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Using Bayesian belief networks to infer catchment phosphorus buffering capacity

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Phosphorus (P) is a key element to all life and therefore plays a critical role in agricultural production. However, its liberal application to land and wider use within the food chain has caused expensive pollution problems: primarily impaired water quality from point and diffuse sources. Connecting these catchment P input pressures to riverine P responses is challenging, since globally only 2-38% of P inputs are accounted for in riverine P loads. The variability of catchment response to P pressure is, in part, due to the innate P buffering capacity of each catchment, i.e. its sensitivity and thus ability to absorb P inputs, determined by hydrological, biogeochemical and ecological catchment characteristics. By further understanding buffering capacity, we can explore how far agriculture could potentially be intensified without causing significant adverse effects to aquatic ecosystems.
Current methods used to determine buffering capacity have relied solely on available data pertaining to catchment characteristics. Assessments have therefore been limited by, or potentially biased towards, available data. The use of Bayesian belief networks (BBNs) therefore offers an opportunity to combine knowledge from expert and stakeholder groups with available catchment data to describe cause and effect relationships determining catchment buffering. We therefore aim to develop BBNs at a yearly timestep for three catchments in the UK, with different data availability and levels of stakeholder interaction to determine the total P buffering capacity. By using BBNs we will be able to create an iterative, engaging process of stakeholder engagement to help enhance stakeholder understanding of P buffering capacity in catchments.