Annals of Agrarian Science

Journal homepage: http://journals.org.ge/index.php

Georgian Natural Resources (Brief Review)

Z.Lomsadze, N.Chitanava, O.Paresishvili, G.Magalashvili, K.Vezirishvili-Nozadze, K. Makharadze, T.Patarkalashvili, L. Kvaratskhelia, N.Mirianashvili

Georgian Technical University, Irakli. Zordania Center for Studying Productive Forces and Natural Resources of Georgia, 69, Kostava Str., Tbilisi, 0175, Georgia

Received: 05 July 2018; accepted: 10 September 2018

A B S T R A C T

In the paper the main natural resources of Georgia are considered. Among them are: soil (more than 20 types), land (the ways of efficient use of its resources), water (including 26060 rivers with total length of 60000 km; the resources of fresh water of distinctive wealth), forest (98% at the slopes of various incline with protective functions), mineral and energetic resource potential of raw material, variety of the reserves of mineral products, the results of their many years and intensive exploitation, the potential of reproducible resources of energy (hydro, solar, wind, geothermal water, biomass), recreational resources as the basic for development of health resort and touristic industry; protected territories with a large set of state reserve, national parks, wildlife preserves, landmarks and protected landscapes.

Keywords: Soil, Land, Water, Forest, Power resources, Recreation.

*Corresponding author: Zurab Lomsadze E-mail address: zlomsadze@mail.ru

Introduction

At the modern stage of the society development the determination – estimation of the potential of local natural resources is necessary, since, in spite of the wide promotion of newest resource – saving technologies, natural resources and their rational use is a main factor of social – economic development of the country.

Natural resources, existing in the country, are the basis of development of its economics and considerably determine the directions of sectoral and regional economics.

In the nearest years, in the conditions of intensive and uncontrolled use, the natural resources may be really found on the verge of pointed deficit and degradation. Therefore, this problem is in the focus of World society.

At globalization, when the solving of many problems requires the joint efforts of World countries, the realization of regular, transparent state policy is necessary in the problems of the use and protection of natural resources to avoid their non-rational and, in some cases, the predatory exploitation and to provide the conservation – sanitation of living space for population.

Natural resources and the peculiarities of their use determine the necessity of permanent research of mentioned problems since the resources of all kind and the demand for them is in constant dynamics, varies with space and time. On this basis the research of modern state of natural resources and of the prospects of their use is very topical [1].

Main part

Georgia is characterized by very distinctive natural conditions. In the country the all thermal groups of World climate (excluding tropical one), all types of relief (macro-, meso- and microreliefs), three types of organisms (green, plants-arboreal, arboreal-grass, grass, desert and lichen and moss; microorganisms and animals, magmatic, metamorphic and sedimentary rocks) are marked out.

Richness of natural conditions determines the uniqueness of soils and soil covering. "The museum of natural conditions of the soils outdoor – the soil covering" is explained by such manner. There is all types of the soils of the most countries of the world and of Europe in our country. Among them are the soils which are not found in Europe [2].

At present more than 20 types of the soils are marked out: Brown Forest soils (WRB: Humic Cambisols, Ferric Cambisols, Eutric Cambisols, Dystric Cambisols), Mountain Forest Meadow soils (WRB: Haplic Umbrisols), Mountain Meadow Soils (WRB: Hyperdistric Umbrisols), Cinnamonic soils (WRB Chromic, Calcaric, Humic, Eutric Cambisols, and Leptic, Haplic, Calcic Kastanozems); Meadow-cinnamonic soils (WRB: Chromic, Calcaric, Gleyic, Eutric Cambisols, and Gleyic, Vertic, Haplic Kastanozems), Yellow brown forest soils (WRB: Stagnic, Ferric, Luvisols, Skeletic Luvisols, and Dystric, Gleyic, Luvic Stagnosols), Terra Rossa (WRB: Rendzic Leptosols (Brunic), Mountain-meadow humus-illuvial soils (WRB: Humic Cryosols (Sombric), Brown forest black soils (WRB: Dystric Stagnosols) Andosols (WRB: Vitric Andosols), Red soils (WRB: Ferralic Nitisols, Haplic Nitisols), Yellow soils (WRB: Ferric Luvisols), Bog soils (WRB: Dystric Gleysols, Eutric Gleysols, Histosols), .Yellow Podzolic soils (WRB: Stagnic Acrisols, Ferric Acrisols), Raw Carbonate soils (WRB: Rendzic Leptosols), Grey Cinnamonic soils (WRB: Calcic Kastanozems, Vertic Kastanozems), Meadow Grey Cinnamonic soils (WRB: Haplic Kastanozems, Gleyic Kastanozems, Vertic Kastanozems), Black soils (WRB: Haplic Vertisols), Chernozems (WRB: Voronic Chernozems, Calcaric Chernozems), Mountain Meadow Chernozems (WRB: Phaeozems), Saline soils (WRB: Vetric Solonchaks, Mollic Solonetz), Alluvial soils (WRB: Gleyic Fluvols, Eutric Fluvisols, Dystric Fluvisols) [2]

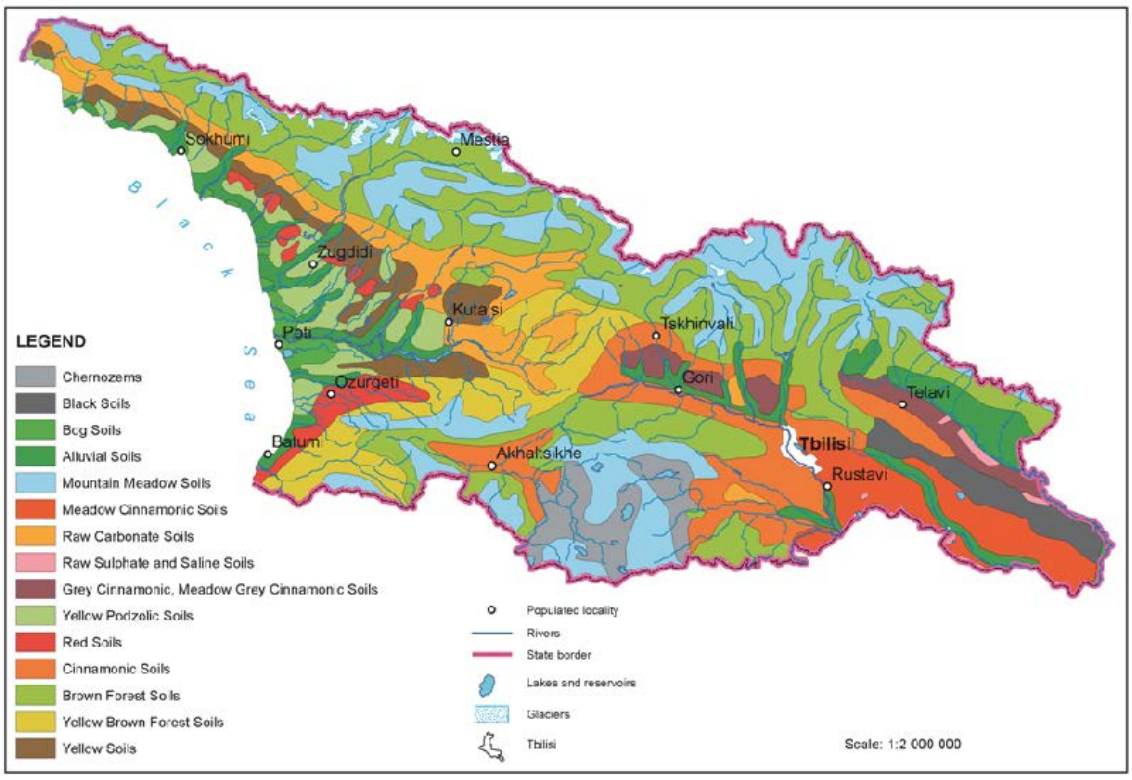

Fig.1. *Soil map of Georgia*

Land resources are very important for country development [3-6]. The use of the land is nonuniform and the land is more intensively used in plain and submountain zones, the soils up to 1000 m above sea level. They comprise 46.1% of country territory. The distribution of non-agricultural lands is very interesting by the property form.

The distribution of non-agricultural lands is the following: settlements – 88.4 thousand hectares, protected territories – 300.7 thousand hectares, forest resources – 2456.2 thousand hectares, industrial, transport, energetics and of other function – 171.9 thousand hectares, religious organisations 4.9 thousand hectares, water resources (including the flow of territorial waters) – 835.1 thousand hectares.

In the modern conditions of agriculture development the rational use of land resources attaches much importance. It must be based on objective estimation of land quality, on well considered, proper organization of the territory, on economic motivation of land protection, on continuous enhancement of the level of agricultural education and on the use of modern progressive methods.

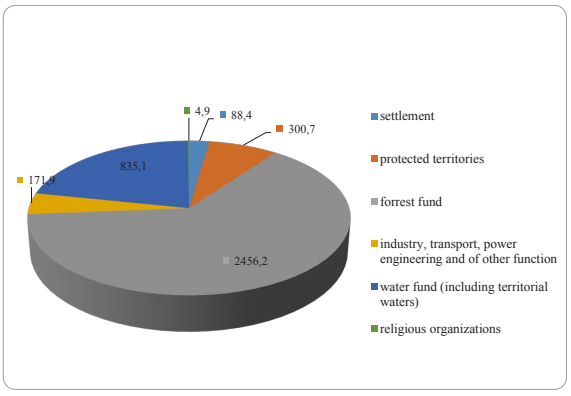

Fig.2. *Distribution of non-agricultural lands in accordance with property form (in thousand hectares)*

Soil protection is a daunting, global problem of modernity which must be directed to qualitative improvement and rational use of the land for conservation and increase of its fertility.

From the 90's of the last century the unstable social-economic events were revealed most sharply in agriculture. By this reason, conduction of the required measures for soil protection and fertility increase were considerably retarded.

Over last 20-25 years the soil degradation was intensively occurred. 30.5% (205.7 thousand hectares) of total area of the cropland is eroded by various degrees. 14.2% of total area of the cropland is highly and, in the mean, eroded. Moreover, over last years the natural calamities (landslide, torrent, flood, etc.) gained the scale effect, which impair considerable losses to agricultural lands. Humus horizon of the soil decreases, fertility and haying-pasture areas reduce, etc.

As a result of the difficulties in the country, caused by unprepared privatization of agricultural lands, careless relation to agrarian sector, hurried disintegration of old economic organization forms was favoured for deepening of crisis state in agriculture. The sphere wasn't provided by agricultural techniques, qualitative fertilizers, pesticides and chemicals. Seed and transplant farms, systems of testing and renewing of the species will cease to operate. Main indices of agrarian sector were sharply impaired. The areas of agricultural plants – arable-seeding, long-standing transplants (orchard, vineyard) were significantly reduced.

Crop production was sharply decreased. Provision of the country by the food was impaired. Existing state made deeper further the unemployment and aggravated the problem of the poverty. This was favoured for activation of the processes of mass migration, especially, from the mountain regions.

There are many unsolved and insufficiently studied problems in the country as yet, in particular, land cadastre and appraisement, soil-climate zoning, study of soil covering by aerospace methods, soil technological research, etc.

Elaboration of large-scale measures against land erosion, landslide and torrent, for recultivation, melioration, exsiccation, lime treatment and their execution by accelerated rate is necessary.

For efficient use of land resources, the agrochemical research of the soil is reasonable. It must be based on the principles and methods of

large-scale mapping of the soils. For this purpose the formation of a scientific center for complex research of land (soil) holdings is necessary which will totally provide scientific service in this direction.

The data bank of land resources must be organized and the control on its use must be established. Qualitative accounting of the land isn't ordered in the country. Determination of land quantitative and qualitative indices, its economic estimation isn't carried out. Land code and land cadastre must be elaborated which will be a basis for regulation of holding relations in modern conditions, for developing of land market. For rational use of land holdings and for organizational-legal regulation, in accordance with their state interests, the creation of integrated state system of land management is reasonable in the country.

After the land privatization the problem of land consolidation became acute. The solving of mentioned problem depends on a number of the factors. Therefore, it requires the system approach. Together with the further developing of the cooperation, the use of other, alternative forms is reasonable. For example, the state land fund(corporation) may be organized which will have the appropriate financial resources for land area purchase, for its ruggedness and hereafter, according to economic reasonability, to alienate it or to hand it on the basis of lease contracts.

The land must not be sold on foreign citizens and legal persons. The land must be transferred to them only on the basis of lease relations.

There are all possibilities for organization of highly developed agricultural production in Georgia, so that the country may become self-sufficient, primarily by ecologically pure food production in the nearest years which will exclude the problem of food safety in the country.

At the use of land resources the role of territorial administration and self-government is of importance. They must assist in improvement-stimulation of business sphere, in creation-developing of processing entities on the basis of local raw material and in stable increase of agricultural production, in creation of working places, in increase of standard of life in the villages and in self-employers welfare.

Development of agriculture and associated spheres, requires a complex approach. For this purpose the elaboration of the State goal program of sustain and safe development of the sector is reasonable, which determines, by stages, development tasks, financial sources and mechanisms for their realization [3-6].

Georgia is characterized by richness of the resources of fresh water [7-15]. Annually the flow comprises 56.5 km3, and including transit flow – 65.8 km3. 75.5% or 49.7 km3 of the latter flows in the Black Sea and 16.1 km3 in the Caspian Sea by passing of neighbour states.

Water resources are presented by river flow, lakes, glaciers, marshes, water reservoirs and underground waters. Water resource in Georgia attains 100 km3 totally (Fig.3)

Thickness of the layer of fresh water, formed locally, comprises 810 mm. By this value Georgia occupies a major place among former soviet republics.

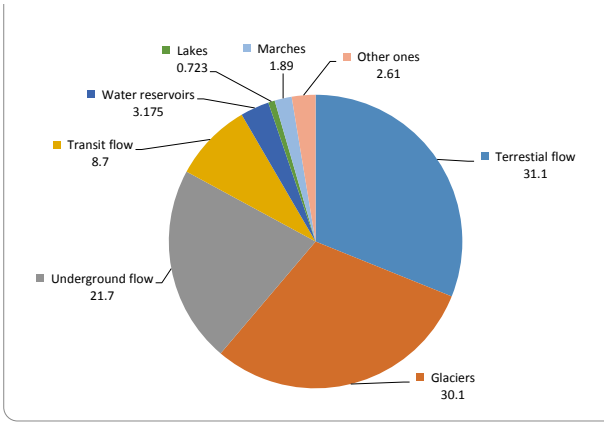

Fig.3. *Percent distribution of water resources*

In the country the following is accounted: 26060 rivers, the total length of which is 60 thousand km; Mean compactness of river set is 0.85 km/km2, in West Georgia – 1.07 and in East Georgia – 0.68 km/km2. Hydrographic set consists of mainly (99.4%) little (<25 km) and very little (<10 km) rivers. From adjacent countries, in average, 9.3 km3of water is entered. Among them are: river Mtkvari – 0.9125 km3, river Potskhovi – 0.252

km3, river Debeda – 0.883 km3, river Chorokhi – 7.25 km3. The river head of the major river of Georgia – Mtkvari is located in Turkey and in the territory of our country flows its middle part (351 km). The most part of the rivers of East Georgia compose an integrated system of Mtkvari basin. Among the rivers of West Georgia river Rioni is the most big and full – flowing (length – 333 km, flow - 12.7 km3), the river head of which is located at south slope of Caucasian mountain ridge and it flows in the Black Sea.

The biggest rivers of Georgia are the following ones (by length and by the area of water collection basin): Alazani (390 km, 11.8 thousand km2), Mtkvari (351 km, 21.1 thousand km2), Enguri (231 km, 4.06 thousand km2), Ktsia-Khrami (201 km, 8.34 thousand km2), etc. The rivers are characterized by mixed feeding: rains, snow, molten glaciers and underground waters.

The most part of Georgian rivers are characterized by high volume of solid flow. Big rivers inject a considerable amount of the floated alluvion in the Black Sea: from 2 to 11 mln tons.

There are 856 lakes in Georgia; the total area of their water surface comprises 170 km2 and water reserve – 0.72 km3. More than one third of the lakes are located in volcanic upland of South Georgia. The biggest lake is Tabatskuri which contains 221 mln m3 of water. Lake Paravani has highest water surface – 37.5 km2. The area of water surface of more than half of the lakes is less than 0.1 km2. In the five big lakes (Ritsa, Paravani, Paliastomi, Sagamo, Tabatskuri), the total area of water surface of which comprises 72.6 km2 , water amount is 535 mln m3. 97.3% of the total volume of Georgian lakes is fresh water and it may be used for economic purposes.

Glaciers occupy nearly 0.7% of Georgian territory. The total number of them comprises 786 with total area 555.9 km2 in which nearly 30130 mln m3 of water mass is accumulated. But there are other data about the amount of glaciers, which is associated with global climate warming. The biggest glaciers are: Lekhziri, Chalaati, Tsaneri, Adishi, Khalde, Boko, Gergeti, Devdoraki. Glaciers are mainly located in the basins of Enguri, Rioni, Kodori and Tergi, 85.2% of total amount and 94.9 % of the surface of glaciers falls on mentioned ones. World global warming caused the decrease of glacier area on Caucasian mountain ridge. Over 1890-1990, the surface of glaciation reduced meanly by 29%.

Only 4% of river flow is regulated in Georgia. Hence there are considerable reserves for increase of sustain flow. At present 44 water basins are in exploitation, total volume of which comprises 3.32 km3 and annual renewable useful volume – 2.27 km3. Total area of their surface comprises 163 km2 which consists of 0.23% of Georgian territory. Water basins of West Georgia are of energetic function. Their total useful volume attains 0.85 km3. Most part of water basins in East Georgia is used for irrigation. Jvari water basin on river Enguri is the biggest and deepest one in South Caucasua. Its volume comprises 1093 mln m3. 37 water basins are located in East Georgia. Total volume of each of them exceeds 1 mln m3. Their total volume comprises 1.45 km3. Water basins are mainly located in Mtkvari basin were 34 water basins are located with total volume of 1.002 km3. 2 of them are of energetic function and one – Zhinvali is of complex purpose. 5 water basins are located in the basin of river Iori. Total volume of three ones – Tbilisi, Sioni and mountain Dali comprises 773 mln m3. To fill the seasonal deficit in the basin of river Aragvi, Zhinvali complex hydrosystem and Narekvavi water reservoir are constructed, the total volume of which comprises 526.8 mln m3.

Marches and highly humid lands (area – 225 thousand hectares) are mainly located on Kolkheti plain, in coastal zone. Their water reserve is 1.9 km3. Kolkheti marches are important hydro-ecosystems which participate in the formation of climatic, hydrological and hydrogeological processes. In 1997, Georgia joined up to Ramsari International Convention which provides the protection of highly humid lands of important marches of the World. Pichora – Paliastomi (1328 mln m3), Chaladidi-Poti (194 mln m3) and Eris Tskali (93.6 mln m3) marshy massifs are characterized by large volume of water reserve.

The part of their water reserve is evaporated, another part flows in the Black Sea by infiltration in water set.

Natural resource of underground fresh waters comprises 18 km3 or 572 m3/sec in Georgia. 63.4% of their total amount falls on West Georgia, 24.1% - on East Georgia and 12.5% - on South Georgia. Approved amount of underground fresh drinking water comprises 145.5 m3/sec. 48% of them falls on West Georgia, 45% - on East Georgia and 7% - on South Georgia. There are many powerful appearances of fresh underground waters in the form of the springs which are characterized by high output, by hydrocarbonate calcium-magnium composition and by low mineralization which determines the possibility of industrial bottling and export of drinking water on their basis.

From numerous springs the output of 135 ones exceeds 5 l/sec. Among powerful springs the group in South Georgia must be marked. Their output comprises 1100-3500 l/sec. Big springs of karst waters are located in Abkhazian Autonomous Republic and their output comprises 1500-26000 l/sec. Output of the springs on Kolkheti plain consists of 300-3500 l/sec. Georgian volcanic upland is characterized by numerous and powerful springs. Among them Samkhari spring in the basin of river Paravani, Ablari spring in Khrami basin must be remarked. Their output comprises 20 m3/sec. High output springs (100 l/sec) are located in upper parts of the rivers – Khvabliani, Uraveli, Injasu. The springs Zilbukhari and Paska-Pufi in the basin of river Khvabliani are among them. Bulachauri, Choporti, Natakhtari and Saguramo springs are located in Aragvi basin. They provide the water supply of Tbilisi. Numerous springs are located in left side of Alazani. Among them the biggest ones are Apeni (220-250 m3/sec) and Patmasuri (188 m3/sec) springs. There are more than 2000 boreholes by highly output in the country for population water supply. Most part of them is located in East Georgia, mainly on Alazani plain.

By data of water balance on country territory 96.9 km3 of precipitations fall on, among them 65.3 km3(2009 mm) in West Georgia and 31.6 km3(859 mm) in East Georgia. 40 km3 (580 mm) is evaporated, among them 22.8 km3 (701 mm) in West Georgia and 17.2 km3 (406 mm) in East Georgia; 56.9 km3 (810 mm) flows, among them 42.5 km3 (1300 mm) in West Georgia and 14.4 km3 (393 mm) in East Georgia. The share of underground flow consists of 30% in total flow: 40% in West Georgia and 27% in East Georgia.

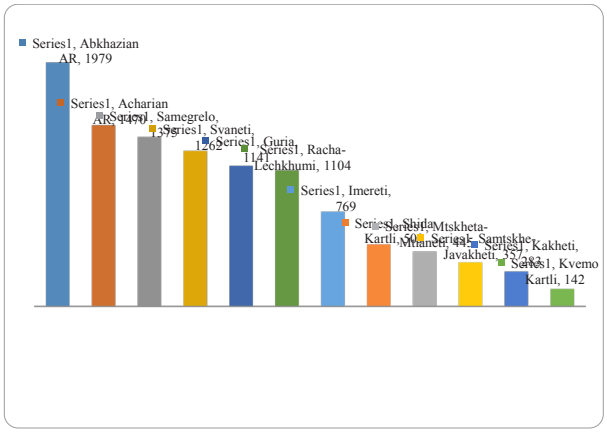

Fig.4. *Distribution of water resources by Georgian regions*

Forest has a very important function among Georgian natural resources. It has a pronounced effect on the environment which is expressed in stabilization of natural processes, Forest regulates surface flow, intensity of snow melting, air temperature and relative humidity, purifies water and air from mechanical and other impurities, reduces wind speed, absorbs carbon dioxide and other harmful gases and liberates oxygen, suppresses or annihilates harmful microorganisms, reduces noise. Forest hinders significantly soil erosion, improves its structure, provides soil high water and air conductivity [16-20].

The forest role is particularly strained in mountain countries such as Georgia where 98% of the forests are located at the slopes of various inclination, among them 78% at steep and highly steep slopes (36o and more). This fact restricts considerably the industrial exploitation of the forest from technical as well as, what is more important, from ecological viewpoint.

The forests serve essential social-protective

functions: soil protection, water saving, water regulation, recreation, etc. Georgian forests protect the population of high-mountain villages from avalanches, mud streams and torrents. Forest richness is mainly expressed by their social-protective, recreative and aesthetic importance instead of pure economic one.

According to the researches of the scientists of various countries, economic profit, obtained from forest ecological functions, exceeds by the factor 20-30 the profit, obtained by wood sale, in direct or indirect forms [21-23].

By the data of 2015, 33.9% of Georgian territory is covered by the forest. In comparison with the indices of 2012 (40.5%), percentage of forest land reduced by 6.6% which is a very anxious fact and is a problem of isolated consideration, since the same was a percentage of forest land in the country after Second World War. And in the conditions of proper management this value increased up to 40%. At present the regress is presented.

Georgian forests are characterized by their biodiversity. Here up to 400 types of trees and bushes raise in wild conditions, among them a number of endemic and relict species. From main forest-creating types the following must be remarked: Beech (occupies 45% of all forests), Oak (10%), Horn beam (9%), Fir (7%), Alder (7%), Spruce (5%), Pine (4%), Chestnut (4%), Birch (3%) [24-26].

By the data of 2016, total area of Georgian State Forest Fund comprises 2.36 mln hectares, 33.9% is covered by the forest. Over last 5 years area of mentioned fund reduced by 460000 hectares.

By relief conditions Georgian forests are divided in mountain and plain ones. Mountain forests occupy 98% of all territory and plain ones - 2%, which are mainly located on Kolkheti plain as well as in near low parts of the rivers Mtkvari, Alazani, Iori, Khrami and other ones.

The most part of Georgian State Forest Fund is degraded and has need for corresponding restorative forest-economic measures. Although, at present, because of low financing, restorative - constructive works are reduced to scanty level. For example, by the data of 2016, the works of forest restoration and cultivation is performed on 142 hectares on total territory of above-mentioned fund, forest seeding and planting - on 21 hectares and works, favourable for natural renewing of the forest - on 121 hectares [27, 28].

At present in the sphere of forest exploitation a number of the problems are accumulated which have need for timely solving, on the basis of the principles of International forest exploitation; in particular: forest exploitation must be based on standard principles of sustain development. The annual amount of required wood must be reasonably estimated, so that the ecological state mustn't be impaired by single economic profit; forest certification must be carried out since certified production is more costly in several times at international market; the entities of wood-working industry, for exportation of only assortmented bucked wood production, must be restored; total account and processing of forest nonarboreal products (wild fruits and berries, medicinal plants, walnuts, etc.) is necessary which will give economic profit to the country as well as will partially fill the basket of goods for local population; accounting of wood secondary resources (remained after tree felling) and their use in various fields of the economic (building, furniture production, combined feed production in the form of biomass, etc.). Timely solving of the problems will be favourable for increase of the level of forest bioresources rational and complex use [29, 30].

Industrial development is considerably determined by existing resource potential of mineral raw material and its valuable and rational use. Georgia has diverse, but non large-scale reserves of mineral products: fuel-energy (oil, gas, coal, geothermal waters, peat); ferrous, non-ferrous and noble metals (manganese, copper, lead-zinc, gold, silver); non-ore raw material for metallurgy (flux limestone, dolomite); mine-chemical raw material (barite, diatomite, talc, serpentinite, mirabilite, lithographic stone, bentonite clay, zeolite, mineral pigments);

building materials (facing and sawing stones, gypsum, cement raw material, quartz - feldspar sand, ceramic raw material, brick and tile clay, sand - crushed stone material, light fillers for concrete, etc.), mineral waters, etc.[31-41].

Over last years (especially from 90-th of last century) the rates of mining-processing of mineral products considerably reduced which, in a certain degree, is determined by less demand for them on local market. Mentioned fact had an adverse effect on export-investment possibilities of Georgian mineral raw material and, respectively, on further development of the sphere. In our country there are real possibilities for expansion of mineral - raw material base, which will allow the increase of the facilities for mining, processing and production of various products.

Geological structure, the results of scientific-research, field-geological, survey and drilling works, performed in the country, allow to conclude that in Georgian interior there is a certain reserve of oil and gas (by some data - solid reserve). Unfortunately, at present real results from viewpoint of indices of their extraction are unfavourable. But it should be noted that in this field were the optimistic believes when over 70-80 years of last century the oil annual extraction exceeded 3 mln tons.

In eastern part of Georgia, especially, in South Kakheti, in deposit suites of various age there is a real reserve, development of which will allow the increase the prospects of the extraction of hydrocarbon containing energy carriers.

In Georgian territory five and, probably, two regions with oil and gas may be divided. Along with it nowadays Georgian territory is divided in license blocks.

Within recent years in Georgia an attention is given on reveal of shale gas. The corresponding works are conducted.

By deposit and mine-geological conditions Tkibuli-Shaori coal deposit is dedicated to complex one. Working of steep inclined and steep layers is accepted reasonable by the method of lower lift failure and by the use of mechanical lining.

In Tkvarcheli all infrastructure is really degraded. Preparation of the deposit for exploitation must be begin by restoration of terrestrial deposit economy and by making it serviceable. Special attention must be placed on Tkvarcheli deposit №8, where in due time the mine-hydropower, mounted in the mine, was constructed. This was unique engineering decision in former USSR.

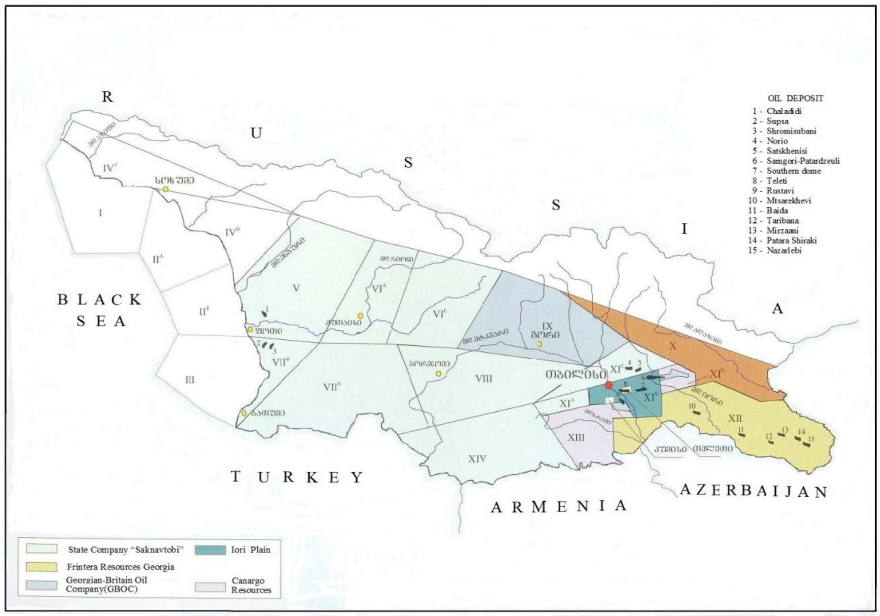

Fig.5. *Map of Georgian License Blocks*

At Akhaltsikhe deposit of brown coal the cover of coal dust and bed are presented by montmorilinite clays. In natural state the rock is characterized by high humidity which is favorable for adsorption of the most heat-conducting compounds - resins, humus acids, etc. from the coal by coal-containing bentonite clay. Hereafter coal depletion and bentonite enrichment takes place and hence, in natural conditions, organic-mineral fertilizer is formed. Coal selective mining by special holing mechanisms is reasonable which will allow the mining of the coal and hereafter – of bentonite clays ("black bentonites") enriched by organic compounds.

There is a serious reserve of the peat in Georgia which must be rationally used as the fertilizer component and as a fuel for home use.

Metallic mineral products occupy the important place in Georgian mineral-resource potential. From ferrous metals manganese must be noted. It is presented by several industrial deposits among which Chiatura deposit should be primarily noted. Its ore resource comprises 201 mln tons. Other marked deposits are Chkhari-Ajameti, Kvirila depression and Shkhmeri.

At present Chiatura manganese deposit occupies the most important place from viewpoint of mining, enrichment and processing. But it should be noted that over last period the reserve of high-grade ore is significantly reduced. Existing conditions at the deposit must be reconsidered which will give the possibility to expanse the contours of manganese-containing blocks.

Copper, lead, zinc, aluminum must be noted from non-ferrous metals. Explored copper reserve is mainly presented by Bolnisi and Achara ore regions. Predicted resources of Kvemo Svaneti and other regions are not estimated. Prospective territories (Abkhazian and Acharian Autonomous Republics, Kakheti, Svaneti and Bolnisi regions) are marked out.

Among prospective objects Chotio ore block, Zheskho and Devdorak deposits deserve attention and further study.

Lead and zinc were mined only at Kvaisi deposit and ore was sent in North Osetia. Unfortunately there are no data about mentioned deposit.

Reduction of boxite resources all over the World caused the need for use of non-traditional minerals for aluminum production. From this viewpoint alunites are prospective compounds. Technology of their processing was elaborated. Apart from aluminum the preparation of a number of useful products such as sulphuric acid, aluminum sulfate, potassium fertilizer, caustic potassium, etc. may be obtained from alunites.

In Achara reasonably large areas of alunite and alunitized ricks are know in several places of Achara. Alunite content varies from 40% to 70%, Al2O3 – from 22% to 36%. Mentioned objects are not studied in detail but, by preliminary data, it may be said that predicted resources of alunite is impressive.

Argilites of Tkibuli-Shaori coal deposit are also prospective for production of limestone and aluminum in which the content of aluminum oxide varies from 27% to 32%.

Study-development of raw material (Achara alunites, Tkibuli-Shaori argilites) for production of limestone and aluminum allow the production of costly ferro-silikoaluminum in the conditions of Zestafoni ferroalloy factory.

From noble metals gold-containing deposits are of importance for Georgia. At present Bolnisi ore region is considered as the most prospective region for gold where existing ores are characterized by gold significant content (Madneuli, Sakdrisi, Tsiteli Sopeli, etc.). It should be noted that region gold potential isn't limited by mentioned deposits (also for copper and other mineral priducts). From this viewpoint the prediction of some researchers about the prospects of Bolnisi ore region deserves attention. They, on the basis of the data obtained by remote methods, divide up to ten cyclic volcanic structures, similar to well-known Zhurab-Nabakrebi (Madneuli). This also must be studied in detail.

The wide spectrum of mine-chemical raw material is presented in Georgia. Among them barite, diatomite, lithographic stone, mineral pigments must be pointed out. Efficiency of their industrial development depends on a number of economic factors. Unfortunately, at present the

objects are in very heavy conditions.

Georgia is rich by various building materials. Among them are: facing and sawing stones, gypsum, cement raw material, quartz- feldspar sand, ceramic raw material, brick and tile clay, sand-crushed stone material, rocks for production of basalt fiber, covering shales, concrete light fillers (volcanic slag, perlite, pumice stone, etc.) It should be noted that the methods of mining and processing of building materials and technological facilities are, in many cases, outdated and require renewing and re-equipment.

As result of long-standing and intensive exploitation of mineral products the share of rich and easily enriched ores decreases in their reserves, and the share of low-grade and hardly enriched ores increases. By the use of traditional mechanical methods of enrichment the preparation of selective conditional concentrates is difficult. For intensive development of the sphere the promotion of innovative technologies is necessary – remote methods for deposit search, automated and robotized systems for drilling, etc. Since the share of hardly enriched ores increases in mining of mineral products, the wide promotion of combined technological schemes of enrichment by the use of bio-hydrometallurgical processes is reasonable in the practice of primary processing of the ores together with traditional methods.

On Georgian territory there are numerous mineral waters of diverse composition (up to 1500 springs and boreholes). From this viewpoint the mountain region of the country is the peculiar national laboratory were the analogues of all types of mineral water, known all over the World, are formed: started from cold and low-mineralized (0.5 g/l) carbon acid waters ("Narzan" type), hot (30-112oC) and finished by highly mineralized (340 g/l) chlorine-calcium brine.

Primarily Borjomi deposit water, well-known all over the World, should be noted. Such mineral waters as Sairme, Nabeglavi, Utsera. Java, Tskhaltubo, Menji, Zvare, Nunisi, etc. are well-known.

From 80's of the last century the industrial extraction and familiarization of natural carbon dioxide (CO2) for food industry has started by its separation from mineral waters.

In 2007, by drilling works in the head of river Tergi, in Truso gorge, the powerful stream of carbon dioxide was obtained. Its industrial bottling is provided which will be favourable for employing of the population of Kazbegi region and for improvement of social conditions.

Within all south slope of Caucasian mountain ridge, where young volcanic centers are existed and up to 800 springs, containing CO2, are accounted, carbon dioxide is intensively emitted. A number of the springs contain pure CO2 (99.9%) as accompanying gas. This is a very important condition for its use in food industry. In mentioned places the production of carbon dioxide in large quantities is possible by inexpensive drilling works.

Hence, inexhaustible resources of mineral waters in Georgia, their diversity and excellent landscape conditions of appearance, on the basis of foreign experience of their use, allows to conclude that Georgia has the wide prospects for large-scale familiarization and for increase of industrial capacities for the resources of mineral waters.

Power engineering is a basic sphere of country economics which provides all sectors and population by energy content.

There are nearly all types of fuel-energy resources in Georgia: coal, oil, natural gas, thermal waters, peat, brown coal, hydro-, wind- and solar energy resources. Their reserves are not important with the exception of hydropower resources and coal [42-49].

Over last two decades in the development of fuel-energy complex of the country, certain quantitative and qualitative variations took place. On the basis of statistical data, the adverse tendencies may be revealed in the sphere of power engineering in future. In particular, preferential increase of national produce is expected in comparison with power generation. This fact will have an adverse effect on country's economic development. This state is caused by low rate of electric facilities which is due to the absence of own investments. Hence the way out is only in

foreign investments.

Performed investigations have shown that, in perspective, the index of the use of local energy resources will be low in fuel-energy balance. By 2020-2025, the hydro resources, coal and biofuel (including firewood) will be mainly used from local energy resources, the total share of their production comprises nearly 36-37% of consumed energy resources. By 2025, 31-37% of technical reserve of country's hydro resources will be familiarized.

The rates of familiarization of sun, wind and geothermal waters will be low in future. Therefore an increase of the scales of the use of mentioned non-traditional, renewable energy resources is necessary which, respectively, will reduce the expected risks of adverse ecological effect. They may be used in agriculture, housing and communal sector, food and light industries, etc. 60% of theoretical potential and more than 50% of technical potential of Georgian hydro energy resources is accounted for 5 rivers and their tributaries among which, 4 rivers-Rioni, Enguri, Kodori and Bzipi are located in West Georgia. More than 70% of technical hydro energy potential of the whole country is accounted for West Georgia.

On the basis of above-mentioned, in perspective, the familiarization of hydro energy resources will be mainly carried out in western part of the country where the construction of hydropower stations will be continued.

Recommencement of the construction of Khudoni hydropower station in Samegrelo-Zemo Svaneti and starting of the process of investments search for construction of prospective hydropower stations of Enguri cascade in upper part of river Enguri is extremely important.

In perspective, the construction of powerful hydropower stations on the rivers Rioni and Tskhenistskali (in Imereti and Racha-Lechkhumi regions) (Namakhvani cascade, Utsera, Tsageri, Orbeli, etc) are also important.

Construction of complex hydrosystems is reasonable on the rivers of West Georgia which will be favorable for regulation of river flow and for rational use of water resources for energetic as well as for water feeding and irrigation purposes.

Familirization of the rivers of West Georgia for energetic purposes will cause the reduction of solid alluvium in coastal zone of the Black Sea. Because of this fact, performance of protective and restorative works in the sea coastal zone is the immediate task.

For increase of the share of solid fuel in fuel-energy balance and to enhance its competitive ability in comparison with other types of the fuel, elaboration and promotion of modern technologies will provide radical restructurization of power engineering. In perspective, the organization of power entity of newest type is possible where, apart from the obtaining of main products: electric and thermal energies, the production of building and insulating materials, marketable nitrogen, oxygen, argon and sulfur, as well as of various metals and secondary products will be carried out.

At gasification in the slag melt from one ton of Tkibuli-Shaori coal secondary product by the cost of 20-30 US dollars may be obtained, which will reduce the cost price of electric power to 0.9-2.5 cent/kW.hour, generated in multiprofile thermal power station.

Production of ferroalloy – ferro-silikoaluminum from the ash, formed after burning of Tkibuli coal in power plant, will also give a great economic effect.

Because intense variation of cloudiness in Abkhazian Autonomous Republic, Samegrelo-Zemo Svaneti, Imereti and Racha-Lechkhumi, the use of solar energy is mainly prospective in the systems of individual heat supply (for heating of buildings and for realization of the processes of hot water feeding).

Regions of Guria and Achara, where heliopower potential is high, Samtske-Javakheti (especially its central and south parts), Kvemo Kartli, plain of Shida Kartli and piedmont territories are prospective for large-scale use of solar energy.

In Mtskheta-Mtianeti region, the municipalities: Mtskheta, Akhalgori and Dusheti have good prospects for generation of thermal energy by the use of thermal collectors of the sun.

Tbilisi and Kakheti region are characterized

by large heliopower potential. In perspective, the large-scale use of solar energy is possible here for generation of thermal and electric power. For this purpose the construction of powerful thermal and photoelectric stations is necessary.

There are good prospects for the use of wind power resource in Georgia. From this viewpoint the perspective locations are: in Racha-Lechkhumi: Mamisoni pass and adjacent territory of Oni municipality; in Samegrelo: vicitity of settlement Jvari, Kolkheti plain, city Poti and adjacent territory; in Imereti: Kutaisi-Ajameti zone and central part of Likhi mountain ridge (mountain Sabueti); in Shida Kartli: Khashuri-Gori section of the gorge of river Mtkvari; in Kvemo Kartli, Mtskheta-Mtianeti and Tbilisi: Mtskheta-Rustavi section of river Mtkvari, Samgori municipality and airport zone, high-mountain zone of Kazbegi municipality and Dusheti municipality. Wind regime in Samtskhe–Javakheti, in Tskhratskaro and Achara, on Kakhaberi plain allows the use of the plants of slow as well rapid wind.

Together with the construction of wind power plants the corresponding measures must be conducted for liquidation or for minimization of such adverse results as losses of land areas, landscape damage, formation of low-frequency harmful noises and of electromagnetic disturbances for communication.

Among the deposits of geothermal waters, West Georgia is characterized by great number of operational and reinjective boreholes as well as by the amount of revealed resources, especially, Samegrelo Region (Zugdidi – Tsaishi deposit) and in East Georgia-Kartli region (Tbilisi deposit). From other deposits Samtskhe-Javaklheti region and Abkhazian Autonomous Republic are of interest in country scale.

The use of the heat of geothermal water for domestic-communal purposes, in agriculture (in greenhouses for supply of technological processes by heat and cold) and in the case of geothermal power stations will be highly favorable for improvement of energy supply of individual regions and for solving of ecological problems.

For correct and efficient functioning of fuel-energy complex, the performance of some measures are necessary. Among them major ones are:

- Adjustment of the potential of resources and creation of integrated data base;
- Rational use of the whole complex of fuel-energy resources of Georgia – hydropower, coal, oil, natural gas and non-traditional sources of energy taking into account ecological requirements;
- Formation of optimal structure of fuel-energy complex appropriate for Georgian conditions;
- Establishment of reliable and favorable energetic contacts with the world's advanced and neighboring countries.

Recreation resources are the base for the development of resort and tourist business for Georgia [50-54]. Those are resources which may be used for recreation and tourism: natural complexes and their components (relief, climate, water reservoirs, vegetation, animal world, etc.); cultural and historical-architectural sights. Although the objects of anthropogenic nature also belong to recreation resources (primarily historical-architectural monuments), yet natural-recreation resources are their basis and have an important function in the sphere of population health protection. They not only have medical-preventive-sanitary and cultural-educational function but also are of great social-economic importance since they are favorable for economic and social activity in health resort - recreation zones and totally in the country.

Climate is the important component of recreation resources. Hereunder by this the totality of weather conditions favorable for various recreation activities (recreation, treatment, travel, etc.) is meant.

Georgian climate is rather comfortable for recreation goals, giving good possibility for the development of health resort - tourist sphere. Country territory is a classical example of vertical zonality of geographical landscapes where all spectrum of climatic zones is presented: from wet subtropics to eternal snow zone.

Georgia is rich in diverse health resort - recreation resources: the Black Sea coast, mountain-climatic, balneological, balneoclimatic.

The most important resources are located in mountain and sea coast zones. The most favorable climatic conditions are in low-mountain (500-1000 m above sea level) and middle-mountain (1000-2000 m above sea level) zones were the part of mountain-climatic and balneological health resorts are located. Balneological health resorts: Nabeglavi, Tkvarcheli, Zvare, Nunisi, Borjomi, Sairme, Surami and others are mainly located at a height of 1000 m. And at a height of 1000-1500 m above sea level - mountain-climatic health resorts: Abastumani, Tsagveri, Tsemi, Kojori, Kiketi, Manglisi and others are located. The upper part of middle-mountain zone (1500-2000 m above sea level) is characterized by soft winter, long-term and high snow cover, moderate cool summer, long duration of sun shining. From the health resorts of the mentioned zone the following ones are well-known: in West Georgia: Shovi, Bakhmaro, Lebarde, Avadkhara (Abkhazian Autonomous Republic), in East Georgia: Bakuriani, high-mountain zone (higher than 2000 m above sea level) is not used at present as resorts. It is mainly used for mountain and downhill skiing.

The Black Sea coast (more than 300 km long) is rich in recreation resources. It is characterized by unusual beaches and climatic conditions. On the Black Sea coast there are 130-135 days annually favorable for recreation, whereas in Baltic countries this index comprises only 60-90 days and in Crimea – 129 days. Rich and diverse vegetation, efficient combination of mountain and sea coast landscapes as well as large possibilities for the use of hydromineral resources enhances considerably aesthetic and recreational importance of the Black Sea beach. In the mentioned zone the following health resorts and resort places are located: Gagra, Bichvinta, Akhali Atoni, Sokhumi, Gudauta (Abkhazian Autonomous Republic), Batumi, Kobuleti, Makhinjauri, Mtsvane Kontskhi, Tsikhisdziri, Gonio, Kvariati, Sarpi (Acharian Autonomous Republic).

The sands containing magnetic iron which are located in the central part of Georgian Black Sea zone, are important natural recreation resources. The sands contain up to 4% of magnetite and create constant magnetic field which is especially useful for children organism as well as for the treatment of cardiovascular, peripheral and locomotor systems (health resort Ureki).

Georgian mineral waters effect on the specialization of the country's territorial-recreational system, determine the high relative share of medicinal-recreational service. There are nearly all kinds of mineral waters in accordance with modern classification.

At present, the mineral springs are used more intensively which are located in plain and low-mountain zones of intermountain areas where transport infrastructure is well developed. Exactly in mentioned places the balneological and balneoclimatic health resorts were organized: Borjomi, Utsera, Java, Tskaltubo, Menji, Surami, etc.

Therapeutic muds are one of the types of natural-recreational resources. Nowadays, two mud treatment health resorts – Akhtala and Kumisi are functioning. Sulfide ooze mud of Kumisi lake is also used in Tbilisi Balneological Health Resort.

The forests rich in vegetation are important recreation resources of Georgia. Their total area comprises 2.7 mln hectares. Georgian forests are mainly broad-leaved, coniferous ones occupy only 35%. 57% of the forests are in West Georgia where they vary from Kolkhurian to subalpine type forests.

In the course of consideration of natural-recreational resources the protected territories of double function: ecological and recreation must be singled out. By the data of the Agency of Protected Territories, at present the total area of mentioned territories comprises 597556 hectares, that is to say, nearly 8.57% of the country territory. In accordance with the criterion of IUCN, there are 88 protected territories in the country by 2018: 14 state wildlife areas with a total space of 139048 hectares, 11 national parks (349327 hectares), 19 wildlife preserves (59857 hectares) 42 natural sanctuaries (2941.43 hectares) and 2 protected landscapes (34708 hectares).

Karstic caves present an important recreation

resource. Georgia occupies one of the first places in the world by the amount of mentioned caves. The total length of more than 1300 revealed underground natural sanctuaries attains 240 km. It should be noted that several caves located in Georgia are among ten deepest caves of the world. Those are: Kruberi (2197 m) and Sarma (more than 1500 m) caves in Abkhazeti, on Arabic massif (Gagra mountain ridge) and Pantyukhin cave (1500 m) on Bzipi mountain ridge.

The functions of caves are diverse: scientific-research, excursion-educational, sporting (speleotourism) and medical (speleotherapy).

Two karstic caves may be used for medical purpose: Anakopia in Abkhazeti, near health resort Akhali Atoni and "White cave" in Tskhaltubo. Microclimate of mentioned karstic caves is characterized by excellent medical properties for the treatment of respiratory tract, cardiovascular, neurological and other diseases.

The part of Georgian caves is characterized by their attractivity: large halls, underground rivers, lakes, stalactites and stalagmites, etc. which opens good prospects for ther development of speleoturism.

Remarkable is "The Promete cave" (former "Kumistavi cave") near Tskaltubo where the simultaneous development of several kinds of speleotourism is possible: educational, extreme and medical ones.

The well-known Ritsa lake (in Abkhazeti) is tourist-recreational object of special importance. Millions of guests visited this object annually. Nowadays, because of the well-known events, the information about this place is restricted. There are interesting lakes within the mountain system of the Great Caucasian ridge: Keli lake, Bazaleti lake (Mtsketa-Mtianeti region), lakes Ertso and Tsiteli Khati (Shida Kartli), Kedi lake (Racha region).

South Georgia highland is rich in lakes: Kakhisi, Tabatskuri, Tsero, Paravani and Sagamo (Samtskhe-Javakheti region).

Artificial water reservoirs may be successfully used for recreation purposes: Tbilisi, Sioni, Gali, Jvari, Lajanuri, Shaori, Tsalka, Algeti and Zhinvali.

At present, there is a great demand on winter sports for the development of which Georgia has unique natural conditions. There are many places in the country with corresponding relief, zones with high and long-term snow cover which may be used for mountain tourism and recreation. From this viewpoint Svaneti, Tusheti, environs of Abastumani, Bakuriani, Gudauri and Bakmaro are the most prospective.

Georgian natural-recreational resources provide unique possibilities for mountaineering, the best conditions for which are in Zemo Svaneti with the highest peaks such as Ushba, Shkhara, Tetnuldi, etc. Prospective for mountaineering development are mountainous Abkhazeti and municipalities of Oni, Java, Kazbegi, Dusheti, Akhmeta, Lentekhi.

The important recreation resource of the country are objects of cultural-educational tourism: historical and architectural monuments, theatres, concert halls, galleries of art, exhibition halls, ethnographic museums, house-museums of well-known persons, pantheons, etc.

Centuries-old history of Georgian people is materially expressed in historical monuments which are located in large quantities in all regions of the country. These are spiritual, defensive buildings and secular ones of last centuries.

All these man-made monuments present anthropogenic tourist-recreational resources and mainly serve for to increase human intellect, to deep knowledge, to provide entertainment, recreation and attract foreign tourists.

The diversity of natural and economic conditions of Georgia effected significantly on the total picture of population settling and determined the originality of the view of populated places. Mountain villages of the following municipalities: Mestia, Lentekhi, Oni, Dusheti, Kazbegi, Akhmeta and others are of great interest to tourists by peculiar architecture and specific style of living. One of them - Svaneti settlement Ushguli (in village Chazhashi) is included in the list of the World Heritage.

The analysis of modern state of natural-recreational resources shows that there are many difficulties and problems to be solved on rational

use and protection of these resources.

In the first place the measures must be carried out for minimization of catastrophic results of natural disasters (landslides, torrents, snow avalanches, erosion events, river washouts, etc.) For this reason planning and realization of large-scale preventive measures are necessary.

References

[1] Georgian Natural Resources, Sakartvelos Metsnierebata Erovnuli Academia, Tbilisi, 2015 (in Georgian).

[2] Tengiz F. Urushadze,Winfried E.H. Blum, Soils of Georgia, Nova, New York, 2014.

[3] Georgian geography, part 1, Physical Geography, Metsniereba, Tbilisi, 2000 (in Georgian).

[4] T. Urushadze, Main Soils of Georgia, Metsniereba, Tbilisi, 1997 (in Georgian).

[5] Georgian Natural Resources and the Problems of their Rational Use, 2. Land Resources. Metsniereba, Tbilisi, 1991 (in Russian).

[6] N.A. Chitanava, The problems of land use in Georgia, J. Annals of Agrarian Science, vol.3, No.3 (2015) 91-94.

[7] I. Zhordania, Z. Lomsadze, K.Makharadze, V.Geladze, R.Pirtskhalava. Water Resource, Georgian Nnatural Resources, v.1, ch.3, Sakartvelos Metsnierebata Erovnuli Akademia, Tbilisi, 2015 (in Georgian).

[8] V. Geladze, N. Bolashvili, A. Javakhishvili, N. Machavariani. Inland Waters. Georgian Geography. TSU Gamomtsemloba, Geographiis Instituti, Tbilisi, 2013 (in Georgian).

[9] R. Gobejishvili. Glaciers. Georgian Geography, TSU Gamomtsemloba, Geographiis Instituti, Tbilisi, 2013 (in Georgian).

[10] Georgian Natural Resources and Environmental Protection. Statistical Collection. Sakartvelos Statistikis Erovnuli Samsakhuri. Tbilisi, 2013, 2014 (in Georgian).

[11] I. S. Apkhazava. Georgian Lakes. Tbilisi, 1975 (in Russian).

[12] L.A. Vladimirov, D.I. Shakarashvili, T.I. Gabrichidze. Georgia Water Balance. Metsniereba, Tbilisi, 1974 (in Russian).

[13] Georgian Natural Resources and the Problems of their Rational Use. ch.4. Water resources, Metsniereba, Tbilisi, 1991 (in Russian).

[14] Levan Tielidze. Glatchers of Georgia. Vakhushti Bagrationi Institute of Geography, Tbilisi 2014 (in Georgian).

[15] Z. Lomsadze, K. Makharadze. R. Pirtskhalava. The ecological problems of rivers of Georgia (The Caspian Sea Basin). J. Annals uf Agrarian Science, vol. 14(3) (2016) 89-94.

[16] E.P.Odum, Ecology, Holt, Reinhart and Winston, New-York, 1961.

[17] E.P.Odum, Basic Ecology: „ Fundamentals of Ecology. Holt-Saunders". New York, 1983.

[18] K.V. Ananichev, Problems of Environment, Energy and Natural Resources, Progress, Moscow, 1975 (in Russian).

[19] M.I. Budiko. Global Ecology, Misl, Moscow, 1977 (in Russian).

[20] G. H. Brantland, Our Common Future. Oxford University Press. New-York, 1987.

[21] J. Michael, David T. Price and Joe Wisniewski., Boreal Forests and Global Change. Kluwer Academic Publishers, Boston, Massachusetts, 1995

[22] T. Steward, A. Pickett, Weiqi Zhou, Global urbanization a shifting context for applying ecological science toward the sustainable city, in: Ecosystem Health and Sustainability, vol. 1, issue 1, (2015), pp. 65-75

[23] Yong long Lu, David W. Inouye, Shirong Liu. 2015.A New Platform for Ecologists to Link Ecology with Policy, in: Ecosystem Health and Sustainability. vol.1, issue 1 (2015) 12-24.

[24] I. Abashidze. Dendrology, Ganatleba, Tbilisi, 1985 (in Georgian).

[25] V.Gulisashvili. Forestry, Ganatleba, Tbilisi, 1975 (in Georgian).

[26] G.Gigauri. Diversity of Georgian forest, Rariteti, Tbilisi, 2000 (in Georgian).

[27] Statistical publication, Sakstati, Tbilisi, 2016, pp.14-28 (in Georgian)

[28] T. Patarkalashvili, Some problems of forest management in Georgia, J. Annals of Agrarian Science. vol. 14 (2) (2016) 108-113

[29] T. Patarkalashvili. Urban forests and green

spaces of Tbilisi and ecological problems of the city, Annals of Agrarian Science. vol, 15, No. 2 (2017) 98-102.
[30] T. Patarkalashvili. Forest Resources. Tbilisi. in: Natoral Resources of Georgia, vol, 1, 2015 pp. 293-368 .(in Georgian).
[31] I. Zhordania, G. Magalashvili, A. Suladze, A. Kakulia, A. Dvaladze, N. Tsertsvadze. Georgian Natural Resources, v.1. Tbilisi, 2015 369-522 (in Georgian).
[32] Georgian natural resources and the problems of their rational use. ch. 1. Mineral resources, Metsniereba, 1991 (in Russian).
[33] G. Magalashvili. Industrial Types of the Deposits of Non-metalic Mineral Products. Tbilisi State University. 2000. (in Georgian).
[34] A. Magalashvili. Recommendations for further increase of the reserves of Madneuli deposit and for proper and efficient search of similar ores, Metsniereba da Technika, 10-12, Tbilisi, (2007) 21-24 (in Georgian).
[35] G. Magalashvili, K. Abashidze, A. Magalashvili. The problem on the possibility of aluminum production in Georgia, Sakartvelos navtobi da gazi, 12, Tbilisi, (2009) 75-79 (in Georgian).
[36] G. Magalashvili, J.Kakulia, L.Kartvelishvili, V.Totibadze, N.Lomidze, M.Kandelaki, Sh.Malashkhia. Establishing of the possibility of trachyte bioprocessing for obtaining of potassium compounds. Sakartvelos Keramikosta Asotsiatsia. II International Conference and Exhibition. Tbilisi, 2009, 139-141 (in Georgian).
[37] A. Tvalchrelidze, A.Silagadze, G. Keshelashvili, D.Gegia. The Program of Social- Economic Development of Georgia, 1. Georgian Natural Resources (Mineral Resources), Nekeri, 2011 (in Georgian).
[38] Z. Mgeladze, I. Bakhtadze. Reasons of small extraction of oil in Georgia and the ways for situation change. Samto J., 1 (28) (2012) 4-7 (in Georgian).
[39] A. Tvalchrelidze. Georgian solid mineral resources. The Center of strategic research and development of Georgia. Bulletin 9, 1998, 54-56 (in Georgian)
[40] N. Tsertsvadze. Georgian Thermal Waters, Tbilisi, 1998, 155 (in Georgian).
[41] S.Sulkhanishvili, N.Lomidze, I. Okrom-chedlidze, L.Kakulia. Considerations about enrichment of Kvirila depression manganese ores. Samto J., 1-22 (16-17) (2006) 66-67 (in Georgian).
[42] I. Zhordania, N. Mirianashvili, K. Vezirishvili-Nozadze, D. Chomakhidze, R. Arveladze, T. Jishkariani. Georgian natural resources. v. II, Tbilisi, (2015), 543-792 (in Georgian).
[43] R. Arveladze et all. Concept of Development of Georgian Power Engineering, 1992 (in Georgian).
[44] K. Vezirishvili-Nozadze. Directions of development of fuel-energy complex, Energy forum. Collection of Papers (2003) 169-172 (in Georgian).
[45] K.Vezirishvili. Efficiency of complex use of geothermal waters, Metsniereba da Tekhnologiebi, 7-9 (2003)118-123 (in Georgian).
[46] A. Zedgenidze. Wind power engineering and prospects of its development, Energia, 1 (1997) 35-39 (in Georgian).
[47] A. Zedgenidze, M. Gelovani et all. Wind Atlas of Georgia, Karenergo, Tbilisi, 2004 (in Georgian).
[48] A. Prangishvili (Head and responsible). Concept of Development of Georgian Power Engineering. Tbilisi, 2002 (in Georgian).
[49] Georgian Natural Resources and the Problems of their Rational Use, 4. Power Resources, Metsniereba, 1991 (in Russian).
[50] O.N. Pavliashvili. Touristic-Recreative Sector, Georgian geography, II. Social-Economic Geography. Tbilisi, 2003 (in Georgian).
[51] www.geostat.ge
[52] N. Saakashvili, T.Chilingarishvili. Georgia - Country of Tourism and Health Resorts. Sakartvelos Matsne, Tbilisi, 2011 (in Georgian).
[53] N. Pavliashvili, Touristic-Recreate Sector, Georgian geography, Tbilisi, 2013 (in Georgian).
[54] Georgian Natural Resources and the Problems of their Rational Use, 6. Recreate resources, Metsniereba, Tbilisi, 1991 (in Russian).