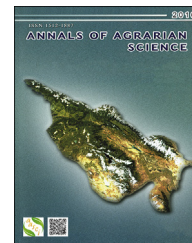


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## The ecological problems of rivers of Georgia (the Caspian Sea basin)

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### ABSTRACT

The increasing demands of fresh water in the world threaten the biodiversity and the supply of water for food production and other vital human needs. Providing adequate quantities of pure, fresh water for humans and their diverse activities is the major problem worldwide. In spite of the fact that Georgia is considered rather rich of fresh water resources our research showed that the major rivers of The Caspian Sea basin are polluted with different contaminants like, nitrates, ammonium nitrogen. Heavy metals, oil products, pesticides and other toxic chemicals. From researched rivers the most polluted are Mashavera and Kazretula (Bolnisi Municipality). They are mainly contaminated with toxic releases of joint-stock company, Madneuli's activities. The rivers are also polluted from other plants, agricultural activities and farms. To protect the public and the environment from toxic releases the government should prevent pollution by requiring industries to reduce their use of toxic chemicals and restore and strengthen protection for all water objects. Concerted actions are needed to safely manage the use of toxic chemicals and develop monitoring and regulatory guidelines. The principles and practices of sustainable development will help to contain or eliminate risks resulting from the chemical pollution.

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### Introduction

One of the global problems today is the acute shortage of fresh water. The increasing demands placed on the global water resources threaten biodiversity and the supply of water for food production and other vital human needs. Water shortages already exist in many regions of the world, with more than one billion people without adequate drinking water [1]. In addition, 90% of the infectious diseases in developing countries are transmitted from polluted water. Nearly half of

the World's population lacks adequate sanitation. This problem is acute in many developing countries, which discharge an estimated 95% of their untreated urban sewage directly into surface waters. Downstream, the untreated water is used for drinking, bathing and washing, resulting in serious human infections and illnesses [2,3].

Providing adequate quantities of pure, fresh water for humans and their diverse activities appears to be a major problem worldwide. New water supplies in future are likely to result from conservation, recycling and improved water-use efficiency rather than from large development projects [4,5].

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## Results and analysis

Among various natural resources of Georgia water resources are one of the major national riches. Georgia was one of the first among former Soviet republics by the total amount of annually formed fresh water (810 mm). Presently, Georgia is the 87th in the world by the amount of renewable fresh water resources [6]. Georgia's total fresh water resources today are 100 km<sup>3</sup> and they are accumulated in rivers, lakes, glaciers, ponds, water reservoirs and ground waters. Among water objects the rivers are the most polluted.

Altogether there are 26060 rivers in Georgia with total length of about 60ths km. The rivers belong to two main basins which are divided by Likhi mountain ridge. 65% of them (approximately 18109) belong to the Black Sea basin and 30.5% (7951 rivers) to the Caspian Sea basin. Among these rivers hydrologically are studied 555 from the Black Sea basin and 528 from the Caspian Sea basin.

The hydrographical network of Georgia (99.4%) mainly consist of little (<25 km) and very little (<10 km) rivers. The average water flow that is formed on Georgia's territory is 56.5 km<sup>3</sup>. Besides, from the neighbor in countries inflow 9.3 km<sup>3</sup> of water, among it: by means of Mtkvari river – 0.915 km<sup>3</sup>, Fotskhovi river – 0.252 km<sup>3</sup>, Debeda – 0.883 km<sup>3</sup> and Chorokhi – 7.25 km<sup>3</sup>, altogether – 65.8 km<sup>3</sup>. From this amount 49.7 km<sup>3</sup> of water flows into the Black Sea and 16.1 km<sup>3</sup> into the Caspian Sea through the territories of neighboring countries (Azerbaijan and Russia) [7].

The characteristics of big and middle size rivers, as well as, of some 50 km of length and more are presented in Table 1. Georgia's major river Mtkvari springs in Turkey and only it's middle part (351 km) flows on Georgia's territory. Almost all rivers of east Georgia make the common system of Mtkvari basin and flow into the Caspian Sea through Azerbaijan's territory.

The rivers of the country are characterized by strong zones of highland water flow elements. The zone of the west part of the Caucasus Ridge and the slopes of the Ajara mountains facing the Black Sea are characterized by full flowing. The average annual flow here is 3500 mm, while on Iori river's

plateau in Kvemo Kartly there are dry ravines where water flows only after thawing of snow or pouring rains [8].

As already have been noted in many countries of the world fresh water deficit is observed now. The main reasons of it are: pollution of fresh water objects with insufficiently purified industrial discharges, decrease of natural water collecting areas, deforestation, inadequate agricultural production methods, etc [9,10].

One of the reasons of constant degradation of water ecological systems is inadequacy between the existed structures of production and consumption on the one hand, and requirements for use of water resources on the other hand. Such situation is observed in many countries of the world including developed ones.

For sustainable development of economy and rational utilization of water resources it's very important the ecological condition of water systems. Melioration, building of new reservoirs, urbanization and other type of technogenic and anthropogenic influence on nature provoke irreversible changes on formation of water flows, surface and ground waters' quantitative and qualitative indices on big territories. So, pollution of water objects is a great problem nowadays and requires appropriate solution [11].

In the process of natural waters pollution it is especially important their contamination with oil products, phenols heavy metals, complex organics (pesticides, detergents) and biogenic substances (phosphates, nitrates) [12].

Surface waters of the urban and industrial territories are characterized by composition of suspended substances like, oil products, toxic residues, etc. These products not only contaminate surface waters, but are accumulated on the bottoms of water reservoirs and promote to the secondary pollution. It is especially noticeable in small reservoirs and water flows.

On the ecological condition of water reservoirs adversely affect agricultural activities, especially the use of mineral fertilizers and pesticides. These long-lasting toxics are very strong to the external factors and preserve their toxic nature for long period. Pesticides and other chemical contaminants that enter water objects through agricultural runoff, storm water drains and industrial discharges may persist in the environment for long periods and be transported by water or air over long distances. The danger of water pollution from mineral fertilizers and pesticides is growing because the refinement of field water flows is practically impossible.

Industrial agribusiness is also a major contributor to nitrate pollution of our water objects. It comes from poultry and processing plants. In addition, fertilizers and other agricultural runoff also account for a large volume of nitrate pollution.

The toxic remains of fertilizers and pesticides are especially dangerous for water reservoirs because they promote to the intensification of eutrophication process (excessive nutrient levels in water), that increases the growth of algae and plants in waters, leading to an increase in cyanobacteria (blue-green algae). The toxics released during their decay are harmful to humans. Besides, it adversely influences on communal and technical water provision and fish farming. The most part of the water reservoirs must be examined and appropriate measures taken until eutrophication process not become irreversible.

**Table 1 – The characteristics of the big and middle size rivers of Georgia (the Caspian Sea basin).**

Rivers	Length of river, km	Space of water collecting basin, km
Alazani	366/362 <sup>a</sup>	11800
Mtkvari	1515/351 <sup>a</sup>	188000
Iori	320	4650
Ktsia-Khrami	205/201 <sup>a</sup>	8340
Algeti	118	763
DidiLiakhvi	98	2440
Ksani	84	885
Faravani	74	2350
Aragvi	66	2740
Mashavera	66	1300
PataraLiakhvi	63	513
Tethami	51	404

<sup>a</sup> The total length of the river/the length on Georgia's territory.

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