



## **Assessment of intrinsic vulnerability of an alluvial aquifer under anthropogenic pressure: cross comparison of 4 index-based groundwater vulnerability mapping models within the Biguglia lagoon watershed (Corsica, France).**

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The geographical position of the Biguglia lagoon watershed south of the Bastia city (80 000 inhabitants), lead to a highly vulnerable hydrosystem setting. This littoral plain is the unique territory available for the urbanisation and for the agriculture activities (cattle breeding). All the activities developed are likely to have a qualitative impact on water infiltration and therefore on groundwater, which is in hydraulic connection with the lagoon system. Beyond this ecological issue, groundwater of this watershed is intensively used as drinking water supply. It appears essential to control the long-term groundwater quality of the Biguglia plain which is the major economic zone of Corsica. Achievement of this issue requires the identification of the areas where the alluvial aquifer is mostly vulnerable to anthropogenic activities.

The results given by 4 of the most popular index-based vulnerability mapping methods (DRASTIC, SI, SINTACS and GOD) are compared. The water table, net recharge, aquifer and soils properties, topography, vadose zone and land uses have been precisely mapped and numerically translated in GIS with a 25m precision. 4 final maps were finally compiled according to the weighting factors of each methods. Hydrochemical investigations were also carried out on 30 sampling points (major ions and anthropogenic tracers) to evaluate the effect of anthropogenic activities on groundwater quality and also to validate the results of the vulnerability mapping.

A comparison between the parametric models shows a significant agreement between the DRASTIC, SINTACS and SI results (2% to 5% of the total area in very low vulnerability class, 10% to 13% in low vulnerability, 16% to 23% in medium vulnerability, 31% to 53% in high vulnerability and 14% to 23% in very high vulnerability). The two first methods are quite similar, which explains the proximity of the obtained results. High vulnerability and very high vulnerability classes are noticeably different for the SI results. This can be partly explained by the consideration of the land use and the absence of parameters related to soil media, vadose zone and hydraulic conductivity in this model, which generates a larger surface in highly vulnerable class at the expense of the very highly vulnerable one. Conversely, the GOD method gives very different results especially in the very low and low vulnerability classes with 11% and 17% of the total area respectively. This last method underestimates the vulnerability in the hydrological context of this work. The DRASTIC and SINTACS models are those that best transcribe the field observations. With these models the most vulnerable zones are correlated with the highest concentrations of nitrates measured in groundwater. Thereafter, it will be essential to integrate the temporal variability of the imputed parameters and to link these results with the acquired data on origin and residence time of groundwater in the alluvial aquifer of Biguglia lagoon.

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