Geophysical Research Abstracts
Vol. 16, EGU2014-9773, 2014
EGU General Assembly 2014

How agricultural landscape features control the transfer of nutrient and eutrophication risk in headwater catchments?

Rémi Dupas (1,2,3), Magalie Delmas (4), Jean-Marcel Dorioz (5), Josette Garnier (6), Florentina Moatar (7), Chantal Gascuel-Odoux (1,2)

(1) Agrocampus Ouest, F-35000 Rennes, France, (2) INRA, UMR1069 Sol Agro et hydrosystème Spatialisation, F-35000 Rennes, France, (3) Université européenne de Bretagne, France, (4) INRA, UMR LISAH INRA–IRD–SupAgro, F-34060 Montpellier, France, (5) Univ Savoie, CARRTEL, INRA, F-73376 Le Bourget Du Lac, France, (6) Univ Paris 06, CNRS, UMR Sisyphe 7619, F-75252 Paris, France, (7) Univ Tours, Fac Sci & Tech, EA 6293, F-37200 Tours, France

The degradation of surface water quality due to nitrogen and phosphorus pollution is a major concern for drinking water quality and ecosystems health. Numerous studies have demonstrated that headwater catchments are large contributors of nutrient loads to downstream waters bodies. In terms of scientific understanding of the processes controlling nutrient transfers, headwater catchments are relevant spatial units to study the role of landscape features because of the relatively low contribution of point sources and in-stream processes compared to larger river networks.

This paper presents an analysis of the variability in space and time of observed N and P loads for a dataset of 160 headwater catchments at a national level (France). A multivariate statistical analysis was performed to relate observed N and P loads to spatial attributes describing agricultural landscapes and the physical characteristics of the catchments: climate, topography, soils, etc. We identified factors controlling N and P loads and N:P:Si ratios in freshwaters; and specifically spatially described factors, by considering river corridors and interaction between soils and land use attributes.

The same catchment dataset is used to calibrate the Nutting model, i.e. a statistical model developed to estimate nutrient emission to surface water, using readily available data in France (Dupas et al., 2013). Nutting is a statistical model linking N/P sources and catchment land and river attributes to estimate mean interannual nitrate-N, total-N, dissolved-P and total-P loads. It allows to extrapolate nutrient loads in unmonitored catchments at a national level and to estimate the risk of eutrophication in freshwaters considering Redfield's (1963) N:P:Si ratios.
Results show that N is in excess over silica in 93% of French headwater bodies, and that phosphorus is in excess over silica in 26%-65% of French headwater catchments. This means that between 26% and 63% of French headwaters are at risk of eutrophication considering the Redfield's ratios, and that phosphorus is the limiting factor in 55%-61% of the headwater bodies at risk of eutrophication.

Dupas R, Curie F, Gascuel-Odoux C, Moatar F, Delmas M, Parnaudeau V, et al. Assessing N emissions in surface water at the national level: comparison of country-wide vs. regionalized models. Sci Total Environ 2013; 443: 152-62.