LAND USE DYNAMICS AND PLANNING IN THE CENTRAL ALBANIA USING GIS APPLICATION

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***Abstract**: Upon the demise of socialism in 1991 Albania implanted a radical land reform, redistributing formerly collective land on an equal per capita basis, leading to drastic changes in land use. The consequences of this transition for the post socialist rural landscapes in Albania are examined in this paper. A village-level survey was conducted to analyze household resources and constraints. The survey was then integrated with data derived from satellite image interpretation and geographic information systems to develop a statistical model of two key land use changes of interest: the abandonment of cropland and forest-cover loss. Findings indicate that cropland is more likely to be abandoned further away from populated places, the national road network, and in villages with a lower household density. Land fragmentation is associated with greater abandonment in the later stages of transition. Forest loss occurs predominantly around the populated places in the period immediately following the collapse of socialism, and occurred in more remote areas within the last decade. New spatio-social partitions are emerging in the landscape, as land users abandon land to seek new opportunities, shift to more profitable market-oriented agriculture, or revert to subsistence strategies in the most marginal areas. Land-use and land-cover change are research aspects that are of global, regional as well as local importance. Examples for global significance are the carbon sequestration potential of soils and the biomass. Regional importance has, for example, the vegetation cover of particularly sloping land due to potential downstream damages caused by sedimentation of upstream topsoil erosion. Locally important are the income generating possibilities of the land, most importantly in rural areas from crop and livestock production. This paper assesses the recent developments in land-cover modifications and land-cover changes in Southeastern Albania with an emphasis on regional and local determinants of land-cover changes including a qualitative discussion of the potential impacts on environmental and socioeconomic development. To derive the state of and the changes in land cover changes satellite images area interpreted for three points in time. The spatially explicit land-cover data is linked to village data derived from a quantitative village survey, and to various indicators derived from geographic information systems (GIS).*

***Key words:** Land use planning, land suitability, land use, land use change.*

INTRODUCTION

Establishing private property rights for former agricultural workers was the main objective of the Albanian land reform, although the policies were also intended to realign land-use incentives to new market conditions. With significant external support, Albania mapped its agricultural and residential land and set up a unified, parcel-based system for the legal registration of real estate. However, the registration system did not stimulate land transfers as expected, as the economic and social incentives to sell or buy were lacking. Rural landscapes exhibit the effects of the macroeconomic shock of the transition, followed by short-term reactions as well as more a gradual adaptation of local land-use practices to new market conditions, and the persistent secondary consequences of the reform (e.g., land fragmentation). The postsocialist transition and the accompanying land reform are inherently complex, multiscale processes. The land reform in Albania was constructed at the national level. The decision of the Albanian government to redistribute the land on a per capita basis was framed by political and economic considerations (CUNGU and SWINNEN 1999). The reform was in turn implemented at lower levels of administration, mediated by district-level investment and policy decisions, and finally implemented at the village level by village commissions. These policies touchdown in a spatially heterogeneous landscape, shaped by variations in agroclimatic suitability, biogeophysical conditions, market accessibility, and rural development levels, where land-use adjustments unfold over time.

The implementation of the National ICT Strategy in Albania is thus creating the required environment for ICT to contribute on the "*consolidation of the public administration and the state's fundamental institutions"*. GIS use will integrate diverse geospatial data, such as topographic, hydro graphic, land and soil suitability, street network, vegetation cover, land use and others in GIS database and their joint analysis. This will increase the quantity as well as the quality of derived information. The use of technologies such as GIS will also enable to analyze trends such as overgrazing, land degradation, land use change, urbanization of agriculture land and land use planning and the development of some applications [1].

MATERIAL AND METHODS

Basically the soil data has been taken from the digital cartel-map information of the Immovable Property Registration System in Albania. For achieving the field study and evaluation of land suitability, topographic maps of scale 1:10,000 were used. The data for land parcel, commune boundary, road network, drainage and irrigation system, urban area of villages (yellow line) have been taken from the cadastral book. In addition, for land use before 1991 were digitized and entered into the database as well. ArcGis 8.3.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 for irrigable agriculture is based on the analysis of a number of *climate, site and soil characteristics* matched against the requirements of that land use [2]. The information for soil has been taken from the soil augering and based on that the main types of soils have been determined and description of soil profile and land suitability assessment has been done. Soil augering is carried out in a terrain with slope less than 25% in a grid system in 300 m distance from each other [3].

The detailed information collected during the field survey has been used to determine the soil types. The landform (flat, terraces, plain, valley, foot of slope etc.), the depth, the soil drainage class, as well as the classes of topsoil texture and subsoil texture have been taken into consideration. It has been determined one representative profile for each soil type. Each profile has been described and samples for each layer have been taken. The samples have been analyzed for the main physical and chemical characteristics.

Land suitability assessment has taken into consideration soil profile data and soil and land survey data derived from all site records. 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, non-agricultural and others. These land use categories are distinguished in classes and subclasses based in 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 2004. The land use change analyses have been made using the Land Use Information System Methodology and Land Use Changes Analyses methodology [11]. Land-use changes have been analyzed at the level of the spatial extent (i.e. in Ha) of the area that suffered changes. The reference unit for all the data collected has been the cadastral parcel. Spatial data have been grouped into Datasets in order to ease the management of different logical sets of data. To group data into datasets, the INSPIRE

(Infrastructure for Spatial Information in Europe - http://www.dublincore.org/) standard has been adopted. Information for yellow line area (existed urban area) and *the buildings* built before and post 1991 has been collected. A spatial association between the parcels and buildings provides information for the zones occupied with buildings. Baseline data for land use planning are population, climate, physiographic, soils, land suitability, vegetation and land degradation. The GIS applications have consisted on zoning of the best agricultural land, zoning of urbanized agricultural land, as well as the GIS-based preparation of land use planning in commune level.

RESULTS AND DISCUSSIONS

The study has been carried out for an area of about 1224 ha in Maminas commune. The soil information has been collected through the 136 total auger bores. The agricultural land suitability assessment is classified in three suitable classes (S2-S4) and one non suitable (N) [11].

The biggest surface in this commune is made of S2 class with a total of 63% of agriculture land and is adjacent to the texture of upper horizon and fertility. Class S3-2S does not count that much since it is only 1% and adjacent to the texture of the lower horizon. Class S3-2T takes a surface of about 21 % and has an inclination of 3-12% that classifies these soils in this class. The remaining 10% is classified in S4 class with an inclination of 13-25% [8].

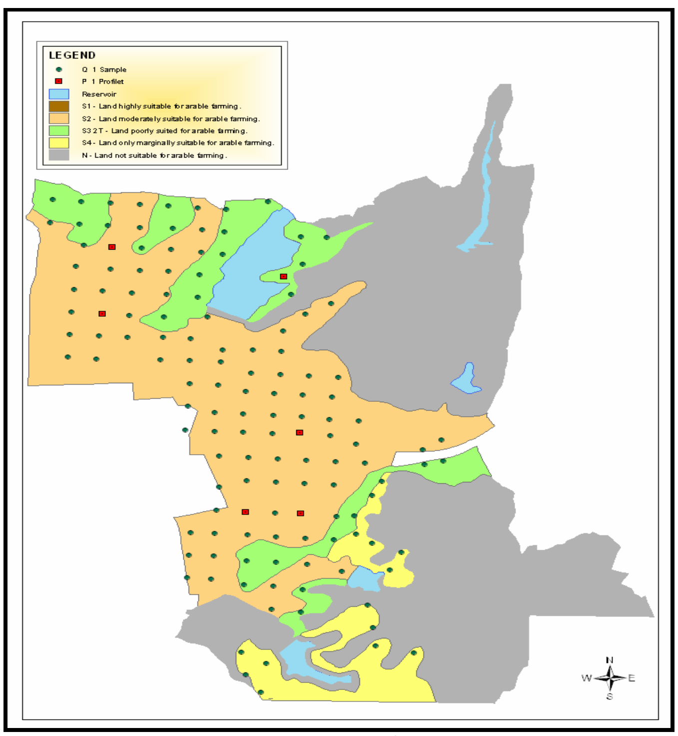

Figure 1. Land Suitability Map of Maminas Commune

One of the applications in GIS for Maminas commune has been developed based in the zoning of land suitability classes and the extension of buildings in agricultural land (Figure

1.), which demonstrates that the most part of new buildings is built in the most suitable agricultural land of commune. The best agriculture land is ranked into four categories, A to D (Table 1). Land of suitability classes S1 and S2 plus S3 and S4 class that have well-functioning (and sufficient) irrigation, either by an irrigation scheme or through informal abstraction from a river or reservoir are considered the best agriculture lands.

Table 1

Classification of best agricultural soils

Land suitability class	Functioning irrigation	Inside non-functioning irrigation scheme	Outside irrigation scheme
S1 + S2	**A**	**C**	**D**
S3 + S4	B		

During the last years the conversion of agricultural land use in non-agricultural use (buildings, roads, etc) has obviously increased in all the country, especially in arable land. It is difficult to get the data for the area of agricultural land converted in urban land. The data collection for the buildings built before and post 1991 shows the trends of this phenomenon, GIS applications have been indicating that a part of buildings is built in the best agricultural land [7]. The data showed (Figure 2), that class A total area is 954.5 ha, occupied area 130.4 ha (14%), and class B total area 53.2 ha occupied area 21.3 ha (40%), while in the land of class N the urbanization is too little (only 1.2%). The purpose of defining best agriculture land is to protect it from urban developments when land of poorer quality is available and to prioritise agriculture investments or irrigation rehabilitation on the basis of returns on investment will be greater on good land.

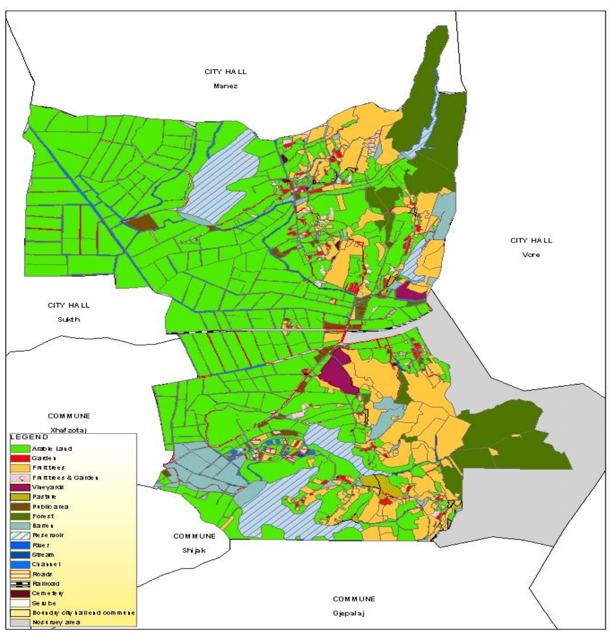

Figure 3. Land use of Maminas commune 1991

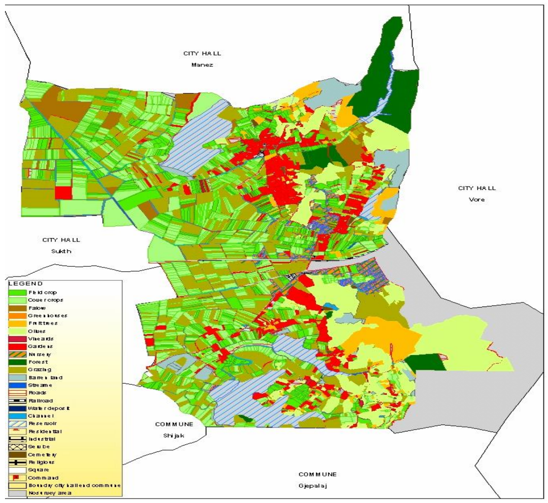

Figure 2. Land use of Maminas commune 2006

The collection of land use data is carried out according to the land use legend structured on the base of two main criteria: the function criterion to distinguish land-use categories followed by the activity criterion within the category [9]. 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 2004 respectively, as well as the land use changes of Maminas commune in Figure 4. The intensity of changes in the period mid 1990s-2004 is high (Figure 3). Arable land is converted into Fallow or Non-Agriculture, whereas Fruit trees are converted into Fallow. There seems to be a shift in land-uses because agricultural land is lost in one place and gained in another, so this change affects different parts of the commune territory [6].

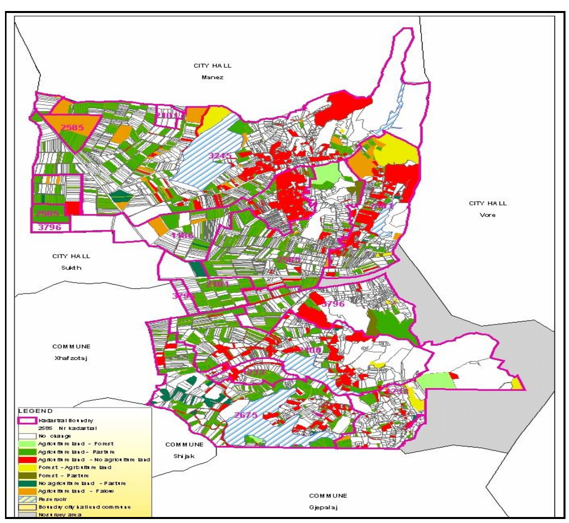

Figure 3. Land Use Changes 1991-2006

MEDIUM-TERM LAND USE PLAN

The units of the legend of land use planning:

Urban

The center of commune (actual), residential-urban management; urban saving (actual), urban industry (actual), residential-urban development (planned), business-residential development (planned)

Agriculture

Low value of rainfall for the plants (low investment), high value of the irrigated plants (high investment), horticultural – residential mix (medium to high investment), low scale of mixed farms in the valleys (low investment), preservation (integrated management of watersheds), natural protection of rivers, protection of mixed agriculture, protection of forests and mixed pastures, protection of not good soils and forests, plantations of forests and watersheds.

Urban development in the mid-term period will take a considerable place as well as the short term development, which is the continuity of hills and the areas along the main road. The part of unit seven with low rainfalls for the cultures will change from residential to horticultural. The residential part and the businesses will become more compact. There are fewer chances for changes in the hills since they are mainly dominated by sloppy relieve. The chances for changes in the agriculture land are mainly in the parts that have problems with drainage, allowing the land to improve partly for the first class. The land improvement will attract and present high productivity of cultures and these changes will be present at unit eight. The changes in land use will affect unit eight. A considerable part of land will have a residential-mix character and will change at unit number eight. It is thought that at the same time the high value of produced cultures will intensify and attract more investments. Many intensive investments can produce the same production in the same or less land. It is also possible that the enlargement of scale and the land market in some periods will get stabilized and become more active and qualitative. This might encourage the agricultural production. By taking into account that the improvement of infrastructure in hills and valleys is already present there is opportunity for improving the production of agricultural cultures and horticulture. The conditions in general are favorable for extending the irrigation and high productivity. Due to these, the lower part of the valley can improve in unit 8. For the remaining part of the hills there have not been many changes in terms of surface improvement.

CONCLUSIONS

Geographic Information System (GIS) is a new technology widely used to survey the land use problem. (GIS) plays an important role in soil survey and land evaluation for land use planning. The analyses of land use before and post 1991 show some undesired changes in land use and need for possible intervention and development in the future. Soil and land suitability assessment shows a great productivity potential of soils in this commune.The agricultural land suitability assessment showed that the biggest surface in this commune is: class S2 with a total of 63% of agriculture land; class S3-2S does not count that much since it is only 1% and adjacent to the texture of the lower horizon; class S3-2T takes a surface of about 21 % and has an inclination of 3-12% that classifies these soils in this class; class S4 takes 10% of the surface and has an inclination of 13-25%.

The data collection for the buildings built before and post 1991 shows the trends of this phenomenon and they are as follows: class A total area is 954.5 ha, occupied area 130.4 ha (14%); class B total area 53.2 ha occupied area 21.3 ha (40%); class N the urbanization is too little (only 1.2%). 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. The present contribution is an example of the system that should be applied in communal level, taking into consideration the systematic catalogue of Albanian's agricultural land quality, potential and land use, the system resulted very effective in different applications in the land use policy and 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. The GIS facility should be considered also as an *assistance tool* that can provide a comprehensive national data base on land and agriculture (and forestry, urban, commercial, tourism), in order to assist the normal functions of local and main government.

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