Journal in Humanities; ISSN: 2298-0245; e-ISSN: 2346-8289; Volume 6, Issue 1, 2017

Water Resources of Georgia and Their Ecological Condition

Nana BERDZENISHVILI*

Abstract

Water resources are one of the most important natural resources of Georgia. There are 26060 rivers with total length 58987 km. A base of hydrographic network are small rivers with length less than 25km and total length 50480 km.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 56.4km3 and to the territory (from Armenia and Turkey) - 8.74 km3. Thus, total water supplies amount for 65.4 km3. Rioni River is Imereti's 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 is used in production, and communal services of the population. On both sides of the Rioni are large industrial facilities that degrade water quality. The problem of water resources protection in 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 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.

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

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. The capital and largest city is Tbilisi. Georgia covers a territory of 69,700 square kilometres, and its 2016 population is about 3.75 million. Georgia is a unitary, semi-presidential republic, with the government elected through a representative democracy.

Georgia is situated in the South Caucasus, between latitudes 41° and 44° N, and longitudes 40° and 47° E, with an area of 67,900 km. (26,216 sq. mile). It is a very mountainous country. The Likhi Range divides the country into eastern and western halves. Historically, the western portion of Georgia was known as Colchis while the eastern plateau was called Iberia. Because of a complex geographic setting, mountains also isolate the northern region of Svaneti from the rest of Georgia. The Greater Caucasus Mountain Range forms the northern border of Georgia. The southern portion of the country is bounded by the Lesser Caucasus Mountains. The Greater Caucasus Mountain Range is much higher in elevation than the Lesser Caucasus Mountains, with the highest peaks rising more than 5,000 meters (16,404 ft.) above sea level.

Water resources are one of the most important natural resources of Georgia. There are 26060 rivers with total length 58987 km. A base of hydrographic network are small rivers with length less than 25km and total length 50480 km.

Discussion

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. Thus, total water supplies amount for 65.4 km3.

The biggest river in Georgia is Rioni whose 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.

There are 850 lakes in Georgia whose total area is 170 km2. There are 734 glaciers with total area of 513 km2 on the Main Caucasus Ridge. More than 250 th.ha are covered by swamps including 220 th.ha in Western Georgia and 31 th.ha in its Eastern part.

* Assoc. Prof. Dr., Faculty of Exact and Natural Sciences, Iakob Gogebashvili Telavi State University, Telavi, Georgia.
E-mail: nanaka.berdzenishvili@yahoo.com

Journal in Humanities; ISSN: 2298-0245; e-ISSN: 2346-8289; Volume 6, Issue 1, 2017

There are 43 water reservoirs including 34 for irrigation and 9 for power generation. Total useful capacity of all water reservoirs amounts for 2222.6 mln.m3. Water supplies in glaciers, water reservoirs and swamps are 35km3, thus total fresh water resources amount for 100 km3. Natural ground water resources amount for 18 km3, including 67% in Western Georgia and 33% in its Eastern part (Kereselidze & Bliadze, 2008). Hydropower resources constitute 91.1% from total energy resources and other resources (wood, oil, gas, coal) constitute only 8.3%. Theoretical energy of surface runoff is 228.5bln.kWt.h and its capacity is 26.1 mln.kWt.h. There is 3.27 bln.kWt.h/km2 including 5.06 bln.kWt.h/km2 in Western Georgia and 1.73bln.kWt.h/km2 in its Eastern part.

The 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.

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). There are centralized sanitation systems in 45 cities including 33 with treatment facilities. The latter were built in 1972-1986 and mostly are out of operation, the rest work unsatisfactorily.

Biological treatment is practically absent.

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).

Since 1992, due to economic crisis industrial production fell down to 15-20% of designed one and consumed water reduced from 1542 mln.m3 (1985) to 229 mln.m3 (1996). Presently, some large plants start to operate and have some perspectives for development. Food industries are concluded in centralized sanitation network and pollution depends on the efficiency of municipal services (Trapaidze, 2012).

3. Presently, serious problem is water treatment from hospitals, recreation and other health centers. There are infectious hospitals in all cities and infectious divisions in rayon hospitals and all these hospitals have not treatment facilities. Six tuberculosis hospitals in Abastumani are particularly dangerous because they have not treatment plants and wastes are released directly to Ozhe and then Kura River. Two tuberculosis hospitals in Borjomi have biological treatment facilities which are out of operation now and wastes are released to Gudzharula and then Kura River. In Tbilisi infectious center has not treatment facilities.

4. Agricultural wastes bring mineral fertilizers and pesticides. The 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 hydro structures were destroyed (Trapaidze, 2012). Funds allocated for O&M are unsatisfactory for repair and rehabilitation that caused irrigated area reduction. In 1997, under WB support project for irrigation and reclamation systems rehabilitation has been prepared. Its implementation start is planned since April 2002. About $100mln. is allocated for this purpose. The project will be implemented during 12 years in three stages. Potential pollutants are cattle breeding and poultry farms, most part of which is not functioning now. But after their rehabilitation treatment facilities will be needed to install.

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 1996 WB experts studied landfills in Tbilisi and prepared recommendations on special polygon for garbage and special plant for its processing.

In accordance with Georgian legislation, water resources are property of state, which gives licenses for water use. The 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 of lObln.kwt.h or 20% of economic potential. Presently, for different reasons, total capacity is 4.5bln.kwt.h. In Soviet time, Georgia was included in common energy system that allowed to provide all economic branches with electricity. At the moment, when Georgia is implementing reforms in its economy, hydropower development became very important. Small hydropower plants construction is recognized as priority but it is postponed due to lack of funding. Hydropower Plants constructed in Soviet time are ageing and need rehabilitation but donors refuse to finance this endeavor.

Journal in Humanities; ISSN: 2298-0245; e-ISSN: 2346-8289; Volume 6, Issue 1, 2017

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. By 1987, there were 469.2th.ha of irrigated lands (including 140.6 th.ha with water lift) and 162.3th.ha of drained lands (including 31.1 th.ha with mechanical drainage) under Water Department Administration. Presently, due to lack of financing for O&M irrigated and drained are is reducing. About 89% of irrigated lands are irrigated with water lift using pumping stations, which technical state is unsatisfactory.

In 2001, 187.2 th.ha were irrigated including 850 th.ha with water lift (Kereselidze & Trapaidze, 2012). Water diversion was 996172 th.m3 from which 449248 th.m3 were supplied to the fields. Irrigation systems efficiency is 0.46. Only 40 th.ha drained lands were used. The main sources of water are Kura, Alazni, Iori, Aragvi, Didi, Patara Liahvi, Ksani, Algeti rivers of Eastern Georgia. There are 34 irrigation water reservoirs, which are also sources for irrigation. Major reservoirs are Sion (325 mln.m3, useful volume is 315 mln.m3), Tbilisi (308.0 mln.m3, useful volume is 155 mln. m3), Algeti (65 mln.m3, useful volume is 60mln.m3), Zonkar (40.3mln.m3, useful volume is 39.0 mln.m3), Jandar (54.28 mln.m3, useful volume is 25.03 mln.m3), etc. Total useful volume of all irrigation water reservoirs amounts for 826 mln.m3, but many reservoirs are filled with pumping stations, which are out of operation because lack of electricity. It worth to note, that Jandar reservoir takes water from Kura river through Gardaban main canal. From this reservoir 8.4 th.ha are irrigated in Azerbaijan through Akstafi reservoir. According to agreement between Georgia and Azerbaijan water should be taken annually in amount of 100 mln.m3 (including 30mln.m3 for irrigation in Gardaban rayon of Georgia), 50mln.m3 are taken Akstafi rayon and 20mln.m3 remain in Jandar reservoir for ecological equilibrium support.

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 of using 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. The main problem is connected with oxygen regime, when lack of oxygen causes anaerobic processes. Reducents exceed producents. Water has not protective potential. Harmful matters concentration exceeds high toxicity level for fauna and flora.

The Alazani is the longest river in Georgia. The Alazani is a river that flows through the Caucasus. It is the main tributary of the Kura in eastern Georgia, and flows for 351 kilometres (218 mile). Part of its path forms the border between Georgia and Azerbaijan, before it meets the Kura at the Mingəçevir Reservoir.

The Alazani originates in the Greater Caucasus, south of the main ridge, in the northwestern part of the Akhmeta District. It flows initially to the south towards the town Akhmeta, then through the fruitful Alazani Valley of Kakheti towards the southeast. The Alazani is the center of the Georgian wine industry. For centuries, it was a main gateway for Persian invaders.

The Alazani dries up during the winter, but in the late spring, snow melt from the mountains swells the river enormously; this regularly causes flooding. The river is mainly used for irrigation and for drinking water (Trapaidze, 2012). In the 1990s, Chinese investors built many small hydroelectric power plants, which use the Alazani's strong current. The river is also popular with tourists for rafting trips.

A light pollution of the river with biological substances comes from untreated sewage from the cities and other communities, as well as from the agricultural areas. In the districts of Kvareli and Lagodekhi, water quality is said to be quite bad.

The Rioni or Rion River is the main river of western Georgia (Berdzenishvili, 2012). 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

Journal in Humanities; ISSN: 2298-0245; e-ISSN: 2346-8289; Volume 6, Issue 1, 2017

Rioni. And the most polluted river in the territory of Kutaisi (Berdzenishvili, 2012). Data are presented in Table polluting ingredients.

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

Conclusion

Assessment of impact on health: Safe drinking water supply is major issue for Georgia. Tapped water is in 85 cities (156 intakes based mainly on ground water with total capacity 3.1mln.m3/day); 45 cities have sanitation facilities including 33 with treatment system with total capacity 1.6 mln.m3/day (including regional treatment facilities in Gardabani with capacity 1.0 mln.m3/day). Water supply pipelines length is 9500 km and collectors for water disposal length is 4000 km (Khmaladze, 2009). Presently, due to difficult economic situation, critical situation takes place in most water supply systems. Most intakes' sanitary state is unsatisfactory: 60% of water pipes and 50% collectors are fully depreciated. 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. Impossibility for supply-sanitation facilities O&M is explained by the fact, that almost all water consumers can't pay (Ghoghoberidze, 1992). Most part of population and state enterprises can't pay for water supply and disposal and this creates financial difficulties for facilities. This crisis situation is aggravated by uncertainty in management sharing between center and local authorities. Many settlements are provided with water from sources under administration of different bodies and operation level is very low. Because supply and sanitation facilities are transferred to local authorities, the latter are obliged to develop this sector. But local bodies have not enough competence to solve these problems.

References

Berdzenishvili, N. (2012). *The Imereti Climatic Resources.* Georgia: Tbilisi.

Ghoghoberidze, M. (1992). *Water Protection and Rational Use of Ecosystems.* Georgia: Tbilisi.

Kereselidze, D., Bliadze, M. (2008). *Water Recreation Facilities Impact, Geographical and Ecological Aspects.* Georgia: Tbilisi.

Kereselidze, D., Trapaidze, F. (2012). *General Hydrology.* Tbilisi: Tbilisi State University.

Khmaladze, C. (2009). *Water Resources of Georgia.* Georgia: Tbilisi.

Trapaidze, V. (2012). *Water Resources.* Georgia: Tbilisi.

Ukleba, M. (1997). *The Use of Water Resources.* Georgia: Tbilisi.