

PROBLEMS OF POLLUTION IN THE REGION OF POLOG

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Abstract

In recent years, the city of Tetova and surrounding settlements are facing different problems of environmental pollution, starting from the pollution of soil, water, and air.

As a result of floods caused by nature and various activities that human factor develops, various pollutants are created, emitted and thrown into the environment, which have caused pollution of the main elements of the environment, such as: soil, water and air.

In this case, the main purpose of this paper is to ascertain what is the main source of environmental pollution, what are the pollutants, causes and consequences of pollution.

Taking in consideration that soil and water pollution results from the disposal of solid waste and wastewater, on the other hand, atmospheric pollution is due to the presence of particulate matter, PM10 particles, the research will be based on the finding and identifying the cause of the pollution as well as identifying the main sources of pollution and pollutants. The data will be provided directly, from the literature as well as by applying the method of analysis and comparison.

Results shows that pollution comes primarily from the activity of the anthropogenic factor as a result of the use of fuels.

Air pollution with particulate matter occurs throughout the year, primarily as a result of the use of fuels by industry and traffic.

Keywords: Pollution, fuel, particles, environment

1. Introduction

Nowadays, many rural but also rural settlements are facing different problems of environmental pollution. In this case, we are dealing with the municipality of Tetova as an urban settlement as well as the rural settlements (six municipalities) around it. Unfortunately, these settlements today face numerous and varied problems that have affected the environmental pollution and the deterioration of life and health of people, material goods as well as negative economic effects. The city of Tetova and other rural settlements, for years, have been facing problems of natural flooding as well as problems caused by the human factor, such as: solid waste, lack of road infrastructure, atmospheric water and sewage, uncontrolled burning of waste, urban traffic, as well as the emission of pollutants as a result of the use of fuel in households, traffic, and industry. All this has resulted in pollution of key elements of the environment, such as: soil, water, and atmosphere. Therefore, as mentioned above, the main purpose of this paper is that by identifying these environmental problems, pollution sources as well as polluting substances, to influence the consciousness and awareness of the population, to influence municipal and state bodies in taking concrete and urgent measures as well as investments in prevention and elimination of these problems and the negative consequences they create.

2. Material and methods

2.1 The research problem

When it comes to environmental pollution issues and problems, they are unfortunately numerous in our country starting from the pollution of soil, water and air. This is mainly due to human activities in daily life, but also by the natural factor. The Republic of North Macedonia, namely its government, for a long time has been facing problems of different nature: political, economic and social. All this has of course, resulted in numerous ecological problems. Its multi-year investment policy in the capital city alone has left aside rural settlements, while municipalities' economic opportunities for investment are severely reduced. This, of course, has caused many other municipalities such as Tetovo to deal with problems of different nature, such as: lack of road infrastructure, atmospheric water, and sewage system, parking lots, regional sanitary landfill (appearance of wild landfills), urban traffic, drinking water supply, etc.

2.2 Research methodology (research methods)

Considering that environmental pollution in Tetovo and its surroundings comes from both natural and anthropogenic factors, we will analyze and investigate the environmental pollution that has occurred in recent years in Tetovo and its surroundings by the natural factor as well as pollution, sources of pollution and pollutants caused by anthropogenic factor. In the end, we will compare which of these factors is the biggest and most dangerous polluter for the environment, nature or human beings?

2.3 Sources of environmental pollution

From field situation research, we have seen that environmental pollution stems from two factors: natural and anthropogenic. In the following, we will present the pollution caused by these factors.

2.3.1 Pollution from the natural factor

It is known that in of 36 years in Tetovo and its surroundings, two natural disasters have occurred. Both cases are related to the Shkumbin river floods. The first case occurred in 1979 and the last one also from the same river flooding in August of 2015 in several other settlements, in which case some people, unfortunately lost their lives and huge material damage was caused. In both cases, the floods have caused extensive material damage, economic and environmental pollution with solid waste and dust, while the last case accompanied by casualties. It is a fact that we can not oppose and stop these natural disasters, but it is also a fact that with our actions we can multiply these negative effects in various ways, as we can also reduce them. In the last case during the floods that occurred, it must be concluded that the human factor has had a major negative impact on the growth of the effect and negative impact of these floods. The human negative impact has come as a result of his irresponsible activity, throwing various inert wastes that cause the interruption of water flow, cutting of trees and deforestation, lack of construction or irregular maintenance of existing barriers (dams) along river flow, not adjusting the riverbed as well as the construction of bridges over the river, which have a very low altitude from the level of the riverbed, such as the bridge in the industrial road, which during the flood was immediately blocked, filled up and flooded throughout the city, by which many basements and houses were filled with water and waste brought on by the flood.



Figure 1. The floods in Tetovo - 1979



Figure 2. The floods in Tetovo - 2015

2.3.2 Pollution from the anthropogenic factor

Unlike pollution that comes from natural factors, which occurs not as often, the greater and continuous pollution comes from the anthropogenic factor. Now the logical question arises, which are the sources of pollution from the anthropogenic factor?

From this research, we came to the conclusion that the sources of pollution from anthropogenic factors are numerous. Environmental pollution mainly results from the use of fuel in: industry, traffic, households as well as uncontrolled burning of various wastes.

2.3.2.1 Pollution from solid waste

While in many developed countries of the world the problem of solid waste has not only found a solution and as such does not exist, but it has become an opportunity to obtain secondary raw materials. In our country, those represent a very major environmental problem and at the same time economic losses. We should emphasize that from the aspect of the legislation everything is in order, as the legal regulation harmonized with that of the European Union has been adopted.

Legal regulations in the Republic of North Macedonia from on environmental protection:

- **Law on Environment**
 - **Law on Waste management**
 - **National Strategy for waste management.** (2008-2020) 12 Y
 - **National Plan for waste management.** (2009-2015) (6 V) 10 Y
 - **National Program for waste management.** 1 Y

At the regional and local level:

- **Regional Plan for waste management** 10 y
- **Regional Program for waste management** 1 y
- **Municipal Plan for waste management** 3-6 y
- **Municipal program for waste management** 1 y

Although there is legal regulation, in practice there are many problems as a result of the inability to implement it. The lack of a regional sanitary landfill, the professional and economic inability and incapacity of municipalities, and the lack of co-operation of municipalities at the regional level, are the main causes of the problem of municipal solid waste.

As a result, there are a large number of “wild” landfills in Tetovo and its surroundings, which means that we do not have complete management of all settlements and

households. In the table below we have presented the data for solid waste management in the region of lower Polog.

Table 1. Population and the amount of municipal waste by municipalities

No.	Name of the MUNICIPALITY	Population calculated in 2011					Quantity of municipal solid waste					
		Total	Managed		Not managed		Generated	Collected		kg/y	Not collected	
1	2	3	Pop.	%	Pop.	%	t/y	t/y	%	resid.	t/y	%
1	2	3	4	5	6	7	8	9	10	11	12	13
Urban municip.		54%					73%					
1	TETOVO	94691	78531	83	16160	17	42415	36500	86	465	5915	14
Total I		94691	78531	83	16160	17	42415	36500	86	465	5915	14
Rural municip.		46%					27%					
3	TEARCE	24558	11781	48	12777	52	3360	1612	48	137	1748	52
4	JEGUNOVCE	11801	4685	40	7115	60	2619	1040	40	222	1579	60
5	ZELINO	26675	12688	48	13987	52	4373	2080	48	164	2293	52
6	BERVENICA	17340	9265	53	8076	47	2822	1508	53	163	1314	47
7	BOGOVINJE	31714	19446	61	12267	39	8481	5200	61	267	3281	39
Total II		112088	57865	52	54222	48	21655	11440	53	198	10215	47
TOTAL I+II		206779	136396	66	70382	34	64070	47940		351	16130	

Source: Doctoral thesis A. Idriži, 2013

2.3.2.1.1 Inert waste

There is no inert waste management at the local and regional levels, so they dumped everywhere in different settlements. As a result, many villages have accumulated large amounts of inert waste along roadsides or river flows.

2.3.2.1.2 Pollution from uncontrolled burning of waste

Uncontrolled burning of solid waste is a very serious problem, which also affects the pollution of the environment-atmosphere. Although there are environmental inspectors in all municipalities, their influence and action are not felt at all.

2.3.2.1.3 Pollution from sewage and atmospheric water

It is one of the main problems of all settlements, mainly rural ones because there is no system for wastewater management and treatment. Even in the city of Tetovo, although there is a system of sewage and collection of atmospheric and sewage waters, there is no system for their treatment and they discharged into the river. In rural areas, households water is collected in septic holes.



Figure 3. a) Solid waste

b) Uncontrolled burning of waste

2.3.2.2 Pollution from traffic

Traffic is also one of the biggest environmental-atmosphere pollutants. Today, Tetovo with its soundings counts approximately 40,000 vehicles that are constantly on the move. Infrastructure problems across the city, lack of urban traffic and parking lots, occupation of pedestrian sidewalks by small businesses have caused a real chaos, and we are not sure which expression is mostly applied for the city of Tetovo: "there is no parking place" or "the whole city is a parking lot". The city of Tetova is not more than 5 kilometers from one end to the other, which road during a standard driving should be traversed for 6 minutes, but thanks to many obstacles along the way, it takes about 10-20 minutes to pass this distance. This means that a car passing through the city consumes fuel and pollutes as many as two or three cars together. The other reason for pollution is that a large number of vehicles are outdated and during their operation, they emit many times more PM10 and PM2.5 particles than new vehicles.

For example, a car under normative:

EURO 3 - in one kilometer past the road, emits 0.5 micrograms of PM particles into the air, while

EURO 5- manufactured from September 2009, emit 0.05 micrograms of PM particles into the air.

2.3.2.3 Pollution from industry

Tetovo in the near past was a city with a developed industry, where there were a large number of industrial facilities located in the so-called "industrial zone". Today, these industrial capacities do not exist or are no longer functioning. Whereas those that still exist, such is the case of the textile factory, work with minimal capacity, while the former territory of the industrial zone is already populated. The only industrial capacity still operating is the Metallurgical Extractive Company "Jugohrom", which is located at a distance of 15 km from the city. But the impact of the operation of this plant is felt in all the area of the municipality of Tetovo and other municipalities around it. The cause of this plant's impact is its inappropriate position, where northern winds disperse the smoke from high chimneys throughout the entire of the region of lower Pollog, due to its relief with mountains all around. The electro-metallurgical combines produce the Ferrosilic FeSi alloy, which processes use silicon dioxide and iron (iron scrap) 25% as raw material. For the reduction of silicon dioxide (SiO_2), coal is used as a reducing agent. In this case, we must emphasize that during normal one-year work at full capacity large quantities of reducing agents, coal, and wood are consumed. In this case, we will present the data we possess for the amount and type of fuel used in 1995 and 2005:

Quantity of fuel

- in 1995 it was 191.423 t
- in 2005 it was 154.387 t
- we have a decrease of - 37.036 t

Type of fuel

Coal:

- in 1995 participates with 160.000 t
- in 2005 participates with 145.444 t

Wood:

- in 1995 participates with 30.000 t
- in 2005 participates with 8.943 t

2.3.2.4 Pollution from institutions and households

2.3.2.4.1 Pollution from institutions

Another source of environmental pollution, specifically of the atmosphere, is the use of fuel in state and municipal institutions located on the territory of these municipalities. These institutions are mainly municipal objects, educational, judicial, police, cultural, banking, and other facilities. These mainly use oil as fuel for heating during the winter season, but there are also some that use electricity. We should emphasize that some of the information on fuel quantity and type was provided directly by the institutions themselves, while the rest was calculated by statistical and comparative methods. These data are presented in tabular form for each municipality.

Table 2. The quantity and type of the fuel used in institutions

No.	Institution	Activity	Type of fuel					Total
			wood	coal	oil	mazut	pellets	
			t/y	t/y	t/y	t/y	t/y	t/y
I	FUEL USED IN INSTITUTIONS							
	Municipalities							
1	Tetovo	Social	0	0	1460	300	0	1760
2	Tearce	Service	0	0	120	0	0	120
3	Jegunovce	Educative	0	0	80	0	0	80
4	Zelino	Educative	0	0	120	0	0	120
5	Brvenica	Educative	0	0	100	0	0	100
6	Bogovinje	Educative	0	0	120	0	0	120
Total			0	0	2000	300	0	2300

2.3.2.4.2 Pollution from households

The households in the settlements of these municipalities mainly use wood as fuel for heating, while a very small part use oil, electricity and recently there is an increasing trend of using renewable fuel - pellets. The calculation of the quantity and type of fuel used in households is based on the average statistical data provided by the statistical office for a period of 7 years.

According to statistical data, the average value of the fuel that each family consumes for heating is 4 m³ wood or 3000 kg per year (1 m³ = 750 kg).

Table 3. The quantity and type of fuel used in households

No.	Municipality	Residents	Household	x 4 m ³	Wood
			ne household.	x 4 m	t
1	TETOVO	94691	21521	86083	64562
2	TEARCE	24558	5581	22325	16744
3	JEGUNOVCE	11801	2682	10728	8046
4	ZELINO	26675	6063	24250	18188
5	BRVENICA	17340	3941	15764	11823
6	BOGOVINJE	31714	7208	28831	21623
Total		206779	46995	187981	140986

Source: From doctoral thesis A. Idrizi

3. The results of the research

The results of the research show that pollution from natural factor occurred in certain years and lasted for a certain timeframe. The consequences of this pollution for a short time were eliminated. But, environmental pollution, mainly air, continues. This indicates that we are dealing with pollution caused by the anthropogenic factor.

Based on the data collected by Automatic Monitoring Stations located in different cities of the Republic of North Macedonia, one of which is also located in the city of Tetovo, it can be seen that from all settlements in Macedonia, it results that Tetovo and its surroundings is one of the most polluted settlements.

Data show that during the 297 days a year (2016) have been polluted above the Maximum Allowed Concentrations with PM10 particles (MAC for PM10 particles is $50 \mu\text{g}/\text{m}^3$). This pollution has been present for several years. Pollution of the atmosphere with PM10 particles mainly results from anthropogenic activities as a result of burning fuel in the above mentioned activities. Then, based on the amount and type of fuel used in these activities, we have determined that the largest amount of fuel is used during the winter season where apart from industry and traffic, households and institutions are also users of fuel for heating at this time.

So, based on the data on the quantity and type of fuel used in three sectors, we have:

- Industry.-data for 2005:

- (Jugokrom Combine 145444t coal + 8943t wood = 154387t, and
- TeteKS+indust. 37700t coal + 2649t mazut + 495t wood = 40844t.

- Traffic-** the amount of fuel is statistically calculated, taking into account the number of vehicles and their average consumption at a distance that this region has from one end to the other - 100 km. So, 40,000 vehicles consuming an average of 6 liters/diesel over 300 days.

- Households and institutions-

- Households-141000 t wood, and
- Institutions- 50 t wood + 2000 t oil + 300 t mazut = 2350 t.

Table 4. The amount and type of fuel used by anthropogenic activities

No.	Institution	Type of fuel						Total	Ne %	
		Coal	Wood	Oil	Mazut	Gas	Pellets		Indiv.	bashk
		t/y	t/y	t/y	t/y	t/y	t/y	t/y	%	%
	THE TYPE AND QUANTITY OF FUEL USED									
I	INDUSTRY									
1	JUGOKROM 2005	145444	8943					154387	38	47.5
2	TETEKS 2005	37700	495		2649			40844	10	
Total 1		183144	9438	0	2649	0	0	195231	47.5	
II	TRAFFIC									
1	40.000x0.006x300=			72000				72000	17.5	17.5
III	HOUSEHOLDS + INSTITUTIONS									
1	Households		141000					141000	34.3	35
2	Institutions		50	2000	300			2350	0.6	
Total 2		0	141050	2000	300	0	0	143350	35	
Total 1 + 2		183144	183158	74000	2949	0	0	410581	100.0	100

4. Discussion

From the results of this research, we can conclude that the environmental pollution in the Tetovo region and its surroundings comes from natural and anthropogenic factors. The pollution that comes from the natural factor has occurred twice over a period of 36 years and was primarily as a result of the flooding of the Shkumbin river. We should emphasize that the negative effect of this pollution also comes as a result of the human factor, so we consider that these floods may be reduced in the future by human intervention.

The main source of pollution in this region mainly comes from the anthropogenic factor as a result of its activities in social, economic and industrial sectors. Of the main environmental parameters, the most polluted turns out to be air, from the presence of PM10 particles. Given that this pollutants result from the use of fuel, according to data from the system of automatic monitoring stations located in the Republic of North Macedonia, it results that Tetova and its surroundings are among the most air-polluted settlements, where during the year, 297 days were recorded above the Maximum Allowed Rates.

Considering that the pollution of the environment-air with PM10 particles occurs throughout the year and considering the amount and type of fuel used in the above-mentioned activities, we consider that the main source of air pollution is industry, specifically in our case, the combine Jugokrom, which during its work uses large amounts of fuel, mainly coal, followed by households and institutions, which use fuel mainly for heating purposes, but only during the winter season. While, the last in terms of the use of fuel and environmental pollution comes to traffic, which is used throughout the year.

5. Conclusions

From this paper we can draw some conclusions:

- Environmental pollution in this region mainly comes from the anthropogenic factor,
- We mainly deal with air pollution with PM10 particles throughout the year,
- The main source of pollution comes from the use of fuel in the above-mentioned activities,
- The main environmental –atmospheric polluter is the Jugohrom combine, due to the lack of filters and the high use of fuel, then come households and institutions, and finally traffic.
- Road infrastructure and uncontrolled burning of solid waste throughout the city and other settlements also have an impact on the environment pollution.

Recommendations:

- Installation of filters in the combine of Jugokrom, respectively compliance to the legal standards on gas emissions,
- Gasification of the city,
- Regulation of road infrastructure and the use of urban transport through the city.

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