



## A simplified model for assessing the impact to groundwater of swine farms at regional level

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Swine manure can be an excellent source of nutrients for crop production. Several swine farms are present in the territory of Regione Umbria and more than 200.000 of swine heads are present yearly in the whole territory while some municipalities host more than 30.000 heads over a relatively limited land. Municipality with elevated number of swine heads has registered particularly higher Nitrate concentration in groundwater that requires a management plan and intervention in order to determine the maximum allowed N loads in the specific region.

Use of manure and fertilizers in agricultural field produce diffuse nitrogen (N) losses that are a major cause of excessive nitrate concentrations in ground and surface waters and have been of concern since decades. Excessive nitrate concentrations in groundwater can have toxic effects when used as drinking water and cause eutrophication in surface waters. For management and environmental planning purposes, it is necessary to assess the magnitude of diffuse N losses from agricultural fields and how they are influenced by factors such as management practices, type of fertilizers –organic or inorganic - climate and soil etc.

There are several methods for assessing N leaching, they span from methods based on field test to complex models that require many input data. We use a simple index method that accounts for the type of fertilizer used - inorganic, swine or cattle manure- and hydrological and hydrogeological conditions. Hydrological conditions such as infiltration rates are estimated by a fully distributed hydrological model. Data on inorganic and organic fertilization are estimated at municipal level by using the nutrient crops needs and the statistics of swine and cattle heads within the municipality. The index method has been calibrated by using groundwater concentration as a proxy of N losses from agriculture. A time series of three years of data has been analyzed.

The application of the simple index method allowed to distinguish the contribute of inorganic fertilization, swine and cattle manuring and can be used as a criteria for the management of the quantity of N load for swine farms in a specific territory. The approach has been applied to Regione Umbria and offers a quantitative approach for the planning of the number of swine farms, swine heads and amount of N loads in the entire region.