

# Use of Geographic Information System (GIS) to Evaluate the Nitrogenous Compounds in Groundwater of Ergene River Basin (TURKEY)

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**Abstract** – In this study water samples were collected from 30 villages located in the Ergene River Basin in summer season of 2018. Nitrate (NO<sub>3</sub>) and nitrite (NO<sub>2</sub>) concentrations of water samples were determined and the results were assessed according to national and international quality criteria. Geographic Information System (GIS) was also used in order to make a visual explanation by presenting distribution maps of investigated parameters. According to data observed, nitrate levels were determined as 0.12 – 10.1 ppm, and nitrite levels were determined as 0.005 – 0.110 ppm in groundwater samples. Although the investigated nitrogenous compounds in groundwater of villages located in the Ergene River Basin did not exceeded the limit values for drinking, it was determined that the villages located in the Ergene River Basin has I. – II. Class groundwater quality in terms of nitrate and II. – III. Class groundwater quality in terms of nitrite parameter in general.

**Keywords** – Ergene River Basin, Nitrogenous compounds, GIS, Drinking water, Water quality

## I. INTRODUCTION

Intensive agricultural activities due mainly to rapid growth of population cause significant environmental pollutions on especially soil and water quality. Lack of environmental awareness in society is also one of the most significant factors on environmental problems. It is known that assessment of water quality is a significant requirement for an effective contamination control and water management [1 – 3].

The Ergene River is the most important river basin of the Thrace Region and it is known to be exposed to a significant agricultural and industrial pressure [4 – 6].

The aim of this study was to;

- determine the nitrogenous compounds (NO<sub>3</sub> and NO<sub>2</sub>) in groundwater of Ergene River Basin,
- evaluate the data according to Turkish Regulations Water Quality Classes and drinking water limits specified by Turkish Standards and
- use of Geographic Information System (GIS) in order to make a visual explanation of investigated data.

## II. MATERIALS AND METHOD

### A. Study Area and Collection of Samples

In this study, groundwater samples were collected in summer season of 2018 from 30 stations from the drill fountains of the villages located in the Ergene River Basin. Groundwater with a volume of three wells was purged before sampling. Water samples were then collected at the outflow of drill pump in polyethylene bottles. Coordinate information and locations of selected stations are given in Table 1.

Table 1. Location properties of villages

Locality	Coordinates	
	North	South
Muratlı	41.17275	27.49570
Sarılar	41.14440	27.66180
Çorlu	41.15593	27.81326
Velimeşe	41.24793	27.88046
Çerkezköy	41.28212	28.00176
Saray	41.44099	27.92175
Karlı	41.36929	27.86502
Marmaracık	41.20692	27.75227
Vakıflar	41.26342	27.64992
Karamusul	41.30349	27.44734
Müsellim	41.34041	27.37037
Düğünçübaşı	41.33248	27.27715
Lüleburgaz	41.40263	27.36572
Babaeski	41.43123	27.09134
Alpullu	41.37195	27.14307
Karakavak	41.32615	27.07046
Kadriye	41.34883	26.99870
Çerkezmüsellim	41.27186	27.02568
Hayrabolu	41.21345	27.10629
Pehlivan köyü	41.34710	26.92391
Danişment	41.30453	26.90137
Çöpköy	41.21846	26.82429
Bayramlı	41.30688	26.82262
Uzunköprü	41.26693	26.68699
Salarlı	41.22682	26.62626
Kurtbey	41.14380	26.57977
Yenicegörece	41.13088	26.46713
Meriç	41.19106	26.41824
Adasarhanlı	41.08398	26.35818
İpsala	40.92896	26.39274

B. Physicochemical Analysis and GIS Maps

Nitrate and nitrite parameters were determined by using “Hach Lange DR3900 Spectrophotometer” device during the laboratory studies. The distribution maps (GIS Maps) of parameters were made by using the “MapInfo” package program.

III. RESULTS

Nitrate and nitrite concentrations of investigated villages located in the Ergene River Basin are given Fig. 1. Geographic Information System (GIS) based distribution maps of nitrate and nitrite concentrations determined in groundwater of Ergene River Basin are given in Fig. 2 and 3.

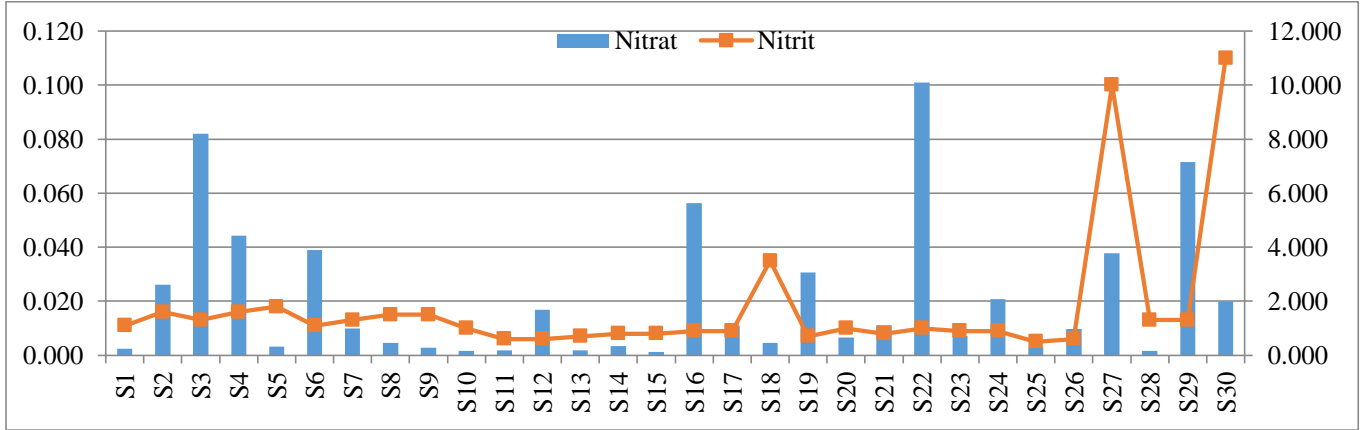


Fig. 1. Nitrate (NO<sub>3</sub>) distributions

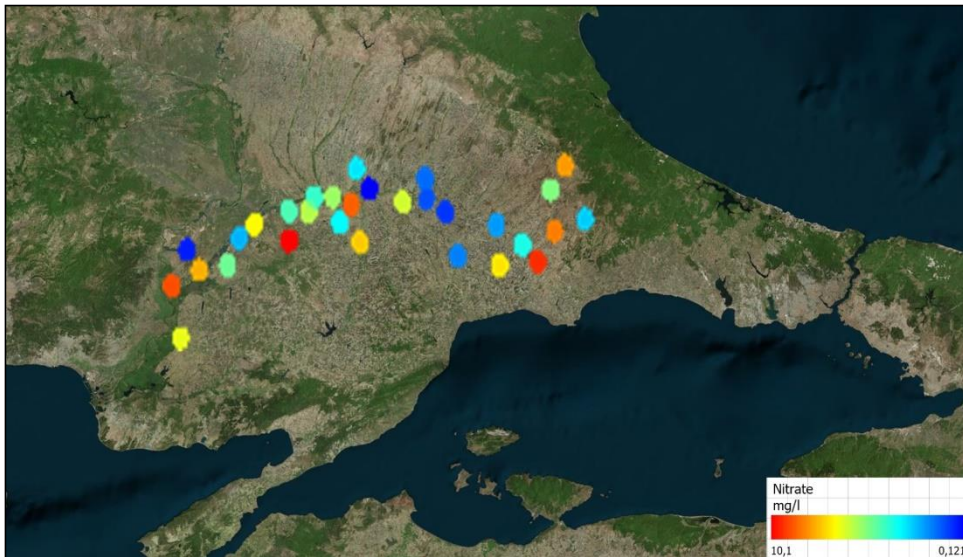


Fig. 2. Nitrate (NO<sub>3</sub>) distributions

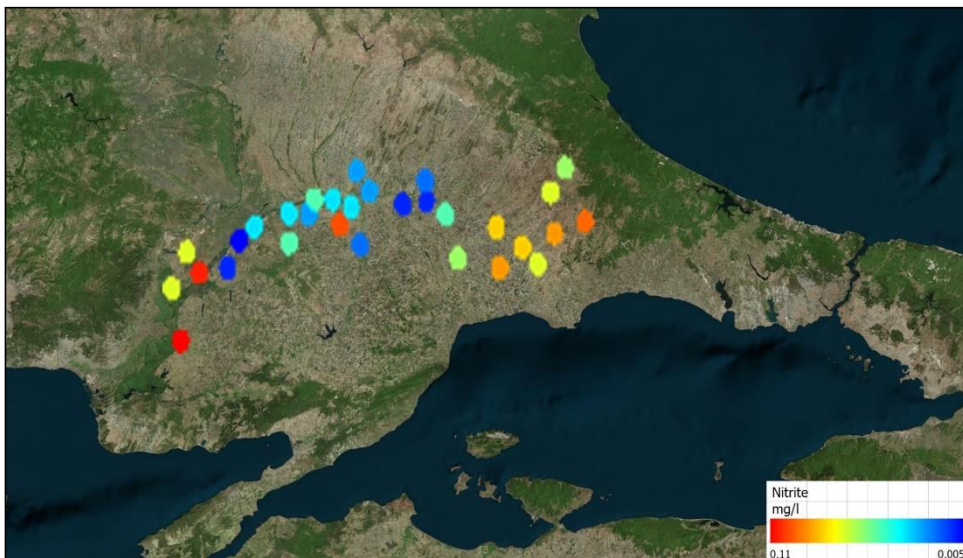


Fig. 3. Nitrite (NO<sub>2</sub>) distributions

#### IV. DISCUSSION

According to the criteria of Turkish Regulations identified for Turkey (Water Pollution Control Regulation in Turkey), 86.6% of groundwater have I. Class water quality, 10% of groundwater have II. Class water quality and 3.3% of groundwater have III. Class water quality in terms of nitrate parameter in the region; and 53.3% of groundwater have II. Class water quality, 40% of groundwater have III. Class water quality and 6.6% of groundwater have III. Class water quality in terms of nitrite parameter in the region in general [7].

It is known that fertilizers used in agricultural activities increase the level of nitrogen compounds in water and soil especially in rural areas [8, 9]. The main sources of nitrogen compounds in groundwater is nitrogen rich fertilizers in general and they are known to be used intensively all around the Ergene River Basin [10, 11].

#### V. CONCLUSION

In the present study, nitrite and nitrate concentrations in groundwater of the Ergene River Basin were investigated. Also Geographic Information System (GIS) was applied to detected data in order to evaluate the results properly. According to detected data, nitrogenous compounds in groundwater resources of the Ergene River Basin were detected in quite high levels. The region has I. – II. Class groundwater quality in terms of nitrate and II. – III. Class water quality in terms of nitrite parameter in general.

In conclusion, agricultural applications have significant place on the economic structure of the region. The water leached through from these agricultural fields are contaminated by fertilizers. These pollution factors reach to the groundwater resources of the system by filtering from the soil.

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