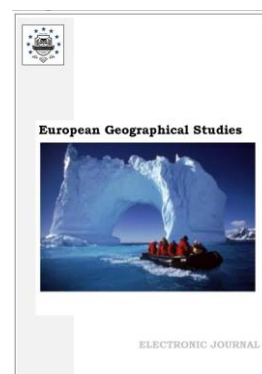


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Published in the USA
European Geographical Studies
Has been issued since 2014.
E-ISSN: 2413-7197
2021. 8(1): 63-67

DOI: 10.13187/egs.2021.1.63
<https://egs.cherkasgu.press>



Ecological Condition of the Rioni River

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Abstract

Water resources are one of the most important natural resources of Georgia. Rioni River Imereti is a main artery of water. It is a left tributary of the largest river Imereti hills – Kvirila, which is connected with Dzirula Chherimeloy, and the right side connects with the waters of the Rioni Tskhenistskali. Rioni water used in production, and communal services the population. On both sides of the Rioni are large industrial facilities that degrade water quality. The problem of water resources protection Imereti and rational use of it, on the one hand has created increasing demand for water by industry, and on the other side of reservoirs pollution. Water pollution in the Rioni begins with the origins. From traditional polluting facilities should be noted Kvaissskoe, Tutiyskoe businesses, a lot of Oni and Ambrolauri businesses that poured on the raw water in the Rioni. And the most polluted river in the territory of Kutaisi.

Keywords: climate, energy, Imereti, Water, Rioni, Alazani.

1. Introduction

Georgia is a country in the Caucasus region of Eurasia. Located at the crossroads of Western Asia and Eastern Europe, it is bounded to the west by the Black Sea, to the north by Russia, to the south by Turkey and Armenia, and to the southeast by Azerbaijan.

Georgia's territory is divided in two main regions: Black sea basin and Caspian Sea basin. Total natural river runoff from the territory of Georgia is 56.4 km³ and to the territory (from Armenia and Turkey) – 8.74 km³ (Elizbarashvili, 2017). Thus, total water supplies amount for 65.4 km³.

The biggest river in Georgia is Rioni which annual runoff is 12.6 km³. There are large rivers in Western Georgia like Inguri (5.9 km³), Chorohi (8.9 km³), Kodori (4.1 km³), Supsa (1.4 km³), Bzib (3.0 km³) and others. In Eastern Georgia there are Kura (7.2 km³), Alazani (3.1 km³), Aragvi (1.4 km³), Big Liahvi (1.4 km³), Khrami (1.0 km³), Lori (0.8 km³) and others.

Major issues are surface water pollution by wastes and irrational water use. Water pollution is connected with human activity. It comes from point and non-point sources.

Point sources:

1. Municipal wastes from cities and settlements.
2. Industrial wastes.
3. Wastes from hospitals, recreation and other health centers.

Non-point sources:

1. Surface wastes from agricultural fields.
2. Storm runoff from cities and landfills.

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1. Municipal wastes from cities and settlements pollute water with organic matters, nitrogen and phosphorus compounds. Most polluted rivers are Kura, Vere, Alazani, Algeti, Suramula (Caspian Sea basin) and Rioni (Black sea basin).

2. Industrial wastes bring oil products, phenols, heavy metals, etc.

Most polluted rivers in the Kura basin are:

- Kura within Tbilisi and Rustavi (oil products, phenols, heavy metals);
- Mashavera (zinc and copper ions).

In the Black sea basin:

- Kvirila (oil products and manganese ions);
- Rioni and its tributary Ogaskura (oil products, zinc and copper ions);
- Tkibuli (mechanical pollution from coal mining industry);
- Kubiszkali (oil products);
- Luhumi (arsenic ion).

3. Presently, serious problem is water treatment from hospitals, recreation and other health centers.

4. Agricultural wastes bring mineral fertilizers and pesticides. Major water consumer is irrigated farming. According to data of 1987, there were 469.2 th.ha of irrigated lands including 409.2 th.ha in Eastern Georgia (Kura basin) and 60 th.ha in its Western part (Black sea basin).

In 90-ies due to political and economic crisis in the country reclamation systems almost fully came out of operation, pumping stations hydrostructures were destroyed. Funds allocated for O&M are unsatisfactory for repair and rehabilitation that caused irrigated area reduction.

5. Storm runoff from cities and landfills also pollute surface waters. Landfills have not treatment facilities and observation wells. They are mostly located on river banks. Landfills in all cities are "burning points" and do not meet water protection requirements.

In accordance with Georgian legislation, water resources are property of state, which gives licenses for water use. Major consumers are power engineering and irrigated agriculture. As it was mentioned before, Georgia is rich in hydropower resources. There are about 100 large and small hydropower stations with designed capacity 10bln.kwt.h or 20 % of economic potential.

2. Discussion

Climatic conditions variability dictates necessity of land reclamation. In Western Georgia with humid climate and intensive precipitation drainage is expedient. In Eastern Georgia with arid climate irrigation is needed.

Water quality assessment: The following categories of surface water bodies are established based on water use purposes:

- first category – water bodies used for drinking purposes;
- second category – water bodies used for recreation;
- third category – water bodies used for fish breeding.

For each category five classes of quality are established:

First class – very good quality (blue color of water). Pure oligotrophic water in natural conditions; insignificant anthropogenic pollution is allowed. Water is characterized by stable high concentration of oxygen close to full saturation. Low concentration of bioorganic elements and bacteria facilitates salmon breeding. Protective water potential is very high.

Second class – quality is good (green color). Insignificantly polluted mezotrophic water. Certain amount of organic matters from wastes after treatment. Water bodies are well saturated with oxygen all round year. Protective potential is well maintained. Inflows do not contain harmful matters.

Third class – water quality is satisfactory (yellow color). Temperate eutrophic water containing insignificant amount of organic matters and bioorganic elements. Sometimes lack of oxygen is possible. Protective potential is weak. Pollution with harmful matters and microbes. Harmful matters concentration varies from natural to toxic level.

Fourth class – water quality is unsatisfactory (orange color). Eutrophic water significantly polluted. Contains organic, bioorganic and harmful matters. Sometimes lack of oxygen is possible. Organic matters destruction and settling facilitate anaerobic processes and cause fish perishing. Pollution exceeds protective potential. Microbes do not allow use water body for recreation.

Harmful matters negatively impact fauna and flora. For fauna and flora harmful matters concentration varies from permanent to highly toxic level.

Fifth class – water quality is bad (red color). Very highly polluted hypertrophic water. Main problem is connected with oxygen regime, when lack of oxygen causes anaerobic processes. Reduents exceed producents. Water has not protective potential. Harmful matters concentration exceeds high toxicity level for fauna and flora.

The Rioni or Rion River is the main river of western Georgia ([Adeishvili, Berdzenishvili, 2020](#)). It originates in the Caucasus Mountains, in the region of Racha and flows west to the Black Sea, entering it north of the city of Poti (near ancient Phasis). The city of Kutaisi, once the ancient city of Colchis, lies on its banks. It drains the western Transcaucasus into the Black Sea while its sister, the Kura River, drains the eastern Transcaucasus into the Caspian Sea. Rioni is the most abundant river. Water pollution in the Rioni begins with the origins. From traditional polluting facilities should be noted Kvaisskoe, Tutiyskoe businesses, a lot of Oni and Ambrolauri businesses that poured on the raw water in the Rioni. And the most polluted river in the territory of Kutaisi ([Adeishvili, Berdzenishvili, 2020](#)).



Fig. 1. Georgia. River Rioni

The investigated region is situated in the western part of Georgia, in the Rioni River delta. Four municipalities share the Rioni River delta within the area of our interest: Khobi, Senaki, Lanchkhuti and Poti regions with port city Poti. This is the populated region with developed infrastructures. The south part of Rioni River floodplain towards the Black Sea is covered in Kolkheti marshes and Lake Paliastomi. They represent the most extensive wetland areas within the Black Sea region. Wetlands in Central Kolkheti have been designated as wetlands of international importance by the Ramsar Convention and represent a national park of the Georgia. The area of park is 28 940 ha ([Jaoshvili, 2004](#)). The total surface of our study area amounts to 350 km².

3. Results

The Rioni River is the principal river of western Georgia. It originates from the Caucasus Mountains, in the region of Racha and flows west to the Black Sea. The length of the river is 327 km, the area of the entire catchment amounts to 13 500 km². Fifty-one percent of the Rioni drainage area is situated in a mountain region. Upstream from Kutaisi, the river flows along a wild, narrow rift while downstream from Kutaisi it flows into extensive swampy lowland that abruptly changes the character of the river's flow to a meandering channel, forming numerous sand islands. The Kolkheti lowland is an intermountain depression with near flat geomorphology and is covered by marine and fluvial sediments ([Maruashvili, 1971](#)). It is tilted to the west where the altitude is less

than 10m above sea level and to the east the heights gradually increases up to 150 meters. The climate is determined by the Black Sea to the West and the amphitheatre of three big mountain ranges (the Great Caucasus, the Likhi and the Meskheta), in addition to the surrounding Kolkheti lowland (wetland) in the centre. Because of its geographic situation the Kolkheti lowland region represents unique climate grouping. It combines a high annual temperature of 14,10 C with extremes ranging from -150 C to +450 C. The annual amount of precipitation varies between 2,531 mm in the south and 1,458 mm in the north of Kolkheti lowland. 29 % of the precipitation falls in summer. Consequently, annual air humidity is high with values between 70 % and 83 % (Poti station).

Rioni River is the largest river of the Georgian Black Sea basin. An average annual water discharge of the river is 430 m³/s with extremes ranging from 2480 to 3640 in the Rioni River delta. Rapid warming, intensive snow melt and/or high precipitations are the cause factors of raising the discharge in the Rioni River. Disastrous floods mainly caused by rapid warming and intensive snow melt or by dike break, result in extensive damage. For example, the population in Imereti was reduced by 30-35 % as a consequence of floods on the River Rioni in 1811–1812. In 1982 inundated area made up 130 km and had cost US \$ 12 million (Bondyrev, Tsereteli, 2009).

Table 1. Analysis of river Rioni master data

Physical and chemical indicators of water	Rioni River until the entrance of Kutaisi	Rioni River in the middle of the city	Rioni River after leaving the city
The total Water vapidity	2.2	21.3	3.1
Transparency (cm)	2	1	3
Reaction (PH)	8.1	8	8.45
particles	282	187	134
Solids	145	115	145
Permanganate oxidation permanganate oxidation	4.13	1.04	3.4
Oxygen in the water	10.3	9.38	9.5
ammonium Nitrogen	1.17	1.09	0.35
Petroleum products	0	5	3.14
chlorides	Not detected	Not detected	0.35
Chromium	Not detected	Not detected	
Manganum	Not detected	Not detected	
Iron	0.5	0.4	0.5
The total number of bacteria	3000	11000	2350
Koli-index	18000	23000	23000
Koli-titer	0.06	0.04	0.04

4. Conclusion

Safe drinking water supply is major issue for Georgia. Presently, due to difficult economic situation, critical situation takes place in most water supply systems. Water quality control is weak and water quality sometimes does not meet standards. More dangerous situation occurs in sanitation and treatment of industrial and municipal wastes in cities and settlements. Treatment facilities mostly are out of operation and destroyed. Because of that, wastes are released to surface water bodies. This is one of the reasons for infectious illnesses growth, carcinogenic and mutant factors (Kereselidze, Trapaidze, 2012). As can be seen from the Table 1, the total number of bacteria, Rioni River until the entrance of Kutaisi 3000, Rioni River in the middle of the city 11000, Rioni River after leaving the city 2350. Rioni in Kutaisi is polluted by industrial enterprises.

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