Nitrate contamination risk assessment in groundwater at regional scale

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Nitrate groundwater contamination is widespread in the world, due to the intensive use of fertilizers, to the leaking from the sewage network and to the presence of old septic systems.

This research presents a methodology for groundwater contamination risk assessment using thematic maps derived mainly from the land-use map and from statistical data available at the national institutes of statistic (especially demographic and environmental data).

The potential nitrate contamination is considered as deriving from three sources: agricultural, urban and periurban. The first one is related to the use of fertilizers. For this reason the land-use map is re-classified on the basis of the crop requirements in terms of fertilizers. The urban source is the possibility of leaks from the sewage network and, consequently, is linked to the anthropogenic pressure, expressed by the population density, weighted on the basis of the mapped urbanized areas of the municipality. The periurban sources include the un-sewered areas, especially present in the periurban context, where illegal sewage connections coexist with on-site sewage disposal (cesspools, septic tanks and pit latrines). The potential nitrate contamination map is produced by overlaying the agricultural, urban and periurban maps. The map combination process is very easy, being an algebraic combination: the output values are the arithmetic average of the input values.

The groundwater vulnerability to contamination can be assessed using parametric methods, like DRASTIC or easier, like AVI (that involves a limited numbers of parameters). In most of cases, previous documents produced at regional level can be used.

The pollution risk map is obtained by combining the thematic maps of the potential nitrate contamination map and the groundwater contamination vulnerability map. The criterion for the linkages of the different GIS layers is very easy, corresponding to an algebraic combination.

The methodology has been successfully applied in a large flat area of southern Italy, with high concentrations in NO_3.