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STATISTICAL ANALYSIS OF MEAN ANNUAL DISCHARGES OF THE RASINA RIVER

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Abstract: The basin of the Rasina River is situated in the southern part of middle Serbia on the surface of 979.6 km². This study analyzes the trend of mean annual discharges of the Rasina from 1961 to 2016. To determine the trend of discharge alteration we used Mann-Kendall test, whereas to determine the trend of the break point, that is, the year in which statistically significant discharge alteration happened, we used Pettitt test. This study classifies the years by water richness, so as to perform more detailed analysis of the occurrence of dry and wet periods in the basin. The obtained results imply that mean annual discharges in Brus and Bivolje have a declining trend. The break point, that is, the year when significant decrease in mean discharge occurs, is 1981 on Brus station, that is, 1982 on Bivolje station. The most years in both profiles are moderately rich in water. Both profiles have more years dry than rich in water.

Key words: The Rasina River, Statistical analysis, Classification of years by water richness

1. Introduction

Water resources, as well as their quality and availability have been the subject of many contemporary analyses and studies. Due to uneven time and spatial water distribution which is partially conditioned by both global climate changes and irrational anthropogenic activities, about 80% of world's population is exposed to a high risk of water shortage or unsanitary water.

In the times when people realize the importance of rational usage of all the natural resources, when water resources are limited and exhausted, there is a need for constant monitoring and active management of water resources. Planned economy and management of water resources have to be based on solving the problem of water supplying of the population and industry, irrigation of arable areas, but great attention should be also paid to preserving

of water quality, flood protection, as well as other water management problems.

All the above mentioned things impose the need for detailed hydrological research, among which are monitoring and alterations in longer hydrological time series. Results obtained in such analyses can be a basis for prevention or solving number of problems (flood defense, irrigation, water supply, water protection, etc.).

Mean annual discharge (Qm), as a basic indicator of the study of water regime of river courses, represents the basic indicator applied to identify water regime trends in long-term intervals (Langović et al., 2017). Statistical analysis of annual, seasonal and monthly discharge trends is the subject of many hydrological studies both worldwide and in our country (Jeneiova et al., 2014; Čanjevac et al. 2015; Zelenakova et al., 2012, Langović et al., 2017; Đokić, 2015; Kovačević-Majkić et al., 2014, etc).

This study analyzes mean annual and monthly discharges of the Rasina River, through analyzing the trend of alteration. The aim of the study is to determine the existence of the alteration trend of this important water regime indicator, as well as if this trend is positive or negative. Apart from defining the alteration that occurred in the series, the aim was to single out the exact year when the alteration happened.

We also analyzed oscillations in mean annual discharges and classified years by water richness, by which we determined how much mean annual values deviate from average multi-annual value, that is, what the frequency of the occurrence of more or less years rich in water is.

2. Research methodology

The Rasina river emerges on east and south-east slopes of the mountains of Goč, Željin and Crni vrh, where its constituents the Velika river (Vranjuša) and the Burmanska river emerge. These two courses meet at Rogavčina, where the Rasina emerges. It flows into the river of Zapadna Morava after the course of 92.3 km as its last significant right tributary, 5 km downstream from the town of Kruševac (Gavrilović et al., 2014). The Rasina basin comprises the surface of 979.6 km^2, it borders with the basin of the river of Ibar in the west, with the Toplica basin in the south, whereas the basin of Južna Morava is situated in the east. In the basin of the Rasina hydrological observations have been done on three stations: Bivolje, since 1922, Brus, since

1953 and Ravni, since 1966. This study analyzes alteration trends of mean monthly and annual discharges on the two stations in the Rasina basin – Brus and Bivolje in the period from 1961 to 2016. The data we used were taken from Hydrological Yearbooks of RHMS (Republic Hydro-Meteorological Service) of Serbia. Calculation was carried out via statistical software for Microsoft Excel – XLSTAT 2014.

The trend of discharge alteration can be checked by various statistical methods. In this study we used Mann-Kendall and Pettitt test, non-parametric tests which do not require any prerequisites related to distribution of time series out of which the data were taken.

Mann-Kendall test was used to determine the existence of the alteration trend in the values of mean discharge, as well as to determine if the trend is positive or negative. It is a non-parametric test which identifies the trend of series on the basis of comparison of relative magnitudes of data alterations (Kendall, 1975). If test results show trend value less than 0, then there is a declining trend; if trend value is higher than 0, there is an increasing trend.

Data analysis by Pettitt test (Pettitt, 1979) was done to determine the existence of trend in data on mean annual discharge, as well as the existence of the moment (year) tc when the obvious mean annual discharge alteration occurs. If the test defines the moment tc, then average discharges in the period before the moment tc significantly differ statistically-wise from average discharges in the period after the moment tc (Radivojević et al., 2015; Stričević, 2015).

Apart from the above mentioned analyses, we classified the years by water richness, which points to the trend in multi-annual water richness regime of a course. Classification of years by water richness for the period from 1961 to 2016 was done on the basis of Log – Person III distribution which proved adequate in hydrological research, as well as classification of years by water richness according to Ocokoljić (1994).

3. Research results

To determine the existance of the trend of mean annual discharge, we used non-parametric Mann-Kendall test. The results of this test imply that there is declining trend in mean annual discharges in both analyzed stations in the Rasina basin. On Brus profile we recorded declining trend of discharge with an average yearly decline of 0.007 m^3/s, whereas in Bivolje we recorded an

average yearly decline of 0.028 m^3/s. In the alterations of mean annual discharges on both stations there was a significance values of which are $\alpha > 0.1$, which implies that there is no statistically significant decline of average discharges during time series of 56 years.

Table 1 – Basic statistical data of analyzed stations in the Rasina river basin

Station	**N**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**
Brus	56	1.20	4.60	2.41	0.7214
Bivolje	56	2.60	13.30	7.37	2.7475

Pettitt test was used to determine whether there is a point, that is, a year, in the analyzed period when a significant alteration in the value of mean discharges occurred. The analysis comprised mean annual and monthly values on the Brus and Bivolje stations.

Table 2 – Results of Pettitt test of the values of mean monthly discharges for the period from 1961 to 2016

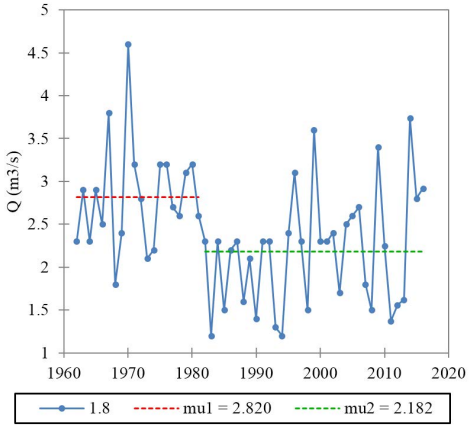
Station	t_c	average value before t_c (m^3/s)	average value after t_c (m^3/s)	p – significance of the test	Difference	
					m^3/s	%
Brus	1981	2.820	2.182	0.0084	0.638	22.62
Bivolje	1982	8.605	6.606	0.0473	1.999	23.23

The results of Pettitt test show that mean annual discharges of the Rasina in Brus and Bivolje have a declining trend.

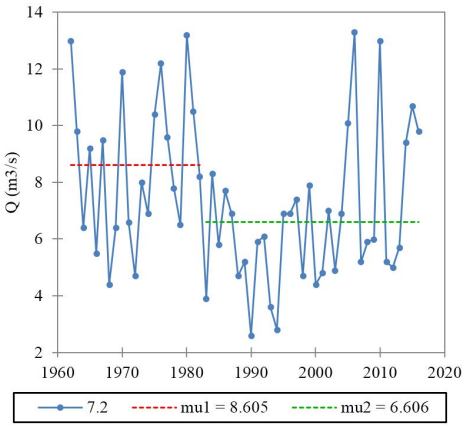
Break point in which there is a decline of discharge in Brus is 1981. Up to that year, average Rasina discharge in the upper part of the basin amounted to 2.82 m^3/s, whereas average discharge dropped to 2.18 m^3/s after 1981. On the most downstream station in the basin, in Bivolje, the year of 1982 was the break point. Average discharge before 1982 amounted to 8.61 m^3/s, whereas it amounted to 6.61 m^3/s in the period after the year of alteration.

When we talk about mean monthly discharges, declining trend occurs in July, August and September in Brus station, while declining trend was recorded in January, February and July in Bivolje station. Since 1982 there has been a significant decrease in mean annual discharges in summer period in the upper part of the Rasina basin, as well as in January in the most downstream part of the basin. In the above mentioned months, mean monthly discharges decreased for almost a third, when compared to the period from 1961 to 1982.

Break points were determined for all the other months, when there was a change in mean monthly discharges, but the obtained values of α significance level are higher than 0.05, which implies that discharge alterations are not statistically significant.



Picture 1 – Mean monthly discharge in Brus from1961 to 2016



Picture 2 – Mean monthly discharge in Bivolje from 1961 to 2016 according to Pettitt test

Table 3 – Results of Pettitt test of the values of mean monthly discharges, p values less than threshold α =0.05 for the period from 1961 to 2016.

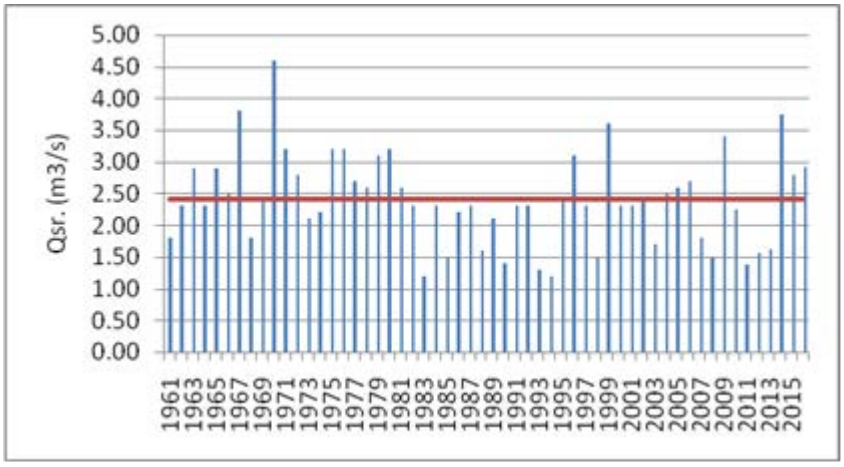
Hydrological station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Brus - t_c	-	-	-	-	-	-	1979-	1982-	1982-	-	-	-
p value	-	-	-	-	-	-	0.0234	0.0073	0.0136	-	-	-
Qm before t_c **(m^3/s)**	-	-	-	-	-	-	2.31	1.14	1.36	-	-	-
Qsr after t_c **(m^3/s)**	-	-	-	-	-	-	1.58	0.79	0,94	-	-	-
Bivolje - t_c	1982-	1986-	-	-	-	-	1983-	-	-	-	-	-
p value	0.0100	0.0146	-	-	-	-	0.0320	-	-	-	-	-
Qm before t_c **(m^3/s)**	9.31	13.43	-	-	-	-	4.83	-	-	-	-	-
Qm after t_c **(m^3/s)**	5.97	8.94	-	-	-	-	3.74	-	-	-	-	-

The obtained results impose the question of what determines declining trend of mean annual discharges in the Rasina basin. The quantity and water flow of water in a river are conditioned by numerous factors, among which the most important are the amount of precipitation and air temperature. In the analyzed period a trend of air temperature rise was recorded in the Rasina

basin, as well as a decrease in precipitation quantity which excretes in the basin. In the upper part of the basin, in stations Milentija, Brus and Kriva River, there has been a significant decrease in mean annual precipitation since 1980 and 1981 (Stričević, 2015; 2016). On the stations in the bottom part of the basin the decrease in precipitation is more prominent in the second half of the 1990s, but "Ćelije" accumulation in this part of the basin affects the discharge greatly.

When analyzing mean annual discharges we noticed that in some years the rivers are rich in water, and then there are years when waterbeds of some courses ran dry during summer period. To gain insight into how much discharges deviate from certain average, expected values, how often high or low waters occur in the examined period, we classified the years by water richness in the period from 1961 to 2016 in the most upstream and downstream station on the Rasina River.

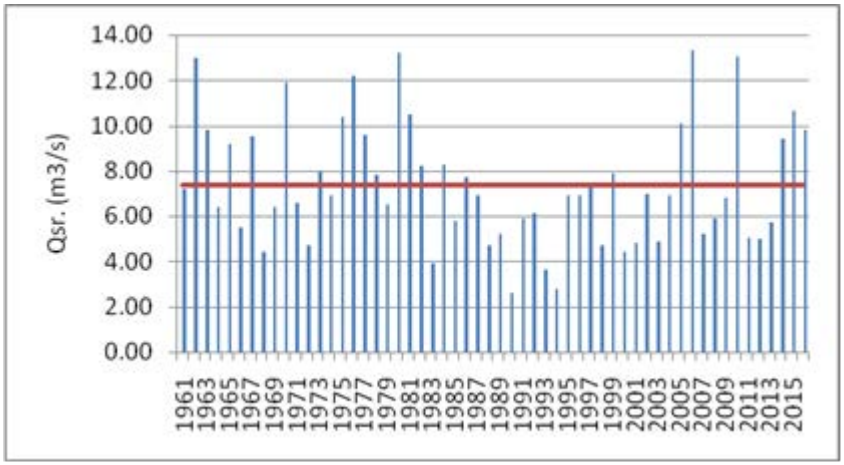
Pictures 3 and 4 show mean annual discharges of the Rasina in Brus and Bivolje, as well as their mean value, as the border which separates the years below and above average rich in water.



Picture 3 – Mean annual values and mean value of the Rasina discharge in Brus (1961-2016)

In the analyzed period, maximum mean annual discharge in Brus was recorded in 1970 and it amounted to 4.60 m^3/s, whereas minimal annual discharge was recorded in 1983 and 1994 and it was 1.20 m^3/s, which is a ratio of 1:3.83. Out of 56 analyzed years, during 23 discharge was above, while it was below average values during 33 years.

Pettitt test determined that the year of 1981 was a break point in the series, when the decline occurred in Brus. Starting from 1982, out of 35 analyzed years, the discharges were below average 25 times, while in the period from 1961 to 1981 discharges below average were recorded only seven times.



Picture 4 – Mean annual values and mean value of the Rasina discharge in Bivolje (1961-2016)

Maximum mean annual discharge in Bivolje was recorded in 2006 and it amounted to 13.30 m^3/s, while minimum mean annual discharge was recorded in 1990, amounting to 2.60 m^3/s, which is a ratio of 1:5.12. Out of 56 analyzed years, during 23 the discharge was above, while during 33 it was below average values.

Pettitt test determined that the year of 1982 was the break point in the series, when the decline in discharge of the Rasina in Bivolje occurred. Starting from 1984, out of 34 analyzed years, discharges were below the average 24 times, whereas in the period from 1961 to 1981 discharges below the average were recorded nine times.

On the basis of Log – Person III distribution, which proved to be adequate in hydrological research, and on the basis of classifying the years by water richness according to Ocokoljić (1994), we classified the years to extremely dry, very dry, dry, moderately rich in water, rich in water, very rich in water and extremely rich in water.

The highest number of years on the river of Rasina in Brus belongs to the group of moderately rich in water (27) and they occur almost every second

year, most often two years in a row or more often. Extremely dry years were not recorded in this profile in the analyzed period, while 1970 was extremely rich in water, mean annual discharge amounting to 4.60 m^3/s. Years which are dry and rich in water occur every fifth year on average.

The highest number of years on the river of Rasina in у Бивољу belongs to the group of moderately rich in water (23) and they occur almost every second year. Years extremely dry and extremely rich in water were not recorded in this profile in the analyzed period. Years which are dry and rich in water occur every fourth or fifth year on average.

Both profiles show very few years rich in water and extremely rich in water, which is in accordance with the general declining trend of discharge values for all the courses in Serbia (Langović et al., 2017). More dry then rich in water years were recorded on both profiles.

Table 4 – Classifying the years by water richness of the Rasina in the period 1961-2016

Station	Water richness of the year	Discharge (m^3/s)	Years	Number of years
Brus	extremely dry	< 1.0	-	0
	very dry	1.0 – 1.34	1983,1993, 1994,	3
	dry	1.34 – 1.89	1961, 1968, 1985, 1988, 1990, 1998, 2003, 2007, 2008, 2011, 2012, 2013,	12
	moderately rich in water	1.89– 2.84	1962, 1964, 1966, 1969, 1972, 1973, 1974, 1977, 1978, 1981, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1995, 1997, 2000, 2001, 2002, 2004, 2005, 2006, 2010, 2015	27
	rich in water	2.84 – 3.66	1963, 1965, 1971, 1975, 1976, 1979, 1980, 1996, 1999, 2009, 2016	11
	very rich in water	3.66 – 4.31	1967, 2014	2
	extremely rich in water	> 4.31	1970.	1
Bivolje	extremely dry	< 2.21	-	0
	very dry	2.21 – 3.42	1990, 1994	2
	dry	3.42 – 5.45	1968, 1972, 1983, 1988, 1989, 1993, 1998, 2000, 2001, 2003, 2007, 2009, 2011, 2012	14
	moderately rich in water	5.45– 9.06	1961, 1964, 1966, 1969, 1971, 1973, 1974, 1979, 1982, 1984, 1985, 1986, 1987, 1991, 1992, 1995, 1996, 1997, 1999, 2002, 2004, 2008, 2013	23
	rich in water	9.06 – 12.19	1963, 1965, 1967, 1970, 1975, 1977, 1978, 1981, 2005, 2014, 2015, 2016	12
	very rich in water	12.19– 14.73	1962, 1976, 1980, 2006, 2010	5
	extremely rich in water	> 14.73	-	0

4. Discussion and Conclusions

This study analyzes alterations in mean annual discharge of the Rasina River on the stations Brus and Bivolje, as well as defining the trend and years when statistically significant discharge alterations occurred. Non-parametric tests determined that declining trend of discharge values is present on both stations. Break point of average discharge values on both stations was recorded at the beginning of the 1980s (1981-1982), which overlaps with the period of decrease in the quantity of precipitation which excretes in the basin, as well as air temperature rise. Apart from the above mentioned climate factors, water usage of the upper course of the Rasina for water supplying of a part of Brus municipality (water system "Paljevštica"), as well as Ćelije" accumulation which for now supplies 70 settlements on the territories of the municipalities of Kruševac, Aleksandrovac and Trstenik have a big impact on the discharge decrease (Stričević, 2015).

Analysis of the years by water richness implies certain cycles of rotating of dry and wet periods. Few years very and extremely rich in water were recorded, as well as drier than wet years.

Understanding of the alterations in discharge values is very important, because in such a way we gain insight into the state of water richness of a basin. On the basis of the above mentioned data we can conclude that water richness of the Rasina has noticeably decreased in the past thirty years. Because of that it is extremely important to take into consideration the obvious declining trend in discharge, that is, water richness of the basin for future planning, otherwise, if we rely only on average values of the discharge, we might get the wrong impression on the available quantities of water. Apart from analyzing the trends of discharge alterations on annual, seasonal and monthly level, further hydrological research should be focused on detailed analysis of all the factors which condition alterations in water regime of a basin, regardless of how big their impact is.

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SOME CONCEPTUAL INSIGHTS INTO GIS APPLICATION IN THE STUDIES OF ENVIRONMENTAL PROTECTION

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Abstract: All causes and consequences of environmental problems have a geographical component and they can be modelled using geographic information system as the main tool for dealing with geospatial data with ability to integrate different information and present it on a map. Data visualization of environmental problems, through GIS and geospatial presentations, provides hypothesis and different views, develop alternative ways for solving environmental problems.

Key words: Geographic information system, layer, geospatial, environmental protection, geovisualization

1. The emergence of geographic information systems

The most important challenges in science, industry and society have a geographic component at their basis. A map has always been the main tool for dealing with geospatial data. This remains so, but through the use of computers, introduction of databases and development of geographic information systems (GIS) new opportunities appear.

Using GIS, we can determine why things are how they are depending on their location and what the relation amongst diverse geographic objects is. Using GIS for analysis purposes we can arrive at precise and updated information or even create new information previously unattainable. Having such information can help us in gaining a deeper understanding of geographic space. The results could be a making the best choice and better preparing for future events and opportunities.

The emergence of geographic information systems which allow us to make a detailed spatial display and handle geospatial data rapidly, undoubtedly begins to change the practice of environmental protection.

The most common theory about GIS origins is that it is developed in sparsely populated Canada which by 1950s viewed its own land and resources as being unlimited. The late but inevitable finding that this was not the case, led the Canadian government to initiate a creation of the list of national

resources - The Canada Land Inventory, whose “broad objective was to classify lands as to their use capabilities” (ARDA: CLI Report No.1, 1965). The most practical way of dealing with geospatial data is if the data is stored on a map. This data was planned to be used for the plans for land management so the large rural areas could be efficiently exploited. The construction of Canada Geographic Information System (CGIS) led to a rapid handling and analysis of maps and data on which they were based. Contemporary commercial packages have been built on the basis of key conceptual and technical innovations of the CGIS. When the project of the CGIS was launched, there was no previous experience on how to structure georeferenced data within computers and a lot of today basic GIS algorithms had yet to be invented. In 1987, the Department of the Environment in the UK issued a report titled “Handling Geographic Information”, which highlighted the significance of GIS for geospatial analysis and compared it with importance "the inventions of the microscope and telescope were to science, the computer to economics, and the printing press to information dissemination" (as cited in Goodchild, 1991).

2. GIS and the environmental protection

With the advent of industrial revolution, man cause a new damage to natural resources. Factories are being built and they become new sources of pollution of air, water and soil. Due to migration, many cities begin to grow, and the question of how to best balance the needs of the environment with the needs of a growing industrial society only begin to arise later on. This become more and more frequent problem in recent times.

The concept of sustainable development is most often used to describe the way in which man acts towards the environment which should be in accordance with the report “Our Common Future”, which, at the invitation of the United Nations, was compiled by the World Commission on Environment and Development (the so-called Brundtland Commission) in 1987. The definition is as follows: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). This concept implies that both technology and society must be organized so that human activities do not overload the capacity of the biosphere, and so that said biosphere is able to absorb their influence.

Sustainable development planning and management is a comprehensive process that deals with multi-dimensional problems in order to achieve balanced economic development, environmental protection, and social equity and protection. In order for geospatial data to be used for decision-making it is necessary to fulfil several conditions, the main being the availability of data and data analysis tools which would integrate into a complex information system.

Although the creation of GIS-based eco-friendly models is still in progress, it is clear that these techniques will enable the construction of geospatial ecological models with the level of detail previously unthinkable. Also, the ways in which the ecological problems were predicted and explained in traditional ecology change. With the application of significant technical innovations, ever-faster computers, increasingly available satellite images, global positioning systems... the future of ecology preserving techniques looks much safer today than a few decades ago.

The combination of natural and anthropogenic influences increases the complexity of environmental problems, and field systems are far more complex than those that can be modelled or even experimentally studied in the laboratory. Sometimes this complexity excludes the creation of adequately controlled field experiments. One of the characteristics of environmental problems is their uniqueness. Some systems are so unique in their structure or composition that laboratory experiments cannot be used to get insight into them. Uniqueness can also make it difficult to create a controlled experiment, or even make it impossible.

GIS technology is being used more and more all over the world to protect the environment. This system provides an insight into the current state that is obtained by the insertion of layers with data that are considered relevant for a particular subject of study or have in some way affected the preservation of the environment in a given area. Layers that can be significant in the study of the state of the environment are: terrain topography, aquatic areas, green areas and parks, forest cover, nearby habitats of plant and animal species, a layer with built-up areas, a transportation infrastructure, a layer with industrial chimneys, a layer with wind data with information about what are the dominant winds depending on the time of year and its power, speed and the height; a hazardous waste warehouse, sewage network, areas of tailings and deposits from mining... and many others depending on the specificity of the area itself. When all the data are entered, an analysis of the current situation, their mutual

relations and the degree of influence of various factors on the environment is carried out.

Techniques of geospatial modelling allow the studying of complex relationships between phenomena. These techniques usually involve the applying a set of statistical algorithms on geospatial data. A wide range of data obtained from various stations, through remote monitoring systems, global positioning systems, maps of all types, annuals, lists, individual research... help in decision-making and go a step further by allowing us to explore alternative scenarios of "what if..." (for example, what if another facility of similar capacity is built next to a refinery, will the amount of dangerous substances then exceed the allowed limits).

By using GIS, it is possible to determine the degree of environmental vulnerability, the reasons for the vulnerability and the possibilities of overcoming them. GIS provides an opportunity to analyse the terrain and determine areas in which, depending on the conditions, pollution and environmental damage have occurred. The reasons for endangering can be varied, for example: discharging untreated wastewater into watercourses, failures on wastewater treatment filters, various types of environmental incidents, noise... Each of the possible causes is entered into a separate layer and then analysed to determine the degree of impact.

One of the crucial things for exploitation of the potential of GIS, and more importantly, avoiding serious errors is a solid understanding of geography by GIS users. Without a strong scientific basis, we cannot be certain that geographic information systems will be used wisely.

3. Some examples of GIS application in environmental protection

The application of GIS in environmental protection implies the handling the raster data (satellite and orthophoto images), polygon, line and point data (e.g. land cover, land use, geology, soil, wells, springs...), network handling (e.g. streams, water supply network, sewage network...), handling relief... These applications can range from simple lists to sophisticated ones that involve the analysis and modelling of spatial data.

The most common pollutant of surface water are suspended sediments both in weight and volume (Howari et al, 2007) but the sewage with additional presence of industrial wastewater is probably the most widespread and most common point sources of pollution of land waters. The main distinction

between point and nonpoint sources is that the first one “discharge pollutants into the receiving water bodies at an identifiable single- or multiple-point location” (Novotny, 2003). If the amount of pollutant is high, in some parts of the watercourse there can be total anoxia and the extinction of the living world. If we were to study the state of the pollution of the watercourse and the possibility of its reduction, we would take into consideration the layer with points where waste water is poured into the rivers (in order to see the most critical parts of the river); water level layer (in order to know when it is necessary to prohibit the discharge of wastewaters in case of low water levels in the summer months); a layer with locations where water was sampled to connect with the results of chemical and microbiological findings (so as to present each of the findings with a special layer, for example, a layer with water temperature, smell, pH value, a layer with oxygen level, cyanide...); plant and animal species... With prejudice-free data, interactively through GIS software, using geovisualization (MacEachren, Kraak 2001) which “provides hypotheses and different alternative views” (Kraak 2013), it is possible to solve ecological problems by examining the causative agents and their relations and successfully preventing ecologic disaster.

Coastal waters, into which the wastewater both indirectly and directly flows through the watercourse, still suffer the strongest blow. They are often the “closest to the sources of pollutants” and at the same time “the most physically, chemically and biologically active zones” (Preston, Chester, 2001). The necessary layers would be: the layer with the living sea world; with the marine currents; layer with quantities and types of fish (determined by sonars and various statistical procedures); places where fish are caught (in order to control and prevent extermination)... It would be possible to easily determine the distance from the coast and the ideal place where waste waters would pour into the sea - far enough from the coast (due to bathers); well positioned in relation to marine currents (to dilute as soon as possible); so that they avoid the habitats of plant and animal species...

The drinking water used in Serbia is mostly underground water. Even if the “magnitude of groundwater pollution is much less compared to surface water as the soil acts as a filter retaining a large part of colloidal and soluble pollutants by mechanical trapping, adsorption and chemical reactions” (Goel, 2006), those water resources could be polluted very easily due to negligence, and its purification is almost impossible. In order to prevent the pollution of groundwater, we would need to process: the industrial zone layer; the layer

with soil, the layer with a geological data, the borehole layer (to determine areas that would be susceptible to infiltration of polluting liquids, i.e. where, depending on the permeability of the soil, the cracks in the geological base or the present boreholes, it would be possible for polluting substances to reach the groundwater); the layer with the roads that transport the raw materials but also the products of the liquid industry (material that could become a chemical or microbiological pollutant, gasoline, oil or acids). By setting a buffer (an area of interest around the entity) around the roads (e.g. 50 meters around the roads) and overlapping it with the borehole layer, we would find out which boreholes are located at a distance of 50 meters from the road. We would determine the slope of the road and the large curves and their distance from the boreholes. At the critical parts of the road, we would later either ban the transport of dangerous goods or limit the speed to reduce the possibility of overturning the tanker trucks.

By applying a buffer and by placing spatial and non-spatial queries in a GIS database in order to find the desired data, we could determine the corridors that should be used to transport industrial waste. The impact would be: layers with residential parts of the city; layers with areas with protected plant and animal communities; road network; layers with traffic intensity depending on the time of day, month, year; layers with current meteorological conditions and weather forecasts for the coming days; layers with a slope of the terrain... Their combinations would give us the shortest and safest route.

Air pollution is (with pollution of water and land) one of the main concerns in developed countries, but just with a certain time delay also a concern in developing countries, which deal with the same problem which the developed ones had earlier (Mage et al, 1996). Air pollution mainly occurs in the lower layers of the troposphere. It badly affects human health by causing diseases of the respiratory organs and chronic diseases, but also on the environment (soil, forest...). The main source of air pollution in industrial cities is the industry itself, but also the increased use of motorized vehicles in such densely populated areas as well as the use of low-quality fuel for heating and cooking purposes. Seasonal changes and chemical reactions contribute to the concentration of polluted air. There are many factors that cause dispersion of polluted air, including climatic factors and climatic elements (such as relief, temperature, speed and direction of the wind, humidity), but also the local situation (forest protection belts, density and layout of built surfaces, ventilation on the traffic corridors...). Each of these factors and climatic

elements could be taken for a special layer, and only imagination can limit the combination of layers, determination of cause-and-effect connections, and the prediction of the occurrences.

Over the last few decades, researchers have confirmed that trees in urban areas improve the quality of life and "fulfils many social functions and psychological needs of citizens, which make urban nature a valuable municipal resource, and a key ingredient for city sustainability" (Chiesura, 2004). GIS would be helpful in selecting locations for raising a forest protection zones that protects residential areas of the city from industrial pollution and traffic as well as from the noise (some of the layers would be the strength and direction of permanent and dominant winds).

The construction of a gas pipeline network and the inclusion of natural gas in industrial processes as a more logical choice from the point of view of environmental protection, economic justification of exploitation and existing resources could also see great benefits from geographic information systems.

We must not forget the impact of possible natural disasters on industrial facilities and their landfills. Earthquakes, floods, forest fires, storm winds, droughts, extremely high and low temperatures, landslides are potential factors and the possibilities of their occurrence should be examined. If an environmental incident or a natural disaster occurs, the emergency response service would arrive to that location shortly with the help of GIS and the global positioning system.

4. Conclusion

Data is an integral element of GIS. Various sources are used to obtain data: different types of maps, lists, terrain surveys, global positioning system, remote sensing and the data obtained by direct research.

Efficient environmental management aims to optimize the use of resources and reduce negative environmental impacts, while maintaining economic growth.

Satellite recording and monitoring are based on the analysis of multispectral and multitemporal satellite images from the same spectral ranges obtained by multi-year recording. Multispectral images allow retrospective testing, which cannot be achieved by any other methodological procedure.

The key trends in GIS are the shift from establishing to generating a hypothesis; from static to dynamic models; from 2D views to 3D views (or

even 4D views if time as the fourth dimension is included in the modelling); from simple cartographic displays to complex visualization (animation, multimedia, 3D; due to the advancement of hardware and software solutions, it is now possible to process a much larger amount of data in a shorter time), all in a new medium such as the Internet. Commercial GIS software is being increasingly advanced and used, and helps us to through geo-visualization find the expected and discover the unpredictable.

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TOURISTIC MOVEMENT IN JAHORINA MOUNTAIN FROM 1999 TO 2016

Emilija Dostović

Abstract: Mountain Jahorina – a so called "snow beauty", represents one of the largest ski and winter resorts in the Balkans. During the 14th Winter Olympic Games in 1984 this region has reached considerable touristic development. The one thing that separates Jahorina as a Winter Olympic Center from the rest is the sheer quality of ski tracks located on site, which are suitable for professionals and beginners alike. Apart from skiing activities, visitors can enjoy the natural scenery that this region has to offer. The mild climate, rich hydrography, lush flora and fauna and anthropogenic values can be found here as well. This is a place where Western and Eastern civilizations meet, sometimes even collide but they enrich this region together nonetheless through their long and fascinating history. After the Winter Olympic Games, a three-year civil war, the economic crisis that followed and basic negligence has resulted in a decline of visitors during the years. This area also suffered from a decline of infrastructure capital and material base, reduction of birth rate and emigration of the population.

This research shows that Jahorina has a good potential to be a regional tourist centre that could be attractive for visiting at any time of the year. Key factors for a recent tourism development of mountain Jahorina as well as the increase of visitors in the period from 1999 and information about existing infrastructure is shown in the next pages of this paper. As an increase of visitors is apparent in recent time, it gives hope and motive for further work on infrastructure and capacity development for sports, winter and summer activities.

Key words: Jahorina, mountain tourism, development

1. Introduction

Jahorina Mountain lies in the southeastern part of Bosnia and Herzegovina and is southeast of the city of Sarajevo. The mountain region was split between Republika Srpska and Federation of Bosnia and Herzegovina. In December 1995 the Dayton Peace Agreement brought a halt to a three year civil war in Bosnia and Herzegovina. Part of the mountain in Republika Srpska fall into Pale and Trnovo jurisdictions that themselves are part of East Sarajevo

(Natek K.,Natek M.,2000). Jahorina has several parts that together make a mountain range with the length of 30 km and width of 15 km. The mountain range takes up an area of 729 km2. Jahorina Mountain belongs to the Dinaric Mountains. The most interesting feature of Jahorina is the Gola Jahorina plateau that's 15 km long and 4-5 km wide. The tallest peak is Ogorjelica (1916 m) while other notable peaks are Sjenište (1910 m), Košuta (1907 m), Kota (1731m), Priratak (1858 m), Trijeska (1804 m) and Duge Stijene (1820 m) (Marković J., 1966). Many hotels, bungalow resorts and appropriate infrastructure were built for the 14th Winter Olympic Games in 1984 and tourism in the region flourished (Tourist Organization East Sarajevo). Sarajevo, at that time, did not have any facilities to accommodate winter sports; however, Bosnia and Herzegovina and its mountains Jahorina, Bjelašnica, Igman and Trebević had the tremendous natural potential for winter activities. The development of mountain tourism in the region was based on favourable location, rich natural features from which we can emphasize terrain configuration, mild slopes (Rajska Dolina) and good climate, all of which make Jahorina one of the most well-known ski resorts in the Balkan. This is a place where Western and Eastern civilizations meet, sometimes even collide but they enrich this region together nonetheless through their long and fascinating history. The whole region has a great opportunity to further develop tourism in the following areas: 1. winter sports, 2. recreational activities, 3. education, 4. business, 5. conferences, 6. culture, 7. excursions, 8. hunting and 9. medical tourism (www.dinarskogorje.com).

Although Jahorina is rich in natural beauty, tourism is still not developed enough. First cable cars were introduced on 29th of November, 1952. Right after the end of Winter Olympic Games, it became evident that the number of visitors has started to decline, natives started to move to larger cities, infrastructure started to decline due to not being properly maintained and the economy was getting worse.The absence of maintained road network blocked Jahorina from becoming a developed tourist centre, although is only 28 km away from Sarajevo. Further development of tourism in Jahorina will significantly transform the mountain from an abandoned project to an initiator of the development of Republika Srpska (Tourist Organization East Sarajevo).

Natural tourism values

Geographic characteristics that have a great influence on tourism development on mountain Jahorina are geomorphological, climate, hydrological and bio-geographical properties. In a geomorphological sense, mountain range Jahorina can be observed as three ridges: Trebević, Ravna Planina and Gola Jahorina. Geologically, Jahorina consists of limestone-dolomite rocks, sandstone and clay (Rodić D.1970). Terrain configuration is suitable for the development of all kinds of winter sports tourism in this part of Europe. Jahorina is rich in watercourses from which the most notable rivers are Kasindol, Crna reka, Bistrica, Paljanska, Miljacka and the longest one – Prača (61 km) (Marković J.1966).

The mild climate in the region greatly contributes to the development of tourism in Jahorina. Main climate factors that affect the local weather are a geographical location in relation to the sea, cardinal direction of the mountain, elevation, terrain diversity and forests. Although it's only 120 km away from the Adriatic Sea, it's protected from the warm Mediterranean air by adjacent mountains Bjelašnica and Treskavica (www.dinarskogorje.com). Areas within alpine climate zones are defined by long and cold winter and short and mild summer, where the average annual temperatures in January are is -0,9ºC to -6,4ºC (Kujundzic Z.,Govedar Z., 2006). Snow cover in Jahorina is present from October through May, which is considered as an advantage for the development of winter sports tourism (National Weather Service BiH).

2. Materials and methods

Research on number of tourists is conducted for the period between 1999 and 2016. The data is provided by Tourist Organization East Sarajevo.

Table 1. A number of arrivals and overnight stays for period of 01.01.1999.-31.12.2016.

Year	Arrivals			Overnight Stays		
Municipality of Pale	total	domestic	Foreign	total	domestic	foreign
1999	9,668	5,019	4,649	3,7342	12,075	25,267
2000	10,480	5,985	4,495	38,697	18,688	20,009
2001	12,736	8,488	448	39,500	24,036	15,464
2002	17,831	11,650	6,181	61,222	35,247	25,975
2003	17,749	10,847	6,902	68,267	29,905	38,362
2004	17,867	10,329	7,538	67,850	30,549	37,301
2005	18,744	9,883	8,861	65,234	30,799	34,435
2006	28,511	14,743	13,768	89,772	38,040	51,732
2007	31,328	14,729	16,599	99,711	42,648	57,063
2008	34,923	17,471	17,452	10,7019	45,360	61,659
2009	34,594	19,999	14,595	96,944	49,018	47,296
2010	34,196	20,256	13,940	90,544	48,870	41,674
2011	30,097	17,335	12,762	80,860	41,626	39,234
2012	33,365	20,410	12,955	98,639	53,746	44,893
2013	40,004	24,191	15,813	115,021	59,741	55,280
2014	41,688	29,407	12,281	93,646	59,880	33,766
2015	54,705	35,337	19,368	137,676	76,606	61,070
2016	44,184	26,876	17,308	120,594	63,079	57,515

Source: Tourist Organization East Sarajevo

Table 2. Number of arrivals and overnight stays per municipality (2012)

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	33,365	20,410	12,955	98,639	53,746	44,893
Sokolac	-	-	-	-	-	-
Trnovo	-	-	-	-	-	-
Istočno Novo Sarajevo	556	465	91	737	575	162
Istočna Ilidža	6,158	5,043	1,115	8,499	6,906	1,593
Istočni Stari Grad	-	-	-	-	-	-
Total	**40,079**	**25,918**	**14,161**	**107,875**	**61,227**	**46,648**

Table 3. Number of arrivals and overnight stays per municipality (2013)

Municipality	Arrivals			Overnight Stays		
	total	domestic	foreign	total	domestic	foreign
Pale	33,242	18,597	14,645	105,428	51,922	53,506
Sokolac	-	-	-	-	-	-
Trnovo	-	-	-	-	-	-
Istočno Novo Sarajevo	626	490	136	857	629	228
Istočna Ilidža	6,136	5,104	1,032	8,736	7,190	1,546
Istočni Stari Grad	-	-	-	-	-	-
Total	**40,004**	**24,191**	**15,813**	**115,021**	**59,741**	**55,280**

Table 4. Number of arrivals and overnight stays per municipality in % (2013)

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	81.10	76.87	92.61	91.66	86.91	96.79
Sokolac	-	-	-	-	-	-
Trnovo	-	-	-	-	-	-
Istočno Novo Sarajevo	01.56	02.03	00.86	00.74	01.06	00.41
Istočna Ilidža	15.44	21.10	06.53	07.60	12.03	02.08
Istočni Stari Grad	-	-	-	-	-	-
Total	**100**	**100**	**100**	**100**	**100**	**100**

Table 5. The ratio of number of arrivals and overnight stays per municipality 2012/2013 in %

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	-00.37	-09.75	+11.54	+06.45	-03.51	+16.10
Sokolac	-	-	-	-	-	-
Trnovo	-	-	-	-	-	-
Istočno Novo Sarajevo	+11.18	+05.10	+33.10	+14.00	+08.59	+28.95
Istočna Ilidža	-00.53	+01.20	-08.05	+02.70	+03.95	-03.04
Istočni stari Grad	-	-	-	-	-	-
Total	**-00.18**	**-07.14**	**+10.45**	**+06.21**	**-02.49**	**+15.62**

Table 6. Number of arrivals and overnight stays per municipality (2014)

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	31,787	21,913	9,874	78,794	49,190	29,604
Sokolac	155	112	43	423	308	115
Trnovo	-	-	-	-	-	-
Istočno Sarajevo	2,733	1,432	1,301	4,716	2,296	2,420
Istočna Ilidža	7,013	5,950	1,063	9,713	8,086	1,627
Istočni Stari grad	-	-	-	-	-	-
Total	**41,688**	**29,407**	**12,281**	**93,646**	**59,880**	**33,766**

Table 7. Number of arrivals and overnight stays per municipality in % (2014)

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	76.26	74.51	80.40	84.15	82.14	87.67
Sokolac	00.37	00.37	00.35	00.45	00.35	00.34
Trnovo	-	-	-	-	-	-
Istočno Novo Sarajevo	6.55	04.86	10.59	5.03	03.83	07.16
Istočna Ilidža	16.82	20.83	08.65	10.37	13.50	04.81
Istočni Stari Grad	-	-	-	-	-	-
Total	**100**	**100**	**100**	**100**	**100**	**100**

Table 8. The ratio of number of arrivals and overnight stays per municipality 2013/2014 in %

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	-04.37	+15.13	-32.57	-25.26	-05.26	-44.67
Sokolac	+100	+100	+100	+100	+100	+100
Trnovo	-	-	-	-	-	-
Istočno Nvo Sarajevo	+77.09	+65.78	+89.54	+81.82	+72.60	+90.57
Istočna Ilidža	+12.50	+14.21	+02.91	+10.05	+11.08	+04.97
Istočni Stari Grad	-	-	-	-	-	-
Total	**+04.04**	**+17.73**	**-22.33**	**-18.58**	**+00.23**	**-38.91**

Table 9. Number of arrivals and overnight stays per municipality (2015)

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	43,758	27,656	16,102	120,693	65,283	55,410
Sokolac	153	123	30	360	305	55
Trnovo	-	-	-	-		
Istočno Nvo Sarajevo	3,951	1,969	1,982	6,402	3,000	3,402
Istočna Ilidža	6,843	5,589	1,254	10,221	8,018	2,203
Istočni Stari Grad	-	-	-	-	-	-
Total	**54,705**	**35,337**	**19,368**	**137,676**	**76,606**	**61,070**

Table 10. The ratio of number of arrivals and overnight stays per municipality 2014/2015 in %

Municipality	Arrivals			Overnight Stays		
	total	domestic	total	domestic	total	domestic
Pale	+37.66%	+26.20%	+63.07%	+53.17%	+32.71%	+87.17%
Sokolac	+100%	+100%	+100%	+100%	+100%	+100%
Trnovo	-	-	-	-	-	-
Istočno Nvo Sarajevo	+44.56%	+37.50%	+52.34%	+35.75%	+30.66%	+40.57%
Istočna Ilidža	-2.42%	-6.05%	+17.91%	+5.23%	-0.84%	+35.40%
Istočni Stari Grad	-	-	-	-	-	-
Total	**+31.22%**	**+20.16%**	**+57.70%**	**+47.01%**	**+27.93%**	**+80.86%**

Table 11. Number of arrivals and overnight stays per month, municipality Pale (2016)

Month	Total Arrivals	Domestic Arrivals	Foreign Arrivals	Total Overnight Stays	Domestic Overnight Stays	Foreign Overnight Stays
1	6,004	2,419	3,585	23,577	8,452	15,125
2	4,461	1,331	3,130	16,907	3,727	13,180
3	4,271	2,364	1,907	9,431	4,425	5,006
4	3,133	2,538	595	6,282	4,995	1,287
5	3,986	3,066	920	11,421	9,304	2,117
6	2,368	1,750	618	6,304	4,802	1,502
7	2,329	1,405	924	5,873	2,981	2,892
8	3,192	1,950	1,242	11,752	5,853	5,899
9	2,496	1,802	694	5,733	4,015	1,718
10	3,406	2,524	882	7,174	5,171	2,003
11	3,204	2,446	758	5,864	4,205	1,659
12	5,334	3,281	2,053	10,276	5,149	5,127
Total	44,184	26,876	17,308	12,0594	63,079	57,515

Source: *Tourist Organization East Sarajevo (all tables)*

3. Results

We can see from the information shown in this study that the number of visitors between 1999 and 2002 has seen a steady increase in the rate of 1000 visitors per year. Following the year 2002, there is a decrease in a number of visitors up to 2004. The main reason for this decrease in numbers was evident economic crisis. However, this period of stagnation had little influence on the overall positive trend which continued to 2008 where it has reached the all-time maximum number of tourists of 34,923 (Table 1). After the said peak, there was constant and steady growth in a number of visitors. The second peak occurred in 2015 when 54,705 tourists have visited Jahorina (Table 10).

The master plan for Jahorina talks about the built roads, accommodation capacities and all the potentials of this mountain. In 2017 trails have been refreshed for the first time since 1983 – in total 6,222 m of trails have been redone according to the FIS standards. New tracks and roads with the total length of 15 km have been built, old installations have been removed so skiers can ski on the 35 km long course. There are two polygons, built for training on which children and beginners can practice and improve their skiing skills, with moving tracks that are 100 m and 70 m long. This area also has tubing courses and playgrounds with winter theme elements. Ski lessons are provided by Bistrica ski school which helps people who have never tried this sport to feel comfortable and safe. (www.oc-jahorina.com)

The latest information regarding the accommodation capacities on Jahorina is from 2011. (Master plan za Jahorinu 2011). In the master plan great potential for development and improvement of sports infrastructure through the construction of new facilities, open playgrounds, sports halls, golf courses, trim trails. Infrastructure that was built in the area was for the needs of the Olympic Games. Hotel Bistrica was built in the same period and it still operates today and in the past couple of years, accommodation capacities are growing. Accommodation capacities in Jahorina include 3,270 beds from which 1,022 are provided in 6 hotels and the rest from private accommodation. Hotels located in Jahorina: Hotel Sun (18 rooms), Hotel Lavina (23 luxury apartments), Hotel Stanišić, Hotel Board, Hotel Termag (21 luxury apartments, 71 rooms and a presidential suite), Hotel Nebojša (26 rooms and 5 apartments), Vila Skočine. Jahorina is a mountain with great potential of becoming one of the most attractive tourist destinations on the Balkan Peninsula. Some of the most important features of Jahorina are ski trails with the total length of 35 km, altitude of the ski centre that fall into the range of 1,300-1,890 m and skiers transport capacity of 13,000 persons per hour. Maximum altitude difference is 590 m and the longest trail is 2,041 m (Master plan za Jahorinu 2011).

Table 12. Ski Trails and Transport Capacity

Ski Trail	Length (km)	Capacity (person per hour)	Type	Altitude difference (m)	Ride length (min)
Skočine	1.45	1,200	chairlift	368	6
Ogorjelica I i II	2.60	2,400	chairlift	320	5
Poljice	1.55	1,200	chairlift	364	10
Olimpik	0.95	900	rope tow	196	6
Rajska dolina	0.95	900	rope tow	260	6
Poljice i baby lift	0.55	600	rope tow	150	3

4. Discussion and conclussions

This study shows that there is a great potential for Jahorina to become a well-known tourist centre that is popular both during the winter and summer. Existing data is showing a steady rise in a number of visitors as well as infrastructure development and increased lodging capacity which is a sign of progress towards set goals. The largest number of tourists are domestic visitors. Municipality of Pale is with the largest number of tourists, with the highest

number of visitors in 2015 followed by the municipality Istočna Ilidža. Recently, right before the winter season, construction works have taken place to build an artificial lake with a total volume of 95,000 m3, which will be crystallized for a refreshment system and over summer for summer tourism. Although infrastructure development plays an important role, cultural, sports and music events and festivals like Exit Fest is what brought Jahorina to life. The Olympic mountain of Jahorina, located in the center of the Balkans in Bosnia and Herzegovina, is the perfect winter destination for this kind of manifestation. A very popular music festival Exit Festival 84 took place from 15th to 18th of March this year, with a great success with over 20,000 visitors. Other sports events are scheduled for the year 2018 as well – race events, FIS competition, qualification for European Youth Olimpic Festival in 2019 (EYOF). EYOF 2019 will take place on Jahorina, where hundreds of young people will compete in slalom and giant slalom (www.oc-jahorina.com). If we take a look at the data, we can see that the number of skiers that have visited Jahorina has significantly increased in just one year from 6,500 (December 2016) to 20,000 (December 2017). The number of overnight stays has also increased by 20% at Hotel Bistrica, where the primary objective is to increase booking of more consecutive nights per guest.

Further development of European road network will connect more people with the region which will inevitably bring more visitors to Jahorina. Tourist interest in Jahorina is evident and is the main drive for further capacity and infrastructure investments and development.

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ETHNIC DISTANCE AND ETHNIC STEREOTYPES OF THE YOUNG IN BOUNDARY MUNICIPALITIES IN SOUTH SERBIA

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Abstract: As a multiethnic region in South Serbia, with majority of Albanian population, the municipalities of Preševo and Bujanovac have been the scene of frequent ethnical conflicts and intolerance. Besides Serbs and Albanians, there lives a large number of Roma people. Since Roma are the people without their own country, they are specific for their merging into autochthonous population with partially preserved cultural heritage. Unlike Roma, Albanians in South Serbia want to annex the territory where they live, claiming on their historical right. This resulted in intolerance and tensions between Serbs and Albanians, which have been constant for more than a century. Therefore, the primary aim of the paper is to present the mutual ethnic distance and ethnic stereotypes between the young population of Serbian, Albanian and Roma nationalities in the boundary municipalities in South Serbia, Vranje, Bujanovac and Preševo. The presented data are the result of the Project „Maintaining Peace and Inclusive Local Development" financed by P. BILD Joint UN Program in South Serbia. The Project included three bordering municipalities in South Serbia- Vranje, Bujanovac and Preševo, while the research was carried out in 2015.

Key words: South Serbs, ethnic relationships, stereotypes

1. Introduction

Even today, Serbia as a multiethnic and multi confessional community faces the problems of establishing the relationships based on non-discrimination in all domains, including ethnic identity as well. The results of ethnic clashes and still unsolved relationships in Kosovo and Metohija are still potentially negative factors in the establishment of ethnic relations on the basis of equality, confidence and safe coexistence. Religion as one of significant

indicators of ethnicity, as well as relationships of religious communities on the Balkans is also a stumbling block in Serbia as a multi religious community.

The conflicts in the Balkans, which broke out in the previous years and led to far-reaching consequences, had basic characteristics of ethnic and religious conflicts. The tensions, which still exist in Serbia, are not immune to this type of antagonism yet. In addition to poverty and unbalanced development in certain regions, the mentioned kind of problems still burdens social reality in Serbia. The "we-they" distinction is partly based on ethnic stereotypes which are an additional identification marker, so that a „different one" is often recognized and labeled as an enemy. The latest research on stereotypes shows the continuity of both positive and negative stereotypes of Serbs as the most numerous people in comparison to other minorities (Gavrilović et al., 2011).

According to the last census data on population, households and flats in 2011, 7 186 862 people live in the Republic of Serbia without Kosovo and Metohija. Out of the total population, 5 988 150 (83.32%) are Serbs, while national minorities and ethnic groups include 1 198 712 people (16.68%), thus the state is relatively homogenous. However, in the municipalities of Preševo and Bujanovac the Albanians boycotted census, so the number of Albanian population and consequently the total percentage of national minorities in Serbia is rather higher than given above. Their distribution is naturally not constant on the whole territory. Vojvodina is specifically composed (ethnically the most diverse) in comparison to mostly homogenous central Serbia. Sandžak is predominantly inhabited by Bosniaks, while the bordering regions are ethnically heterogeneous, therefore generalizations may offer a wrong picture. In Serbia, Hungarians are the most numerous (253 899 i.e. 3.53%), Bosniaks (145 278 i.e. 2.02%, Roma people (147 604 i.e. 2.05%) and Yugoslavs (23 303).

In some cities in Serbia, national minorities are ethnic majority at local level (Albanians in Bujanovac and Preševo, Bulgarians in Bosilegrad and Dimitrovgrad).

The municipalities of Vranje, Bujanovac and Preševo, which are the subject matter of this paper, are located in Pčinja District of Southern Serbia, with the area of 3 520 km^2. The seat of District is the City of Vranje; in addition to Vranje, Bujanovac and Preševo, the District includes four more municipalities: Bosilegrad, Trgovište, Surdulica and Vladičin Han. To the west is the border with Autonomous Province Kosovo, to the south is state border

with the Republic of Macedonia, while the border with the Republic of Bulgaria is on the east. Pčinja District has very favourable geographic and traffic position, because it is crossed by the internationally significant corridor E-75, which connects central Europe with the Aegean Sea, i.e. the corridor Budapest – Belgrade – Skopje- Athens. The municipalities mentioned above are on the corridor, while Preševo is also at Macedonian border crossing.

2. Basic demographic characteristics of the region

As a bordering region, Pčinja District is ethnically very heterogeneous. According to the census data on population, households and flats in 2011, Pčinja District had 159 081 people, including 96 085 (60.4%) Serbs, 42 156 (26.5%) Albanians, 9 068 (5.7%) Roma and 6 999 (4.4%) Bulgarians. However, Albanian community seems to be larger; the boycott of census by Albanians in Preševo and Bujanovac resulted in a reduced number of census units.

Roma are the population without their own country; they are characterized by integration with the representatives of major population and partial preservation of own identity (language, customs). Since, in addition to Serbs, about 5% of Roma and 0.3% of Albanians live in Vranje, a lower distance between Roma people and Serbs and less negative characterization is presumed, while higher towards Albanians. The population of Preševo consists of 88% of Albanians, 9% of Serbs and 2.4% of Roma people, hence more positive perception and less distance towards Albanians than towards Serbs is expected. The percentage ratio of the three communities is the most proportional in Bujanovac; therefore the most balanced distance between Roma and other two people is expected.

The relationships between Serbs and Albanians have been one of the crucial social issues on the Balkans for more than a century. Serbs and Albanians are two people with very rich history of mutual contacts, close relations and associations together with animosity which goes back to the middle ages. However, the separation which took place during Ottoman period and final break up, followed by the occurrence of nationalism in the twentieth century resulted in their taking opposite sides in recent history.

After the end of NATO intervention on the Federal Republic of Yugoslavia (Serbia) in 1999, the ethnic intolerance increased in the South of Serbia as a region with high percentage of Albanian population. The

intolerance between Serbs and Albanians has been long present, resulting in territorial pretensions, and claim on their historical rights. This led to threats, pressures, poor communication, doubts and antagonistic behavior. Differences in lifestyle, religion, customs and interests were observed, and that resulted in increase of nationalism. Given that in this conflict was not possible for both sides to achieve positive outcome, it prolonged, including new issues thereby multiplying negative interactions. Both Serbian and Albanian side had own aims, similar but incompatible; both sides pretended to the same positions (social and political), each trying to prevent the other side from their realization; both claimed to have been threatened by the other side. Due to their involvement in conflict, both sides believed that the other side is to be blamed for the current situation, both distanced from each other, and the members of *„the other"* ethnic group are still considered less valuable and are negatively described.

Apart from a great number of Albanians and Roma people in Pčinja District, they are not equally distributed, which shows that these three ethnic groups have had various cultural-historical and economic influence, therefore their mutual experience has been different.

There have been many projects aimed to moderate tensions and promote coexistence as a solution, since coexistence includes partnership without restrictions. The whole situation is additionally important considering the fact that all previous investigations of mutual ethnical relationships, stereotypes and distance in Serbia revealed that in comparison to other ethnic groups, Albanians were the most rejected, most negatively described followed by Roma as the top second (Šaćirović et al., 2013).

In addition, this region is extraordinary patriarchal, and the position of women in all three communities (Serbian, Albanian and Roma) is especially difficult and very similar. A woman is mostly concentrated on her home and family, she hardly takes part in any public and political life. The situation is somewhat more favorable in Vranje as a city, while it is drastically different in Bujanovac and Preševo.

3. Defining basic concepts

Ethnic distance is a measure of closeness or distance of an individual in a relation to certain ethnic group. The greater the distance is, the stronger are its effects on the behavior in the community, i.e. impossibility of social

communication and participation in mutual projects aimed at improvement of widespread life conditions. The concept of ethnic or social distance was first used by R. Park, sociologist, but today the notion is mostly connected with E. Bogardus who created a specific scale for measurement of this phenomenon. For Bogardus, social distance is a degree of understanding and psychological closeness (i.e. distance) between diverse groups or members of those groups. Social distance is in fact tested as willingness to participate in social contacts of varying degrees of closeness. For testing, it should be defined through characteristic social relationships which can represent various degrees of closeness or distance.

The concept of ethnic stereotypes was scientifically introduced by Walter Lippmann in 1922. In stereotypes he saw a kind of notion or attitudes which allowed an individual to adapt and to manage more easily in the complex world. Unlike Lippmann and his followers, another attitude has been created in psychological literature, by which stereotypes are the irrational presentation of existing prejudices related to ethnic groups. This attitude was supported by Gordon Allport and Hans Jürgen Eysenck (Milošević, 2004).

4. Research procedure

Two hundred and twenty four young Serbs, Albanians and Roma, 17-18 years of age, from three municipalities in South Serbia – Vranje, Preševo and Bujanovac participated in the research.

According to their places of residence, 84 examinees, Serbs and Roma (37%) were from Vranje; 73 examinees, Serbs, Albanians and Roma (33%) were from Bujanovac, while 67 Albanians, Serbs and Roma (30%) were from Preševo.

The sample consisted of 112 males and 112 females, so it was balanced in gender as follows: 42 males and 42 females from Vranje, 36 males and 37 females from Bujanovac and 34 males and 33 females from Preševo.

The sample was balanced in ethnicity, too. It consisted of 34% Serbs, 31 % Albanians and 35 % Roma people; in Vranje, 42 Serbs and 42 Roma (50%); in Bujanovac 21 Serbs (29%), 29 Albanians (40%) and 23 Roma (31%), while in Preševo 41 Albanians (60%), 13 Serbs (20%) and 13 Roma (20%).

The data were obtained by using modified Bogardus scale[1] which contained seven types of social relations. The relationships were arranged beginning with the least degree of distance (the highest closeness) to the highest degree of distance (the least closeness). They were articulated in the form of statements. In order to identify ethnic distance of the young population of Serbian, Albanian and Roma ethic groups, the examinees were asked to circle the answer „Yes", „No" or „Neutral". They were offered the following relationships related to other ethnic groups: 1. I would marry him / her, 2. I would have him / her as a friend, 3. I would live in the same neighborhood, 4. I would work at the same company as them, 5. I would go out to the same places, 6. I would live in the same country and 7. I would like the member of other ethnic group to lead my country. The scale ranged from 0 points (complete distance, which does not necessarily mean complete acceptance or complete refusal, since the examinees may have answered „Neutral", which should be borne in mind during the analysis) to 7 points (because 7 relationships were defined), which denoted no distance. The results of total distance were obtained by summing up all points provided by the answers of all examinees to the offered questions.

Likert scale[2] examined the characteristics ascribed to specific people, national minority or ethnic group, i.e. how Serbs, Albanians and Roma see each other. The following attributes were given: laborious, courageous, clever, sensitive, sincere, honest, cultural, clean, kind, hospitable, peaceful, unselfish, civilized, love other people, proud. By circling one of the five-level scale items (Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree), the examinees showed to which degree the typical representatives of these people, national minorities or ethnic groups showed each of the given attributes.

5. Results of the previous research

The research conducted by D. Pantić showed the increase of ethnic distance in the mid-1980s. According to the results in 1985, D. Pantić concluded that 30% of Albanians accepted Serbs as spouses, while 44% of

[1] More detailed of Bogardus scale in: David Krech, Richard S. Crutchfield, Egerton L. Ballachey (1972): Individual in Society translated by Dobrivoje Uštević] *Pojedinac u društvu*, Belgrade: Zavod za udzbenike i nastavna sredstva.

[2] More details on Likert scale in the literature marked as Footnote 1.

Serbs would marry Albanians. In 1986, while examining national hetero-stereotypes of the young, the same author obtained the following results: the young Serbs from Serbia mainly negatively evaluated Albanians: do not like other people (54%), stagnant (51%), insidious (34%), closed (33%), rude (20%), hot tempered (16%), lazy (14%), selfish (8%), and courageous (5%). The research on ethnic distance in 1990 and 1993 showed even greater increase of ethnic distance, especially towards Albanians, Moslems and Croats (Mihajlović, 1996: 423; Kuzmanović 1994: 233).

From 1992-2002, D. B. Đorđević and D. Todorović socio-empirically examined ethnic-religious distance between the majority people (Serbs), other national minorities (Albanians and Bulgarians) and Roma people. The obtained data confirmed continually strong intensity, either in the relationship „Serbs-Roma" or „members of other minorities – Roma" (Đorđević, Todorović, 2000: 153-178; 2002: 175-186).

By examining ethnic auto-stereotypes and hetero-stereotypes in Kosovo[3], Srećko Mihailović (1998: 411) found that both Serbs and Albanians had high opinion of themselves (hospitable, courageous, peaceful, clean...). Albanians primarily thought that Serbs were insidious, selfish, rude and that they hated other nations. When describing Serbs, Albanians used only 7% positive and even 93% negative characteristics. Serbs thought that Albanians were stagnant, rude, laborious and hated other nations. They ascribed 32% positive and 68% negative characteristics.

6. The results of empirical research in Vranje, Bujanovac and Preševo

The results of ethnic distance will be shown through acceptance of specific relationships separately, i.e. each relationship with other ethnic group will be presented separately.

The results for the first offered relationship: „I would marry him / her" are presented in the Table 1.

[3] This refers to the research of public opinion in Kosovo and Metohija in 1997, realized by the Forum for Ethnic relations from Belgrade in cooperation with the Institute for Philosophy and Sociology in Prishtina ((Dušan Janjić, Đerđ Rapi, Srećko Mihailović et al.).

Table 1 - Acceptance by the criterion „I would marry him / her“

I would marry him / her	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	52	48	31	38	26	30
Albanians	17	16	33	41	45	52
Roma people	39	36	17	21	15	18
Total	108	100	81	100	86	100

From the Table 1 it can be seen that the examinees accept Serbs to the greatest percentage, even as spouses, then Albanians and Roma people. The Albanians are accepted as spouses in the highest percentage in Preševo (52%), while 48% of Serbs and 36% of Roma are accepted in Vranje, which is in accordance with the proportional ratio of total population.

The greatest refusal was recorded in the readiness of young people from Vranje to marry Albanians (only 16%), while this acceptance of Serbs was logically the highest (48%). In Bujanovac, the greatest refusal was towards Roma people (21%), then Serbs 28%, while Albanians achieved the highest percentage of acceptance as spouses in this municipality (even 41%).

The refusal of getting into marriage is probably the result of long lasting ethnic conflicts of these two ethnic groups. Other influential factors may have certainly led to this attitude; this general unwillingness for such a direct contact with the members of other ethnic groups is due to the fact that marriage is the closest relationship, which includes other interactions with the group whose member is to be married. War, suffering, historical heritage, noticeable hostility, differences in religion and culture are certainly the factors which made those peoples distant. The intention to preserve both identities (individual and national) due to the feeling of national threat, led to sticking to own ethnic group.

Table 2 shows the results based on criterion of being fiends with the members of other ethnic group.

Table 2 - Acceptance by the criterion „I would have him / her as a friend“

„I would have him / her as a friend“	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	70	41	33	37	41	33
Albanians	37	22	25	28	53	43
Roma people	62	37	31	35	30	24
Total	169	100	89	100	124	100

The obtained results show that the highest percentage of acceptance of friendship is related to Serbs, then Roma and finally Albanians. These results may not be surprising providing the number of mutual interactions of the people in this region.

The examinees from Vranje refused the offered relationship with Albanians to smaller extent than the previous one (marriage), but in higher percentage in comparison to the residents of Bujanovac and Preševo, while the offered relationship towards Roma people was accepted more willingly than in other two municipalities.

Roma people are most accepted as fiends in Vranje, 37%, then in Bujanovac 35%, while they are the least accepted in Preševo (24%). It seems that such result depends on the percentage of population and everyday interactions. However, Serbs are the least willing to enter into those relationships. Only 33% of Serbs would be friends with other two ethnic groups. It may show that in this region Serbs are „afraid of"disturbing personal and national (psychological) boundaries.

The Albanians are most accepted in Preševo (43%), which is in accordance with their proportional participation in total population.

The criterion of living in neighborhood is presented in the next Table.

Table 3 - Acceptance bythe criterion „I would live in the same neighborhood"

I would live in the same neighborhood	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	68	41	37	42	45	36
Albanians	36	22	20	22	48	39
Roma people	61	37	32	36	31	25
Total	165	100	89	100	124	100

These results show that the order of acceptance is similar to the previous criteria. Again, Serbs are accepted most, then Roma people and Albanians. The most frequent acceptance of Albanians was recorded in Preševo (39%), where they were majority of population; in that municipality, Roma people were the least accepted (only 25%), while the acceptance of Serbs was 36%.

Absolute non-acceptance of „neighbors", mostly between Serbs and Albanians is the result of multiculturalism without interculturalism (coexistence without interaction), as those people live in different parts of the town. The greatest acceptance of Serbs as neighbors is in Vranje (41%), which

is understandable since they are the major population; the acceptance of Roma people is 37%, while Albanians are the least favorable as neighbors in the same municipality (22%). This ratio is more balanced in Bujanovac in relation to other municipalities, but here, Serbs are again most acceptable as neighbors (42%), then Roma people (36%) and finally Albanians (22%).

Living in neighborhood implies higher distance than friendship, therefore, it was expected that higher percentages of examinees would rather accept this relationship in comparison to the previous ones, which was not the case. This could be explained by the fact that living in neighborhood includes coexistence on the same territory, which generates the feeling of threat. This explains the fact why such a low percentage of Albanians (22%) is accepted as neighbors. However, friendship is possible to make without being a neighbor, which could be the reason of difference in these two criteria. Another reason may be that in the former case (when thinking of a friend), the examinees thought of individuals with their personal characteristics, while in the latter case the individuals were taken as representatives of specific ethnic group.

The next Table shows the acceptance i.e. refusal of members of other group to be employed at the same company.

Table 4 - Acceptance by the criterion „I would work at the same company as them"

I would work at the same company as them	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	73	41	68	38	47	35
Albanians	42	24	52	29	53	39
Roma people	63	35	58	33	35	26
Total	178	100	178	100	135	100

Serbs are most widely accepted as colleagues in Vranje (41%) and Bujanovac (38%), while in Preševo this percentage is somewhat lower. In Preševo, Albanians are mostly accepted as colleagues to work at the same company (39%); in Bujanovac this percentage is lowered to 29%, while the least readiness to work with Albanians at the same company is found in Vranje (24%). The Roma people are the most accepted as colleagues in Vranje (35%), then in Bujanovac (33%) and finally in Preševo (26%).

This criterion is characterized by the highest acceptance of other ethnic groups. Marriage, friendship and work are classified as vital priorities; therefore success in these domains is the measure of happiness and fulfillment of fundamental needs. In the current situation, when the relationship between

nations is weakened, satisfaction of all needs is directed mainly towards the members of the same ethnic group. This is the reason why the result obtained is slightly surprising or encouraging. However, bearing in mind that the members of different ethnic groups traditionally work (or worked) together in this region, this result could have been expected.

Table 5 shows the data obtained by the criterion of acceptance of other ethnic groups for going out to the same places in the city.

Table 5 - Acceptance by the criterion „ I would go out to the same places"

I would go out to the same places	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	68	44	32	44	22	24
Albanians	30	20	18	25	44	48
Roma people	55	36	22	31	26	28
Total	153	100	72	100	92	100

The previously established order of acceptance is also found in this criterion as well. In total, Serbs are most accepted, then Roma people and Albanians with the exception of Preševo where Albanians are accepted most, then Roma people and finally Serbs. In Vranje and Bujanovac Serbs are accepted in equal percentage (44%), while in Preševo this percentage drastically decreases to only 24%, which is by 20% lower in comparison to other two municipalities. Considering going out to the same places, Roma people are accepted by 36%, while in Bujanovac by 31%. The percentage is much lower for Albanians; in Vranje it is only 20% and in Bujanovac 25%. In Preševo, Albanians are accepted most (48%), followed by Roma people (28%).

The acceptance of Roma people in Vranje is somewhat surprising, because there is no place in this town where it really happens. Considering the obtained percentages, it seems possible to influence decrease of distance between these groups, but the question remains whether this is a real wish, or just a formal answer; nevertheless, a „new" era may have come.

Table 6 - Acceptance bythe criterion „I would live in the same country"

I would live in the same country	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	69	45	56	41	38	32
Albanians	28	18	39	29	49	42
Roma people	56	37	40	30	30	26
Total	153	100	135	100	117	100

The residents of Vranje are most willing to coexist in the same country, but only with Roma people, which points out that they are not ready for such an issue. The members of multiethnic regions are more willing, in this case in Bujanovac and Preševo.

By this criterion, Serbs are most accepted in Vranje (45%) and Bujanovac (41%), while the least in Preševo (32%). Roma are most accepted in Vranje (37%), then Bujanovac (30%), while in Preševo only 26%. The acceptance for coexistence is quite opposite with Albanians; they are most accepted in Preševo (42%), then Bujanovac (29%), while the percentage of acceptance strongly decreases in Vranje (only 18%).

Table 7 - Acceptance by the criterion „I would like the member of other ethnic group to lead my country"

To lead my country	Vranje		Bujanovac		Preševo	
	Distance	%	Distance	%	Distance	%
Serbs	66	43	42	42	39	34
Albanians	28	18	35	35	48	41
Roma people	58	38	23	23	29	25
Total	153	100	100	100	116	100

The results in the Table 7 show that the examinees, similarly, do not accept the participation of other ethnic groups either in local administration or at the state level. Each nation tends to have its own state, i.e. country which personifies the nation. Allowing the members of other ethnic group to lead the state would mean to breach into their national domain, threatening the feeling of safety, therefore full confidence and support is given to the member of their own nation. Thus in Vranje, Serbs are logically most accepted as leaders (43%), then Roma people (38%) and Albanians (18%). In Bujanovac the percentage is relatively balanced; again, Serbs are predominant (42%), which is only 1% less in comparison to Vranje, but Albanians are considerably more accepted (35%) than in the former municipality, followed by 23% of Roma people; Albanians are most accepted as leaders in Preševo (41%), then Serbs (34%) and Roma people (25%)

In accordance with the second task in this research, which is to define ethnic stereotypes of Serbs, Albanians and Roma, among themselves, the characteristics ascribed to other people, national minorities and ethnic groups and their mutual judgments were analyzed by using Likert scale. The results of the research showed that the stereotypes about Roma people and Albanians

were the most negative, which could have been expected, considering the results obtained by using Bogardus scale.

The prejudices of the members of one ethnic group related to those belonging to other groups are presented as percentages of the total number of examinees.

According to Serbs, Albanians are aggressive (66%), arrogant (61%), mean (54%), insidious (46), hate other people (65%) and like to rule (59%); Roma people think that Albanians are aggressive (40%), arrogant (37%), ugly (22%), primitive (21%), dishonest (19%).

Albanians think that Serbs are aggressive (56%), cultural (49%), friendly (41%), intelligent (40 laborious (31%), progressive (29%), %), hate others (33%), and like to rule (28%). Roma people think that Serbs are beautiful (59%), courageous (54%), intelligent (51%), friendly (47%), pugnacious (44%), good natured (4%), clean (40%), sincere (8%).

Serbs think that Roma people are cheerful (47%), dirty (42%), solidary (38%), uncultivated (36%), good hearted (35%), stupid (33%), quarrelsome, ugly, underdeveloped lazy (3%). Albanians think that Roma people are good natured (36%), stupid (33%), uncultivated (30%), aggressive (29%), cheerful (28%), cowards (26%), sincere (24%), dirty (23%).

Roma people have rather negative image of Albanians, while rather positive of Serbs. Albanians and Serbs do not have very negative opinion of Roma; however, the characteristics, which describe them as good natured but stupid and uncultivated, prevail.

Albanian description of Roma people does not include those characteristics which would describe them as people who threaten them, which can be found in the description of Serbs.

On the other hand, that is exactly how Serbs see Albanians – the people who tend to threaten other ethnic groups; hence they are not willing to see Albanian positive characteristics. However, Albanians, in spite of seeing Serbs in negative context, often ascribe some positive characteristics to them (cultivated, friendly, intelligent...). They both describe the other ethnic group as aggressive, and people who love to rule and hate others.

7. Conclusion

The result of the empirical research, done in South Serbia in 2014 showed that the degree of ethnic distance was high, and the stereotype images between the young population of Serbs, Albanians and Roma people were mainly full of negative attributes. Distrust and ethnic distance can be partly explained by actual socio-political situation. Great distance towards Albanian national minority is a result of political atmosphere, i.e. unsolved problem and status of Kosovo and Metohija. The establishing of peace, opening of borders and normalization of economic relations between these people is a significant step towards the decrease of distance.

As the results of research have shown, the policy of isolation and disregard of other ethnic groups creates barriers and increases stereotypes. Stereotypes, both positive and negative are the result of disregard and the fear of the unknown and the different. It is necessary to continue the initiated process of overcoming speech of hatred and ethnic intolerance through educational, social and political programs. Distrust should be reduced and fears should be eliminated. In that process, media have a significant role, since in every society, either with developed or developing democracy, the influence of media is great.

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DEMOGRAPHIC CHANGES IN THE COUNTY OF TOPLICA

Maja Novović, Marija Mihajlović

Abstract: Modern demographic development of the municipalities of Toplica region follows major changes in population trends, natural and mechanical movement of population and population structures. Statistical analysis of previously collected and processed data came to the conclusion that these changes result from a number of mutually conditioned factors that led to changes in the development of the population, which have had a negative impact on the demographic development of the Toplica district in recent decades.

Keywords: Population, movement, natural population growth, age structure, education, demographic development.

Introduction

The county of Toplica is located in the southern part of the Republic of Serbia. It covers an area of 2,231 km². It includes the following municipalities: Prokuplje, Blace, Kursumlija and Zitoradja, with a total of 267 settlements, of both urban and rural type. It has a total population of 91,754 (according to the census of 2011). It has a favorable position even though it is not on the major international routes. We can say that on the basis of the comparative method if we look at other regions. Its location in the beginning of the twentieth century greatly improved, building rail and road routes. In this way, it is linked with neighboring regions. According to the results of archeological research, the county of Toplica was inhabited in prehistoric times. The first inhabitants were Dardin, an Illyrian tribe, known as good herders and warriors. Due to specific historical circumstances in the past, the county of Toplica has a very simple ethnic structure. Serbs and Montenegrins are the majority of the population.

Geographical location of the county of Toplica

The county of Toplica covers the southern part of the Republic of Serbia and includes historical and geographic area, known as Toplica. Towards the east, it reaches the Nisava River, in the north to the Rasina River, south-east to the Jablanica River, and south to the Kosovo district. The county of Toplica includes the basin of the Toplica River, the region between the north part of mountain Jastrebac, Kopaonik Mountain on the west, Rudarska

Mountain, Djaka, Sokolovica, Vidojevica and Pasjaca Mountain to the south-west and south, and the valley of the South Morava River eastward. The town of Prokuplje is the center of the district.

Physical-geographical characteristics

In addition to geographical location, physical and geographical characteristics are an important element of the geographical environment, which affects the entire society, and certainly the demographic development of certain areas.

Geomorphological features

Place of Toplica is not unique either in the geological structure or the configuration of the terrain. It consists of two different valleys: the valley of the Toplica River, and the valley of the Kosanica River, as well as several smaller expansions and cliffs in the valleys of tributaries of the Toplica River. In the basin of the Kosanica River, there are mostly volcanic, fluvial and abrasive forms of relief. One of the abrasive terraces, dissected river courses and almost destroyed the Devil's Town. "This is actually a collection of several hundred clay pyramids, built of sandstone and marl, on the top of which are andesite plates, which in the form of caps protect the surface beneath them from taking the end destruction." (J Markovic., 1996). Due to volcanic activity, the area is rich in various minerals, especially mica, feldspar and iron.

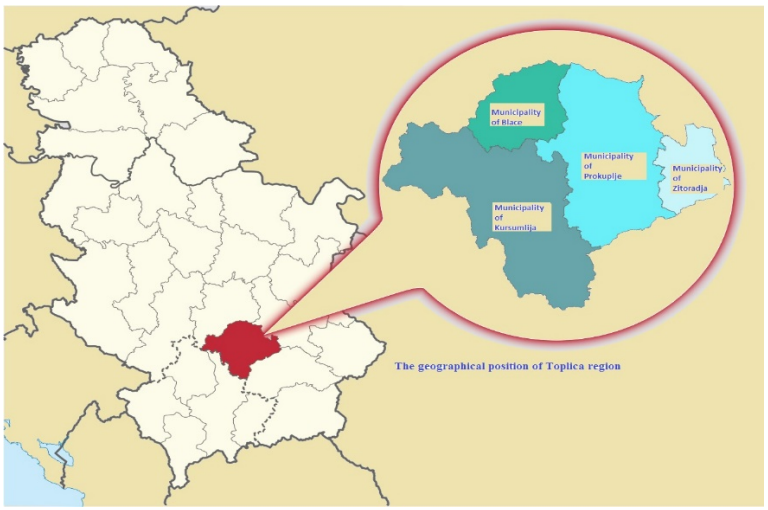

Figure 1 - The geographical position of the Toplica region (model of this picture was taken from the local administration of the municipality of Prokuplje).

Climate characteristics

The county of Toplica has a moderate continental climate, with the influence of the mild climate. Summers are quite hot and dry, and winters are moderately cold. The warmest month is July and the coldest are January and February. The average annual air temperature is 10.6° C.

Hydrological characteristics of the Toplica

The largest river of Toplica region is the Toplica River, after which the whole region got its name. The Toplica River is the largest left tributary of the South Morava River, in length, and by the amount of water. It stems from two streams: the Djerekarusa River and the Lukovska River. Its length is 130 kilometers.

The origin of the population in the area of Toplica County

According to the results of archeological research, Toplica was inhabited in prehistoric times. This is proved by archeological findings in Prokuplje, Vica, Bace and Plocnik. These settlements belong to Starcevo culture and Vinca culture. Starcevo culture belongs to the Neolithic period between 6200 and 4500 BC. Vinca culture dated to the period between 5700 – 4500 BC. Roman bricks were found in Prokuplje, a Roman bath, various bronze objects, and the Hissar was the Roman fortress-castle. Due to the specific historical conditions in the past, the county of Toplica has a lot of simple ethnic structure.

Population and territorial distribution

Distribution of the population changes in the total population are complex and conditioned by many factors. The total population of a certain area changes under the influence of natural population growth (birth and death) and under the influence of migration (immigration and emigration). Movement of the total population by municipalities in the region of Toplica can be analyzed on the basis of a list of eight executed censuses after WWII, as follows: 1948, 1953, 1961, 1971, 1981, 1991, 2002 and 2011.

Population trends of the Toplica region from 1948-2011

Historical events had a strong influence on the movement of residents and numerous households in the area of Toplica District. After the liberation from the Turks, the first census in the newly liberated areas was carried out. Then, the territory of Toplica region had about 17,000 Serbs. After the liberation, Toplica remained deserted, and then an organized colonization was carried out and population increases. This population growth is a result of the large immigration of population from Montenegro, county of Uzice, Rasina, Morava, Vlasina and other parts of Serbia.

Table 1. Population growth in county of Toplica

Year	Population	Average annual increase	Absolute increase in population
1948.	141,502		
1953.	149,421	1,584	7,919
1961.	141,141	-1,035	-8,280
1971.	129,542	-1,160	-11,599
1981.	121,933	-761	-7,609
1991.	111,813	-1,012	-10,120
2002.	105,208	-600	-6,605
2011.	91,754	-1,495	-13,454

Source: (The Census of Population, Households and Dwellings in 2002, the book 9, National Bureau of Statistics, Belgrade, 2004)

Changing population density

The main indicator of the intensity of population is the population density. It expresses the number of inhabitants per square kilometer. According to the census of 2011, the population density in the Toplica district was 41.12 inhabitants per km². This is a half of the total population density of the Republic of Serbia, which is 81 inhabitants per km².

Table 2. The overall population density in the municipalities of the Toplica district 2011

	Area in km²	Population	Density of population
County of Toplica	2,231	91,754	41.12
Blace	206	11,754	57.05
Zitoradja	314	16,368	52.12
Kursumlija	952	19,213	20.18
Prokuplje	759	44,419	58.52

Source: (The Census of Population, Households and Dwellings in 2011 in the Republic of Serbia, Republic Institute for Statistics, Belgrade, 2013)

Table 3. The movement of population density by municipalities of the Toplica region from 1948 to 2011.

	Area in km²	Population on km²	
		1948	2011
County of Toplica	2,231	63	41.12
Blace	306	77	57.05
Zitoradja	214	99	52.12
Kursumlija	952	39	20.18
Prokuplje	759	78	58.52

Source: (The Census of Population, Households and Dwellings in 2011 in the Republic of Serbia, Republic Institute for Statistics, Belgrade, 2013)

Natural demographic trends

Natural demographic trends imply a change of the total population in a certain territory due to the effect of its two main components: births (birth) and death (mortality). The difference between these two components represents the natural growth or decline in some populations.

Table 4. Navigating the birth rate, mortality and natural growth after ten years (‰)

		1963-1970	1971-1980	1981-1990	1991-2001
	B.R	15.0	13.5	12.0	11.1
County of Toplica	M	8.3	9.8	12.8	15.4
	N.G	6.7	3.7	-0.8	-4.3

Source: For some years, the documentation of the Republic Institute

"Taking into account the annual rate on a world scale, there are three different types of birth:

High (more than 25‰)

Middle (15-25‰)

Low (less than 15‰) birth rate ". (Kicosev S., Golubovic P., 2004)

The birth rate from 1963 to 1971 had a value of 15.0‰ and the highest value in the birth rate period. Mortality rates have a different trend. The mortality rate rose steadily throughout the period. The lowest mortality rate of 8.3‰ was in the period from 1963 to 1970 and the highest 15.4‰ in the period from 1991 to 2001. As the birth rate and the natural growth in the entire period, tends to fall, in the period from 1981 to 1990 it recorded a negative rate of natural growth. This trend continued in the postwar period, when it was -4.3‰. Toplica region is economically an underdeveloped area, and therefore, employment opportunities are slight. This is why population, especially the young, are forced to emigrate. As the vast majority of the population was moving out of fertile age in the Toplica district became depopulated. In many

villages the mortality rate is above the birth rate, and there was a biological depopulation too.

Navigating the birth rate in the municipalities of Toplica region from 1963 to 2001

The birth rate of the population of Toplica region in general was high until WWII. After that, there were significant changes in the movement of birth. Except for the first post-war years, the birth rate recorded a constant decrease. The number of live births in the district of Toplica in the period from 1963-2001 had a declining trend. Accordingly, birth rates had low values.

Table 5. The birth rate from 1963 to 2001 (‰)

	1963-1970	1971-1980	1981-1990	1991-2001
County of Toplica	15.0	13.5	12.0	11.1
Blace	12.3	10.6	7.6	8.5
Zitoradja	15.9	14.6	11.1	10.7
Kursumlija	16.1	13.0	12.2	11.3
Prokuplje	15.1	14.2	13.0	12.0

Source: For some years, the documentation of the Republic Institute

In the period from 1963 to 1970, three municipalities had a birth rate above 15‰. They belonged to the zone of medium fertility. Those were the municipalities of Prokuplje, Zitoradja and Kursumlija. Blace municipality belonged to the low birth rate zone (less than 15‰). At the end of the period, in the censuses from 1991 to 2001, there were significant changes in the movement of the birth rate. The lowest birth rates were recorded in the municipality of Blace, only 8.5‰, while the highest rate was recorded in the municipality of Prokuplje 12‰.

Changes in mortality rate in the municipalities of Toplica region from 1963 to 2001

Mortality is the negative component of natural population growth, which leads to a decrease in a number of people in one territory. The period before WWII on the territory of Toplica region was characterized by high mortality. In the post-war period the mortality trend recorded a faster fall. The decrease in population mortality is due to improved health and hygiene conditions of life, good health organization. In addition to medical factors, the

reduction in mortality rates affected the general level of culture of the population and various forms of social protection. In the period from 1963 to 2001, there was a significant change in this component of natural population growth. At the level of the Toplica district mortality rates recorded constant growth from 1963-2001. The lowest mortality rate of 8.3‰ was at the beginning of the period under review, while the highest in the period from 1991 to 2001 when it was 15.4‰.

Table 6. Changes in mortality rates from 1963 to 2001. year (‰)

	1963-1970	1971-1980	1981-1990	1991-2001
County of Toplica	8.3	9.8	12.8	15.4
Blace	9.2	10.7	14.8	16.9
Zitoradja	7.4	8.7	11.8	13.9
Kursumlija	8.2	9.7	13.2	15.6
Prokuplje	8.3	9.9	12.3	15.4

Source: For some years, the documentation of the Republic Institute

Natural increase

Natural increase is the difference between the number of births and number of deaths in a certain area in a certain period of time. Thus, natural population growth is directly associated with fertility and mortality. Natural growth as an essential component of demographic development, it can be positive (when the birth rate is higher than mortality) or negative (when the mortality rate exceeds the birth rate).

The movement of natural growth in the municipalities of Toplica region from 1963 to 2001

The area of Toplica region after WWII is largely characterized by a high birth rate and mortality. Nevertheless, the birth rate had over the rates of mortality, natural growth was positive, which inevitably led to an increase in the number of inhabitants.

Table 7. The movement of the population growth rate from 1963 to 2001(‰)

	1963-1970	1971-1980	1981-1990	1991-2001
County of Toplica	6.7	3.7	-0.8	-4.3
Blace	3.1	-0.1	-7.2	-8.4
Zitoradja	8.5	5.9	-0.7	-3.2
Kursumlija	7.9	3.3	-1.0	-4.3
Prokuplje	6.8	4.4	-0.2	-3.4

Source: For some years, the documentation of the Republic Institute

After WWII, there was a higher population growth rate, especially in the buffer period. However, keeping in mind that this period was short, but from the sixties things began to change affecting the overall demographic development. At the level of the district population growth rates were constantly decreasing during the period. The highest are at the beginning of the period (6.7‰) and the lowest at the end (-4.3‰).

Migration

Migration movements in the Toplica district were intensified between the two world wars, and after WWII. The reasons for the intense migration were mainly conditioned by the economic situation. After the liberation, economic life rapidly intensified as it did in other parts of Serbia too. Due to high natural increase and the lack of employment opportunities, there was also a relative surplus of population. Increasing volumes of migrations in the period from 1961 to 2011 can be traced from the change in the percentage share of the indigenous and migrant population. In 196 the share of the total migratory population in Toplica was 30.1% and ranged from 24.3% in Zitoradja, 28.9% in Kursumlija, 30.2% in Blace to 33.2% in Prokuplje. According to the census in 2002, the share of the total migrant population in the area of Toplica region is 40.1%. Regarding the 2011 census, a decline was observed in the total migrant population in relation to the previous census period. At the level of the district, the largest share of migrant settlers was from the territory of the same municipality (50.4%) and the lowest from other countries 0.8%. According to the 2002 census, the largest share of immigrants from the territory of the same municipality was in Kursumlija 1.5%, and the lowest in Prokuplje 45.7%. On the other hand, Kursumlija municipality had the smallest proportion of immigrants from the territory of other municipalities of the same republic (24.9%), while the percentage is the highest in the municipality of Zitoradja and amounts to 44.2%. The share of immigrants from other republics or

provinces was far less than the two previously mentioned categories, but it was the largest in the municipality of Prokuplje. It is interesting that in the context of less developed municipalities migration taking place within the municipality, i.e. the share of immigrants from the territory of the same municipality is relatively high. This mobility of population led to significant changes in the structure of the population of villages and towns. There is a deterioration in the economic and age structure of the population in the countryside, but also an increase of the concentration of people in less space, in the city center.

Gender structure of population in the municipalities

Masculinity coefficient of the total population of the district of Toplica in 1961 amounted to 894.3, the lowest value of this ratio in the period. After that, the coefficient of masculinity was growing, and in the next census period in 1971 reached the value of 941.7. According to census data from 1981 the value of masculinity coefficient was 984.6, and already in the next census period 986.6. Since 1991, the value of masculinity coefficient in the area of Toplica region increased and in 2002 amounted to 977.7. On the whole, the coefficient of masculinity during the whole period was lower than 1000, indicating an excess of female compared to male population.

Table 8. The changes of the coefficient of masculinity in the municipalities of Toplica region from 1961 to 2011

	1961	1971	1981	1991	2002	2011
County of Toplica	894.3	941.7	984.6	986.6	997.7	1,011
Blace	869.2	923,3	965.8	964.4	981.7	993.2
Zitoradja	930.5	980.0	1,028.6	1,034.7	1,029.3	1,043
Kursumlija	883.0	937.4	988.0	994.4	1,025.1	1,055
Prokuplje	897.6	936.4	974.8	972.5	987.7	986.3

Source: (Calculated on the basis of the results list, the documentation of the Republic Institute)

As per municipalities of the district, there are some differences. Thus, the coefficient of masculinity in all municipalities of Toplica region was lowest in 1961. After that, the coefficient of masculinity was growing, and already in 1971, in the municipality Zitoradja reached the maximum value (980.0), and since 1981 exceeded 1,000 in the same municipality. Among other municipalities of the county, only the municipality of Kursumlija had the

masculinity ratio above 1,000 (2002 census). According to the results of the 2011 census, the largest value of the coefficient of masculinity was recorded in the municipality of Kursumlija, which amounted to 1,055. The lowest value of the same year was recorded in the municipality of Prokuplje (986.3). Gender structure by age groups was mainly different. The highest rates of masculinity occur in the age group of 0-19, and the lowest in the age group of 60 and over according to the census of 1961. However, according to the 2011 census, the situation changed. The largest share of men in the total population was in the age group of 20-39, while the share of the age group of 0-19 was slightly lower. The smallest share of the total male population was in the age group of 60 and over. As for the coefficient of femininity in the entire county, it was 989. The largest number of femininity is in the age group of 60 and over and it was 1,199.1. As per the municipalities of the district, the femininity ratio was lower than 1000 in all age groups except the last (60 years and over). Only the municipality of Blace in this age group had a lower coefficient of femininity from other municipalities of the county and it was 977.

Table 9. The changes in the coefficient of femininity by age population in 2011

	In total	0-19	20-39	40-59	60 and more
County of Toplica	989.0	914.2	910.2	928.3	1,199.1
Blace	1,006.9	956.8	873.4	930.7	977
Zitoradja	95.9	966.8	905.6	846.05	1,111.9
Kursumlija	948.2	864.2	862.2	477.8	1,190.2
Prokuplje	1,014	907.8	941.2	976.1	1,238.9

Source: (The Census of Population, households and apartments in 2011 in the Republic of Serbia, the Republic Institute for Statistics, Belgrade, 2012.)

Changes in the age structure in the municipalities of Toplica region

There were significant changes in the natural and mechanical movement of the population in the area of Toplica region in the second half of the twentieth century, which was reflected in the age structure of the population of the district as a whole. These changes mostly had negative tendencies, and influenced the deterioration of the age structure of the population.

"The demographic studies of the age structure of the population, is an important indicator of the aging index, which shows the number of persons aged 60 years and over in relation to the number of persons younger than 20 years. The importance of this indicator is reflected in the fact that it shows the

relative proportions of the old and young population. As a critical value is taken 0.4“. (Kicosev S., Golubovic P., 2004). Looking at the county in the period from 1961 2011 we can see a steady erosion of the share of the young population in the total population from 40.6% (1961) to 20.8% in 2011. The share of the older population increased from 8.8% at the beginning of the period, to 27.9% in 2011. Municipalities had a reduction in the share of young and an increase in the share of the older population in the total population. By the municipalities of the district, we can see differences in index values. At the beginning of the period, all municipalities have the index value under 0.4. Already in 1981, the value of the index exceeds, and has the highest value in the municipality of Blace (0.87). However, in 2011, the index value exceeds the age of 1, both at the district level, as well as on the territory of all municipalities.

Table 10. The index age Population in the municipalities of Toplica region in 1961, 1981 and 2011.

	1961	1981	2011
County of Toplica	0.21	0.60	1.35
Blace	0.24	0.87	1.9
Zitoradja	0.21	0.59	1.38
Kursumlija	0.18	0.55	1.28
Prokuplje	0.22	0.55	1.22

Source: (Calculated on the basis of census data for individual years, the documentation of the Republic Institute)

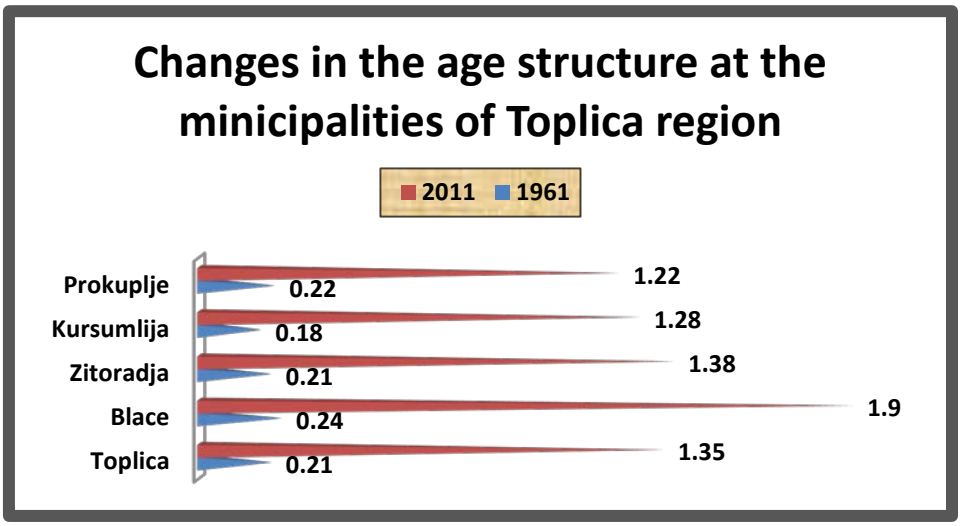

Figure 2 - The index age population in the municipalities of Toplica region in 1961 and 2011

The economic structure of the population

After World War II, due to changes in the structure of the economy, as well as various demographic processes, there has been a change in the population of Toplica region by economic factors. According to the criterion of activity of the population is divided into three categories:

The active population (labor force)

Persons with personal income and

The dependent population.

Table 11. Population Toplica region by activity in 2011

	Active population		Persons with personal income		Dependents	
	Number	%	Number	%	Number	%
County of Toplica	32,014	34.9	24,476	26.7	35,264	38.4
Blace	4,098	34.9	3,822	32.5	3,834	32.6
Zitoradja	4,949	30.2	4,376	26.7	7,043	43.1
Kursumlija	6,440	33.5	4,916	25.6	7,857	40.9
Prokuplje	16,527	37.2	11,362	25.6	16,530	37.2

Source: (The Census of Population, households and apartments in 2011 in the Republic of Serbia, the Republic Institute for Statistics, Belgrade, 2012)

Analysis of the total population of this region by activity in the period from 1961 to 2002 indicated a decline in the share of the active and dependent population in the total population and increasing proportion of persons with personal income. According to census data from 1961, the active population consisted of 50.0% of the total population and the activity rate in 1971 increased to 52.4%. In the coming periods there was a decrease in the activity rate, so according to the 2002 census, it was the lowest in the municipality of Zitoradja (39.9%). In other municipalities of the county the activity rate was slightly higher. Another tendency observed at the level of the district is an increasing number of people with personal income, which is recorded in the whole observed period. The causes of this increase in people with personal income are the result of an increase in the number of people using various forms of social assistance, changes in the age structure of employees. The third category of the population in terms of activities is dependents, where the opposite trend it evident, unlike in the case of the previous categories. Bearing in mind that this category had mainly young people (pupils, students), it is clear that the downsizing was a direct result of the misbalance in the age structure

of the population which was reflected in the declining share of young people in the total population. Based on the results of the 2011 census, there is a downward trend of increasing the share of active and dependent people in the total population and reducing the share of persons with personal income.

The educational structure of the population

The educational structure of the population is an important feature of any population which is directly related to the achieved level of socio-economic characteristics of the development of the population. The basic characteristics of the population by the educational structure are literacy and qualifications.

Table 12. Population aged 15 and over by educational attainment

	1961				1981					2011					
	No education or incomplete	Primary education	High school	Higher education	No schooling	Primary education	High school	Higher education	High education	No schooling	Primary education	High school	Higher education	High education	Unknown
County of Toplica	90.6	4.8	4.1	0.5	31.7	20.9	16.1	1.7	1.2	19.9	24.02	45.1	5.01	5.67	0.39
Blace	90.3	4.3	3.1	0.3	36.8	17.6	14.6	1.3	0.9	23.3	21.1	45.0	5.01	5.4	0.2
Zitoradja	94.2	3.6	2.0	0.2	36.5	19.0	10.5	0.9	0.2	28.2	26.4	40.0	2.9	2.0	0.4
Kursumlija	92.5	3.8	3.3	0.4	33.9	22.2	14.6	1.2	1.2	18.6	26.7	44.8	4.3	5.5	0.1
Prokuplje	87.6	5.9	5.7	0.8	27.2	22.1	19.3	2.3	1.7	16.3	22.7	47.1	6.1	7.1	0.5

Source: (Calculated on the basis of the results of the census of 1961, 1981 and 2011, the documentation of the Republic Institute).

Literacy

According to census statistics, literate people are those who are 10 or older, who can read and write. In the area of Toplica region, the number of illiterates was reduced from 32,527 to 3,629 people in the period from 1961 to 2011. At the same time, there was a decrease in the share of illiterate people in the total population from 28.7% in 1961 to 4.36% in 2011. One of the factors that contributed to the decrease in the share of illiterate people in the total population is the introduction of compulsory eight-year education, as well as courses for literacy for the adult population.

Educational attainment

This structure can be traced on the basis of the list after WWII, in this case on the basis of census data of 1961, 1981 and 2011, with a difference that using the methodology of the census of 1961 covered people older than 10 and the censuses of 1981 and 2011 individuals older than 15. The total share of the population of Toplica region without school education and primary school leavers in 1961 was 90.6% and in 2011 was 19.9%.

Conclusion

Modern demographic development of the municipalities of Toplica region follows major changes in population trends, natural and mechanical movement of population and population structures, changes in the number, size and structure of households and families. A sharp decrease in the birth rate is evident and also an increase in the mortality rate and a decline in natural growth, both at the level of municipalities and the Toplica district. There is a significant process of demographic aging, another demographic process the population of Toplica district is also affected by. All demographic trends observed in the municipalities of Toplica district are a major problem that requires adequate scientific treatment, as well as the engagement of the state in the implementation of population policy measures aimed to a better demographic future.

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