

## Evaluation of Agri Resource Potential of Georgia's Landscapes by the Use of Mathematical Methods



### Geography

**KEYWORDS :** agri resource potential, etalon-object, landscapes, multi factorial analysis

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### ABSTRACT

*Method have been developed to determine agri resource potential of the territory on the bases of weighted metrics introduced in the factors' space and the relevance of using this method by this point of view is established. On the bases of the closeness value to the etalon-object are identified territorial distribution of the agri resource potential of Georgia and also different altitudes, landscapes and administrative units with maximum potential are determined. On the bases of a large amount of data processing and systematization also is created a DB of agri resource potential for Georgia's territory and a series of thematic maps. Data processing and visualization was implemented through GIS technologies.*

### INTRODUCTION

Evaluation of agri resource potential is important for both theoretical and practical point of view. It forms the bases for the sustainable use of natural resources and it imposes a special role in working out a particular area's landscape strategic planning process.

In Evaluation of agri resource potential of a particular territory many factors should be considered, which is a difficult scientific task due to the different dimensions of these indexes. Therefore, it is recommended to use the mathematical apparatus which makes it possible to estimate comprehensively the data of dramatically different range of numerical values and different dimensions.

In refer to Georgia, the issue is actual by the point of view that the results of the comprehensive evaluation of agri resource potential should become the bases for the country's socio-economic development of strategic plans. Such an approach will not only promote the rational and the efficient use of natural resources but also will create scientifically grounded base in terms of environmental protection.

Although in recent years (2005-2011), in Georgia, there is a decreasing trend in the share of agriculture (14.8 %-18.8 %) in GDP, it still remains the leading field for the country's economy (Agriculture of Georgia 2011). Despite the high quality of agricultural lands, agri productivity here is quite low and at least twice lower than the European rate (Davitaia, Seperteladze 2009). Because of the diversity of natural conditions, agriculture here is multi branch and is characterized by inter-structural regional peculiarities what complicates the possibility of evaluation of agri resource potential. Urgency of the issue is related to the fact that in the last 20-30 years has changed the space-temporary structure of the agricultural sector which led to the emergence of the need to evaluate the country's agri resource potential. Because of the different natural conditions for various regions of Georgia and accordingly by the agri resource potential, it is important to evaluate its territory not only according to different altitudes and landscapes but also separately by the regions. It makes possible to evaluate the forthcoming landscape changes and elaborate recommendations for the sustainable environmental

planning. This even more will promote regional management and socio-economic development of effective strategic plan.

The aim of the research is: to work out comprehensive evaluation method of agri resource potential of the territory by the use of mathematical methods and its review-analyses in the context of Georgia.

Despite the fact that definite research has been conducted in this regard, although not from the Complex - Geographic approach (Arveladze 2006).

Introduction of Mathematical methods in Complex Physical-geographic researches are implementing with difficulties due to the complexity of research object (defined factors) and lack of data (Klitsunova 2007; Viktorov 2006). Searching of this issue is rather significant for assessment of a number of Landscapes, mainly, for determination of its natural- resource potential.

The main scientific innovation of the research is to work out the type of the evaluation method of agri resource potential by the use of mathematical methods which will allow us to reveal the suitability of any area by this point of view. Therefore, the landscape approach to the mentioned research is used for the first time.

### STUDY AREA

Georgia is represented by 14 types, 23 sub-types and 71 species of landscapes. There are landscapes started from Western Georgia with extra humid subtropical (wetlands, poly-dominant Colchis forests), but in Eastern Georgia with semi-arid and arid subtropical (steppes and half deserts) and ended by the high mountain meadows, with sub-nival and nival glacial. Georgia is a country of outstanding landscape diversity. In this respect, it is ranked 12<sup>th</sup> place in the world, but by calculation of per unit to the area it holds the 1<sup>st</sup> place. The country is also distinguished with the diversity of agri landscapes.

Forests occupy 40 % of the total territory Georgia, but virgin forests - almost 10%. However, the landscapes which remained relatively untouched during the centuries were also affected by anthropogenic influence (Beruchashvili 2000).

Georgia consists of 2 climatic types and 22 climate zones (National Atlas of Georgia 2012). So, different topography, climate, soil and vegetation types, entirely natural conditions and particularly a humid subtropical climate with mild winter and moderate-moist summer of most plain landscapes of Georgia, make it a favourable place to produce a diverse variety of agriculture.

Land area suitable for cultivation is 0.21 ha per capita, which is very low and cannot satisfy the country's food needs. The situation is further complicated by the fact that the tendency of decreasing cultivated lands' area is observed at the expense of growth of pastures and land area for non agricultural purposes. During last decade the decreasing share of agriculture sector is sharply visible. During of 2005-2011 years share of agriculture in GDP decreased from 14.8 to 8.8 % (Agriculture of Georgia 2011).

It should be mentioned that during 1990-2005 the portion of the population of rural areas increased from 44.7% to 47.7% (Agriculture of Georgia 2006). This tendency continued in the next years (The conception of the development of Agriculture of Georgia).

The problems are connected with land use management too. This is not new problem. In 1970-80s land-related problems were caused by poor land use planning. There was no coordination between industrial planning and land use planning, local natural conditions were ignored.

Insufficient mechanisation and lack of capital to invest in fertilisers and irrigation make the production highly inefficient (Agricultural Sector 2011).

From the point of view of anthropogenic transformation of the territory Georgian landscapes are rather different. Practically, the fully transformed landscapes hold only 1% of the whole square of the territory of the country. Average density of population here is more than 300 inhabitants on 1 sq. km, though agricultural land area makes up 80% of total area of the landscape. Though, rather significant area (19% of total area of the territory of the county) mainly comes as a part of strongly altered landscapes, where average density of the population is 150-300 inhabitants on 1 sq. km.

#### RESEARCH ON AGRI RESOURCE POTENTIAL IN GEORGIA

In these scientific works the particular attention is given to the different issues. These works analyze the existing situation and define the role of agriculture in the country's economy (Geography of Georgia 2003). In some works are realized the interrelation between natural conditions and agriculture according to regions of Georgia. The particular attention is given to the climatic and other factors that have an influence on the types of soil formation (Meladze, G., Meladze M. 2010; Meladze, G. Meladze, M. 2012; Urushadze *et al.* 2012). The data of 24 meteorological stations and 20 checkpoint post data are especially very important, which are characterised by a relatively long range of regular observations (Kartvelishvili 2011).

A lot of works are done in agricultural mapping. A series of maps were created as for certain species spread, the productivity, favourable environmental conditions, so for the reflection of the figures of the whole agriculture of Georgia (National Atlas of Georgia 2012). Some of them include schemes for the agri cultural zoning of Georgia.

So, there are a lot of works that provide analysis and evaluation of agri resource potential of Georgia, but it can be said that there are still left unstudied sides for these issues. This is mainly related to its comprehensive approach, multi factorial analyses, appropriate use of mathematical method and landscape approach. Unified methodology of evaluation of agri resource potential of Georgia and every districts of our country does not exist. Thus, mathematic methods of evaluation of agriculture potential haven't been used yet.

#### RESEARCH METHODS AND INITIAL DATA

There are different methods and principles of studying of multi factor analysis. Each of them plays a varied role according to its significance. An evaluation of agri resource potential of a particular territory requires multi factor analysis too. Therefore, it is important to select a method which will maximum ensure the correct assessment of current situation. From this point of view, on the one hand it is important to take into account the entire complex of factors, but on the other hand - to demonstrate the leading factor. From the above mentioned, for evaluation of agri resource potential is relevant to determine the weighted distance from various territorial units to the etalon-object (mark and feature) by considering the priority factors, grouping of objects according to the etalon object closeness value.

#### The research was conducted in several stages:

To create the DB for determination of indicators of agri resource potential. Data have been grouped according to three categories: administrative units (11 regions), different altitudes (8 levels 0-50, 50-100, 100-200, 200-500, 500-800, 800-1000, 1000-1500, 1500-2000, and more than 2000 m) and of landscapes (71 species).

On the basis of the program MATLAB and consideration of the priority factors from each object to etalon-object were calculated weighted distances, and they were grouped according to Sturges' formula.

According to a series of maps of GIS have been revealed the features of territorial distribution for the closeness value to etalon-object and also have been determined those administrative units, different altitudes and landscapes, which have a maximum agri resource potential.

Evaluating the landscapes for the agricultural purpose, the nature components and parameters, which make basic influence on it, should be viewed in details. This will be a pre-requisite for detection of the events and processes, which significantly influences on agricultural production. (Seperteladze 2009).

The research was based on factors determining the agri resource potential: the sum of active air temperature ( $>10^{\circ}\text{C}$ ), the annual amount of atmospheric precipitations (mm), relative humidity of air (%), air humidity deficit (mb), duration of period without frost (number of days), hydro-thermal coefficient, altitude.

For determining of agri resource potential of landscapes some other parameters were took into account too. These parameters are: humus amount in the A and B horizons or in the 1 m layer, and productivity of vegetation..

Data processing was carried out with the mathematical models in several stages:

- Formation of Matrix  $A = (a_{ij})_{n \times m}$ ,

where  $a_{ij} = K_j(O_i); i = \overline{1, n}; j = \overline{1, m}$  (1)

$O_1, O_2, \dots, O_n$  and  $K_1, K_2, \dots, K_m$  appropriately determine objects (territorial units) and selected quantitative characteristics in accordance with the aim of redistricting process.

- Data normalizing, because of range of numerical values variations corresponding to marks and features may differ from each other by several row.

$$k_j(O_i) = \frac{K_j(O_i)}{K_j^*}, i = \overline{1, n}, j = \overline{1, m}$$

Where

$$K_j^* = \max\{K_j(O_1), K_j(O_2), \dots, K_j(O_n)\}, j = \overline{1, m} \quad (2)$$

- Composition of normalizing data matrix

$$B = (b_{ij})_{m \times n}, b_{ij} = k_j(O_i), i = \overline{1, n}, j = \overline{1, m} \quad (3)$$

- Determination of priority coefficient for  $i$ -characteristic  $c_j, j = \overline{1, m}$ , where

$$\sum_{j=1}^m c_j = 1, \tag{4}$$

- Formation of normalized values

$$e_j = \frac{E_j}{K_j}, j = \overline{1, m}, \tag{5}$$

Where  $E_j (j = \overline{1, m})$  are the components of etalon-object  $E$ .

- Calculation of „weighed” distances from  $O_i$  object to E etalon-object in Euclid  $n$  dimension space:

$$d_i = \sqrt{\sum_{j=1}^m c_j (b_{ij} - e_j)^2}, i = \overline{1, n} \tag{6}$$

- Determination of full range of distance dispersion from the object to etalon

$$d_{\max} - d_{\min}, \tag{7}$$

Where  $d_{\max} = \max\{d_1, d_2, \dots, d_n\}$ ,

$$d_{\min} = \min\{d_1, d_2, \dots, d_n\}.$$

By Sturges formula (Khans, Engelman 2006)

$k = 1 + 3,222 \log n$  for  $n$  optimal amount of grouping of objects were determined and determination of verge of grouping intervals:

$$h = \frac{d_{\max} - d_{\min}}{k}, \tag{8}$$

- On the basis of complex characteristics the intervals for grouping of objects was defined:

$$(rd_{\min}, rd_{\min} + h), r = \overline{1, k}. \tag{9}$$

Based on the obtained, to take into consideration the entire complex of mark and features, in the first category  $r=1$  are the objects that are most close to the etalon-object, but in category  $r=k$ -objects that are far from the most.

In some of the works, we may see a different approach to the complex evaluation problem solving of the territorial units. In this regard, our present model is specific and has a number of advantages, which can be grouped:

The possibility of consideration of mark and features different nature (in regard with types and values of measurement and range variations of scales).

The introduction of weighted measure by the priority coefficient of mark and features of the closeness value to the object.

Model universality in the sense that it can be used as for the evaluation of separate agriculture so for the evaluation of complex agri resource potential, when the problem of grouping and selection of the optimal objects is solved by simultaneous consideration of multiple criteria.

Time-consuming calculation should be considered as the faulty part of the model, especially with the increase of mark and features. However, it should be noted that by consideration of modern technologies and software capabilities, the current problem can be solved successfully.

The advantage of this method lies in the fact that it can be used in other similar multi-factored geographical analyses, such as selection of analogue objects and optimal conditions on the bases of several criteria, as certain the degree of anthropogenic transformation of the territory and other. However, the method has fault parts what for the first relates to agri resource potential with respect of assigning various ranks to almost equal importance objects. The most important role in achieving accurate results fulfils the correct selection of agri resource potential determining factors and their meanings as well as determining correctly their meanings (ranks.)

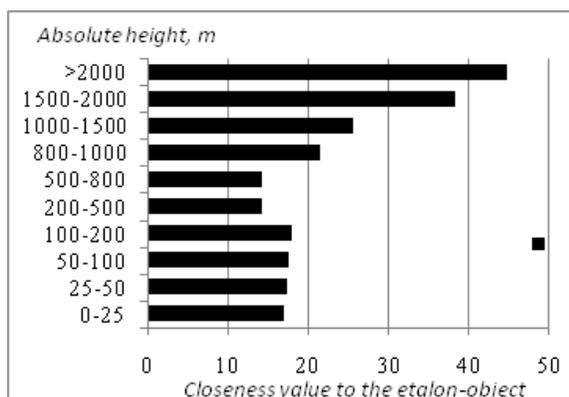
A special interest is paid to landscape approach, which implies complex-geographical studies.

The research is based on the use of the landscape map of the Caucasus, where the smallest classification unit is the landscape species (Beruchashvili 2000). Agri-meteorological data were based on the climate reference books (Scientific-applied reference book of Georgia 2004).

**MAIN RESULTS**

By the total weighted ranking (distance) method, with regard of agri resource potential, as a result of closeness value to the etalon-object were revealed the peculiarities of territorial distribution according to various territorial units of Georgia's - different altitudes, landscapes and regions. All three territorial units were assessed as interrelated. This approach showed more varied picture and gave us the opportunity to reveal a number of territorial peculiarities.

Analyses of the closeness value to the etalon- object according to different altitudes. It is logical that with regard of agri resource potential, the closest to etalon-object are territories with 200-500 m altitudes (Fig. 1). However, due to the uneven moisture, what is the most important factor for the growth of agricultural crops, there are substantial differences between Eastern and Western Georgia. In Western Georgia such conditions are on 0.25 m altitude. What primarily, due to favourable climatic and topographical conditions typical of the Black Sea. To the height of 200 m above the sea level, relatively higher hypsometrically, etalon compared to more distance, what can be explained by the reason of excess moisture of the territory. But the Colchis foothills which are on 200 m height above the sea level is much better drained and represented with a wide area of humid subtropical agriculture spread. Another reason is average air temperature.



**Figure 1. Closeness value to the etalon-object according to different altitudes in terms of agri resource potential.**

It is colder in the Caucasus than in other regions of the such conditions are on 0.25 m altitude. What primarily, due to favourable climatic and topographical conditions typical of the Black Sea. To the height of 200 m above the sea level, relatively higher hypsometrically, etalon compared to more distance, what can be explained by the reason of excess moisture of the territory. But the Colchis foothills which are on 200 m height above the sea level is much better drained and represented with

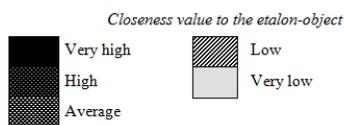
a wide area of humid subtropical agriculture spread. Another reason is average air temperature. It is colder in the Caucasus than in other regions of the same latitude. Here, it is colder by 4.5°C in January and by 2.8°C in July. Only in Colchida (especially in its southern part) are the January temperatures close to mid-latitude ones. Consequently, here is the maximum proximity to the etalon.

Due to the large hypsometric range of Georgia's territory (the sea level 0-5203 m) is characterized the general tendency of decreasing proximity to the etalon-object by absolute altitude rising, however, with some regional differences.

Almost for the whole territory of Western Georgia is characterized the decreasing tendency of closeness value to the etalon-object 200-500 m height above the sea level in regard with agri resource potential. It reaches maximum in range of 200-800 height m above the sea level but in the direction of higher different altitudes there is again a irreversible tendency of decreasing proximity. The same tendency is typical only for Kakheti in Eastern Georgia (Table 1). In all other regions of the Eastern Georgia the tendency of far away distance from the etalon-object is expressed in the whole vertical range.

**Table 1. Closeness value to the etalon-object according to different altitudes and Georgia's regions in terms of agri resource potential.**

Abs. height, m	1	2	3	4	5	6	7	8	9	10	11
0-25	Very high	High	Average								
25-50	Very high	High	Average								
50-100	Very high	High	Average								
100-200	Very high	High	Average								
200-500	Very high	High	Average								
500-800	Very high	High	Average								
800-1000	Very high	High	Average								
1000-1500	Very high	High	Average								
1500-2000	Very high	High	Average								
>2000	Very high	High	Average								



**Regions of Georgia:** 1 – Adjara, 2 – Abkhazeti, 3 – Guria, 4 – Imereti, 5 – Racha-Lechkhumi-Kvemo Svaneti, 6 – Samegrelo-Zemo Svaneti, 7 – Kakheti, 8 – Mtskheta-Mtianeti, 9 – Samtskhe-Javakheti, 10 – Kvemo Kartli, 11 – Shida Kartli.

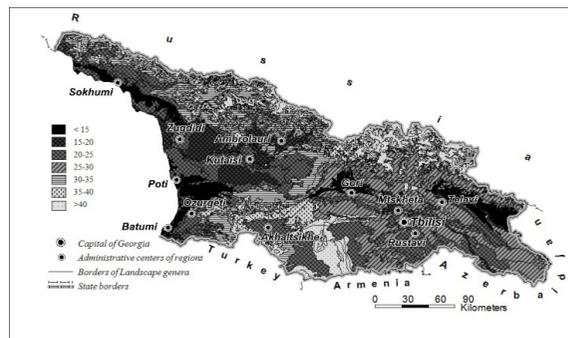
The maximum closeness value to the etalon-object on 200-800 m height range above the sea level is characterized for the Western Georgia, especially for Adjara, Guria and Abkhazeti. As for the Colchis lowland, its eastern part unlike the western part is closer to object etalon. Because it is better drained and consequently, is more favourable for the growth of agricultural crops. Racha-Lechkhumi, Kvemo Svaneti is the only regions, where the maximum proximity to the etalon-object is mentioned on 500-1000 m height range above the sea level. This figure is record not only for the Western Georgia, but for the whole territory of the country. The reason for it is the optimum amount of warmth and moisture of depression, what relatively creates the most favourable condition for the growth and development of the wine and other agri cultural crops, on such high altitudes. But this height range is not fully utilized for agricultural purposes.

In Western Georgia, the closeness value to etalon-object is different according to different altitudes. It reaches a maximum in Kakheti, on 200-800 m height range above the sea level but 500-800 m height range in Inner Kartli. The mentioned heights,

due to the relatively small inclination and hydrothermal regime are very convenient for agriculture purposes and also widely used in this field.

Analyses of closeness value to the etalon-object according to landscapes. Even more ambiguous situation occurs in regard with agri resource potential while analyzing closeness value to the etalon-object according to landscapes.

In General, it can be said that from the lowlands to the direction of the mountain landscapes, similar to altitudes has a place a gradual reduction of the closeness value to the etalon-object. However, the situation is more ambiguous. For the first, the increase of the closeness value to this etalon-object has a place from plain to the foothill areas direction, but in direction of the Lower Mountain and especially Middle Mountain on the contrary the reduction (Fig. 2).



**Figure 2. Closeness value to the etalon-object according to the landscapes in terms of agri resource potential.**

The total humus reserves in the 1 m thick layer of the soils of Georgia are 1.2 billion tons. Therewith, the highest values of humus reserves in the 1 m thick layer of the soils of Georgia is recorded in the cool humid high-mountain subalpine landscapes (283 million t) - of the total humus reserves in the country. The humus reserves are also high in the warm temperate mid-mountain forest landscapes (25% of the total area) (Nikolaishvili, Matchavariani 2010).

This is a logical result. In some places of the plains and lowlands with cinnamon soils, is characterised by a medium content of humus, and the siallitic type of weathering. Here, the most unfavourable conditions for the development of agricultural crops (excess of moisture or moisture deficit), the closeness value to the etalon-object is much lower.

Landscapes analysis revealed a more diverse picture according to separate regions. For example accumulative landscape of the plain lowland with Alder forest, Peat-moss and Scirpus marshes. Which stretches across the western part of Colchis Lowland is characterized by the high proximity to the etalon-object, so, it appears in the second grade. But if we consider the fact that the landscape is within 4 administrative units (Abkhazeti, Samegrelo-Upper Svaneti, Guria, Adjara) then we will see that it appears in various grades (<15, 15-20 and 20-25).

Similar results were obtained in other landscape cases.

The pattern of the spatial distribution of the closeness to etalon-object is not identical in all mountains and also in low mountain forest landscapes. The fact is that, the natural conditions are rather different. Different situation is observed in Samtskhe-Javakheti high mountain volcanic landscapes with steppe vegetation and mountainous chernozems. Here, a very high humus amount is recorded, where the humus amount averages 363 t/ha. But the favorable factors for the humus accumulation are not enough for many agri cultures. So, the combination of heat and moisture defined that these landscapes occupy the average place of closeness to etalon-object for Georgia.

The research of closeness to etalon-object has shown that it

would be reasonable to classify landscapes of Georgia into three groups according to agri resource potential (Table 2). These groups are:

Landscapes with high closeness to etalon-object and also with high agri resource potential - occupies 14.2 thousand km<sup>2</sup> area are represented basically with plain and lowland landscapes. The share of these landscapes is 20% of the entire territory of Georgia. Firstly, this fact is explained by favourable physical-geographical factors, such as the less steep slopes, the weaker erosion and removal of the fertile soil layer, the optimal number of precipitation, also optimal conditions of humidity and duration of period without frost.

**Table 2. Closeness value to the etalon-object according to different groups of landscapes.**

Closeness value to the etalon-object		Number of landscape types	Landscape area, km <sup>2</sup>	Percent from entire territory of Georgia, %
High	< 15	6	3.8	5.5
	15 – 20	11	10.4	14.9
Medium	20 - 25	14	10.8	15.5
	25 – 30	14	8.8	12.6
Low	30 – 35	10	13.4	19.2
	35-40	4	9.8	14.1
	40	12	12.7	18.2
Total			69.7	100

This is especially visual in foothill landscapes of humid subtropics of Western Georgia, where are represented the red and yellow soils. The red soils (Rhodic Alisols) have deep profiles, a high content of humus, and ferrallitic type of weathering. The yellow soils (Chromic Alisols) are characterized by their deep profiles, and a high content of humus (Nikolaishvili, Matchavariani 2010). Amongst the mountain landscapes only 2 landscape genera are belonged to this category (with high closeness to etalon-object).

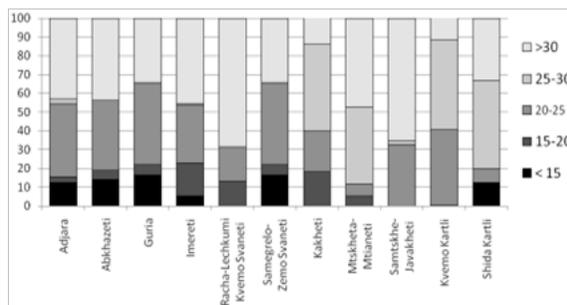
Landscapes with medium closeness to etalon-object and also with medium agri resource potential - occupies 19.6 thousand km<sup>2</sup> areas. These landscapes are mainly part of foothill and low mountain landscapes;

Landscapes with low closeness to etalon-object and also with low agri resource potential – occupy 35.9 thousand km<sup>2</sup> area. The greatest area, less than half territory (47.5 %) of Georgia, occupies the landscapes with low closeness to etalon-object. Here are united 26 landscape genera. These landscapes are high-mountain and partially middle mountain landscapes.

The mountainous meadow soils (Leptosols, Cambisols, Cryosols; Leptosols and Histosols) and the brown forest soils (Dystric Cambisols; Eutric Cambisols), the most widespread here, are characterized by a high amount of humus, but because of deep steepness of slope, also cool and humid climate make them the unfavorable for agriculture.

Analyses of closeness value to the etalon-object according to the regions. Analyses of closeness value to the etalon-object according to the regions of Georgia in terms of agri resource potential, revealed very diverse situation (Fig. 3). It is clear that on the one hand, in all regions are the landscapes characterized by favourable natural conditions for agricultural exploitation, and on the other hand, the landscapes characterized by less agri resource potential or its complete absence. In particular, with the high resource potential of the landscape area, the most distinguished are: Imereti, Samegrelo-Upper Svaneti and Guria (Fig. 4). The two regions mentioned besides Imereti are also remarkable with average rate. The lowest agri resource potential is in Samtskhe-Javakheti and Lower Kartli. Although, in these regions are found the landscapes with high agri resource potential, however their area is much smaller. It is especially

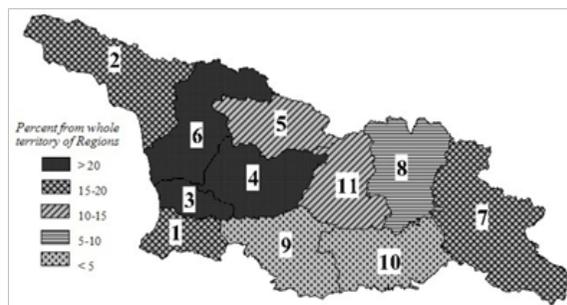
notable for fruit growing, which produces rather high quality fruit. Here approximately a quarter (26%) of total fruit harvest of Georgia is grown and it is only behind Imereti among the regions of the Country, from this point (Geography of Georgia, 2003). It's enough to name the fact that maximum amount of humus in Georgia is observed in transitional to moderate warm semi-arid landscapes of Javakheti Plateau with steppe vegetation which amounts to an average of more than 300 t/ha in the soil metric layer (Nikolaishvili, Matchavariani 2010).



**Figure 3. Closeness value to the etalon-object according to the Regions in terms of agri-resource potential.**

Kakheti known in terms of agriculture - as one of the most attractive with landscapes, did not appear among the regions having a maximum agri resource potential. This is primarily due to the distribution of wetland and salty areas on a large territories, which land use is impossible without the implementation of high cost melioration measures. In addition, there are a variety of natural conditions that characterize what is, as a result of very different climatic hydrological-geological conditions of relief. Accordingly, some territories are the most useful, while some are very poor in agricultural points of view.

Thus, the analysis of data has shown that the agri-resource potential of Georgia's landscapes has very diverse character and this diversity is related to many factors, such as: the growth of the absolute elevation, the distance from the sea and etc.



**Figure 4. Landscape area in terms of agri resource potential with maximum closeness value to the etalon-object (legend-see Table 1).**

**CONCLUSION**

The agri resource potential of landscapes were valued considering different parameters. Analysis of these parameters revealed that agri resource potential of landscapes are quite different and that this difference is revealed at every administrative units and landscapes classification stage. While one parameter plays a decisive role in one landscape, the second is essential for another. Sometimes, two or even more parameters are of paramount importance.

**A number of important results have been obtained on the base of the research:**

- Agri-resource potential evaluation methods for the territorial units were worked out, which is based on the calculation of weighted distances through the priority coefficient of factors to the etalon-object;

- A database of agri resource potential of Georgia's Territory and a series of thematic maps was created;
- The characteristics of territorial distribution of agri resource potential of Georgia were revealed, in particular, maximum high potential of different altitudes, the landscapes and administrative regions;
- A map of humus reserves in the landscapes of Georgia has been compiled. This map allows us to compare different landscapes and use quantitative data for the assessment of their resource potential.

Methodological base of this study might be model for other multifactor analysis and also for other territories.

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