

Science for Environment Policy

Indicators for more sustainable phosphorus management

Phosphorus is essential for modern agriculture. Supplies are dwindling and markets are concentrated, presenting a serious threat to food security. Tackling this emerging global sustainability risk requires effective governance to ensure phosphorus is available and accessible to farmers worldwide. This study presents a series of phosphorus security indicators to support this goal.

Phosphorus is essential for life on Earth; it is an integral part of DNA, the cellular energy source ATP and cell membranes. As all crops depend on phosphorus, it is vital to [agriculture](#), which relies on added phosphorus compounds in fertilisers and recycled organics.

Phosphorus therefore underpins global food security, ensuring that [soil](#) remains fertile and that agriculture remains productive. There are uncertainties in phosphorus resource estimates, but the use of the element has been increasing consistently over the past decades. According to the International Fertilizer Industry Association (IFA), in 2008, close to 53.5 million tonnes (Mt) of P₂O₅ (i.e. 175 Mt of phosphate concentrates, averaging 30.7% P₂O₅ content) was mined¹. By 2020 demand for phosphate rock is expected to increase in every major part of the world compared to 2010 levels².

While renewable sources of phosphorus, such as compost, were traditionally used to maintain soil fertility, in the mid-20th century the use of phosphate rock took over. Today, almost all farmers worldwide depend on this source of phosphorus. While mined phosphate rock helped to fuel the Green Revolution, it is a finite resource, with some estimates stating that the depletion of reserves will occur this century³.

If action is not taken, farmers are likely to face increased costs and reduced access to phosphate, leading to reduced crop yields and eventually increased hunger worldwide. Furthermore, many of the world's 795 million people living in food insecurity are farmers and their families⁴.

In order to prevent this, governments and industry must work towards achieving phosphorus security by making sure that phosphorus is available, accessible, and used efficiently. An efficient use of phosphorus in agriculture is important as an excessive and unbalanced use of phosphorus-containing fertilisers leads to adverse environmental effects (i.e. eutrophication).

One way of stimulating this is to use sustainability indicators, which provide measurements of sustainability to support environmental policy and raise awareness of challenges such as phosphorus vulnerability.

Indicators of the key drivers in phosphorus security could be used to stimulate action and evaluate progress towards phosphorus security. However, currently no independent, uniform indicators exist. This study therefore attempted to develop a set of indicators of phosphorus vulnerability.

This work builds on the recently published [Phosphorus Vulnerability Assessment Framework](#), which identified the relationships between 26 factors that can lead to phosphorus vulnerability. Alongside this framework, the authors assessed a range of sustainability indicators that have already been developed for issues including food and water security to identify relevant criteria. The researchers also used datasets including the [World Development Indicators](#) and statistics held by the UN Food and Agriculture Organization ([FAOSTAT](#)).

Continued on next page.



3 September 2015
Issue 425

[Subscribe](#) to free
weekly News Alert

Source: Cordell, D. & White, S. (2015). Tracking phosphorus security: indicators of phosphorus vulnerability in the global food system. *Food Security* 7(2), pp.337–350. DOI: 10.1007/s12571-015-0442-0.

Contact:
Dana.Cordell@uts.edu.au

Read more about:
[Agriculture](#),
[Environmental economics](#), [Resource efficiency](#), [Risk assessment](#), [Soil](#), [Sustainable consumption and production](#)

The contents and views included in *Science for Environment Policy* are based on independent, peer-reviewed research and do not necessarily reflect the position of the European Commission.

To cite this article/service: "[Science for Environment Policy](#)": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. IFA (2009) Fertiliser Supply Statistics
2. Lars Stoumann Jensen, 'A Global Perspective on the Resources and Future Supply of Phosphorus for Agriculture' (presented at the Conference on the Nitrates Directive and Phosphorus, Danish Ministry of the Environment, Copenhagen, May 10, 2012).
3. Cordell, D., White, S. (2014) Life's Bottleneck: Sustaining the World's Phosphorus for a Food Secure Future. *Annu Rev Env Resour.* Vol. 39(1): 161-188. DOI: 10.1146/annurev-environ-010213-113300
4. FAO (2015) *The State of Food Insecurity in the World*, Food and Agricultural Organisation of the United Nations. <http://www.fao.org/3/a-i4646e.pdf>

Science for Environment Policy

Indicators for more sustainable phosphorus management

(continued)

3 September 2015
Issue 425

[Subscribe](#) to free
weekly News Alert

Source: Cordell, D. & White, S. (2015). Tracking phosphorus security: indicators of phosphorus vulnerability in the global food system. *Food Security* 7(2), pp.337-350. DOI: 10.1007/s12571-015-0442-0.

Contact:
Dana.Cordell@uts.edu.au

Read more about:

[Agriculture](#),
[Environmental economics](#), [Resource efficiency](#), [Risk assessment](#), [Soil](#),
[Sustainable consumption and production](#)

The contents and views included in Science for Environment Policy are based on independent, peer-reviewed research and do not necessarily reflect the position of the European Commission.

To cite this article/service: "[Science for Environment Policy](#)": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

The outcome was a set of global phosphorus sustainability indicators: global phosphate price, market concentration and supply risk, relative physical phosphorus scarcity and eutrophication potential.

The following national phosphorus indicators were also proposed: farmer phosphorus vulnerability, national phosphorus vulnerability, national phosphorus equity, and soil phosphorus legacy (build up of the nutrient in soil following years of fertiliser use).

The next step for the researchers is to establish an expert panel to review and validate the indicators. When complete, the indicators will be used to identify the key phosphorus vulnerabilities in the food system, and where interventions could be beneficial. They will also allow monitoring and comparisons of progress in different countries and of different interventions.

The researchers intend the indicators to raise awareness of the need to better manage and govern this critical resource and ultimately encourage effective government actions. In the longer term, this could facilitate more sustainable phosphorus management, which will aid healthy aquatic ecosystems (unharmful by agricultural runoff), more sustainable farmer livelihoods and global food security.

