APPLICATION OF DRASTIC METHOD FOR ASSESSING AQUIFER VULNERABILITY OF MAGURA DISTRICT OF BANGLADESH USING ARCGIS

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1. INTRODUCTION

In Bangladesh about 98% of drinking water and 80% of irrigation water supply is being provided by ground sources. According to the BWDB officials, in Magura except the areas of acute arsenic contamination, shallow aquifer water is being used for daily purposes which is facing challenges due to increasing population, anthrpogenic activities, changes in landuse and landcover etc. To maintain sustainable groundwater quality management, potential source of pollution and critically vulnerable area are needed to be identified first. There are so many ways to determine the groundwater vulnerability. Among them DRASTIC model is being used throughout the world. This is an intrinsic vulnerability assessment method which generally does not consider the attributes and behaviour of a specific contaminant rather it is related with the degree of protection provided from the system itself in case of accidental pollution. However, this model was also criticized. In spite of that, the advantages of this method were considered to overcome its shortcomings. Considering its simplicity and incorporation of available data this method was chosen for this study which is a prerequisite for prioritizing protection, monitoring and landuse planning.

2. METHODOLOGY

Magura is a district in south-western Bangladesh. It is a part of the Khulna Division having an area of 1048.61 sq. km. Location map of the study area is shown figure 1.



Figure 1: Location Map of Magura District

DRASTIC is a methodology through which pollution potential of an area can be evaluated systematically (Aller et al., 1987). The factors considered to determine the pollution potential are depth to water table, net recharge, aquifer media, soil media, topography, impact of vadose zone and hydraulic conductivity of the aquifer. A thematic layer of depth to water table for Magura was created using IDW interpolation of ArcGIS 10.3. Due to lack of availability of direct recharge data, a formula proposed by Piscopo, (2001) was used

Recharge Value = Slope % + Rainfall + Soil Permeability (1)

A typical rating of 6 was used for aquifer media due to the presence of sand particles. A GIS shape file of the soil texture of Bangladesh was collected from BARC and rated accordingly. Topography of the study area was generated from DEM using ArcGIS 10.3. The vadose zone media of the study area is sedimentary formation consisting of sandstone. A typical rating of 6 was used for large parts of the area. The rating was also adjusted to 3 for Salikha and Magura sadar upazilla due to the presence of silty clay. The average value of conductivity was taken as 40 m/d at 50-60m depth. Thus a rating of 6 was adopted for the parameter.

3. RESULTS AND DISCUSSION

Using the raster calculator of the ArcGIS 10.3 Equation (2) was solved and DRASTIC vulnerability map of Magura was produced.

Drastic Index,
$$DI = D_R * D_W + R_R * R_W + A_R * A_W + S_R * S_W + T_R * T_W + I_R * I_W + C_R * C_W$$
(2)





Figure 2: Reclassified DRASTIC Vulnerability Map of Magura

From the reclassified DRASTIC vulnerability map in figure 2 it is observed that majority of the area falls within low vulnerability. Very low vulnerable area was found in the Magura Pourasava which is mainly due to concrete covering as contaminant particles can't seep through it. Mohammadpur upazilla of the district is moderately vulnerable with some parts of Digha union with very high vulnerability which was also found in the Sreekul union and in the boundary region of Sabdalpur, Kadirpara and Nakol.

4. CONCLUSION

From the reclassified vulnerability map, it is found that in Magura 1.02% area is very highly vulnerable to groundwater contamination. Maximum area (52.14%) of the district is under low vulnerability. This study can help in future planning related to local groundwater resources by prioritizing very highly vulnerable areas.

5. REFERENCES

Aller, L., (1985). *DRASTIC: A standardized system for evaluating ground water pollution potential using hydrogeologic settings*. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, US Environmental Protection Agency.

Piscopo, G. (2001). Groundwater vulnerability map, explanatory notes—Castlereagh Catchment. *NSW*. *Department of Land and Water Conservation, Australia*.