# Global TraPs

**Global tra**nsdisciplinary **p**rocesses for sustainable **p**hosphorus management (2010–2015)

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Special edition


## Editorial

*By Amit H. Roy, Practice-Leader, IFDC*

All of us, as members of the Global TraPs project recognize the important role of phosphorus (P) in world food security and many other technologies important to our way of life. Recently, concerns emerged about the short-term scarcity of P and phosphate rock as a natural resource. While these concerns were properly addressed, we must reflect on various constraints that limit access to P inputs in many regions of the world resulting in low crop yields, nutrient depletion and eventual soil degradation. In other parts of the world overuse of P is resulting in contamination with negative impacts on ecosystem health. By focusing on options for more efficiently using P, for technological innovations and improving environmental and social standards in mining, processing and using P, Global TraPs is addressing these important interlinked issues.

The Global TraPs project is the first global transdisciplinary project. Since early 2011, many scientists from notable universities have joined with representatives from industry, international organizations, public and private research institutes, non-governmental organizations, environmental groups and farmer organizations from the North and the South to participate in a unique learning process and stakeholder discourse on how to improve the use, management, recycling and overall stewardship of P. The 4th Global TraPs Workshop on March 17–18 was a continuation of the "learning experience" and an important milestone of the project. This workshop built on the results of the 3rd Workshop – in particular the identification of knowledge gaps with respect to sustainable P management. Having agreed on the major knowledge gaps, workshop participants then proposed potential case studies that would address the knowledge gaps. The final step will be the launching of case studies that will

Photo: P. Krütli, ETH Zurich

*Participants of the 4th Global TraPs Workshop at the site of Sidi Chennane (Morocco)*


NSSI Natural and Social Science Interface

IFDC

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

Photo: D. Ruppen, ETH Zurich

*Roland W. Scholz and Amit Roy*

address the knowledge gaps and provide information to help answer critical questions on the P cycle (e.g. how much P is lost in what part of the use chain) and provide options for improvements.

The workshop also provided an opportunity for discussing and critiquing the drafts of chapters for Global TraPs first technical publication, a SpringerBrief, tentatively titled "Sustainable Phosphorus Management: a Transdisciplinary Roadmap." During the workshop, the discussion and improvement of these recently disseminated chapters was a key element of building up the "comprehensive picture" of sustainable P use for the future.

Finally, on behalf of all Global TraPs participants, I wish to thank the Office Chérifien des Phosphates (OCP) for their financial support to the workshop and their excellent hospitality. In particular, we thank Mr. Mohamed Ibnabdeljalil and his colleagues for the informative presentations, sharing of information and organizing the field trip to Khourigaba. For many of the workshop participants, this was their first exposure to the investment required to mine the phosphate minerals essential for virtually all species in the plant and animal kingdom. This understanding and knowledge is central to identifying strategies for sustaining P use in the future.

## World stakeholders identify knowledge gaps for Phosphorus (P) stewardship: A Summary of the 4th Global TraPs Workshop

*By Chris Thornton[1], adapted from the Scope Newsletter 86*

The 4th workshop of the Global TraPs project was held in Morocco, 16–18 March 2012, hosted by representatives of OCP who participated as guests (see below). Around 90 participants from across the world, including international organizations (FAO, United Nations Environment Programme , European Commission), NGOs (Greenpeace), farmers' representatives, scientists working on food security, agriculture, phosphorus management, societal approaches and industry (representatives from various fertilizer manufacturers and industry-supported entities including the International Plant Nutrition Institute [IPNI] and the Global Phosphate Forum) met to discuss the state of knowledge in the production and use of phosphorus.

Most of the workshop's participants met on March 16th for a mining excursion organized by OCP that offered the participants insight into industrial activity at their largest mining center located in the province of Khouribga. At the site of Sidi Chennane, the visitors had the opportunity to observe several mining operations such as the excavation of phosphate sediments by draglines and trucks, transportation to the conveyer belt and the ore storage in stockpiles. The field excursion gave valuable impressions of the magnitude of the mining activities, the impacts on the landscape and environment, and the strategy for renaturation and environmental protection of the OCP Group, the world's third-largest phosphate producer.

On March 17th the 4th Global TraPs Workshop was formally opened by Roland Scholz (ETH) and Amit Roy (IFDC). The 4th Workshop built on the work done at previous workshops in identifying "knowledge gaps," or areas where data or

[*] Chris Thornton coordinates research and communications for a number of industry associations, including CEEP (Centre Européen d'Etudes des Polyphosphates) and the Global Phosphate Forum, which bring together manufacturers of phosphates for detergents in Europe and worldwide. Among many other commitments, Chris is editor of the "SCOPE Newsletter," which summarizes scientific information concerning phosphates and the environment.

information is lacking and research is considered necessary to understand how phosphorus (primarily in the form of phosphate) is produced and used, where opportunities exists to reduce losses or waste and what policies could be developed to address these various issues. This discussion follows the "guiding question" defined for the Global TraPs project in previous workshops:

***"What new knowledge, technologies and policy options are needed to ensure that future phosphorus use is sustainable, improves food security and environmental quality and provides benefits for the poor."***

Speakers began by reminding participants that phosphorus is essential for all living organisms and is crucial for increased agricultural production and food security, yet it is seldom seen as a priority. For example, in a loaf of bread valued at $1 USD , associated phosphate costs are around 0.1 cent compared to oil at 14 cents. One dollar spent on phosphate fertilizer can generate $4 USD to 9 (India) dollars through increased crop yield. Overall, every world citizen spends, on average approximately $6 per year on phosphate embedded in food consumed.

**Anjan Datta**, United Nations Environment Programme (UNEP), opened the workshop via videolink and emphasized the importance given to phosphorus stewardship and phosphate fertilizer availability by UNEP. The UNEP recognizes phosphorus and phosphate fertilizers to be essential for global food security.

**Vijoo Krishnan**, All India Kisan Sabha (small farmers' organization with over 22 million members) underlined the many problems facing small farmers in India, and linked the problems (primarily debt) to increasing suicide rates. Mr. Krishnan noted that India's Green Revolution was largely based on subsidized fertilizers, free water, subsidized electricity for irrigation and credit. While yields have increased substantially, subsidies are often not logical, and can result in challenges and misuse such as promoting the heavy use of nitrogen (N) fertilizers at the expense of phosphorus (P), potassium (K) and other nutrients. The inappropriate use of N,P. and K fertilizers is attributed to the preferential higher subsidy on urea N fertilizers, as compared with P (as phosphate) or K (as potash) fertilizers. This policy resulted in fertilizer misuse and soil degradation.


*Vijoo Krishnan*

**Timothy Busienie**, Kenya Cereal Growers Association, also emphasized problems resulting from inappropriate subsidy systems – for example subsidizing DAP (diammonium phosphate) due to its N and P nutrient content, but not other fertilizers (e.g. NPK fertilizer) which might be better adapted to prevailing crop needs. Despite fertilizer subsidies, many farmers cannot afford to use fertilizers, so their crop productivity remains very low. Delivering affordable fertilizers to smallholder farmers in a timely manner is a major issue in many developing countries, and is the result of many factors including limited demand for fertilizers, poor infrastructure, lack of finances, etc. Such situations can benefit from the use of "smart" subsidies that help farmers' transition from subsistence to commercial production. For a subsidy to be characterized as "smart," it should be targeted and accompanied by an exit strategy that provides for a reduction/removal of subsidies over time.

**Christian Nolte** of the Food and Agriculture Organization(FAO) of the United Nations presented the organization's policy of "sustainable crop production through intensification" (see: http://www.fao.org/agriculture/crops/core-themes/theme/spi/en/ ). This is based on three objectives: food security, sustainable agriculture and rural development, and conservation of natural resources. Overall, FAO considers that crop production is generally P efficient, applied P not used by the crop is mostly stored in the soil as residual P, and P losses from cropping systems are primarily associated with topsoil loss and soil erosion. Animal production, on the other hand, is viewed as highly phosphorus-inefficient.

**Luc Maene** of the International Fertilizer Industry Association (IFA) stated his organization represents fertilizer manufacturers worldwide, including organic fertilizer producers. He emphasised IFA's sustainability development work, in particular the "International Agri-Food Network". He noted the need to address phosphates in the context of other nutrients, and that Global TraPs should fix a number of clear, targeted objectives and questions.

**Ajay Vashee**, former President of the International Federation of Agricultural Producers, also emphasized the need to consider all nutrients, not just phosphorus. He underlined the issue of cost and that phosphorus efficiency should also be considered as cost-efficiency, and that society, not just farmers, must pay the bill for adjusting phosphorus management or for increased phosphate costs.

*Audience in the Doukkala room at the Mazagan Beach Resort*

**Elena Bennett**, McGill University Canada, presented the importance of communicating phosphorus issues to decision-makers and the difficulty of some of the issues in question. Many freshwater ecologies are so sensitive to phosphorus, that it is nearly impossible to reduce phosphorus run-off from agriculture to levels that will enable restoration. According to her analysis, phosphorus is one of the most critically modified global geochemical cycles, and significantly over the threshold for global cycle disruption.

**Paul Speight**, European Commission, explained that by mid-2012 the Commission will present a "Green Paper on Phosphorus." This will be a short document (10-20 pages), officially published (translated into the EU languages), outlining key questions concerning phosphorus management in Europe and requesting stakeholder reaction and input. He indicated that Europe is also currently working on the question of contamination of soils related to cadmium in some mineral phosphate fertilizers.

**Reyes Tirado** of Greenpeace spoke of the importance of looking at long-term questions. For a sustainable planet, phosphate management must be part of an integrated farming and food system that is moving away from centralization and concentration to locally "closing the loop." This must ensure soil health (bacteria and micro-fauna...), avoid soil erosion, restore soil organic matter, whilst ensuring the restoration of biodiversity and the avoidance of chemicals and GMOs. This can be achieved through small farmers, replacing intensive energy and chemical use by human presence and know-how. In her view, mineral fertilizers will not contribute to global food security in the long term because they are expensive, leading to farmer dependency, cause pollution and damage the soil. She considers that Global TraPs should contribute to the capacity building needed now to start moving towards this long-term vision. Global TraPs should particularly look at the problems of soil loss, and the sustainability questions of centralization of sewage collection and treatment and the concentration of livestock productions.

*"Sustainability Visions of OCP",*
*a guest talk by Mr. Ibnabdeljalil*

The workshop's guest speaker, Mr **Mhamed Ibnabdeljalil**, Executive Vice President of Sales, Marketing & Raw Material Procurement of the OCP Group, addressed the company's sustainability policies. Mr. Balafrej, Director of Sustainable Development of the OCP Group, joined the discussion and complemented Mr Ibnabdeljalil's speech with his expertise.

Mr Ibnabdeljalil outlined that OCP has been entrusted, by the Moroccan State, with a resource which belongs to the nation and to future generations. Because Morocco has considerable reserves of phosphates, OCP believes it has the responsibility to make these resources available to its customers throughout the world in order to address food security, but is equally committed to promoting efficient use and minimization of losses and waste.

This sustainability policy is enacted in three directions:

- Improving mining, transport and processing of phosphate rock
- Minimizing environmental impacts and improving social benefits
- Innovating in the promotion of more effective fertilizers and better fertilizer use

The company's current investments in improved beneficiation and transport of rock and improved chemical processing will reduce phosphate losses by 6–8 percent, allow the use of lower grade ore (enabling the use of 2.5 times more of the mined layers, so extending reserves) and save energy and water.

Transport will be radically improved by the completion of a 187 km pipeline (capacity 44 million tonnes of phosphate rock per year) to move phosphate rock in a slurry from the Kouribga mines to the chemical processing complex and port of Jorf Lasfar (instead of using trains) this year. This pipeline will use 5 million m3/year of recycled water obtained by treating sewage from the city of Kouribga (200,000 population) and water piped from mountain dams, thereby avoiding use of local groundwater. In addition the energy savings are calculated at 900,000 tonnes of $CO_2$/year.

With the pipeline OCP will open two new mine sites near Kouribga and double phosphate production capacity.

*Mhamed Ibnabdeljalil*

The chemical processing site at Jorf Lasfar is being expanded and modernized, including recovering 60 percent more energy from sulphuric acid production, installation of a desalination plant (using this recovered energy) to provide water. This site offers "plug and play" opportunities, with a full infrastructure and logistics, to other companies wishing to install plants using phosphates, with the advantage of reliable supply directly from the OCP installations.

Overall, OCP is investing some $15 billion USD over 10 years. OCP is also investing in social development, through the "OCP Skills" programme (training 15,000 young people with skills to fulfill identified future employment profiles) and investing in environmental rehabilitation of the mine sites including reestablishment of trees and shrubs.

To conclude, OCP has changed both its business model and its organization, to become a developer and supplier of added value fertilizers. The company is opening offices and reinforcing its presence across the world, in order to be closer to farmers, and to develop fertilizers specifically adapted to regional crop requirements, for example by including calcium, adjusting nutrient ratios or including macro- or micronutrients. Specific products are already launched or being tested for local markets (Morocco) and for crops such as cacao, rice and cotton. This contributes to improving the efficiency of phosphate use and sustainable food production.

## Knowledge gaps along the P cycle

The current status of knowledge on the global phosphorus cycle, identifying areas where more data and investigation is needed, will be presented in a short SpringerBrief book, currently under preparation. A first draft text was discussed in the plenum and in the node meetings and is being finalized. This will address phosphate reserves (exploration), mining and processing, agricultural and other uses of phosphorus, dissemination and losses, recovery and recycling, trade and finance.

In addition to the specific knowledge gaps identified at each level of the phosphate supply and use chain, a number of global issues were raised by different participants, including:

- Beyond the quantity of phosphate reserves (on which data is still lacking or needing clarification), how will other resource issues develop in the future: quality of rock, contaminants, supply security, geographical concentration of supplies?
- How can phosphorus efficiency be improved (avoiding loss but also supplying adequate P for crop productivity) in parallel to soil management (maintaining soil fertility and quality, avoiding soil erosion) and management of other nutrients?
- How can phosphorus (and other nutrients) be recycled regionally ("closing the loop") and what are the implications (energy use, other contaminants ...)?

Photo: D. Ruppen, ETH Zurich

*A dragline excavator at Khourigaba.*

- How to change societal attitudes, to better manage phosphorus production and use, to accept and implement phosphorus recycling, and to avoid phosphorus wastage?
- What does P stewardship imply for the organization of urbanization, sewage collection and treatment, concentration of livestock production, intensification of farming – does it imply questioning current society models?

*M. Stauffacher and I. Watson, the mining node leaders*

## Case studies

To address these general knowledge gaps, and the specific questions raised by the different working groups (representing different levels of the value chain including exploration, mining, processing, use, recycling and dissipation, and cross-cutting issues including trade and finance), Global TraPs will develop a range of transdisciplinary "case studies." These include both research already underway in scientific institutes involved, which can be brought in to illustrate and contribute to Global TraPs conclusions, and new questions for which the project will look for funding, partners and researchers. In all cases, the studies will involve relevant stakeholders, and aim not only to collect existing information, to further knowledge through research, but also to enable discussion between parties such as industry, consumers, farmers, NGOs, policymakers, etc. to develop a consensus vision or identify differences, and where possible identify feasible strategies and policies. Up to 25 case studies are expected to be launched in 2012–2013, to run for two years.

## Next steps in the Project Timeline

*Roland Scholz and Désirée Ruppen (Global TraPs Zurich)*

The following milestones were achieved after the first four workshops:

- Definition and consensus on a guiding question for the project
- Identification of critical questions on sustainable/unsustainable P use
- Set priorities on what aspects, flows and impacts should be improved
- Initiation of the case study process to provide preliminary answers to the critical questions and help define necessary research programs
- Collaboration on the editing and writing of the book "Sustainable Phosphorus Management: a Transdisciplinary Roadmap", providing the basis for the 2013 Global TraPs World Conference
- Secured first funding from OCP, FHG, IFA, Keytrade and others The effort of this work has resulted in the successful partnership with more than 100 representatives from business, industry, public institutions, NGOs, research institutes, universities etc. to actively and trustfully collaborate in finding new pathways to improve phosphorus use.

The current priorities of the Management and Steering Board are to:

- finish the Spinger Briefs book
- compile a set of case studies
- prepare the first Global TraPs World Conference in early spring 2013
- write proposals for funding (there are four partners/institutions which will be asked to support the Global TraPs case studies)

During the 4th workshop, the first experts on phosphorus and nutrient use from political institutions and agencies were included. We aspire to have experts for all stages of the phosphorus supply chain, meaning mining, processing, use, recycling & dissipation, and trading P, from all key countries at the 2013 Global TraPs World Conference.

Finally, we want to convey the growing understanding amongst the members of the Global TraPs project of what transdisciplinarity means. The members have seen the added-value of running discourses and mutual learning in this way, in order to ultimately find sustainable transitions of phosphorus use. For those who want to learn more about transdisciplinarity, the Leuphana University Lüneburg (close to Hamburg, Germany), which is very active in the Global TraPs project, is offering a training course from September 3–12, 2012. Please contact Ulli Vilsmair (Td coordinator Use Node), if you would like to participate. We will publish more information on the Transdisciplinarity Summer School 2012 in the next newsletter.

Looking forward to collaborating with you for the next important steps of the Global TraPs project.

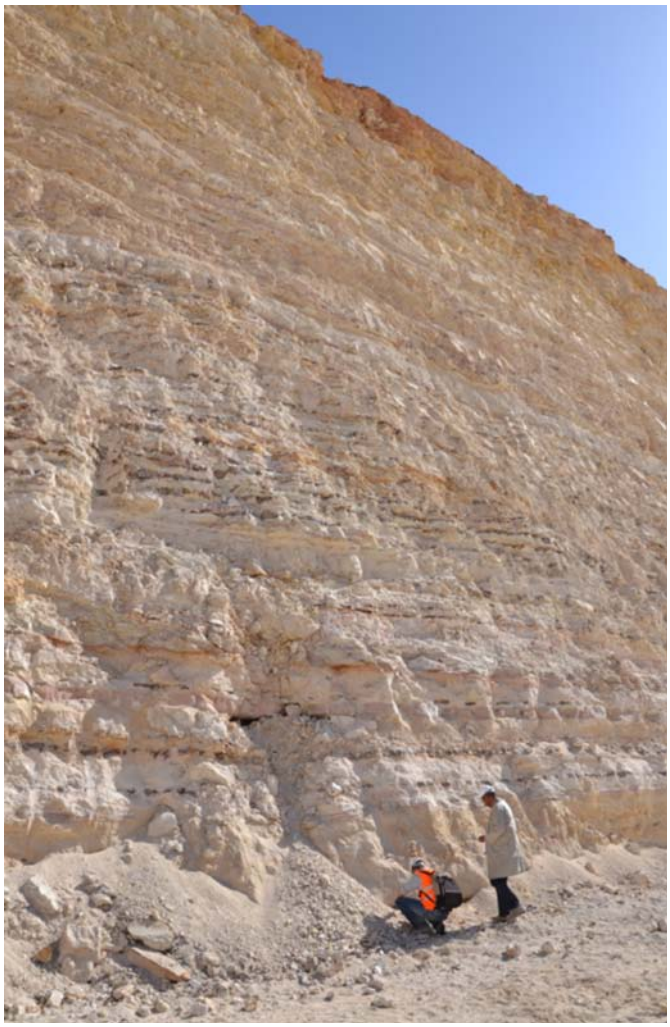

*Photo: D. Ruppen, ETH Zurich*

*Sedimentary phosphate deposits at Sidi Chennane, Morocco.*


GLOBAL TraPs

TRANSDISCIPLINARY PROCESSES FOR SUSTAINABLE PHOSPHORUS MANAGEMENT

## Contacts

To inquire about involvement in Global TraPs, please contact the Global TraPs management team:


- Science leader

  Roland W. Scholz, Tel. +41 44 632 58 91

  E-mail: roland.scholz@env.ethz.ch

- Practice leader

  Amit Roy, Tel. +1 256 381 6600

  E-mail: ARoy@ifdc.org

- Science manager

  Désirée Ruppen, Tel. +41 44 632 91 63

  E-mail: desiree.ruppen@env.ethz.ch

- Practice manager

  Debbie Hellums, Tel. +233 246 634 216

  E-mail: dhellums@ifdc.org


For updates about the Global TraPs effort, visit our website: **»» http://www.uns.ethz.ch/gt**

This newsletter has been produced by S. Bösch, D. Hellums, A. Roy, D. Ruppen, R. W. Scholz, and C. Thornton.