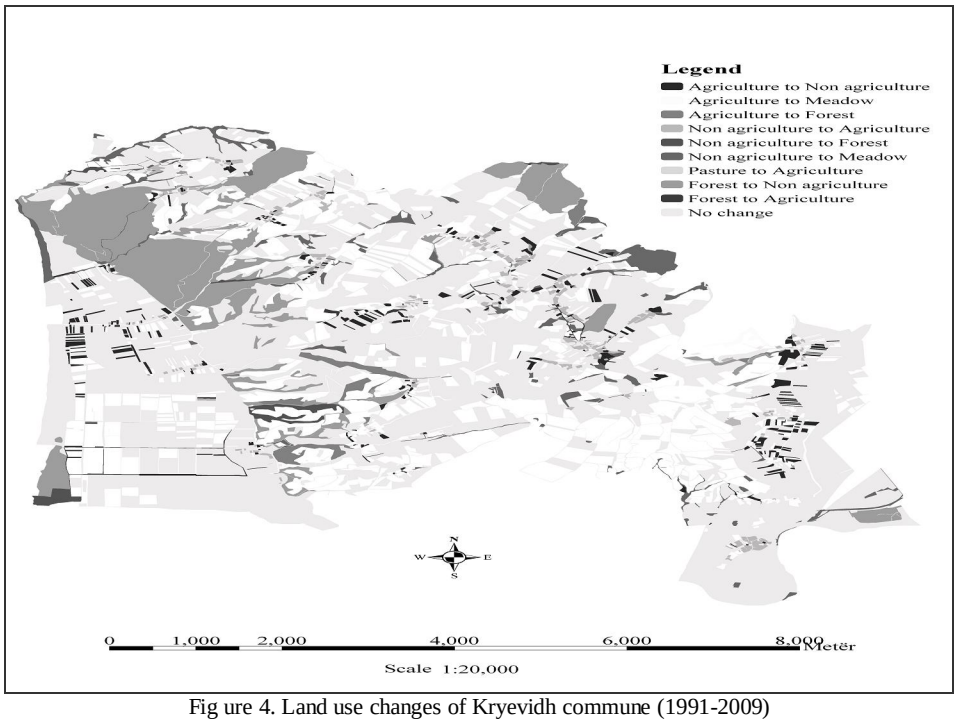

Fig ure 4. Land use changes of Kryevidh commune (1991-2009)

CONCLUSIONS

The analyses of land use before 1991 and past shows some undesired changes in land use and needs for possible intervention and development in the future. A GIS-based decision support system would provide an invaluable tool for all aspects of the land use planning process: conducting a land suitability analysis, projecting future land use demand, allocating this demand to suitable locations, and evaluating the likely impacts of alternative policy choices and assumptions. Soil and land suitability assessment show a great potential productivity of soils of this commune. The present contribution is an example of the system to be applied at communal, scale in consideration of the systematic catalogue of Albania's agricultural land quality, land potential and land use, very effective in different applications in the land use policy and land use planning. GIS facility should serve as an *assistance tool* to Albanian Government. Individual government department's usually hold only narrow collections of data that serve for their own highly specific operations.

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