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Explicit definition of phosphorus source, pathway and delivery in a karst aquifer

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Karst aquifers in the west of Ireland have been defined as being of 'poor status' due to high phosphorus (P) concentrations that may impact aquatic ecology when 75% of any impacted receiving surface water (>0.035mg P L-1) is from karst groundwater and diffuse pollution is a primary cause. This is determined from routine monitoring data from emergent springs. Conduit and other karstic flows to the aquifers, connecting agricultural soils and activities, are considered to be the main hydrological mechanisms that transfer phosphorus from the land surface to the groundwater body. In this study, we defined the soil source and pathway components of the nutrient transfer continuum at a high spatial resolution; field-by-field soil P status and mapping of all surface karst features was undertaken in a >35km2 spring contributing zone. Additionally, P delivery was monitored in the emergent spring at a high temporal resolution with TP and TRP sampled on a sub-hourly basis since January 2010. Despite moderate to intensive agriculture, varying soil P status and a high karstic connectivity potential, background P concentrations in the spring were low and indicative of being insufficient to increase the surface water P status of the neighbouring river. However, episodic P tranfers via the conduit system increased the P concentrations in the spring during storm events (>0.035mg TRP L-1). Using the nutrient transfer continuum as a theoretical framework, it appears, therefore, that this karst aquifer is not at risk from P transfers. However, the mobilisation of P during high flow events in conduit flow is synonymous with other catchments where the predominant transfer is via episodic, surface flow pathways and that the risk to receiving surface water bodies is also from this surface mobilisation process and not from groundwater eutrophication.