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BACKGROUND OF VEGETABLE MULTI-CRITERIA ANALYSIS IN MUNICIPALITY OF KALOYANOVO, BULGARIA

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Abstract

Horticulture is one of the importance parts of Bulgarian agricultural sectors. Crop growing specification requires deep and good knowledge about agricultural development and practices. Advanced research and carefully gathered and analysed information is the first step of the successful result. This publication presents the structure and more necessary data for complex analyzing of environmental factors and their influence on agriculture structure in Municipality of Kaloyanovo, Plovdiv region, Bulgaria. The study area is 347 sq.km and average elevation - 198 m. An overview would show the present state of physiography, climate, crop cultivation, landscape, elevation, labor force, marketing, farmers practices, areas under cultivation, land use, soil type, water resources, road systems, erosion level, the most spread vegetable marketing, demography and socio-economy opportunities. Methodology is based on thematic maps and analysis, creating by GIS application. It aims to identify current status of the most appropriate plants development, land management and changes in land use form. Spatial data and thematic maps present increase and decrease of agricultural availability in the study area. Results obtained will be relate to multi-criteria land suitability evaluation, accordingly to vegetable crop characteristics. This model of land evaluation helps farmers and vegetable growers to realise potentiality of their land parcel and required management procedures.

Key words*: multi-criteria analysis, GIS, environmental factors, vegetable crops.*

INTRODUCTION

Agriculture is permanent developing structure, connected to the sensible land use and land management. From the beginning of the civilization man has used the land resources to satisfy his needs. The land resources regeneration is very slow while the population growth is very fast, leading to a nunbalance. On a global scale, agriculture has the proven potential to increase food suppliesfaster than the growth of the population (Davidson, 1992).
Sustainable vegetable farming system is associated with good practices related to people cantered development, sustainable live lihood, agro-ecological practices, sustainable forestry system, community based natural resources management, participatory policy development, indigenous farming system, fair labour condition, good agricultural practises, equitable access to water and others (Baniya, 2008). Sustainability is the ability of an agricultural system to meet evolving human needs without destroying and, if possible, by improving the natural resource base on which it depends (USAID, 1988). In order to determine the most desirable direction for future development, the suitability for various land uses should be carefully studied with the aim of directing growth to the most appropriate sites.
Necessary of sustainable agricultural development is mentioned by different authors (Stoeva, 2013; Christova et al, 2013; Toskov, 2013; Nikolova, 2013). According to them, it is important to create developing strategies about vegetable production and management. Natural resources have to be ruled and used carefully for good sustainable future yields. Careful planning of the use of land resources is based on land evaluation, which is the process of assessing the suitability of land for alternative land uses (Fresco et al, 1994). Information on land resources is a key to their careful and effective evaluation.
The main purpose of this article is to present the important and necessary environmental and

human developing factors for formulating sustainable vegetable developing. Establishing appropriate suitability factors is the construction of suitability analysis. Agricultural evaluation is concerned with the assessment of various land actions and used for specified purposes. It involves an analysis of some basic surveys of geographic situation, soils, land using, demography state, saved areas by lows, road systems, water resources, etc. All data is response with plant requirements. This is mean to present the importance of preliminary environmental assessment of some area and its positive and negative sides for sustainable vegetable developing.

Study area

In Bulgaria it is not so spread and usual, farmers to make a preliminary study of the future cultivated area. This study presents the essence of necessary factors for making good vegetable production. The study area is Municipality of Kaloyanovo. Situated in the north part of the Upper Thracian plain, covering area of 347 sq. km., the municipality is part of the region of Plovdiv and consists of the municipal center Kaloyanovo, and 14 settlements as well - Begovo, Glavatar, Gorna Mahala, Dolna Mahala, Duvanlii, Dalgo Pole, Zhitnitsa, Ivan Vazovo, Otets Paisievo, Pesnopoy, Razhevo, Razhevo Konare, Suhozem and Chernozemen. Up to the present moment the population of the municipality amounts to 12800 people. Municipality of Kaloyanovo has an important transport-geographic position. The main thoroughfares, which connect the north and south part of Bulgaria, respectively the countries from North-East Europe and Scandinavian countries with Turkey and the Near East pass through its territory. The railway road Plovdiv-Karlovo passes through six of the settlements and the railway road Plovdiv-Hisarya passes through other three settlements. Kaloyanovo is situated 24 km. from the regional center Plovdiv and 16 km. from "Trakia" highway, which connects Western Europe with Near East.

The selected municipality is good representative for analysing agricultural practices and making important points of preliminary knowledge about environmental structure. The extensive research of natural factors gives opportunities to increase positive sides of vegetable production. So it is essential to have profound analysis and necessary information before doing agricultural actions in some area.

MATERIALS AND METHODS

The base information about land management for making successful vegetable developing presents the present situation of land use and land management. The necessary data contents coordinated geographical borderlines of villages in the Municipality of Kaloyanovo, road systems, water resources, land using data, public or social property, population, classify-cation of cultivated terrains. All information is gathered from Municipality of Kaloyanovo and statistic data from different researches. Some of them are:

- Cadastre maps- The digital model formats are ZEM, CAD. Information source: the Geodesy, Cartography and Cadastre Agency.
- Statistic data about population, land use, land category, road and water systems– source http://www.kaloianovo.org/.
- Soil characteristics- Information source: The Soil Resources Agency and the Institute of Soil Science “Nikola Pushkarov”.

All action related to spatial data as collecting new information, organize in groups, creating connection between them, logical links, correct and sufficient presentation and sharing can be realized by Geographical Information Systems, named GIS (Stefanova et al., 2014). Methodology is based on using GIS platforms and application for analysing and presenting the results. All transformation actions of collected data are made by ArcGIS software and appropriate spatial data filters. The results are thematic maps of collected information.

RESULTS AND DISCUSSIONS

Multi-criteria analysis is complex information from different branches. It includes geographic information, coordinated location of the studied area, climate, soil type, elevation, population, demographic data, statistic information, agro-ecological settings, land use and management, etc. All necessary information is collected and arranged carefully by different experts from various scientific branches. Information

transformation from paper to spatial data and introduced into computer managed software is obligatory action for easily dealing with a huge amount of heterogeneous data. The core of this study is presenting the necessity of background agricultural analysis and making well-arranged future actions for more profits. Brief description of the study area in general is presented by thematic maps about some of the important agricultural points. Attributes of the study area has marked effects on the tradition and culture and in turn to the cultivation practices. The information would show the basic facts to be considered for the data analysis and interpretation of the results. Environmental factors and technics progress urge forward making consideration of the study area information and put it on prime importance. It includes information from the socioeconomic, demography, land use and vivid dimensions. All data is collected from different sources, geographic transformed and coordinated and introduced into GIS software. The spatial data can be easily manipulated, manual added, clearly presented and used for future predictions. GIS application allows additions in every time and enriching the past and present data with new information. So GIS tools allow making multi-criteria analysis and combined various data from different branches.

The studied area is situated in South Bulgaria and it is a part of Plovdiv region. This is the most developed agricultural region for vegetable production (Arnaudova et al., 2014). Today, Municipality of Kaloyanovo faces a number of various environmental and ecological innovations and yield increased challenges. The development and implementation of an environmental action plan for the valleys are associated with the strategy position and closely connection with another neighbour agricultural areas. The picture above presents the Municipality of Kaloyanovo position into Bulgaria map (Figure 1).

Figure 1: Bulgaria map and Municipality of Kaloyanovo (original)

In the municipality are situated 14 villages with one center city, named Kaloyanovo. The bigger village is named Razhevo Konare with area of 46.01sq.km and the smallest one is Glavatarwith area of6.23 sq.km. Next map (Figure 2) presents the position of 14 villages in Municipality Kaloyanovo. The relief is plane to hilly and average elevation is 250 m. The climate is transcontinental, characterized with an open winter and a hot summer. These factors are essential and favorable for vegetable developing.

Next maps (Figures 3 and 4) present information about land use and soil distribution in the studied area. Dominant soil types are sandy-clay and loamy, presented in the next map (Figure 3). These soil characteristics are useful for cultivation of various vegetable plants- tomatoes, papers, cabbages, carrots, etc.

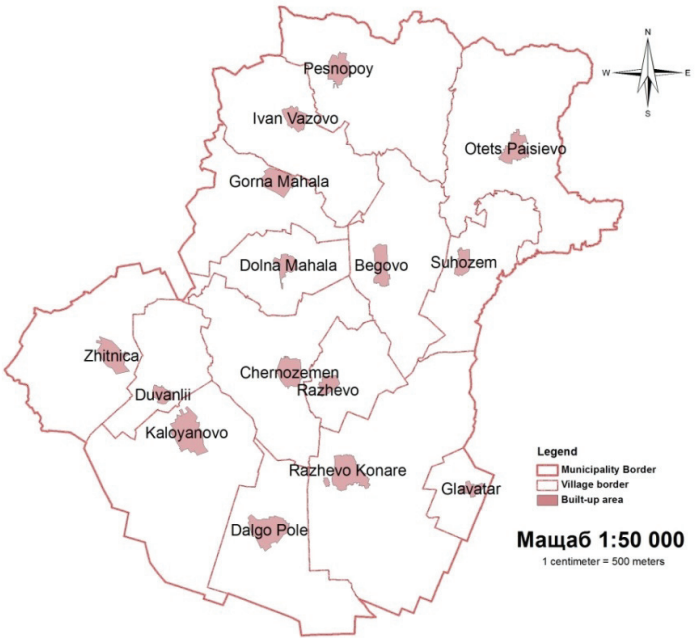

Figure 2: Map of the studied area- Municipality of Kaloyanovo (original)

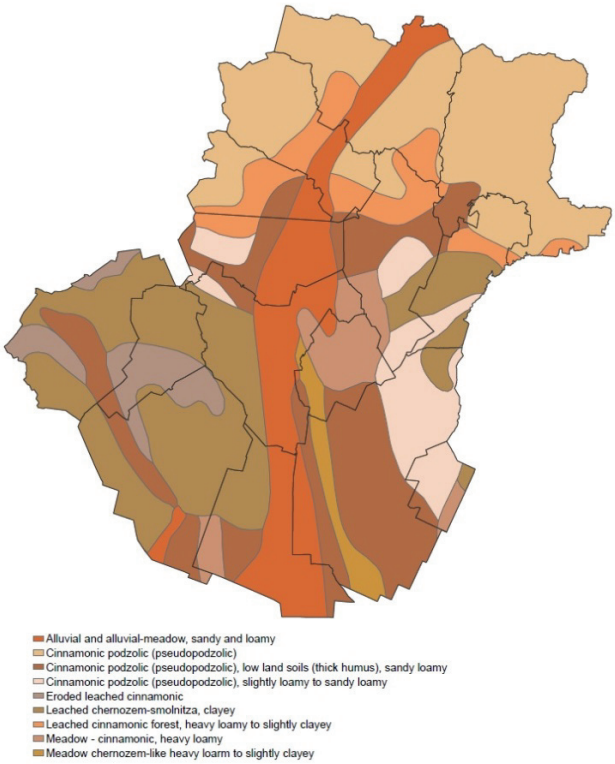

Figure 3: Map of Soil type in the studied area- Municipality of Kaloyanovo (original)

Good environmental factors advantage good agricultural actions. Above 50% of the land area is cultivated. Only the latest north terrains are covert with forest. More over 75% of the cultivated land is covered by corn fields, vegetable sorts and fruit plants. Forest area is 14,5%, almost 3.99% of urban area, 4.16% water resources and another 2.35% for road systems, useful fossils, depots, scraps, etc. More agricultural land allows cultivating and developing of more different vegetable plants and opportunity of increasingly yields. All this information is presented by the next map (Figure 4).

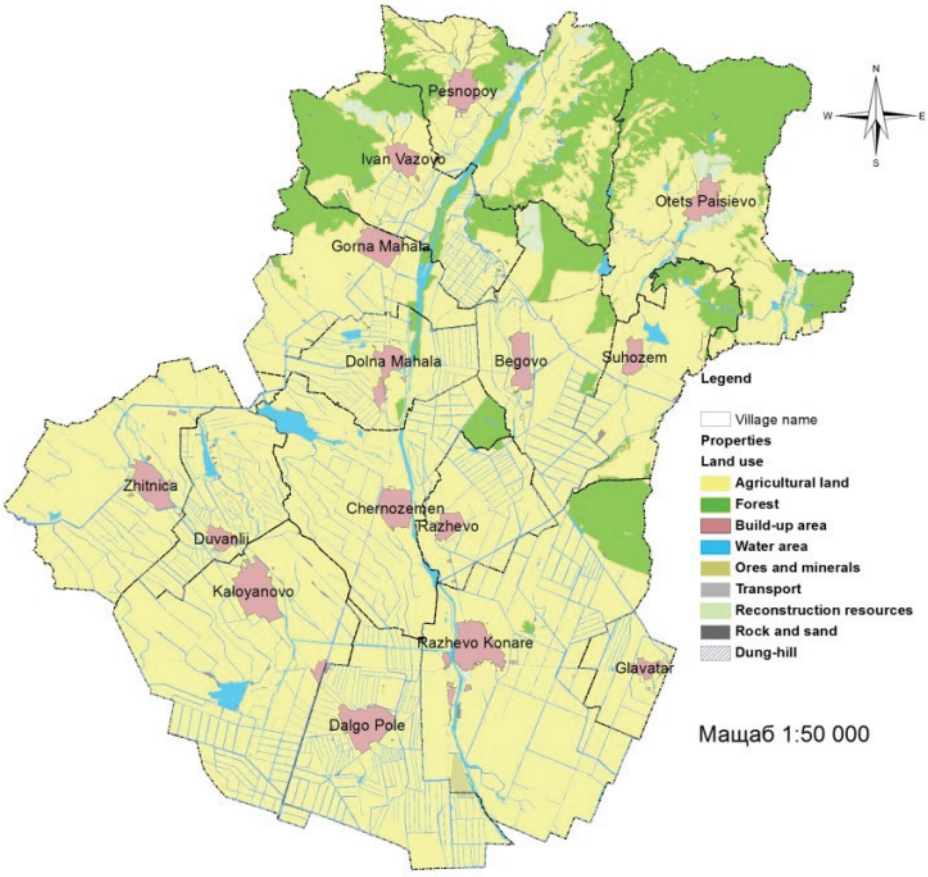

Figure 4: Land use map of Municipality Kaloyanovo (original)

According to the property of land in Municipality of Kaloyanovo (Figure 5) almost all cultivated area is private – 60.22%. State property is 16.8%, municipal area is 18.66% and built-up area 4.32%. So the most appropriate area for agricultural actions is private terrains. Private section is more developing and can be in funds by its own profits. So it is important for vegetable farming systems to be subsidized and to rely on its own production.

Categorization of cultivated land area (Figure 6) is made by 10 categories of comparison. This method of land classification is the most spread in Bulgaria and it is consistent with climate conditions, relief, soil characteristics, plant requirements, etc. The classification is based on number from 2 to 10. Land category is assessment of land characteristics. The lowest number shows the best land for cultivation. Dominant land category is between 2 and 4, so it is very good for agricultural actions. Categorization is presented on the next map and categories are shown by different colors.

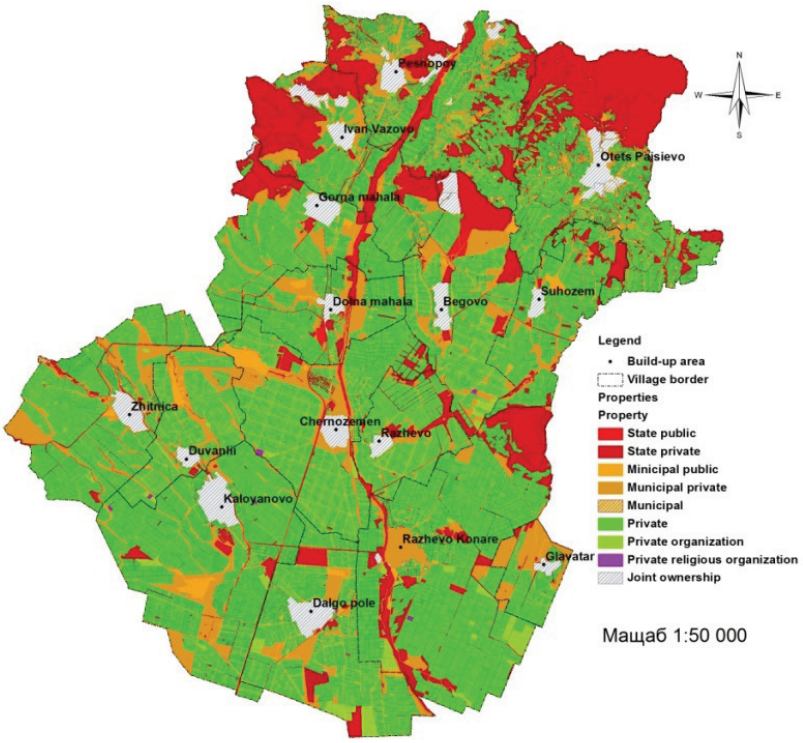

Figure 5: Property land map of the studied area (original)

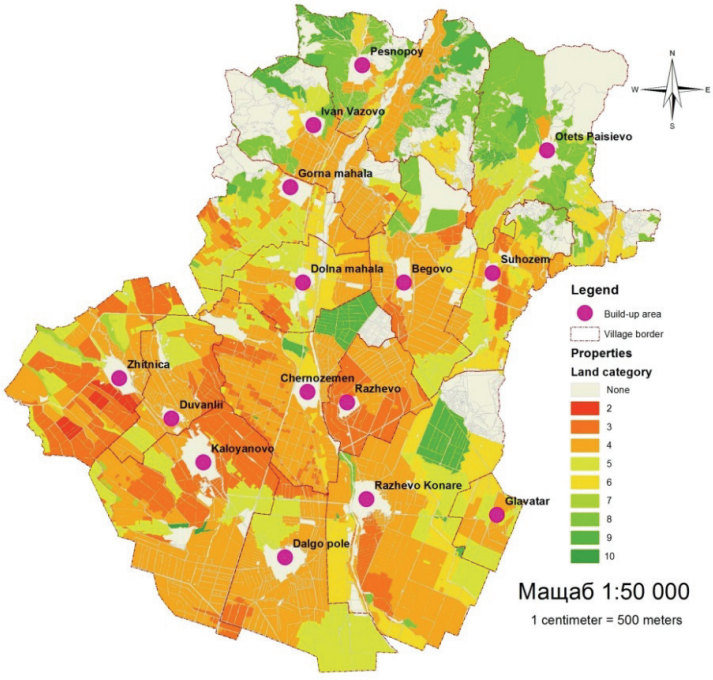

Figure 6: Map of Land category in Municipality Kaloyanovo (original)

Transport system (Figure 7) is amount to 152 km. It mainly contents roads from class 2 with length 24 km, class 3 with length 21 km and class 4 with length 62 km. During the studied area is situated railway with length 45 km. Municipality has important transported role of connecting North with South Bulgaria. Road information has influence on fast transportation of agricultural production to the market systems. Good structured roads help for connecting to the nearest factories and vegetable shops.

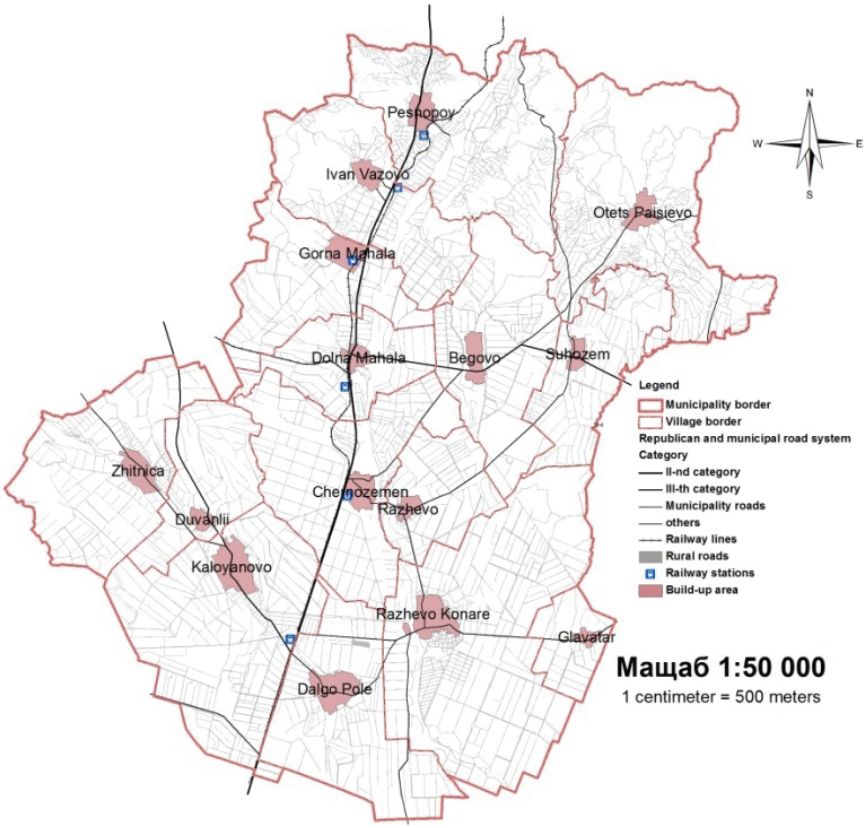

Figure 7: Map of road system (original)

Water resources (Figure 8) covered 14 500 ha area. Water system is presented by irrigation systems, rivers and canals. Length of water systems is 116 km. Next thematic map illustrates the situation of present irrigation systems and water resources in the Municipality of Kaloyanovo. Water resources are very substantial for vegetable growing. Analysed data face on good built and supported irrigation systems, which is permanently used and upgraded for agricultural practices.

Demography situation is presented on the next map (Figure 9). By the last census of the population in the studied area, organized during 2011 year, the population is 11 879 people. Dynamic is shown about the period 1934-2007 years. The most developed area is municipal center Kaloyanovo (Figure 10), so it is center city. In comparison with past years, population is decreased from small villages and move to the cities. The new technology tempts young people to the bigger cities, so the smaller villages become uninhabited areas. These results will have negative reflection on future agricultural development. It can be improved by implanting new facilities and more modern agricultural machines.

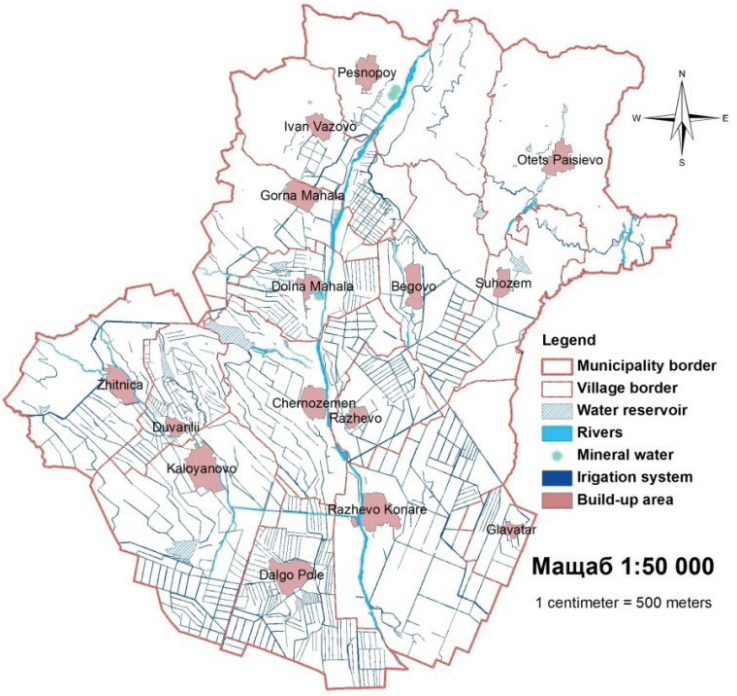

Figure 8: Map of water resources (original)

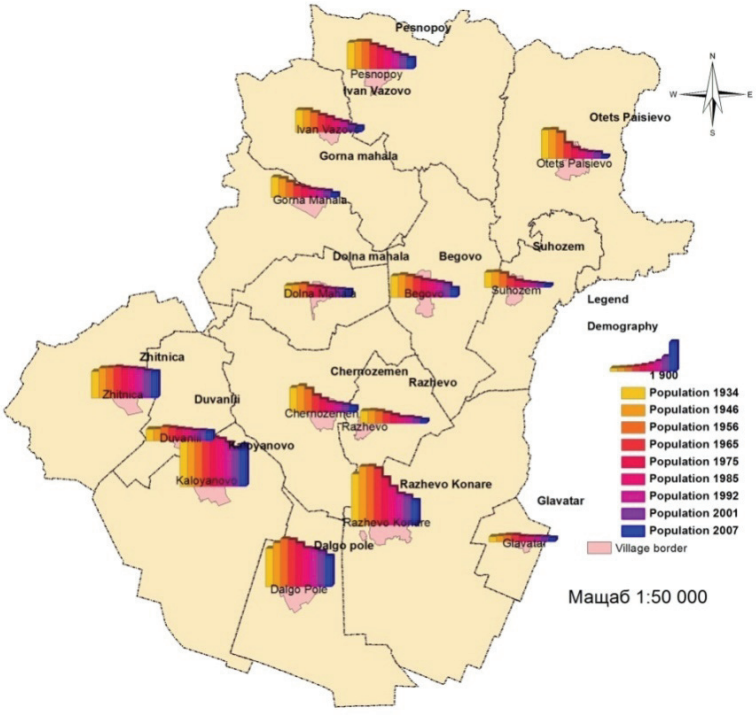

Figure 9: Demography map of studied area (original)

The main objective of the land evaluation is the prediction of the inherent capacity of a land unit to support a specific land use for a long period of time without deterioration, in order to minimize the socio-economic and environmental costs (De La Rosa 2000). Finding suitable land area for demanding agriculture crops is the need of present day farming system. So it is essential to know in advance if one area is good for agricultural practice or not. Background study is important part of farming management and it is the base level of expert knowledge.

All presented information is linked to the latest years. Spatial data transformation and implementation it in GIS show an easily way to analyze present information about nature and environmental resources. Agricultural development depends on environmental facilities. For good success and minimized losses, farmers have to do advanced research about environmental factors and nature resources. Results from the study have to be suitable for all plans requirements.

Figure 10: View from the studied area (http://www.kaloianovo.org)

CONCLUSIONS

Agriculture is a sector influenced by different parameters: nature resources, land use and management, water and road systems, population, plant requirements, etc.

All information is combined and presented by GIS tools. The data related to spatial information and boundary are calculated with the scale of 1:50000. Resulted thematic maps present the importance of environmental and human practices.

Municipality of Kaloyanovo is good area for agricultural development. All natural factors-soil distribution, water resources and land category will have positive effects on crops development. Good arranged road system and private land property increase product transportation to the vegetable markets and factories.

All nature factors have positive effects on distribution of land use - mainly cultivated areas. As a negative factor is a result about decreasingly population in the smaller villages. It may be change by using more modern techniques.

Cultivation is difficult decision making and based on a huge factors. So advanced multi-criteria analysis is the method of mixing necessary information. GIS being one of the powerful tools, efficacy of the evaluation process will be maintained (Baniya, 2008). Non spatial parameters can also be analysed in the spatial basis to help making decision process easier. It is very essential to understand land capacity to support appropriate plants cultivation. So farmers are advised to use research for vegetable cultivating, according to nature and environmental potentiality. Site specific classification in order of suitability is main interest of vegetable growers for further profitable vegetable crop development.

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