# Groundwater and Nitrate Dynamics in an Agricultural Catchment near Tsukuba City: Preliminary Results

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## 1. Introduction

Nitrate loads derived from agricultural activities represent both an economical and health hazard of major concern in developed countries. Much of the nitrate pollution arises directly from the leaching of fertilizers but as dissolved species migrate in groundwater, they are subjected to different reactions which can play an important role in the contamination characteristics and its attenuation. The purpose of this study is to determine the nitrate transport in the groundwater system of a small agricultural watershed, and get a better understanding of the processes and mechanisms affecting its fate.

## 2. Methodology

A network of 35 multilevel wells distributed throughout the catchment provided on monthly groundwater quality data, and were combined with a simple 3-D steady state groundwater flow and contaminant simulation to strengthen the conceptual model and interpretation of observed patterns.

## 3. Results and Discussion

The subsurface system consists of a layered sequence of sand deposits forming two major aquifers, confined by clayey aquitards. The horizontal hydraulic conductivity of the aquifers range from 2xE-03 to 2E-05 cm/sec, although lower values were recorded at some points. Conductivity decreases in some orders of magnitude at the confining units. Precipitation is almost the only source of recharge. Even though it is uniformly distributed over the area, its rate is controlled by the topography and land use. More than 70% of the infiltrated water is constrained to the upper layers, the rest migrating downward through the aquitard into the deeper units. These conditions result in a set of two local flow systems of distinctly chemical quality moving horizontally and with little connection at the uplands, but converging near the riparian zone, consequence of the discontinuities in land surface and the disappearance of the impermeable strata. Patterns of nitrate transport are expected to deviate from the groundwater flux, as other factors aside from advection would influence its migration. Among them, decay by denitrification seems to be the most significant, as contributes to eliminate the plume over time. Nitrate depletion takes place in depth below the aquitard, associated to longer water residence times, and laterally at the riparian zone under favorable redox conditions. Observed trends indicate that nitrate removal in groundwater is associated to minimum values of Eh and oxygen. According to the NO3/Cl ratio dilution would be subordinated to denitrification, although the wide range of ages found in waters at the discharge points suggests it might have an important role in the flush out of the contamination.