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Water resources in Kosova[#]

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Abstract: Water resources in Kosova are presented as surface waters, groundwater and sources. Hydrometeorology Institute is doing the monitoring of climate, surface waters and water's quality. Kosova is divided into the 4 basins (Figure1), which are varying as from geographic position and the available water's quantity. Total amount of water in our country is small around 1600m^3/inhabitant/year. Having in consideration natural characteristics of our territory, distribution in time and water resources areas, water springs utilization, water's protection and protection from water, are duties that needs particularity. Yearlong, uncontrolled pollution of environment has influenced in degrading of all its potentials as for surface water and underground water. As result of that we have cases of permanent pollution of water surface flows and underground water.

Key words: rivers, surface water, precipitation, groundwater, water quality, monitoring

Introduction

Kosova lines on the highlands (500-600m above sea level) and it is surrounded by the mountains reaching the altitude of more than 2000m (Figure 1). Water resources in Kosova are relatively small, and the rivers are seriously polluted. The biggest water user is agriculture abstracting water for irrigation. Presently, during the irrigation period the water use is in the range of 20 m^3/s. Natural water flows (without reservoirs) of the main rivers are at the same time only 5-10 m^3/s. Because the present pollution load is 1.5 million populations equivalent (p.e.), the average water quality in the rivers is very poor (Jamas, 2003).

Duty of the Water Resources Management Department is to provide the water sector with a framework of policies, regulations, strategies, plans and procedures destined to create a basis for economic and social development and the conditions for the improvement of living conditions of the population. The Ministry of Environment and Spatial Planning promotes a sustainable and concerted administration of the water resources to meet the present and future needs of towns and villages, agriculture, energy, industrial commercial and recreation users with due consideration to environmental protection (Jamas, 2003).

Water sources

The rivers of Kosova runs in directions of three seas: Drini i Bardhë in Adriatic Sea, Lepenci in Edge Sea and rivers: Ibër, Sitnica, Morava e Binçit in Black Sea. Kosova's is surface of 10,877 km^2 and has four rivers basins; also it has a very developed hydrographic net.

Measured by population served, 60% of raw water supply of the water utilities is based of surface water. Rural population and smaller municipalities mainly use ground or spring water (Hart & Hines, 1992). The quality of raw water from surface water in Kosovo is, general, moderate, because water is abstracted from artificial reservoirs. Some water sources are reported to be polluted or potentially endangered by organic contamination, due to lack of wastewater treatment, neglected maintenance of sewerage system, intensive deforestation, or agriculture

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(Batelaan *et al*., 1996). The raw water supply of the public water utilities is mainly (60%) abstracted from surface waters.

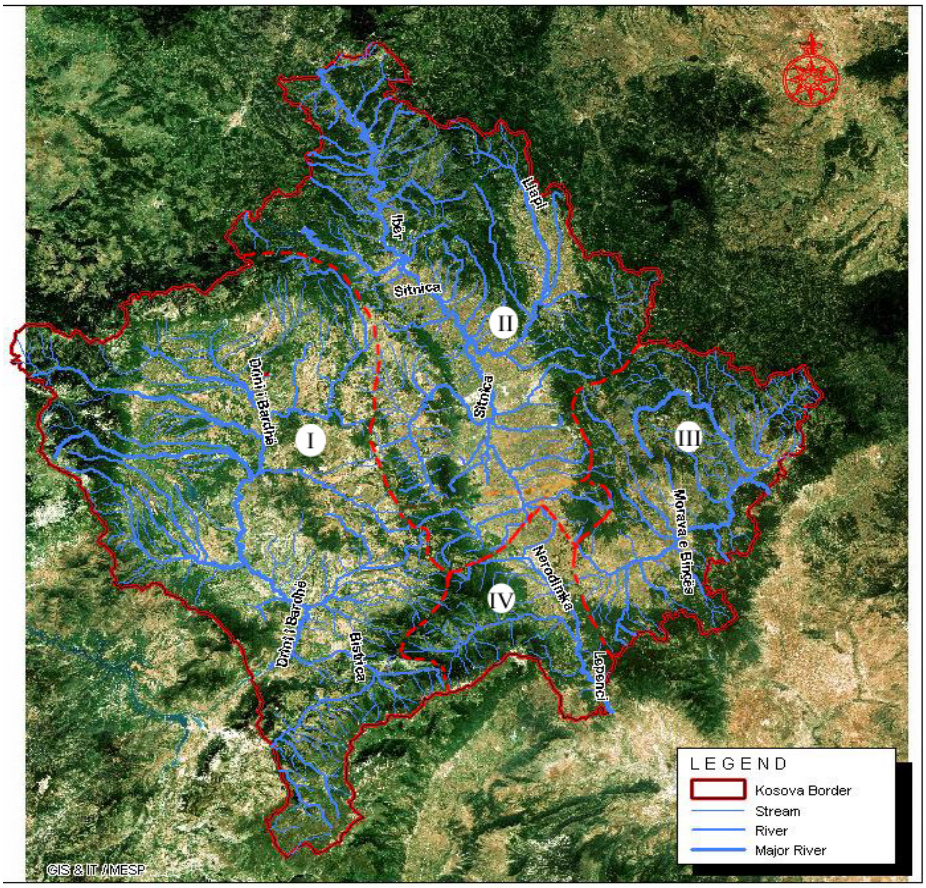

Figure 1. Four main river basin in Kosova.
I-Drini i Bardhë basin, **II**-Ibri basin, **III**-Morava e Binçit basin, **IV**-Lepenci basin

Table 1. Main river basin in Kosova

River basin	Catchments area (km^2)	Flow MQ m^3/s	Run-off Mq $l/s/km^2$
Drini i Bardhë	4313.4	61	33
Ibri	4145.5	32.6	7.6
Morava e Binçit	1934.5	6.1	5.9
Lepenci	656.5	8.7	15.5

Precipitation and run-off

The western part of Kosovo belongs to the Drini i Bardhë river basin. Drini i Bardhë discharges its water to Albania and finally to the Adriatic Sea. The area consist of several small stream from the mountains, water flows into tributaries and Drini i Bardhë river. The mean run-off in the area is 141 $l/s/km^2$ but it varies considerably (5 to 50 $l/s/km^2$) (Anonim 2003). Precipitation varies from 600 to 1400 mm/a. The dry season is in July-August and the wet season in November-December.

The eastern part of Kosovo belongs to the Ibri and the Morava e Binçit river basin, which are upstream areas of one tributary of the Danub. Annual precipitation is mainly less than 700mm, but in some areas it is 900mm. The specific run-off (average 7 l/s/km^2) in the area is much smaller than in the western part of the country, from 2 -10 l/s/km^2.

In southern Kosovo the Lepenci river basin with an area of about 800 km^2 belongs to Axios river basin discharging into Aegean Sea. The annual rainfall is 670-1,000 mm and specific run-off 8-10 l/s/km^2 (average 10 l/s/km^2). There are also steep mountains in this area.

River, lakes and reservoirs

Even the main rivers are relatively small and they originate from the nearby mountains. The Drini i Bardhë (MQ=61 m^3/s) in the western part of Kosovo flows to the south to Albania and the Ibër (MQ=32.6 m^3/s) and the Morava e Binçit (MQ=6.1m^3/s) flow to the north to Serbia (Table 1). The Lepenci flows to the southwest to Macedonia. There are no rapids because Kosovo is mainly a plain area.

There are practically no natural lakes in Kosova. Due to high variations of water flow five reservoirs have been constructed with the total volume of 2.700 million m^3 (Table 2).

Table 2. Artificial dams in Kosova

Dams	Catchments area (km^2)	Yearly flowing (mil m^3/year)
Gazivoda	1060	439.40
Radoniqi	34	117.84
Batllava	250	56.29
Badovc	103	21.26

Groundwater resources

Kosova's geology is made of rocks from different geological ages. In west dominates rocks with high porosity (limestone, marble) and sedimentary rocks. Those regions are characterized with a lot of sources of ground waters that might be used for different destinations. Sedimentary rocks of east side are very weak collectors of water and it is very hard to use the water on those regions.

Hydrogeological characteristics mostly depend from lithological consist and granulometrical consist of alluvial covers and hydrogeology parameters: filterable coefficient, source debit, ground waters, regime of ground waters and the source flow form.

Based to the lithological consist, porosity structure, isolator and collector rocks of water and rocks complex in Kosova region there are this types of aquifers: crowded, cleavage, carst and waterless regions (Avdullahi & Fejza, 2002).

-crowded aquifers-are developed on rocks with inter granular porosity. Alluvial deposits on lengthwise of main rivers flow of Kosova are suitable places for aquifer forming that might be used for drinking water, irrigation, industry etc.

Those aquifers are made of unconnected sediments and half connected with different fatness such as: sand-gravel or gravel-sand. The most important aquifers in alluvial deposits in Kosova are lengthwise of rivers: Drini i Bardhë, Sitnica, Llapi, Reka e Keqe, Morava e Binçit and Ibër (Figure 1).

-aquifers of the cleavage types- Mostly can be found on the cracked and cleavage rocks. These aquifers can be found on the northern side of Kosova. Based to the hydrogeology consist of this rocks, this aquifers can be found on the rocks from the neogen and Paleozoic ages. Since those rocks are exhibited to physical-chemical alteration, they are full of crack and cleavage.

-karst aquifers-in the complex of the strong rocky mass from hydro geological aspect the most important are limestone and marble from which are made strong carst source. These are regions of Mokna, Koritnikut, Pashtrikut, Sharrit, Bjeshkët e Nemuna *etc*. In hydrogeology

aspect, carst sources in limestone's masses are full of water. Limestones are rocky and very carst masses with a lot of cleavages, caverns, caves etc. In carst aquifers with high porosity debit is based to geology-structural construction, morphological construction, grounds and surface waters.

-waterless regions there are regions with a very small amount of water. These regions are with a different stratums and ages. Porosity of these rocks are very low so from these rocks sources with low debit are not expected a big quantity of water which are situated on the east part of Kosova.

Surface waters quality

The water quality of streams flowing from the mountains is good. In the southern part of Kosovo soil is causing some acidity problems. Waters are heavily polluted due to lack of big treatment of wastewater and disposal of solid waste (Armstrong & Armstrong, 1990). The main rivers downstream of big municipalities and industry, especially downstream from Prishtina, are so polluted that water cannot be used as a source of water supply, in some place not even for irrigation. The main polluters of the surface waters are municipalities and industry. Municipalities and communities discharge their wastewater without treatment.

Industrial activities decreased dramatically during the Kosovo conflict. According to available information there are currently about 85 water polluting industrial plants (Daci, 2003). However, no production plant has any kind wastewater treatment. The biggest polluters are mining and metallurgical industry which cause heavy metal and phenol emissions. There are no reliable data about the degree of pollution or amount of pollution land available (Batelaan & De Smedt, 2001).

Ground waters quality

The groundwater is mainly of high quality, provided that there are no pollution sources nearby. But, the uncontrolled and yearlong pollution of Kosova's environment has affected in degradation of all its potentials as in groundwater as well, as result of that some groundwater sources are everlasting polluted (Korça, 2003). The use of Kosova's groundwater; industrialization and urbanization in the backward and uncontrolled today's actions have resulted with large consumption and because of that hereafter the conditions for a routine of groundwater use and protection are obtrusive (Avdullahi & Fejza, 2002).

Monitoring of water resources

Monitoring of air, water and soil in level of Ministry of Environment and Spatial Planning respectively of Kosovo Trust Agency is done by Hydrometrological Institute of Kosova according to the law for protection of Kosova's environment. For an authentic monitoring are expanded the surface water and groundwater monitoring nets, meteorology and rainfall stations nets, air monitoring net according to the pollution level in all territory of Kosova and ground monitoring net in all territory of Kosova.

Hydrologic activity is based to the three main columns as follows:

-waters use
-waters protection
-protection from water

Surface and groundwater monitoring is based to the waters protection and protection from water in Kosovo.

In the past hydrometric net of Kosovo had 33 monitoring points in all basins of Kosova. After the war this three metering points are too much defected and with European Agency for Reconstruction subvention is expanded a new hydrometric metering net and that in 22 metering points (profiles) according to the basins of Kosova (Figure 2). Metering technology is software and produced by German Company "Seba" where are monitored 12 pollution parameters as

acidity, cloudiness, dissoluble and indissoluble oxygen, electricity conduction etc (Cooper et al., 1996). For monitoring of the surface water's pollutions measure according to the cadastre of the stiff, liquid and gaseous pollutions, in monitoring net are 22 profiles where they do sampling and physics- chemistry analyses of surface waters (Haberl & Perfler 1990): In Kosova there is no locality or town that do sewage and industrial water treatment, because of that rivers bottoms usually are similar to collectors of garbage that is made from the war consequences and after the most of that garbage is thrown in to the rivers of all Kosova's localities (Brix *et al*., 1989).

Figure 2. Hydrometric net of Kosova

Conclusion

Water resources in Kosova are very much limited, so wherefore it is necessary to be draw needful strategy for their use and protection in that way that unforeseen problems will not be created in the future. Supply with quality and sufficient water in every time is prerequisite for development of a modern society (ATV-a 262, 1997).

1) There is no reliable information about the present state of water resources and water use in Kosovo.
2) Water resources are relatively small in Kosovo, compared and arable land.
3) Seasonal variations in precipitation and river flows are high (also due to lack of lakes).

4) During the growing season (June-July), water use for irrigation is high, but flows in rivers are nearly at their minimum (NQ in August).
5) There is a big potential and need for irrigation, which might lead to serious lack of water.
6) Rivers are much polluted (except in the rivers in the upper flow) and flows are low during the irrigation season in the vicinity of the Albania and Serbia borders.
7) Good quality ground or spring water resources are unevenly distributed (mainly in the western part) and are only partly available for water supply.

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