Project title: Constructed Wetland for Nutrient Reductions in the Waters of Tirana River (1 November 2009 - 31 August 2010)

FIRST REPORT OF ENVIRONMENTAL ASSESSMENT IN TIRANA RIVER (Place Bregu Lumit) – February 2010

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Introduction

Institute for Environmental Policy (IEP), in partnership with Ekolëvizja and Tirana Municipality, has started and is managing the "Constructed Wetland for Nutrient Reductions in the Waters of Tirana River in Albania" project. The aim is to set up a wetland for one or two discharge channels, in the place known as Bregu Lumit (Fig. 1), in order to reduce the nutrients input in Tirana River; wetland vegetation and other aquatic microorganisms will help to capture, degrade and process the excessive nutrients.

The group of experts for the first environmental assessment

The first environmental assessment was made by the following group of chemists and biologists from the Faculty of Natural Sciences, Tirana University:

- Dr. S. Duka, chemist, working group of Analytical Chemistry, Department of Chemistry;
- Prof. M. Hysko, microbiologist, working group of Molecular Biology-Microbiology, Department of Biology;
- Prof. A. Miho, botanist (microscopic algae - diatoms), working group of Botany, Department of Biology.

Two visits were carried on in the zone:

- The first was in 19 January 2010, aiming to know with the place and select the most proper stations for monitoring.
- The second was in 09 February 2010, ore 13.00, where the samples were collected, and other measurements in situ were carried on. The details about the sampling stations, and types of the samples collected are given in the table 1, and shown in the satellite map of figure 2. Four set of samples were collected (Tab. 1): a) for physico-chemical analysis; b) nutrients (nitrogen and phosphorous; c) for microbiological state; and d) for periphyton (microscopic algae – siliceous algae or diatoms - *Bacillariophyta*).

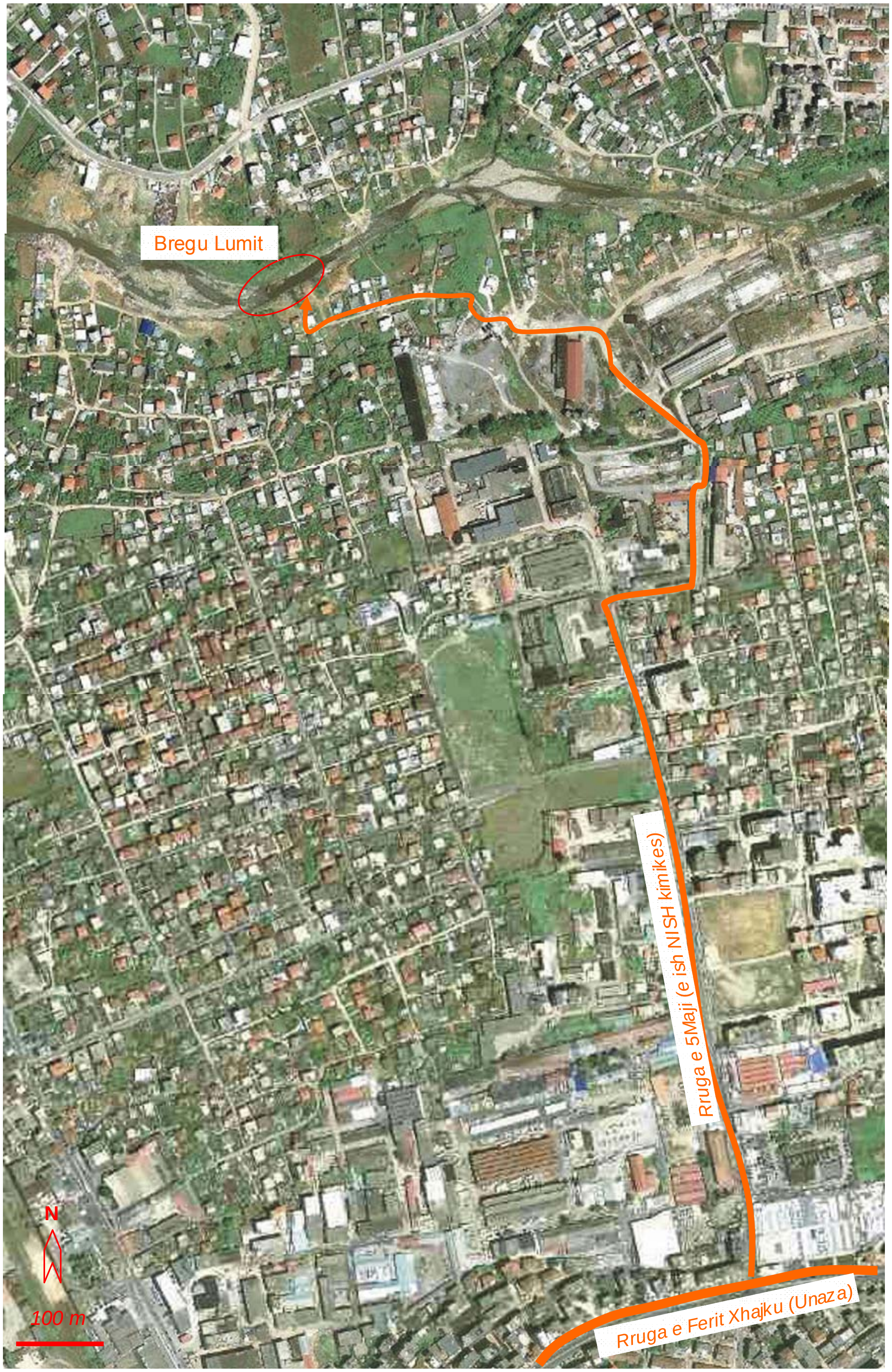

Figure 1. Satellite view where the river place Bregu Lumit is shown (elaborated after Image © Terremetrics, Europe Technologies and Digital Globe, Google Earth 2008).

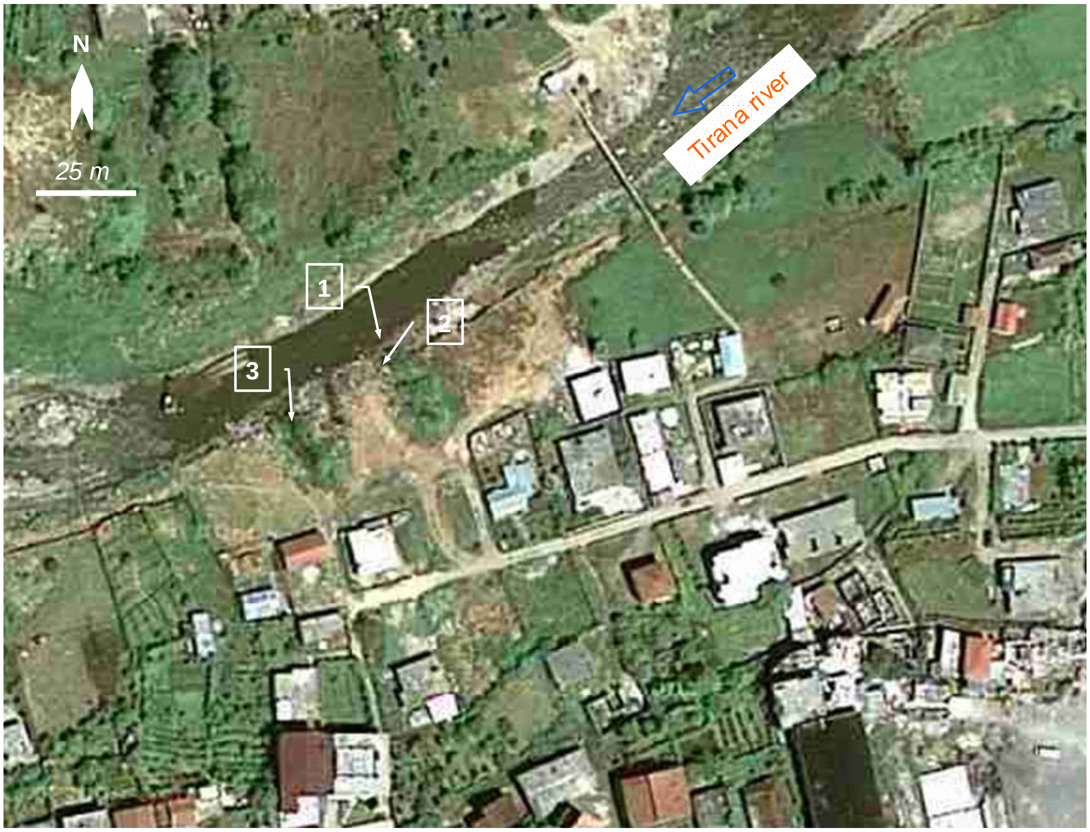

Figure 2. Satellite view of the three stations in the river place Bregu Lumit (elaborated after Image © Terremetrics, Europe Technologies and Digital Globe, Google Earth 2008).

- The position of the place and the related sampling station are shown in the map of the figure 1 and 2. While the photos of the figure 3 show the state of the place where the wetlands is intended to be build, with the two discharging channels and Tirana river bank.

Description of the place

The place is found ca. 2 km far from the main road Ferid Xhajku (known as Unaza) at the north-eastern part of Tirana; it can be reached through the road 5 Maj (Fig. 1); at the end of the road, there are some abandoned rests of the former industrial place (former Chemical Enterprise); the place now is almost urbanized by small houses; some of them in the way of building even in the present day, even less than 30 m far from the river bank.

The two small wastewater channels are close to each other (ca. 20 m) (Fig. 2); their water course is quite low, running in open part only ca. 20 m far form the lakeshore; their upstream part goes under ground in a collecting pipeline. Probably, these two channels were formerly small torrents, transformed in collectors of the wastewater from the urbanized and the former industrial area; nevertheless, the quantity of water was quite low in both channels. Their open part is covered scarcely by the vegetation, like shrubs of *Salix* sp., *Rubus* sp. and *Typha* sp., and bacterial patches that help somehow to phytoremediate the water. The riverbanks were almost transformed from its natural state, due to the rests of the building materials deposited along. The riverbed is build up of gravel and stones; the water course was higher than normal, due to the heavy rainfall during previous period; the color of the water was green milky, highly turbid, due to the high amount of suspended solids. Riverbed as the riverbanks was heavily spoiled with plastic garbage and other solid waste. The photos in the figure 3 show different view from the discharge channel (A and B) and from the river place Bregu Lumit (C and D).

Figure 3. Photos from the river place Bregu Lumit: A-B) view of the discharge channel (sampling station 2); C-D) views from the down and upstream parts of the river (sampling station 1) (Photos A. Miho).

Table 1. Sampling code, stations and other details about the environment assessment of Tirana river, in the place known as Bregu Lumit

Kode	Station	River	Date	Notes
1	River	Tirana	09.02.2010	a) Physico-chemical measurements *in situ*; b) Nutrient water samples; c) Microbiological water samples; e) Periphyton samples over plastic garbage submersed on the water
2	Discharge 1 (upstream)			
3	Discharge 2 (downstream)			

Methods of the analyses

Physico-chemical analyses ad nutrients: Conductivity, pH, temperature, suspended matter, nitrites, nitrates, ammonium and phosphates were analyzed after Hach (2001) and APHA/AWWA/WPCF (1995). Nutrients: Nitrogen (N_{O2}-N, NO_3-N, NH_4-N) and phosphorus (PO_4-P) in water were measured using UV-VIS spectrophotometry, following the standard methods recommended by APHA/AWWA/WPCF (1995).

Microbiologic investigation: The microbiologic investigation was carried on following the relevant ISO standards for microbiological water analyses. About 200-250 mL of water was taken in each station using sterile glass bottles (at 180°C for 90 minutes); the samples were transported in a chilly bin to the laboratory within the sampling day, and tested within 30 hours (ISO 5667-6:1990). The MPN (Most Probable Number) test and the nutrient Media EC were used for the **fecal coliform** testing (Tab. 2); the incubation was done at 44.5ºC. Looking for gas production tubes, the confirmation test in Mc konkey media plating was used and the indol test, as well. The measurement was done by using the MPN statistical tables for river waters and is expressed as the number of organisms per 100 mL (CFU/100ml). The MPN (Most Probable Number) test and the Nutrient Media Lactose Broth (LB) are used for the **total coliform** testing; the incubation was at 37ºC, looking for gas production tubes, and the confirmation test in Mc konkey media plating. The measurements were done by using the MPN statistical tables for river waters. The **heterotrophic bacteria** testing were made by using the YEA Nutrient Media, using the Petri dishes plating; the incubation was in 28º and 37ºC. The measurement is expressed as the number of organisms per 100 mL (CFU/100mL) (Hysko, 2007). EU standards after ISO 7899-1 for fecal and total coliforms of water quality in rivers and streams are given in table 3.

Tabela 2. Microbiological methods and nutrient media used in each testing type

Test types	**Method**	**Incubation temperature**	**Nutrient media**
Fecal coliforms	MPN	44.5ºC for 24 hours	EC Mc Konkey agar Indol test
Total coliforms	MPN	37ºC For 24 hours	Lactose Broth (LB) Mc Konkey agar
Heterotrophic bacteria	Plating	28ºC and 37ºC for 48 hours	YEA

Table 3. Microbiological standards (ISO 7899-1) for fecal and total coliforms of water quality in rivers and streams

Microbiology	**EU Standard ISO 7899-1**			
	Very good	*Good*	*Bad*	*Very bad*
Fecal coliforms, CFU/100 ml	250-500	500-1,000	1,000-2,000	over 2,000
Total coliforms, CFU/100 ml	1,250	2,500	5,000	10,000

Biological investigation: Communities of microscopic siliceous algae (diatoms–*Bacillariophyta*), growing on garbage substrates and even in clay, were studied by light microscopy, following the EU Guidance standard for the routine sampling and pretreatment of benthic diatoms from rivers (EN13946:2003) and the other EU Guidance standard for the identification, enumeration and interpretation of benthic diatom samples from running waters (EN14407:2001). Cleaning of diatom frustules was done boiling the material with hydrogen peroxide H_2O_2cc. Microscopic slides were prepared using Naphrax (index 1.69) and examined using a LEICA DML microscope (objective 100x). Determination of the species was based on Krammer & Lange-Bertalot (1986-2005) keys. To get reliable data (confidence 95%) more than 400 valves were counted in the microscope. Permanent slides are deposited in the Lab of Botany, Tirana University.

The Trophic Index of Diatoms (TI_{DIA}; ROTT *et al*., 1999; 2003), Saprobic Index (SI; ROTT *et al.,* 1997) and the Index of Pollution Sensitivity (IPS, originally developed by Coste in Cemagref, 1982) were calculated using the formula of Zelinka & Marvan (1961). Of the above indices, only the IPS (Indice de Polluosensibilité Spécifique or Index of Pollution Sensitivity), show strong correlations to organic pollution (BOD, COD, total N and particularly P), ionic strength (chloride, sulphate, conductivity) and eutrophication (chlorophyll and nitrate) (Prygiel & Coste, 1993). In addition, the Diversity Index (H'; Shannon & Weaver, 1949) was calculated, too. In table 4 there are reported the class boundary limits for IPS.

Table 4: Class boundary limits for IPS (Indice de Polluosensibilité Spécifique or Index of Pollution Sensitivity) in different European countries (after Coste in Cemagref, 1982)

Cilësia / Quality	**Francë, Belgjikë**	**Suedi**
Lartë/High	17 ≤ IPS ≤ 20	17.5 ≤ IPS ≤ 20
Mirë / Good	13 ≤ IPS ≤ 17	14 ≤ IPS ≤ 17.5
Mesatare / Moderate	9 ≤ IPS ≤ 13	10.5 ≤ IPS ≤ 14
Varfër / Poor	5 ≤ IPS ≤ 9	7 ≤ IPS ≤ 10.5
Keqe / Bad	IPS < 5	IPS < 7

General consideration about the environmental sate of the place and the related waters

The EC Fish Directive 44 (2006) guide values for nitrites for high quality fresh water are <0.01 mg/L (*Salmonid* waters) and <0.03 mg/l (*Cyprinid* waters) respectively; the EC guide and the mandatory values for total ammonia are <0.04 and <1 mg/L (*Salmonid* waters), <0.2 and 1 (4) mg/L (*Cyprinid* waters), respectively. As it can be easily suspected, the nutrients in the assessed place of Tirana river were higher than the EC guide values even for *Cyprinid* waters (Tab. 5); i.e. the nitrite values were respectively 0.13, 0.19 and 0.95 mg NO_2/L, or 4 to 32 times higher than the EC Guide; the ammonium content was respectively 1.66, 1.49 and 0.79 mgNH_4/L, which was even higher from the mandatory values of 1 mg/L for Cyprinid waters. The high level of ammonium and nitrites indicates reducing conditions in the river and in the discharging channels due to the high organic load, as a direct consequence of untreated liquid wastes from the town. The situation was also shown in other stations of Tirana river, as well as other tributaries of Ishmi river, Lana and Gjola. More details were reported from (Miho *et al.,* 2005; Cullaj *et al.,* 2005).

Table 5. Physic-chemical data and nutrients for the three stations of Tirana river in Bregu Lumit, measured in 09.02.2010

Parameters	Station 1 (River)	Station 2 (Discharge 1)	Station 3 (Discharge 2)
Physico-chemical in General			
Dissolved oxygen, DO mg/L	7.9	-	-
Dissolved oxygen, DO %	85.4	-	-
Water temperature, ˚C	9.1	-	-
Conductivity, µS/cm	476	332	-
pH	8.03	7.62	-
Total Suspended Solids, TSS mg/L	117.14	24.05	15.25
Nutrients			
Phosphates, P-PO_4^{3-}, µg/L	275	330.8	256.3
Ammonium, N-NH_4^+ mg/L	1.29	1.16	0.612
Nitrites, N-NO_2^-, µg/L	40.6	57.3	290.15
Nitrates, N-NO_3^-, mg/L	0.88	1.38	1.34
Phosphates, PO_4^{3-}, µg/L	842.88	1,013.90	785.56
Ammonium, NH_4^+ mg/L	1.66	1.49	0.79
Nitrites, NO_2^-, µg/L	133.57	188.52	954.59
Nitrates, NO_3^-, mg/L	3.90	6.11	5.93

High contents of suspended solids (TSS) in the river were 117.14 mg/L (Tab. 4), that exceed more than 4 times the value of 25 mg/l, the EC Fish Directive 44 (2006); it was also easily evidenced with the naked eye from the dirty and high turbidity of the waters; but the state of turbidity was better in the discharging channels (stations 2 and 3); despite the fact the place was almost dirty and even the bed smell was quite strong all a round in the place of the riverbanks (Fig. 3). The high content of suspended solids (TSS) is quite common in river courses of Western Adriatic Lowland, as evidenced in other monitoring activities (Cullaj *et al.,* 2005; Miho *et al.*, 2005; 2008); it show the high rates of soil erosion upstream, as a direct evidence of poor land use activities in their respective watershed areas, such as woodcutting, overgrazing, even intense gravel mining in the riverbeds, as mentioned even by Troendle (2002) in his report about the Albanian Watershed Assessment. Discussion about the pour land use in watershed areas, soil erosion and related human activity in Bovilla watershed, focused in were discussed in the Limnological Study of Bovilla watershed, the main drinking water source for Tirana town (Miho *et al.,* 2009). The water of Tirana river is of the first quality in its upper part in Zall Dajti village (Fig. 4: A & B), but its quality is heavily changed soon after Brari village (Fig. 4: C & D), when the river is approaching the Tirana town, transformed in a simple collector of solid and liquid waste, and used also for gravel mining.

Figure 4. Photos from Tirana river in upstream part of the sampling place Bregu Lumit: A-B) views of the river in Zall Dajti village; C-D) views from the river in Brari village, just approaching the Tirana town, in he year 2002 (C) and in the year 2006 (D) (Photos L. Shuka and A. Miho)

From the microbiological data reported in the table 6, if compared with the EU Standard ISO 7899-1 (Tab. 3), the situation of the place seems extremely bad, as suspected; **the values of fecal coliforms and total coliforms are several fold higher even for the respective guide values for very bad waters.** The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals. At the time this occurred, the source water may have been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Table 6. Microbiological data measured for the three stations of Tirana river in Bregu Lumit, measured in 09.02.2010

Parameters	**Station 1 (River)**	**Station 2 (Discharge 1)**	**Station 3 (Discharge 2)**
Fecal coliforms, CFU/100 ml	25,000	26,000	22,000
Total coliforms, CFU/100 ml	26,000	28,000	24,000
Total heterotrophes in 28˚C CFU/100 ml	160,000	80,000	96,000
Total heterotrophes in 37˚C CFU/100 ml	360,000	400,000	300,000

Siliceous microscopic algae known as diatoms (*Bacillariophyceae*), taken into consideration by us, are known to be very sensitive to changes in environmental variables such as environmental conditions and pollution (Rott *et al.,* 1997; 1999; 2003; etc.). The calculated trophic indexes are reported in Table 7, while in the table 8 the checklist of the whole species of diatom community found during the microscopic examinations and their percentiles. More than 65 species of diatoms were found (Tab. 8), only four of them were centricae, the rest were pennatae; the most common species were *Stephanodiscus medius, S. parvus* and *Cyclotella commensis* (all centrics), and *Nitzschia palea, N. incospicua, Nitzschia* sp.*, Hantzschia amphyoxis, Luticula mutica* and *Surirella angusta* (among the pennatae group). It is worth to confirm that the diatom community in the sample 1, from the periphyton collected in the river was very scarce; the abundance of the species was very low, and the confidence limit was to count at least 400 valves was not achieved; therefore, the trophic values are only indicative and not reliable. The scarce quantity of microscopic algae in the sample 1 may be due to the winter condition, but also caused by the stressing condition in the river water, probably to the high amount of suspended solids and the turbidity, where the diatoms are very sensitive (as photosynthetic plants).

Table 7. General data calculated for the diatom community in two stations of Tirana river in Bregu Lumit, measured in 09.02.2010

Station	**River**	**Discharge 1**	**Discharge 2**
River	Tirana	Tirana	Tirana
Date	09.02.2010	09.02.2010	09.02.2010
Code	**1**	**2**	**3**
Numri i llojeve / Number of species, N (total 66 species):	***28***	***35***	***34***
Treguesi i Ndryshueshmërisë / Shannon index, H' (Shannon & Weawer, 1949):	**4.42**	**4.00**	**4.25**
Treguesi Ushqyes i Diatomeve / Diatom Trophic Index, TI_{DIA} (Rott et al.,1999):	**2.8**	**2.8**	**3.0**
Klasat ushqyese përaktëse / Relative trophic classes (Rott et al.,1999):	Eu-polytroph	Eu-polytroph	Eu-Polytroph
Treguesi Saprobik / Saprobic Index, SI (Rott et al.,1997):	**2.0**	**1.9**	**2.3**
Klasat saprobike përaktëse / Relative saprobic classes (Rott et al.,1997):	Quality II (?)	Quality II	Quality II-III
Treguesi i Ndjeshmërisë së Ndotjes / Index of Pollution Sensitivity, IPS (Coste in Cemagref, 1982):	**12**	**7**	**8**
Klasat përkatëse të Treguesit të Ndjeshmërisë së Ndotjes / Relative classes of the Index of Pollution Sensitivity, IPS (Coste in Cemagref, 1982):	Varfër / Poor	Varfër / Poor	Varfër / Poor

The Trophic Index of Diatoms (TI_{DIA}) calculated on periphyton structure of diatoms was relatively high, 2.8-3, corresponding to the eupolytrophic state (Rott *et al*., 1999), due to high inorganic pollution, as concluded also form the high amount of nitrogen and phosphorous reported above (Tab. 5). The saprobic values (SI) corresponded to the water quality class II-III (Rott *et al*., 1997), showing moderate to high organic pollution. The Index of Pollution Sensitivity (IPS; Coste in Cemagref, 1982) is relatively low, 12 in the river station, and 7 and 8 in the discharge channels, respectively, showing the poor water quality, in all cases.

Table 8. List of diatom species and their percentile found in microscopic slides of periphyton samples from two stations of Tirana river in Bregu Lumit, measured in 09.02.2010

Station	**River**	**Discharge 1**	**Discharge 2**
River	Tirana	Channel	Channel
Date	09.02.2010	09.02.2010	09.02.2010
Code	**1**	**2**	**3**
Emri i species/Name of species	**p_i%**	**p_i%**	**p_i%**
Centrales			
Cyclotella commensis Hustedt	**5.0**	**0.9**	**1.1**
Cyclotella ocellata Pantocsek	**2.5**		
Stephanodiscus medius Håkansson	**16.3**	**1.3**	**5.9**
Stephanodiscus parvus Håkansson	**5.0**	**0.7**	**2.4**
Pennales			
Achnanthes catenata Bily & Marvan			**0.7**
*Achnanthes coarctata (*Brébisson*) Grunov*			**0.7**
Achnanthes lanceolata (Brébisson) Grunow agg.		**1.1**	**0.4**
Achnanthes minutissima Kützing var. *minutissima*	**2.5**		
Achnanthes minutissima var *jackii* (Rabenhorst) Lange-Bertalot		**7.3**	**4.9**
Amphora montana Krasske		**10.5**	**8.8**
Amphora pediculus (Kützing) Grunow		**2.1**	**0.7**
Caloneis cf. bacillum (Grunow) Cleve		**0.3**	
Cocconeis placentula var. *lineata* (Ehrenberg) Van Heurck	**1.3**		
Cymbella minuta Hilse		**0.1**	
Cymbella prostrata (Berkeley) Cleve	**2.5**		
Cymbella descripta (Hustedt) Krammer		**0.3**	
Cymbella microcephala Grunow gr.		**1.1**	
Cymbella affinis Kützing		**1.6**	
Denticula tennius Kützing		**0.1**	**0.4**
Diatoma ehrenbergii Kützing	**2.5**		
Diatoma mesodon (Ehrenberg) Kützing		**0.3**	
Diatoma moniliformis Kützing	**1.3**		
Fragilaria capucina var. *capitellata* (Grunow) Lange-Bertalot	**3.8**		
Fragilaria capucina var. *vaucheriae* (Kützing) Lange-Bertalot	**7.5**		
Fragilaria lapponica Grunow in Van Heurck (=Staurosirella lapponica (Grunow in VanHeurck) D.M.Williams & Round)			**1.3**
Fragilaria ulna (Nitzsch) Lange-Bertalot agg.	**10.0**	**0.1**	
Gomphonema angustum (Kützing) Rabenhorst	**2.5**		
Gomphonema brebissoni Kützing		**0.3**	

Station	River	Discharge 1	Discharge 2
Gomphonema olivaceum (Hornemann) Brebisson gr.	**2.5**		
Gomphonema parvulum Kützing agg.	**2.5**		**0.4**
Gomphonema pumilum (Grunow) Reichardt & Lange-Bertalot	**3.8**	**2.1**	
Gomphonema sp.			**0.7**
Hantzschia amphyoxys (Ehrenberg) Grunow	**1.3**	**3.7**	**5.3**
Luticula mutica Kützing	**2.5**	**2.1**	**0.5**
Luticula muticopsis (Van Heurck) Mann		**1.5**	**1.3**
Navicula accommoda Hustedt			**0.7**
Navicula agrestis Hustedt,			**1.5**
Navicula asellus Weinhold ex Hustedt			**0.2**
Navicula atomus (Kützing) Grunow			**1.3**
Navicula cryptotenelloides Lange-Bertalot	**2.5**	**0.3**	
Navicula perminuta Grunow		**3.2**	**11.5**
Navicula saprophila Lange-Bertalot & Bonik		**1.2**	**2.7**
Navicula seibigii Lange-Bertalot		**3.7**	**4.6**
Navicula sp.		**4.1**	
Navicula tripunctata (O. F. Müller) Bory	**3.8**		
Navicula veneta Kützing		**2.9**	**3.3**
Nitzschia amphibia Grunow	**2.5**	**0.3**	
Nitzschia cf. pusilla (Kützing) Grunow			**15.9**
Nitzschia dissipata (Kützing) Grunow			**0.4**
Nitzschia hungarica Grunow		**0.3**	
Nitzschia incospicua Grunow	**5.0**	**13.9**	**6.2**
Nitzschia lacuum Lange-Bertalot		**3.4**	
Nitzschia linearis (Agarth) W. Smith var. *linearis*		**0.3**	**0.2**
Nitzschia linearis var. Subtilis (Grunow) Hustedt	**2.5**		
Nitzschia palea (Kützing) W. Smith var. *palea*	**1.3**	**21.4**	**5.3**
Nitzschia sp1.			**6.8**
Nitzschia sp2.	**1.3**	**6.8**	**2.2**
Pinnularia borealis var. rectangularis Cralson	**2.5**		**0.9**
Pinnularia microstauron var. brebissonii (Kützing) Mayer			**0.4**
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	**2.5**		
Sellaphora pupula (Kuetzing) Mereschkowsky		**0.3**	
Surirella angusta Kützing	**1.3**	**0.7**	**0.7**

The most abundant species belonged to genus *Nitzschia*, represented mainly by *Nitzschia palea* (more than 20% of the whole diatom community), *N. incospicua*, etc.; this group of species was found often in polluted stations. Other represented genus was *Navicula*, represented by *N. perminuta, N. saprophyllus, N. atomus*, etc., mainly saprobiontic species that tolerate the high amount of nutrients. The high trophic values, corresponding to the low quality waters were also found in other monitoring activities, reported by Miho *et al.* (2005; 2008), etc.

Conclusions

Concluding we may confirm that the place Bregu Lumit represent an excellent model of a highly polluted part of the River Tirana, with extremely high values of several parameters, form the nutrients (nitrogen and phosphorous), to the microbiological data and periphyton community. Beside the very ugly scenery that this river part show in Tirana capital, the bed quality of waters are very harmful to the water biota, but also to the human community living along the river banks and elsewhere; the bad situation is accumulated downstream the river, collecting even more nutrients and other pollutants that increase further its harmful impact in Gjola and Ishmi, and for sure in Ishmi delta (Rodoni bay and Patoku lagoon).

Strong measures of restoration and protection of water quality must be taken, as soon as possible. Tirana region with more than 850'000 inhabitants is situated in the Ishmi, Lana and Tirana watershed. Industry, especially food industry, is growing rapidly in the Tirana plain. Wastewater and solid waste continues to be disposed abusively along the riverbanks. In contrast, much water is used from the rivers for irrigation, livestock, fishing, drinking through the wells in suburban areas or wells of food factories. Furthermore the Patoku lagoon, an important site of high biodiversity in both flora and fauna, especially fishes and water birds, is situated close to Ishmi delta, too; that region is always under the risk of deterioration.

The National Strategy and Action Plan of Biodiversity (NEA/AKM, 1999) was approved in 2000 and since 1991, Albania has signed more than 13 international conventions and agreements dealing with environmental issues. Therefore, taking the appropriate measures in important and sensitive watershed areas will help to prevent further damage to biodiversity and humans, and help to regain the original beauty of the landscape. The Albanian territory is important for the water supply on the Eastern Adriatic coast as well. Sustainable watershed management would guarantee the fulfillment of related tasks on a regional and international level.

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