

PERSPECTIVES AND VIEWPOINTS

“In a vicious circle of night-soil¹ fertilizer production, more people were produced and more people produced more night soil, which produced more crops, which fed more people. Eventually even the land of the *fenfa*² had to resort to artificial fertilizers, which usually contained phosphorus. China again is agriculturally advantaged, having one of the largest phosphate reserves in the world, but even China cannot make the finite infinite. Estimates for when the world's exploitable phosphate reserves will be exhausted range from sixty years from now to 130, but they will run out sooner if current rates of exploitation continue. Biogas made agricultural, financial, and energy sense.”³

“A study by the Center for Chinese Agricultural Policy (Qiao et al. 2006)⁴ recently confirmed that China's farmers are overusing fertilizer. Specifically, farmers in many parts of China are applying chemical fertilizers – especially nitrogen – inefficiently.”⁵

“Concerns have also been raised about negative environmental consequences of fertilizer overuse. High levels of nitrates and **phosphorus** are present in all of China's major lakes and rivers, and there are related links to poor groundwater quality. Nonpoint source pollution from fertilizer is blamed for falling aquaculture output and chronic disease. Using less fertilizer could improve the environment by reducing fertilizer runoff.”⁶

“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.”⁷

1 “Night-soil” – a polite term for human excrement.

2 “fenfa” - Chinese word for those who are in charge of collecting human excrement (night-soil) for spreading on fields. Loosely defined as “Poop Lords.”

3 Rose George, *The Big Necessity: The Unmentionable World of Human Waste and Why it Matters*, (New York, 2008) Ch. 5, China's Biogas Boom – A Pig in every Bedroom, p. 118.

4 F. Qiao, L. Zhang, J. Huang, and S. Rozelle, “Do China's farmers overuse fertilizer: An empirical analysis”, Working Paper, Beijing, China, Center for Chinese Agricultural Policy, Chinese Academy of Sciences, 2006.

5 Jikun Huang, Ruifa Hu, Jianmin Cao, and Scott Rozelle, “Training programs and in-the-field guidance to reduce China's overuse of fertilizer without hurting profitability”, *Journal of Soil and Water Conservation*, Vol. 63, No. 5, Sept/Oct 2008, p. 165A.

6 Ibid. [Bold added]

7 Dana Cordell, *The Story of Phosphorus: Sustainability implications of global phosphorus scarcity for food security*, Doctoral Thesis, Linköping Studies in Arts and Science No. 509, Department of Water and Environmental Studies, Linköping University, Linköping, Sweden, 2010. [from Abstract]

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“Perched on the bed in her Xi'an office, Wang Mingying tells me that for her, it was all about the trees. In the mid-1990's, she worked in the Propaganda Department of the Women's Federation. In 1995, she attended the UN Women's conference in Beijing, and it changed her life. 'I saw,' she tells me, 'how the poverty of women is directly related to the deterioration of the environment.' Poor rural women try to clear more land for crops by cutting down forests. This brought on soil erosion, so more forest was cleared for new crop land. It was a vicious cycle that no one knew how to escape.”⁸

“An ancient Vedic scripture in Sanskrit states the importance of soil more directly: 'Upon this handful of soil our survival depends. Husband it and it will grow our food, our fuel and our shelter and surround us with beauty. Abuse it and soil will collapse and die, taking humanity with it.’”⁹

“Continued accelerated eutrophication of fresh waters caused by elevated phosphorus inputs places pressure on agriculture to implement phosphorus-based nutrient management strategies, particularly for confined animal feeding operations. As phosphorus-based strategies usually have a negative impact on farm economics, current challenges are to define where and how much of a problem exists, how to implement and maintain effective conservation practices (CPs), and what are the best incentives for farmer adoption.”¹⁰

“The following challenges facing poultry production need to be addressed:

- Can the farming system become economically and environmentally sustainable?...
- Can more alternative uses for litter be developed?...
- Can manure transport within and among watersheds be encouraged to fully utilize this valuable phosphorus resource?...
- Can cost and phosphorus-loss reduction efficiencies of existing CPs be enhanced further?...
- Even so, the bottom line is still who will pay to adopt costly new strategies? Should it be the public who want cheap produce and clean water? Should it be the integrators who are meeting a market demand and profitability margins? Or should it be the growers who are managing manure and litter? The answer is all of the above. The question is, how can the financial responsibility be apportioned fairly among those directly involved in poultry operations[*] and those benefiting from them?”¹¹

*Does this question apply to all agricultural operations?

SUGGESTED WEBSITES FOR MORE INFORMATION

Be Phosphorus Smart! web site at www.beposphorusmart.msu.edu/

Sustainable Phosphorus Futures at <http://phosphorusfutures.net/>

Florida Institute of Phosphate Research at <http://www.fipr.state.fl.us/>

“Phosphorus Recycling in the phosphorus industry”, *Environmental Technology* 22 (11) (2001) 1337
<http://www.thermpos.com/Documentation/~media/Pdf/documents/PhosphorusRecycling%20pdf.ashx>

8 See footnote 3, p.119.

9 Rattan Lal, “The urgency of conserving soil and water to address 21st century issues including global warming”, *Journal of Soil and Water Conservation*, Vol. 63, No. 5, Sept/Oct 2008, p.141A.

10 Andrew N. Sharpley, Sheri Herron and Tommy Daniel, “Phosphorus-based management challenges and strategies for poultry farming”, *Journal of Soil and Water Conservation*, Vol. 62, No. 6, Nov/Dec, 2007.

11 Ibid.