P-FUTURES

Phosphorus: Future urban transformations for under-governed resources by engaging stakeholders

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Integrating sustainable phosphorus management into urban decision-making and planning

Hanoi workshop

Institute of Environmental Science and Engineering
Hanoi University of Civil Engineering

24th November 2014

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Introduction:

Hanoi workshop

Institute of Environmental Science and Engineering
Hanoi University of Civil Engineering

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International Research Partners

VIETNAM: Institute of Environmental Science and Engineering
Hanoi University of Civil Engineering

AUSTRALIA: Institute for Sustainable Futures,
University of Technology Sydney

U.S: Global Institute of Sustainability,
Arizona State University

CANADA: McGill University

MALAWI: Centre for Water, Sanitation, Health and Appropriate Technology Development (WASHTED), University of Malawi

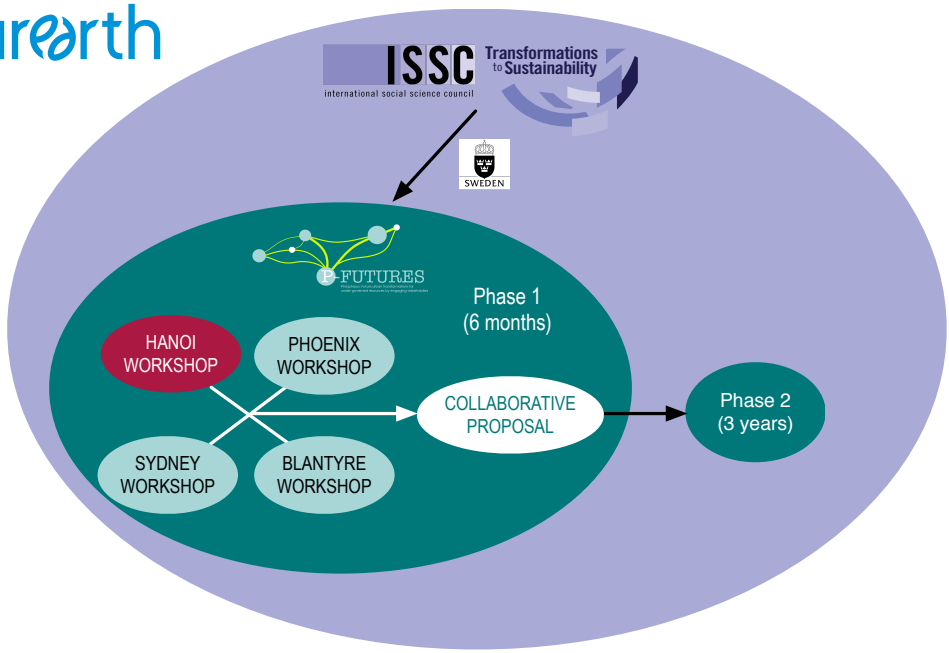
Other partners:

Funded by:

Endorsed by:

Project structure

futureearth



Overarching Project Goals

Facilitate cities in transforming how they govern phosphorus, taking into consideration the unique local context, synergies with other local sustainability goals, and global phosphorus security goals.

Co-develop a sustainable urban phosphorus framework with our partner cities (Hanoi, Vietnam; Sydney, Australia; Phoenix, United States; and Blantyre, Malawi)

- Place-based knowledge creation
- Individual cities learn from other locations
- Participatory scenarios of sustainable phosphorus futures

Guide transformation towards phosphorus sustainability through building adaptive capacity and small-scale pilot projects.

Workshop objectives

Specific objectives for this workshop are to:

- Explore **risks and vulnerabilities** for Hanoi to the **global phosphorus challenge** (such as fertilizer price spikes, algal blooms, growing food demand, inefficient sanitation infrastructure, etc.)
- Explore **opportunities** for Hanoi to **effectively adapt** to such challenges, taking into account Hanoi's future visions and existing plans.
- Contribute to **shaping the research agenda** for a larger three-year project in all four cities (Hanoi and other three cities) to develop ways to transform the way cities manage phosphorus

Workshop agenda

Time	Program
8h00 - 8h30	Registration
8h30 – 9h00	Welcome and Introduction
9h00 - 9h30	Global phosphorus scarcity and pollution
9h30 - 10h00	Tea/Coffee Break
10h00 - 11h30	Hanoi's priorities and vulnerabilities related to P sustainability goals and global challenges
11h30 - 12h00	International case studies
12h00 - 13h30	Lunch Break
13h30 - 14h00	Future pathways for Hanoi
14h00 - 15h00	Wrap-up: Design future collaboration, implementation, and feedback

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The Global P Challenge:

Too Little and Too Much

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The Global P Challenge

Too Little and Too Much

Scarcity (too little)

Pollution (too much)

Phosphorus

Essential to all living organisms (plants, animals, bacteria)

No substitute in food production, cannot be 'manufactured'

Chemical fertilizers (N,P,K) have contributed to feeding billions by boosting crop yields

Modern agriculture dependent on phosphate rock – non-renewable, high quality reserves becoming scarce

2008 price spike: US$50/tonne to US$430/tonne

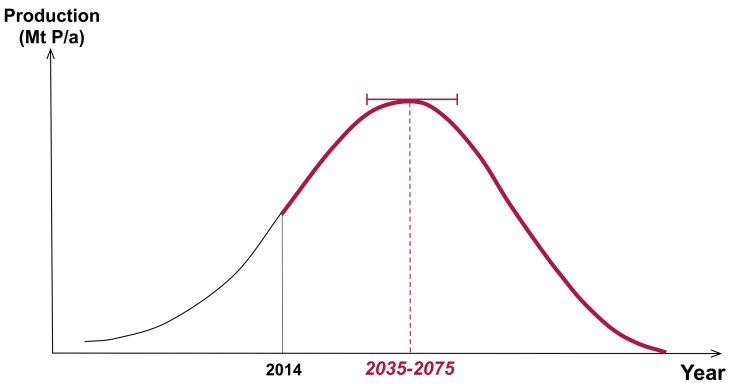
Physical Scarcity

Peak Phosphorus

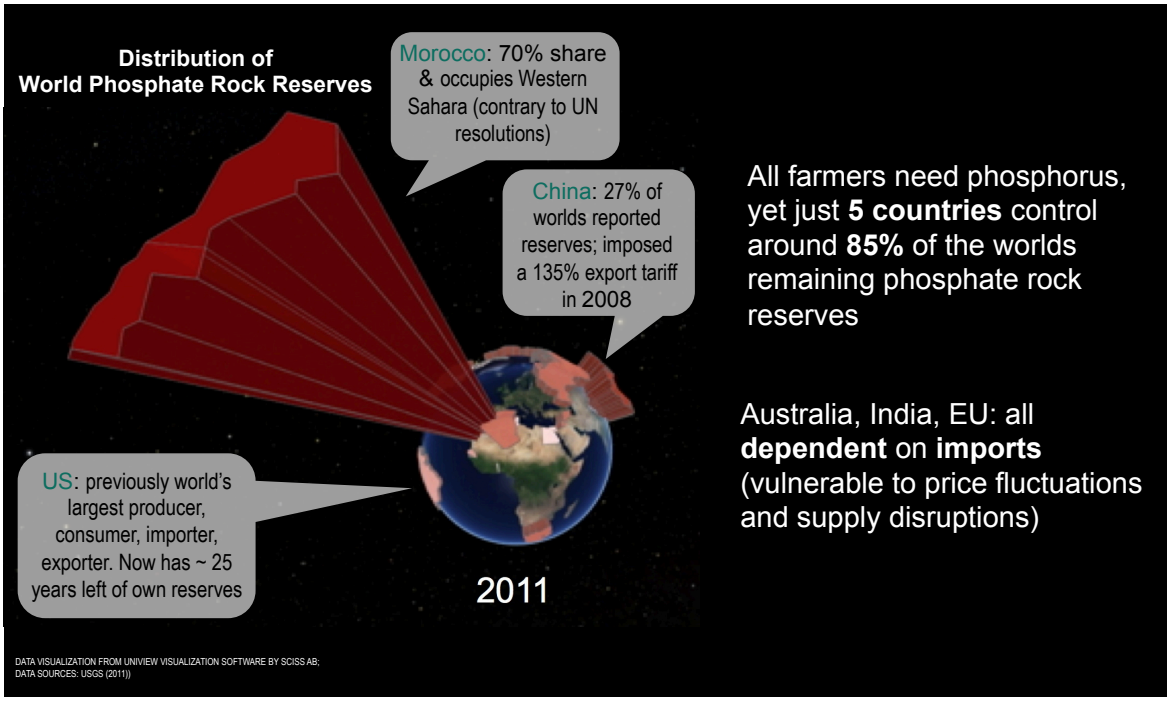
Demand will surpass supply of phosphorus this century, estimated between 2035-2075

New phosphate rock reserves:

- quality declining
- access more difficult
- energy increasing
- costs increasing
- wastes increasing



Geopolitical scarcity
Remaining reserves



All farmers need phosphorus, yet just **5 countries** control around **85%** of the worlds remaining phosphate rock reserves

Australia, India, EU: all **dependent** on **imports** (vulnerable to price fluctuations and supply disruptions)

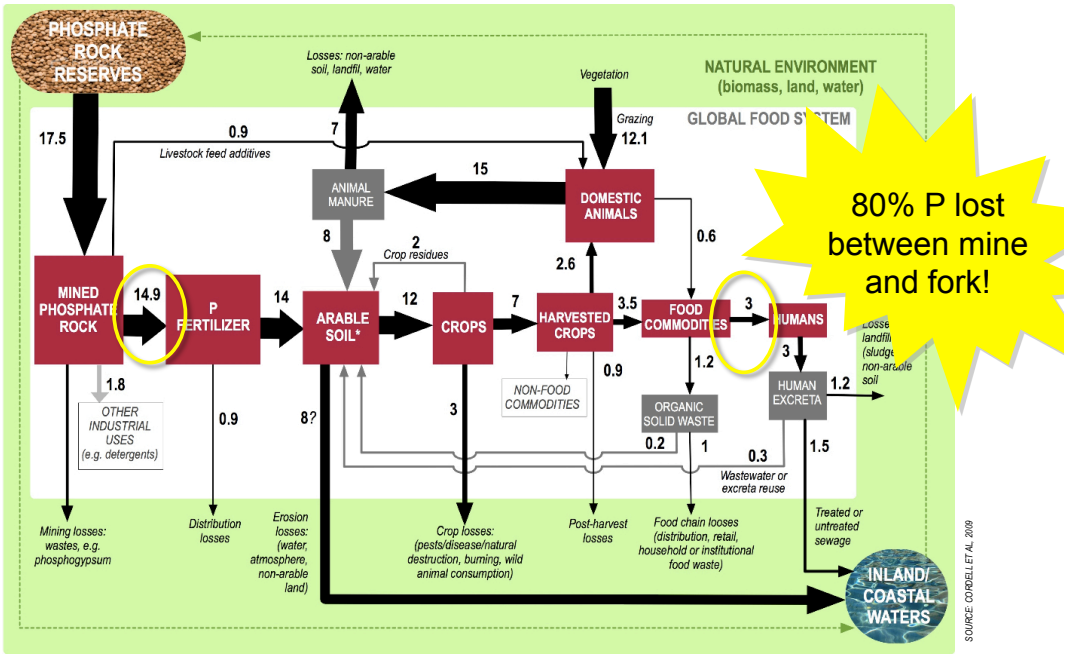
Economic scarcity
Lack of access to phosphorus

Farmers need both short- and long-term access to fertilizers

Almost a billion farmers lack purchasing power to access fertilizer markets

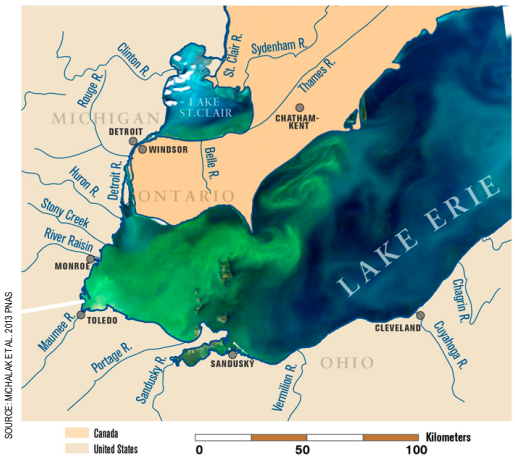
'Silent' demand from farmers with low purchasing power in sub-Saharan Africa, where soil fertility is low & food insecurity

Inefficient phosphorus use
in the global food system



The Global Challenge
Too much

- Losses can cause aquatic pollution in lakes and coastal areas
- Algal blooms caused by too much P can pollute drinking water and be toxic to humans
- Loss of oxygen from algal blooms can destroy fisheries and negative affect recreation and amenities



Losses from many sources
Concentrated and diffuse

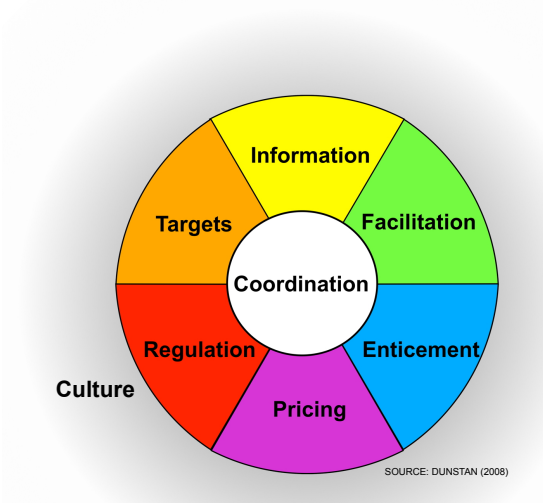
Losses of phosphorus that cause problems can come from:

- Runoff and erosion from fields, gardens, and lawns
- Sewage that is not properly treated
- Animal manure if it is not properly contained
- Detergents and other products that are in urban water

Lack of effective P governance

There are currently no international or national policies, guidelines or organisations responsible for ensuring long-term availability and accessibility of phosphorus for food production

3RD SUSTAINABLE P SUMMIT, 2012



The Future

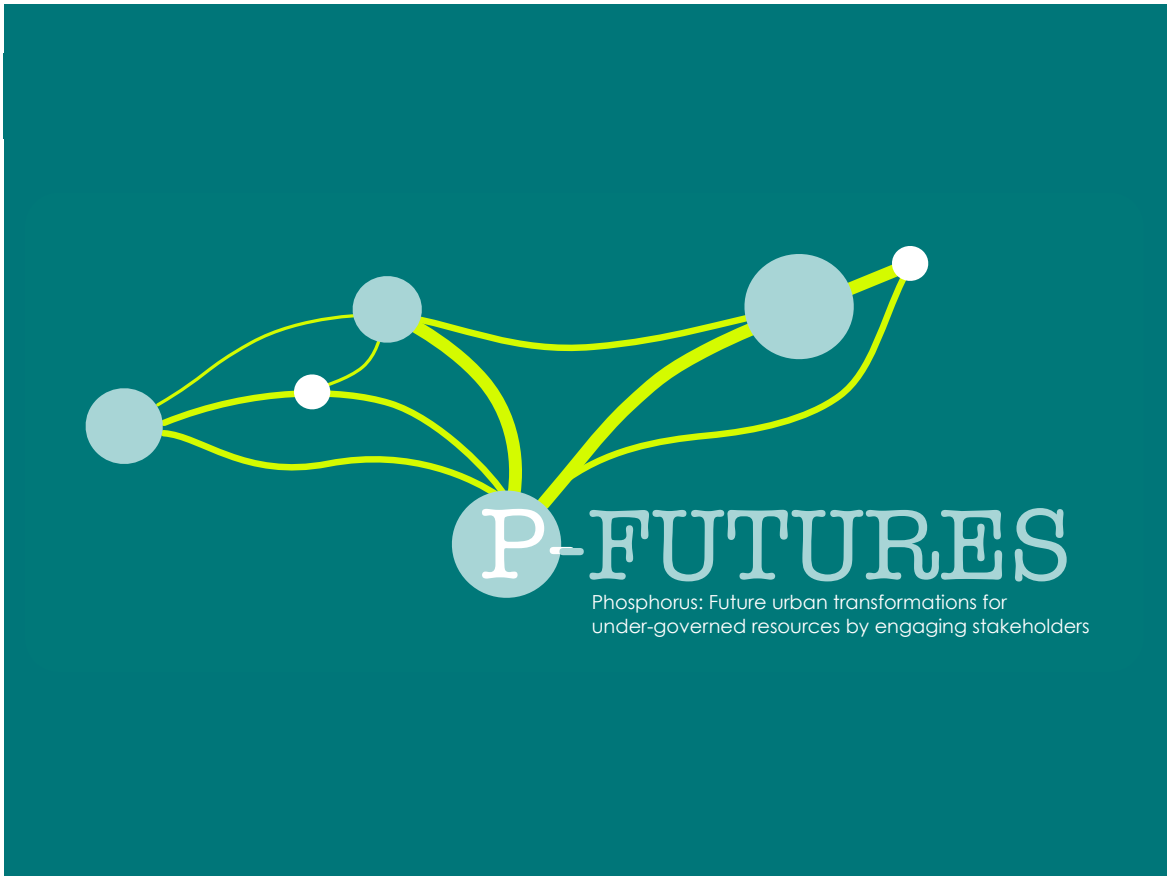
Hard landing vs soft landing

Business-as-usual future:

If we don't change current phosphorus use trajectory, we are heading for a hard landing: increasing **energy**, **costs** and **waste**, **volatile prices**, **geopolitical** tensions, reduced **farmer access** to fertilizers and reduced **crop yields** and **food insecurity**

Sustainable future (a soft landing):

Phosphorus security *ensures all farmers have short- and long-term access to sufficient phosphorus to grow enough crops to feed to world, while maintaining ecosystem integrity and societal functioning*



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Solutions to the P challenge:

International case studies and sustainable pathways in Hanoi

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Phosphorus use efficiency in agriculture

Decreasing phosphorus losses to waterways

SOURCE: S HIRSH

Natural buffer strip
Iowa, USA

SOURCE: GREENPEACE CHINA

Preventing algal blooms - fertilizer application guidelines
CHINA

Phosphorus recovery from wastewater

Developing renewable fertilizers & improving water quality

SOURCE: OSTARA

Ostara struvite recovery technology
Durham, USA

SOURCE: B ETTER, EAWAG

Low-cost struvite recovery from urine
NEPAL

Urban agriculture

Increasing food security & recycling local food waste, water, and sewage

SOURCE: IWMI

Vacant lot garden
Accra, GHANA

SOURCE: L DAGERSKOG (CREPA)

Onions fertilized with urine (left) & without (right)
BURKINA FASO

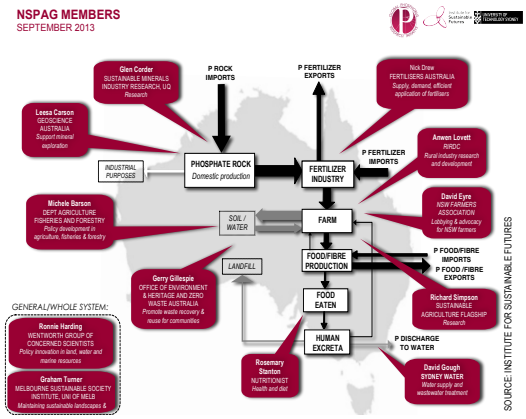
SOURCE: G METSON

Community gardens
Montreal, CANADA

Multi-stakeholder platforms

Dialogue & action through industry, government & science partnerships

European Sustainable Phosphorus Platform
EUROPEAN UNION



National Strategic Phosphorus Advisory Group,
AUSTRALIA

Toolbox of phosphorus solutions

Selecting context-specific options
from a range of sustainable phosphorus technologies & practices

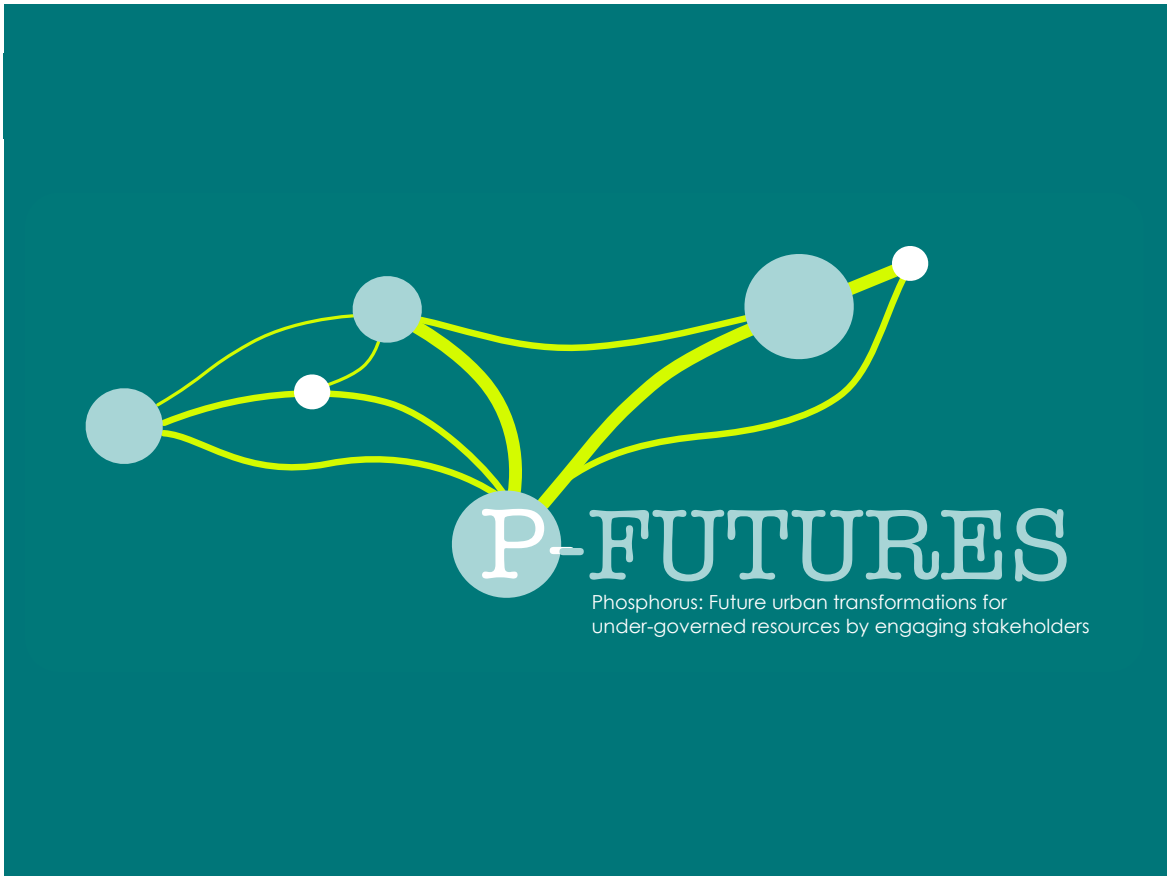
Sector	SUPPLY MEASURE (S) Recycling (S1)	SUPPLY MEASURE (S) New source (S2)	DEMAND MEASURE (D) Efficiency (D1)	DEMAND MEASURE (D) Reduce demand (D2)
Mining (M)	MS1.1 – mine tailings [h]	MS2.1 – phosphate rock [h]	MD1.1 – reduce avoidable losses	MD2.1 – *(all other measures)*
Fertilizer (F)	FS1.1 – phosphogypsum [h]	FS2.1 – algae, seaweed	FD1.1 – reduce avoidable losses	FD2.1 - *(AD2, LD2, PD2)*
Agriculture (A)	AS1.1 – crop waste [b,d,e] AS1.2 - *(LS1, PS1, WS1)*	AS2.1 – *(FS2)* AS2.2 – green manure	AD1.1 – fertilizer placement AD1.2 – application time AD1.3 – application rate AD1.4 – soil testing AD1.5 – erosion reduction AD1.6 – microbial inoculants	AD2.1 – plant selection AD2.2 – improved soil characteristics
Livestock & Fisheries (L)	LS1.1 – manure [a,b,f] LS1.2 – bone [a,d] LS1.3 – blood [a] LS1.4 – fish [a]	LS2.1 – phosphate rock (supplements) [h]	LD1.1 – fertilizer placement LD1.2 – application time LD1.3 – application rate LD1.4 – soil testing LD1.5 – erosion reduction LD1.6 – microbial inoculants LD1.7 - phytase enrichment LD1.8 – manure P reduction LD1.9 – wastewater management	LD2.1 – plant selection LD2.2 – improved soil characteristics LD2.3 – animal selection LD2.4 – changing diets
Food production (P)	PS1.1 – food production waste PS1.2 – cooked food waste	PS2.1 – phosphate rock (additives) [h]	PD1.1 – reduce avoidable losses PD1.2 – producing food closer to demand PD1.3 – consumer food planning/preparation	PD2.1 – reduce P-intensive diets PD2.2 – reduce per capita overconsumption PD2.3 – healthy bodies PD2.4 – minimize use of P additives
Wastewater & human excreta (W)	WS1.1 – urine [a,c,d,h] WS1.2 – faeces [b,c,d,h] WS1.3 – greywater [c, h] WS1.4 – untreated wastewater [a] WS1.5 – treated effluent [a] WS1.6 – struvite [c] WS1.7 – biosolids [a,b,f,h] WS1.8 – sludge ash [d]		WD1.1 – repairing cracked pipes WD1.2 – minimizing sewer overflows WD1.3 – soil management WD1.4 – avoid dumping biosolids in water WD1.5 – reduce spreading biosolids on non-ag land	

Recycled via: [a] direct reuse, [b] compost, [c] precipitation, [d] i… mentation, [f] dewatering, [h] other chemical treatment.

SOURCE: CORDELL & WHITE 2013

Future pathways

If there one thing you could change about Hanoi (given what you heard today) what would you change?



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Next steps:

Designing a future collaborative project

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Guide transformation towards phosphorus sustainability through building adaptive capacity and small-scale pilot projects.

Project structure

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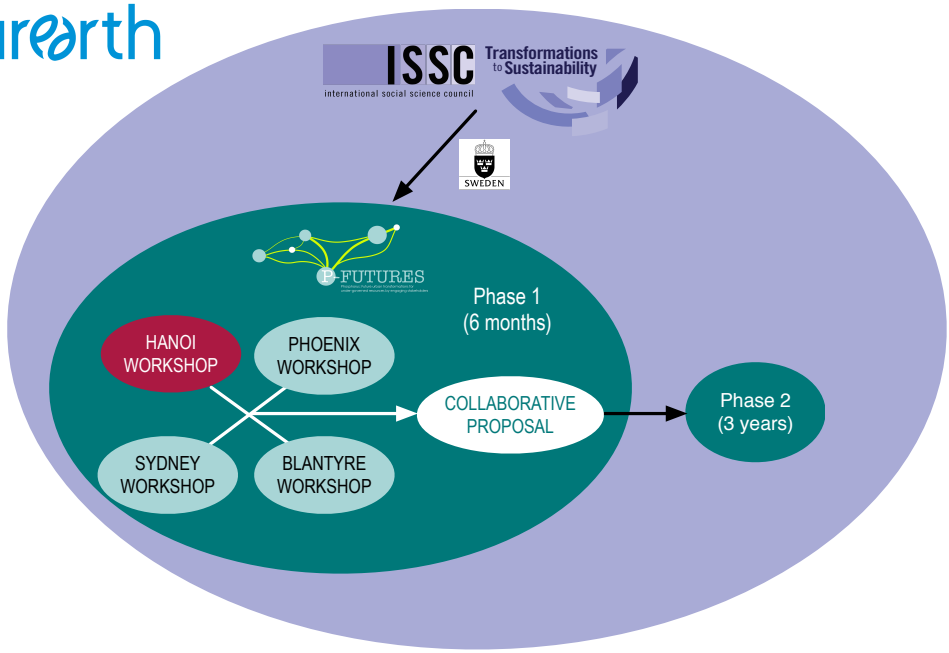
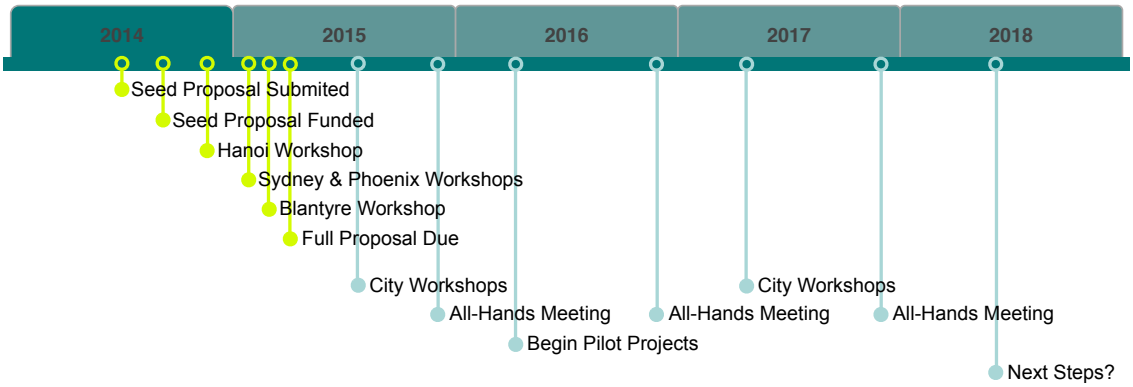


Key events (tentative)



P-FUTURES: Hanoi

What would you like to see in a 3-year project with the aim to identify and implement sustainable phosphorus urban management?

What are our research & practice goals?

Who else should be involved?

What are potential pilot implementation projects?

How do we want to interact with other cities?

Thank you!

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