

Nutrient cascade through the agro-food system and the terrestrial-water continuum: exploring scenarii for combatting coastal eutrophication

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The EU-Water Framework Directive (2000) has led to drastically decrease phosphorus (P) concentrations in surface waters and delivery to the coastal zone, so that many coastal waters of the North EU-Atlantic façade have shift from nitrogen (N) to P limitation. Although these changes led to reduce eutrophication in rivers, the remaining nitrogen excess is recognized as being responsible for coastal eutrophication and harmful algal blooms. River basins contributing to nutrient supplied to the Seine Bight, including the Seine River (75,000 km²) and other small coastal rivers (22 river basins, 26,000km²) were analyzed using the generic biogeochemical Riverstrahler model. After validation of the model for the period 2002-2014, we constructed a scenario assessing a non- human impacted pristine-like state and another one for the 1980's past situation, with still low wastewater treatment (WWT). In addition, we established prospective scenarios storylines integrating the compulsory improvement of WWT plants, the achievement of good agricultural practices and also considering more radical re-organization of the agro-food system, including organic farming, reconnection of crop- and livestock systems and modification of human diet. Whereas the pristine and the 1980's scenarios represented two extreme situations, the full application of the current regulation options would neither allow recovering acceptable water quality (for drinking water production) in the river basins, nor preventing eutrophication at the coast. Only a full re-orientation of agriculture would achieve this goal.