

The story of phosphorus : sustainability implications of global phosphorus scarcity for food security

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ABSTRACT:

The story of phosphorus began with the search for the philosopher's stone, and centuries later the critical role of phosphorus in soil fertility and crop growth was highlighted. Eventually, phosphorus was implicated in the global environmental challenge of eutrophication. Now, we are on the brink of yet another emerging chapter in the story: global phosphorus scarcity linked to food security. Through a transdisciplinary and systemic inquiry, this thesis has analyzed, reconceptualized and synthesized the physical and institutional dimensions of global phosphorus scarcity in the context of food security, leading to a new framing, 'phosphorus security' to guide future work towards a more sustainable and food secure pathway. In a world which will be home to nine billion people by the middle of this century, producing enough food and other vital resources is likely to be a substantial challenge for humanity. Phosphorus, together with nitrogen and potassium, is an essential plant nutrient. It is applied to agricultural soils in fertilizers to maintain high crop yields. Phosphorus has no substitute in food production. Therefore, securing the long-term availability and accessibility of phosphorus is crucial to global food security. However the major source of phosphorus today, phosphate rock, is a non-renewable resource and high quality reserves are becoming increasingly scarce. This thesis estimates peak phosphorus to occur before 2035, after which demand will exceed supply. Phosphorus scarcity is defined by more than just physical scarcity of phosphate rock and this thesis develops five important dimensions. For example, there is a scarcity of management of phosphorus throughout the entire food production and consumption system: the global phosphorus flows analysis found that only 20% of phosphorus in phosphate rock mined for food production actually reaches the food consumed by the global population due to substantial inefficiencies and losses from mine to field to fork. There is also an economic scarcity, where for example, while all the world's farmers need access to sufficient fertilizers, only those with sufficient purchasing power can access fertilizer markets. Institutional scarcity, such as the lack of governance structures at the international level that explicitly aim to ensure long-term availability of and access to global phosphorus resources for food production that has led to ineffective and fragmented governance of phosphorus, including a lack of: overall coordination, monitoring and feedback, clear roles and responsibilities, long-term planning and equitable distribution. Finally, geopolitical scarcity arising from 90% of the world's remaining high-grade phosphate rock reserves being controlled by just five countries (a majority of which are subject to geopolitical tensions) can limit the

availability of phosphorus on the market and raises serious ethical questions. The long-term future scenarios presented in this thesis indicate that meeting future global food demand will likely require a substantial reduction in the global demand for phosphorus through not only improved efficient use of phosphorus in agriculture, but also through changing diets and increasing efficiency in the food chain. The unavoidable demand for phosphorus could then be met through a high recovery and reuse rate of all sources of phosphorus (crop residues, food waste, manure, excreta) and other sources including some phosphate rock. A 'hard-landing' situation could involve further fertilizer price spikes, increased waste and pollution (including eutrophication), increased energy consumption associated with the production and trade of phosphorus fertilizers, reduced farmer access to phosphorus, reduced global crop yields and increased food insecurity. A preferred 'soft landing' situation will however require substantial changes to physical and institutional infrastructure, including improved governance structures at the global, national and other levels, such as new policies, partnerships and roles to bring together the food, fertilizer, agriculture, sanitation and waste sectors for a coordinated response. Finally, this thesis proposes a new global goal - phosphorus security - to be integrated in the dominant research discourses and policy debates on global food security and global environmental change. Among other criteria, phosphorus security requires that phosphorus use is decoupled from environmental degradation and that farmers' access to phosphorus is secured.

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The Australian story of phosphorus: sustainability implications of global phosphate scarcity for a net food-producing nation, in review. Article · May 2010 with 17 Reads. How we measure 'reads'. With no reserves of phosphorus source in Spain, increased dependence on phosphorus in agriculture have not only increased dependence on imports but also has raised concerns on its future availability as a resource. A Phosphorous Flow Analysis (PFA) was conducted for Spain for the year 2012 focusing on the food production and consumption systems. The results obtained were finally compared with PFA at both country level and continent level (EU-27). To quantify food and non-food flows systems, country specific data were considered. Phosphorus needs to be applied and management in

agriculture more efficiently, we need to eat more vegetarian food, and increase efficiency throughout the food chain. At the same time we need to recover and reuse a large part of the phosphorus that exists in crop residues, food waste, manures human faeces and other sources. The dissertation is titled The Story of Phosphorus: Sustainability Implications of Global Phosphorus Scarcity for Food Security. make a difference: sponsored opportunity. Story Source: Materials provided by Expertanswer. Note: Content may be edited for style and length. Cite This Page: MLA. Phosphorus is essential for food production and modern agriculture currently sources phosphorus fertilizers from finite phosphate rock. The 2008 food and phosphate fertilizer price spikes triggered increased concerns regarding the depletion timeline of phosphate rock reserves. 3. Clarifying Common Misunderstandings about Phosphorus Scarcity. Whilst the critical nature of phosphorus in food production as highlighted above is not in doubt, there is much debate over the long-term availability of phosphate rock for meeting future global food demand. The main point of contention is the 'timeline' of remaining phosphate rock, or 'million tons of reserves'. Moreover, the global distribution of phosphate production and reserves is highly skewed and has the potential to pose a threat to food security in developing countries through factors such as the volatility of the phosphate rock price or price setting by suppliers with significant market power. This paper overviews the recent literature and data on the availability of phosphorus and discusses the economic aspects of phosphate scarcity by describing major price determinants of the global phosphate market. We show that past price fluctuations of phosphate rock and phosphate fertilisers are not a reflection of physical phosphate rock depletion but rather attributable to numerous other demand- and supply-side factors.