Global footprints of soil phosphorous from 1970-2017

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Human activities changes Phosphorous(P) balance in agricultural soil with P surplus and deficit widespread, posing environmental and food security challenges. International trade is a key driver of anthropogenic P balances in agricultural soil. Existing P footprint studies, as a well-known way to comprehensively evaluate tradeâ€™s impact on P cycle, primarily focus on excessive P fertilizer input and its environmental risk, such as eutrophication of water ecosystems. However, P deficits, covering 35% of global agricultural area in 2017 up from 21% in 1970, which could lower crop yields and trigger food insecurity, receive less attention. In this study, we integrate detailed spatial and sectoral information on anthropogenic P balances in soils into a global trade model to capture how trade and consumption drive global soil P surpluses and deficits across 90 countries and regions. In our spatially-explicit global P footprint assessment we find that, from 1970 to 2017, the global anthropogenic P deficit (APD) â€“ largely ignored in previous studies â€“ has more than doubled, far exceeding the 24% growth rate of the global anthropogenic P surplus (APS). Consumption in West Europe and East Asia (excluding China) contributes 73% to global APS and 66% to global APD caused by global trade, respectively. Twenty-four low-income food-deficit countries as categorized by the Food and Agriculture Organization (FAO), exported five times as much APD from cropland as they imported, highlighting the food security risks related to APD implicated in global trade.