FACT SHEET: Axios River Basin

The Axios (or Vardar) River Basin has a drainage area of 24397 km^2 originating from North Macedonia and draining into the Thermaikos Gulf of Greece. It also drains parts of Serbia, Bulgaria, and northern Greece. The river is 373 km long. The basin population is 2 million inhabitants as of 2015. 46.3% of the basin is agricultural cropland and the remaining 53.2% is designated urban areas and forest. Table 1 presents the main characteristics of the basin.

Figure 1. The Axios River Basin.

Table 1. Axios River Basin characteristics

Axios/Vardar
COUNTRIES: NORTH MACEDONIA, GREECE, SERBIA, BULGARIA
Pedo-climate: Southern and Continental region , North Mediterranean, Mediterranean Mountains and Continental zones
Drainage Area 24,397 km^2
Maximum altitude: 2720 m
Annual average rainfall 679 mm/year
Main land uses: Agriculture 46.3%; Forest 51.4%, and Urban 1.8%
Population in 2015: 2,019,975
River length 373 km
Strahler Order – 7
Discharge at outlet 82.5 m^3/s
Outlet coordinates: 40° 30’ 50’’ N, 22° 42’ 57’’ E

Agriculture and water in the Axios Basin

In the Axios basin, high nutrient surpluses have been estimated in both cropping and livestock systems (Laspidou and Samanzi, 2015), and better management of fertilization is recommended (Fytianos et al., 2002; Stefanidis et al., 2016). More than 90% of the water is used for agriculture (Chatzinikolaou et al., 2010; Psomas et al., 2016).

Milovanivic (2007) conducted an assessment for the water quality along the Axios River with the aim to identify pollution sources. Based on surface water data, nutrient excess from agriculture appears to be the most considerable source of pollution in the cultivated areas of Tetovo, Veles and Koufalia. In addition, the author stated that agricultural activities in Northern Macedonia (Polog, Ovce Pole, Gevgelija) and Greece (Axioupoli, Chalastra) increase nutrient concentrations in the river water and impact the groundwater. The aquifer in the lower catchment in Greece has been impacted significantly by both agricultural pollution and sea water intrusion due to pumping.

There are two major aquifer systems in the basin, one in Northern Macedonia (Polog, Ovce Pole, Gevgelija) and the other in Greece (Axioupoli, Chalastra). The Northern Macedonian aquifers have significant capacity, but are not being utilized due to geologic constrains. The phreatic horizon aquifers in the plains of Greece have been affected by agricultural pollution in terms of pesticides. Papadopoulou-Mourkidou et al. (2004) examined the potential of pesticides to contaminate groundwater. Measurement from the phreatic horizon detected residues of atrazine, prometryne that exceeded 0.1 μg/L. Herbicides alachlor, propanil, arbofuran and paraoxon-methyl were detected occasionally above the 0.1 ppb level. These chemicals were also detected in the irrigation/drainage canal network. The results showed that the mobility of pesticides in soils and the potential to contaminate surface and shallow (phreatic horizon)

groundwaters in the Axios River basin, an important source of drinking water for the city of Thessaloniki, were significant.

Litskas et al. (2010) studied the quality of irrigation and drainage network waters in the Axios River Delta and concluded that the drainage water entering the protected area of Thermaikos Gulf is affected by the rice irrigation regime and the drainage network characteristics. Part of the problem is the over-irrigation of the fields.

Impact on coastal areas

The impact on coastal water is also influenced by urban emissions, and wastewater treatment plant emissions (Nikolaidis et al., 2009). Despite red tides have been mentioned in literature (Nikolaidis et al., 2009), nutrient (nitrogen and phosphorus) loadings to the coastal zone appear for now not too much in excess of silica loading, with negative ICEP-N and ICEP-P (indicator for coastal zone eutrophication potential; Billen and Garnier, 2007).

High anthropogenic nutrient pressure in the Axios basin (agricultural activities and domestic wastewaters; Karageorgis et al., 2003), hydraulic managements such as canals, dams and drain systems which cover the drainage basin (Milovanovic, 2007) might contribute to nutrient elimination within the basin, with strong environmental threats through excess of water use. Nevertheless, nutrient fluxes coupled with the relatively high flush rate and short residence time, reduce risks of eutrophication in the coastal zone.

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