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Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Understanding feedbacks between economic decisions and the phosphorus resource cycle: A general equilibrium model including material flows



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ARTICLE INFO

Keywords:

Phosphorus recycling
General equilibrium
Fertilizer choice
Agricultural economics
Material flow analysis
Socio-economic metabolism

ABSTRACT

By combining an economic two-sector general equilibrium model with a material flow model we study the coupled human-resource-environment feedbacks associated with phosphorus use and recycling, and the economic and environmental effects of implementing phosphorus recovering technologies from waste water. Using recycled phosphorus as fertilizer increases environmental quality and profits in the agricultural sector. Furthermore, the economy does not depend as much on mineral fertilizer imports and is therefore more resilient to a price increase on the global phosphorus market. However, there is a need to improve the quantity and quality of recycled phosphorus products. Overall, reduction of phosphorus in soil and water bodies as result of economic decisions is only possible if phosphorus is recovered from waste water and the prices of imported mineral fertilizer rise. Policy makers can support this technological change by subsidizing recycled phosphorus or introducing taxes or tolls for imported mineral fertilizer to increase its price. Alternatively, societal values would have to change. Such a change may be induced by putting a higher preference on a healthy environment and hence being willing to pay more for food and consequently production inputs like phosphorus fertilizer recycled from sewage sludge.

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<https://doi.org/10.1016/j.resourpol.2019.02.010>

Received 7 June 2018; Received in revised form 10 February 2019; Accepted 11 February 2019

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