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Socio-hydrological approach to the evaluation of global fertilizer substitution by sustainable struvite precipitants from wastewater

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Phosphorus is an element necessary for the development of organic tissue as it forms a key, structural component of DNA and RNA. Currently, much of this unrenewable resource is being wasted to the ocean through the discharge of untreated or partially treated wastewater from urban areas and livestock industries. Analysing the potential phosphorus production of these two sectors in possibly meeting the partial demand of the agricultural sector, will be an important tool in tackling both phosphorus depletion from natural sources as well as phosphorus pollution of water sources . In this study, a global overview is provided where a selection of P-production nodes and P-consumption nodes have been determined using global spatial data. Distances, investment costs and associated carbon footprints are then considered in modelling a simple, alternative trade network of struvite precipitant, phosphorus flows. The network is then optimized to maximum trade flow after which an international, free-market P-commodity price is determined. Carrot-stick policy measures such as subsidies and carbon taxes are evaluated in their benefits to supporting sustainable phosphorus consumption over the non-sustainable counterpart. Preliminary results have revealed that there exists a total anthropogenic production potential of 3.3 MtP for 2005. Very crudely, but in accordance to results by Milhelcic et al. (2011) who reported 22%, approximately 20% of the reported global fertilizer consumption could then be satisfied by recovering urban phosphorus. Phosphorus recovery from wastewater for secondary utilization will prove an important step in creating sustainable communities through closed circle economic development. It is also a step towards prolonging our phosphate rock reserves, granting more time to revise our current phosphorus throughput cycle before the depletion of the remaining reserves.