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Application of drastic method for determining the vulnerability of an alluvial aquifer: Morsott - El Aouinet north east of Algeria: using arcgis environment

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Abstract

This study aims at the vulnerability assessment of an alluvial aquifer in a semi-arid environment, Morsott, Boukhadra and El-Aouinet region, N.E of Algeria, an alluvial area that has suffered of increasing salinity toward the northern part of the basin.
A vulnerability map has been developed using DRASTIC model based on a geographic information system (GIS), this method accounts for the aquifer parameters like depth to water, net recharge, aquifer media, soil media, impact of Vadose zone and hydraulic conductivity. The DRASTIC Vulnerability index (DVI) is calculated as the sum of product of ratings and weights assigned to each of the parameter.
Examination of the vulnerability map allowed us to determine three classes ranging from very low to very high. The northern part of the plain show the highest vulnerability class, indicating that it is the most vulnerable to external contamination. The moderate class is scattered in the southern and east also the northwest area, the low class vulnerability occupies the most part of the plain which will guarantee a satisfactory sanitation in space and time, in the case of accidental pollution.

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Keywords: pollution; vulnerability; SIG; DRASTIC; Morsott-El Aouinet; Algeri

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1. Introduction:

Groundwater contamination is a widespread problem in the process of urbanization. When aquifers become polluted, contamination is persistent and difficult to remediate due to their large storage, long residence times and physical inaccessibility (Foster and Chilton, 2003). [7]

In the last years, the international scientific community has shown great interest on this topic and, thus, many works focused on environmental management for groundwater protection (Adams and Foster, 1992; Drew and Hotzl, 1999; Arnaud, 2001; Morris, 2001; Eliasson et al., 2003; Gerth and Forstner, 2004). [3]

Regeneration of polluted aquifers is prohibitively costly. Therefore, scientists have sought to develop aquifer vulnerability to assess the most vulnerable areas of the study area that are susceptible to the exploitation and overall contamination.

Many techniques that exist to estimate groundwater vulnerability, among the most simple and widely used techniques is DRASTIC index that measures intrinsic vulnerability developed by Aller et. al, 1998, the intrinsic vulnerability is closely dependent on the hydrological, geological and hydrogeological characteristics of the study area (Zwahlen 2004) [10]

this Study is designed to produce a technically-sound and scientifically defensible vulnerability map of the Study Area along with a user-friendly Geographical Information System (GIS) tool, which will allow the District to better focus groundwater management programs. The tool will also allow the District to readily assess potential groundwater quality impacts from future changes in land use.

2. Study area:

The study area is located within the semi-arid zones of Algeria, situated fifty kilometres to the North of Tebessa city and is characterised by a precipitation of less than 400 mm per year. It extents from El Aouinet in the north, to Morsott to the south, on about 240 km² (Figure1).

The study area is a part of a narrow trough which forms a small portion of the great plio-quaternary tectonic depression of Morsott.(Fehdi 2009) [6]

The region is bound by Djebel Mesloula ,Djebel Boukhadra to the West and East respectively , by Djebel Guelb El Gounatas to the North and by adminestrative boundry to the South (Fehdi 2009) [6] (Figure.2)

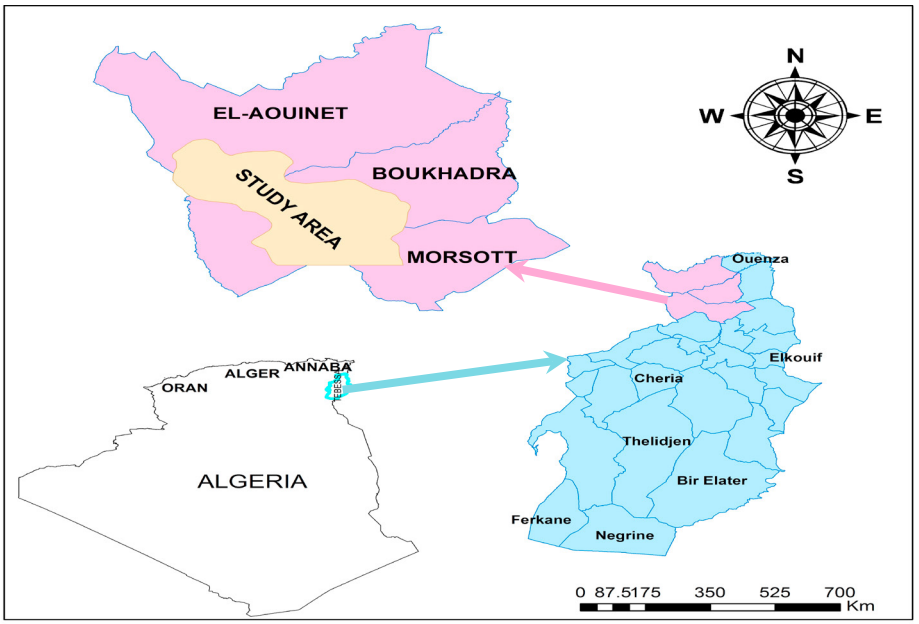

Figure 1: Location of the study area in ALGERIA