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Research Article

GROUNDWATER QUALITY MONITORING OF A SIGNIFICANT HABITAT IN TRAKYA UNIVERSITY: BALKAN ARBORETUM AREA (EDIRNE, TURKEY)

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ABSTRACT

Balkan Arboretum Area is located in the northeast part of the Balkan Campus of Trakya University in Edirne Province of Turkey. The aim of this study was to determine the groundwater quality of Balkan Arboretum Area by monthly monitoring some water quality parameters including total dissolved solids (TDS), salinity, electrical conductivity (EC), pH, turbidity, sulphate (SO_4), nitrite (NO_2), nitrate (NO_3) and phosphate (PO_4). Groundwater samples were collected monthly from Güllapoğlu Well between the dates of January 2016 – December 2016. The collected data were evaluated according to the criteria of Water Pollution Control Regulation in Turkey and evaluated as drinking water according to the criteria of Turkish Standards Institute, European Communities and World Health Organization. According to data observed, nitrate and phosphate concentrations detected in groundwater resources of Balkan Arboretum Area were high levels and may pose a significant risk factor in the future for the ecosystem and human health.
Keywords: Balkan arboretum area, Trakya University, groundwater quality.

1. INTRODUCTION

Intensive agricultural activities due mainly to rapid growth of population cause significant environmental pollutions on especially soil and water quality. Permanent monitoring of freshwater ecosystems is known as one of the most effective and cheap to cost – effective protection (Arslan et al., 2011; Tokatlı et al., 2013; Çiçek et al., 2013; Köse et al., 2014; Köse et al., 2015; Tokatlı, 2015).

Balkan Arboretum Area, which is located in the Thrace Region of Turkey, in the northeast part of the Balkan Campus of Trakya University, contains a few important freshwater resources (Güllapoğlu Stream, an artificial pond and Güllapoğlu Well). Intense agricultural activities are being conducted around the Balkan Arboretum Area and this situation negatively effects the water quality, especially the underground sources of the system (Tokatlı, 2013).

In the present study, groundwater quality of the Balkan Arboretum Area located in the Balkan Campus of Trakya University was investigated and the data collected was evaluated according to national and international drinking water standards.

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2. MATERIAL AND METHOD

2.1. Study Area and Collection of Samples

Balkan Campus of Trakya University has 256.835 square meter closed and 2.215.744 square meter total area. Balkan Arboretum Area is located in the Balkan Campus of Trakya University and contains an important surface and groundwater potential (http://www.trakya.edu.tr/; Tokatlı, 2013). Groundwater samples were collected monthly from Güllapoğlu Well between the dates of January 2016 – December 2016 and the location of Güllapoğlu Well were given in Figure 1.

2.2. Physical and Chemical Analysis

Total dissolved solids (TDS), salinity, electrical conductivity (EC) and pH parameters were determined by using a multimeter (Hach Lange HQ40D) during the field studies while a portable turbidimeter (Hach Lange 2100Q) was used for the measurement of turbidity. Parameters of sulphate (SO_4), nitrite (NO_2), nitrate (NO_3) and phosphate (PO_4) were determined by using a colorimeter (Hach Lange DR890) during the laboratory studies.

Figure 1. Location of study area

3. RESULTS AND DISCUSSION

Groundwater quality parameters determined in Güllapoğlu Well are given in Table 1 and Figure 2 and some national – international limit values are given in Table 2.

Table 1. Physicochemical data detected in Güllapoğlu Well and water quality classes (*Uslu and Türkman, 1987; SKKY, 2004; SKKY, 2015)

	TDS (mg/L)	**Salinity** (‰)	**Turbidity** (NTU)	**EC** (ms/cm)	**pH**	**SO_4** (mg/L)	**NO_2** (mg/L)	**NO_3** (mg/L)	***PO_4** (mg/L)
January	237	0.24	0.58	472 **Class II**	7.3 **Class I**	73 **Class I**	0.004 **Class I**	5.6 **Class II**	0.75 **Class IV**
February	244	0.24	0.94	503 **Class II**	6.9 **Class I**	27 **Class I**	0.005 **Class I**	5.7 **Class II**	1.02 **Class IV**
March	241	0.24	0.32	495 **Class II**	6.99 **Class I**	27 **Class I**	0.031 **Class II**	5.4 **Class II**	0.72 **Class IV**
April	239	0.24	0.31	492 **Class II**	7.21 **Class I**	23 **Class I**	0.01 **Class II**	5.9 **Class II**	0.24 **Class III**
May	245	0.24	1.49	505 **Class II**	7.26 **Class I**	19 **Class I**	0.007 **Class I**	5.6 **Class II**	0.15 **Class II**
June	245	0.24	0.53	505 **Class II**	6.84 **Class I**	22 **Class I**	0.001 **Class I**	5.8 **Class II**	0.16 **Class III**
July	299	0.23	0.43	384 **Class I**	7 **Class I**	17 **Class I**	0.011 **Class II**	5.4 **Class II**	0.17 **Class III**
August	225	0.23	0.63	470 **Class II**	6.9 **Class I**	26 **Class I**	0.019 **Class II**	5.7 **Class II**	0.52 **Class III**
September	234	0.23	0.41	484 **Class II**	6.89 **Class I**	14 **Class I**	0.001 **Class I**	5.6 **Class II**	0.98 **Class IV**
October	239	0.24	0.6	475 **Class II**	6.96 **Class I**	16 **Class I**	0.001 **Class I**	4.8 **Class I**	0.21 **Class III**
November	233	0.23	0.3	336 **Class I**	7.17 **Class I**	22 **Class I**	0.001 **Class I**	5.8 **Class II**	0.22 **Class III**
December	238	0.24	0.63	495 **Class II**	6.94 **Class I**	24 **Class I**	0.008 **Class I**	5.7 **Class II**	0.22 **Class III**
Minimum	*225.00*	*0.23*	*0.30*	*336.00*	*6.84*	*14.00*	*0.00*	*4.80*	*0.15*
Maximum	*299.00*	*0.24*	*1.49*	*505.00*	*7.30*	*73.00*	*0.03*	*5.50*	*1.02*
Mean	***243.25***	***0.24***	***0.60***	***468.00***	***7.03***	***25.83***	***0.01***	***5.43***	***0.45***
SD	*18.45*	*0.00*	*0.33*	*52.92*	*0.16*	*15.46*	*0.01*	*0.20*	*0.33*

TS266 – Turkish Standards Instıtute; EC – European Communities; WHO – World Health Organization

Water quality regulations in Turkey separate inland waters into four classes. Class I includes high – quality water that has a high potential to be used for drinking water, recreational purposes, and the production of trout. Class II refers to less contaminated water that can be used as surface water is to become potential for drinking water outside of trout production and for all uses other than Class I. Class III includes polluted water, which can only be used as industrial water after treatment. Class IV refers to heavily polluted water that should not be used at all (SKKY, 2004; 2015).

Table 2. Some national and international limit values

Limit Values and the Results of Present Study		Parameters								
		pH	**EC** (mS/cm)	[a]**TDS** (mg/L)	**Sal** (‰)	**Tur** (NTU)	**NO_3** (mg/L)	**NO_2** (mg/L)	**SO_4** (mg/L)	[b]**PO_4** (mg/L)
Turkish Regulations Water Quality Classes (2015)	**I. Class**	6.5-8.5	400	500	-	-	5	0.002	200	0.02
	II. Class	6.5-8.5	1000	1500	-	-	10	0.01	200	0.16
	III. Class	6.0-9.0	3000	5000	-	-	20	0.05	400	0.65
	IV. Class	Out of 6.0-9.0	>3000	>5000	-	-	>20	>0.05	>400	>0.65
Drinking Water Standards	**TS266** (2005)	6.5-9.5	2500	-	-	5	50	0.5	250	-
	EC (2007)	6.5-9.5	2500	-	-	-	50	0.5	250	-
	WHO (2011)	-	-	-	-	-	50	0.2	-	-

[a]Turkish Regulations, 2004; [b]Uslu and Türkman, 1987; Sal: Salinity; Tur: Turbidity

According to the criteria of SKKY (Water Pollution Control Regulation in Turkey), Güllapoğlu Well have I. Class water quality in terms of pH and sulphate parameters; and it has II. Class water quality in terms of EC and nitrate parameters except the recorded values in July and November for EC (I. Class) and in October for nitrate (I. Class). In terms of nitrite parameter, the well has I. Class water quality January, February, May, June, September, October, November and December seasons, II. Class water quality in March, April, July and August seasons. It has also III. – IV. Class water quality in terms of phosphate parameter except the recorded values in May (II. Class) (Uslu ve Türkman, 1987; SKKY, 2004; 2015).

According to the limit values specified by Turkish Standards Institute (TS266), European Communities (EC) and World Health Organization (WHO) for drinking water, sulphate (250 mg/L for TS266 and EC), nitrate (50 mg/L for TS266, EC and WHO), nitrite (0.2 mg/L for WHO), EC (2500 ms/cm for TS266 and EC) and pH (6.5 – 9.5 for TS266) parameters detected in groundwater of Balkan Arboretum Area were suitable for drinking (TS266, 2005; WHO, 2011; EC, 2007).

No significant differences were found during the year except nitrite and phosphate parameters in general. It is thought that the rise in phosphate parameter especially in January, February, March and September and the rise in nitrite parameter especially in March were due to excessive rainfall and increase in drainage from agricultural lands to the underground.

In study performed to determine the groundwater quality in Havsa District of Edirne Province, where is quite close to Balkan Arboretum Area, it was stated that the Havsa District has I. – II. Class water quality in general and did not exceed the drinking water limits (Tokatlı and Uğurluoğlu, 2017). In another study performed in Edirne Province, groundwater quality of İpsala District was investigated (Tokatlı, 2014). According to data observed, as similar to the present study, investigated parameters were not exceeded the limit values for drinking but the region has II. – III. Class water quality in terms of nitrite and nitrate parameters in general.

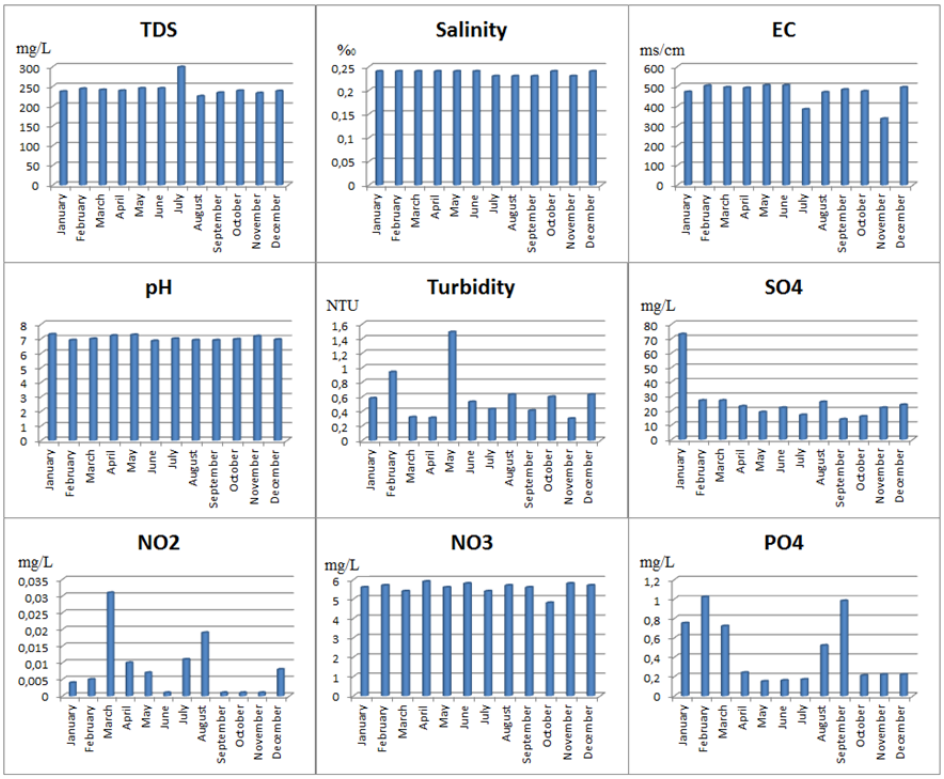

Figure 2. Diagrams of measured parameters

4. CONCLUSSION

In the present study, groundwater quality of Balkan Arboretum Area in Balkan Campus of Trakya University (Edirne, Turkey) was investigated in a period of 12 months in the year of 2016 and the detected data were evaluated according to the national and international surface water quality and drinking water quality criteria.

According to the results of this study, groundwater resources of Balkan Arboretum Area have quite high nitrate and phosphate concentrations and these high nutrient concentrations in groundwater reflect the intense pressure of fertilizers being used in agricultural activities around the region.

As a result of detected data, groundwater quality in Balkan Arboretum Area seems to decrease further in the future. This situation may pose a significant risk factor for both this ecosystem and human health, who drinks this water regularly.

In order to protect the groundwater resources of this significant ecosystem, environmental awareness has to be placed in the local society and technical supports may be provided to agriculturalists especially on the use of fertilizers consciously.

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