THE IMPLICATION OF A LINEAR GLOBAL PHOSPHORUS SUPPLY CHAIN ON THE WORLD'S REGIONS

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INTRODUCTION

Overall research question:

Which world regions are most affected by the linearity of the phosphorus supply chain?

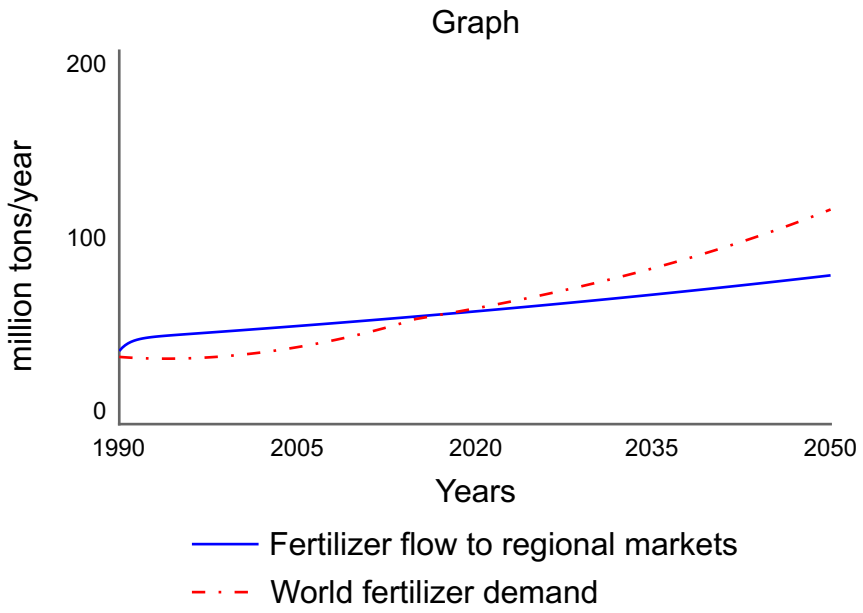
General objectives of project:

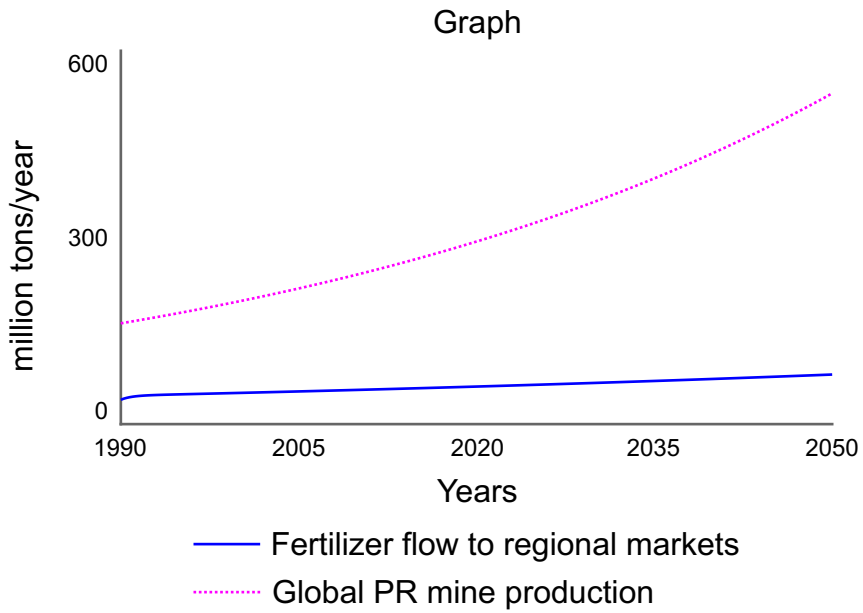
- To analyse the relationship between P supply and demand globally and between world regions, taking into account the market;
- To examine the environmental impact in terms of climate change and eutrophication between world regions;
- To investigate the social impact of regional P dynamics with regard to risk of conflict/social unrest.

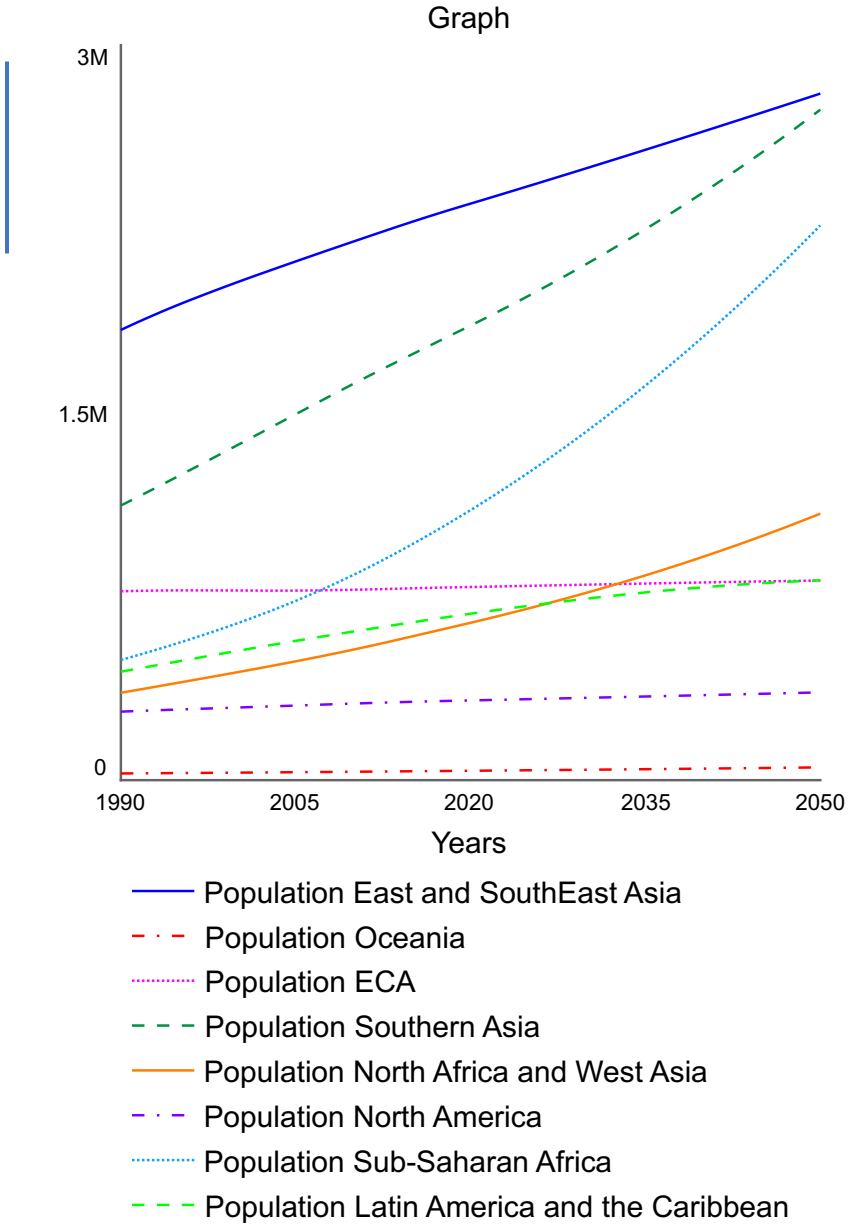
METHODS

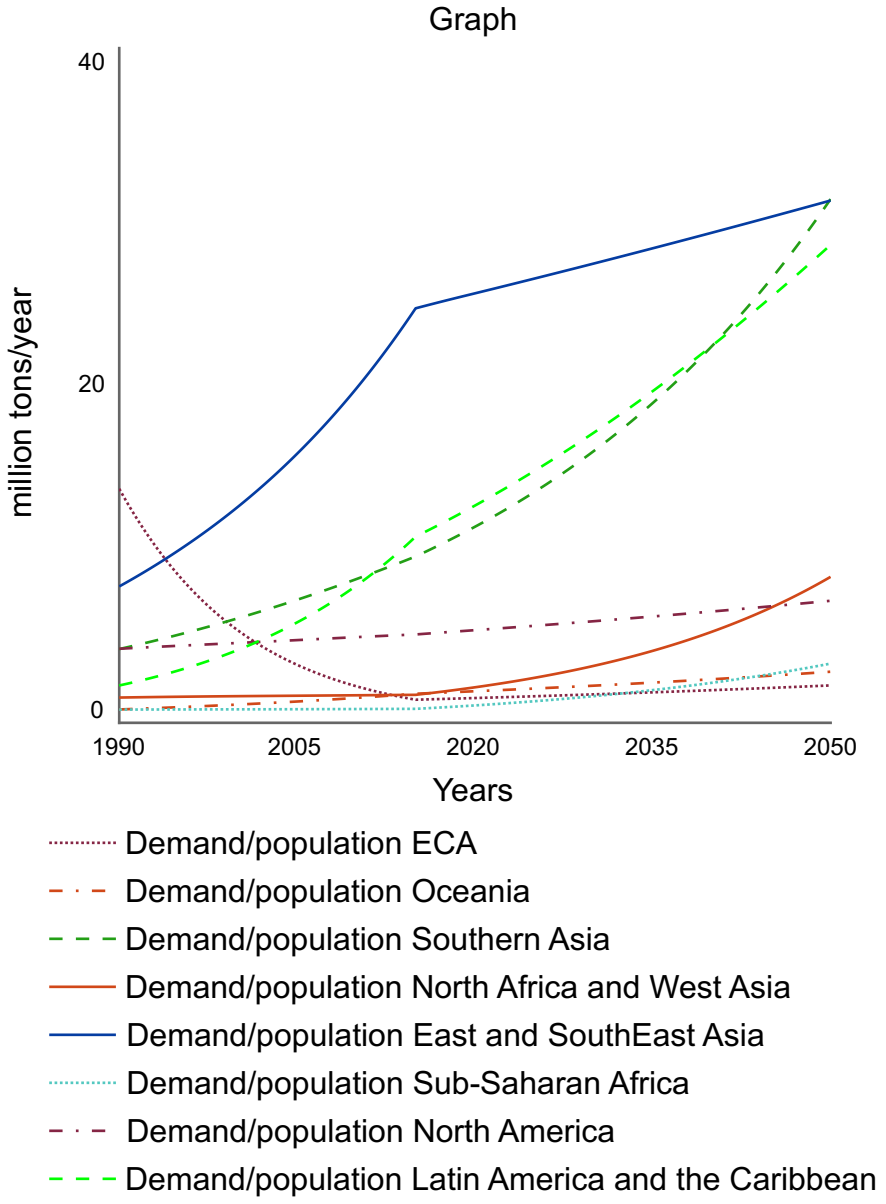
- System dynamics modelling in STELLA™. 1990-2050 now but 1961-2050;
- 8 world regions, following a combination of FAO/UN Population Division: Europe and Central Asia; North Africa and West Asia; South Asia; East and SE Asia; Sub-Saharan Africa; North America; Latin America & the Caribbean; Oceania;
- Data from USGS, FAO, IFA, UN Population Division;
- Global PR production, global fertilizer production and global P market but regional modules afterwards with population, P demand, environmental impact and social impact;

PRELIMINARY RESULTS

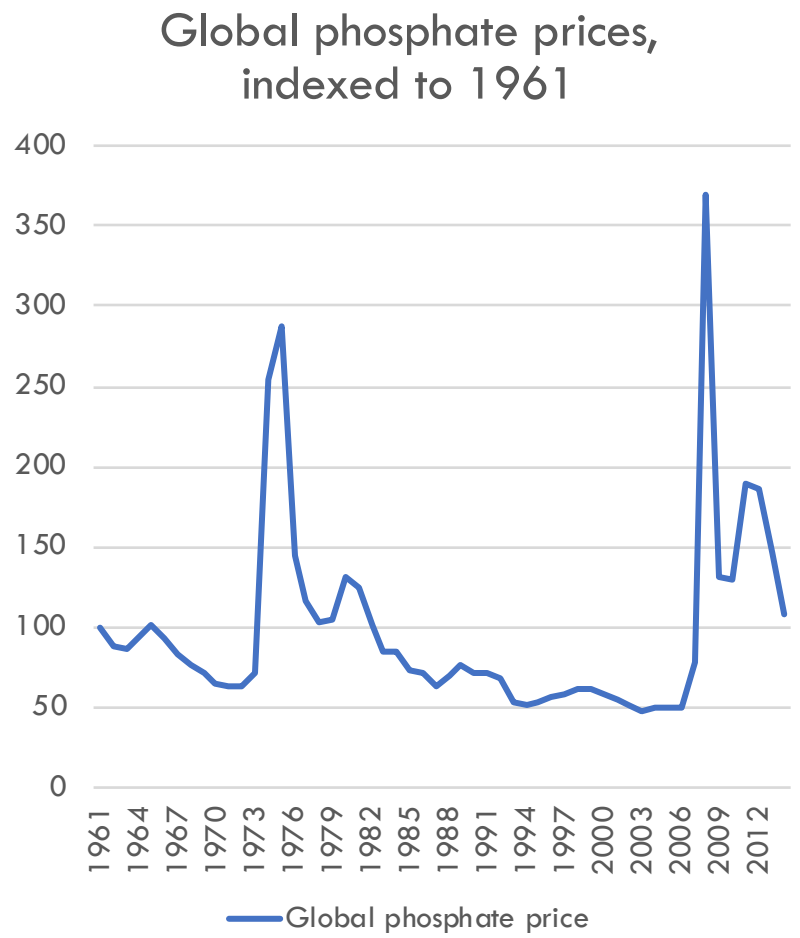


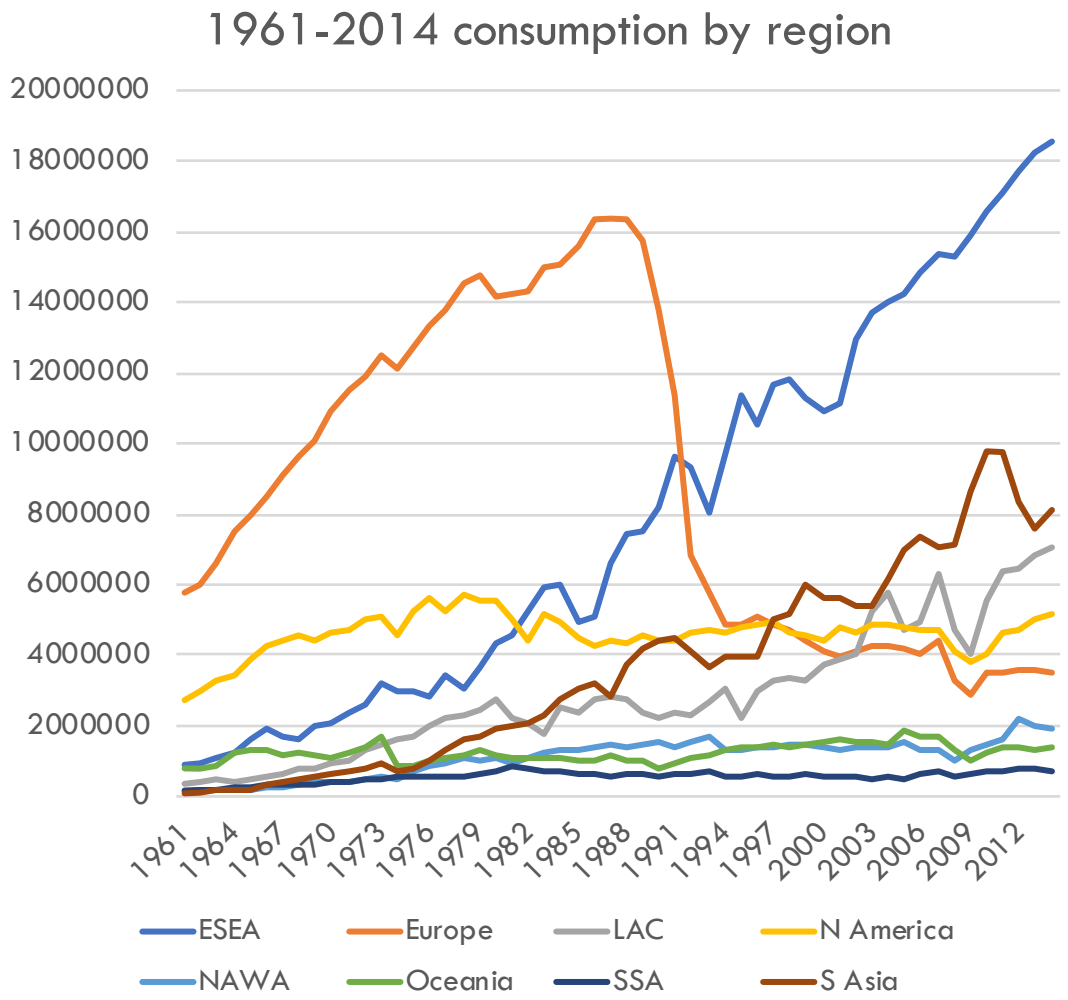



Graph
3M
1.5M
0
1990
2005
2020
2035
2050
Years
Population East and SouthEast Asia
Population Oceania
Population ECA
Population Southern Asia
Population North Africa and West Asia
Population North America
Population Sub-Saharan Africa
Population Latin America and the Caribbean

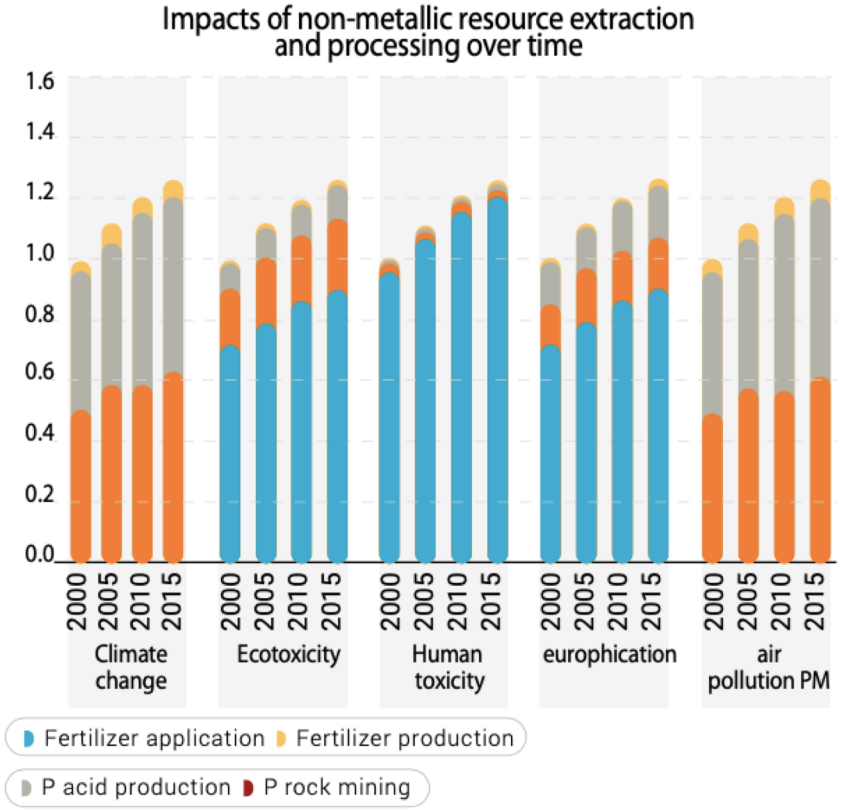

Graph
40
20
0
million tons/year
1990
2005
2020
2035
2050
Years
Demand/population ECA
Demand/population Oceania
Demand/population Southern Asia
Demand/population North Africa and West Asia
Demand/population East and SouthEast Asia
Demand/population Sub-Saharan Africa
Demand/population North America
Demand/population Latin America and the Caribbean

NEXT STEPS – MARKET FEEDBACK, SOCIAL IMPACT

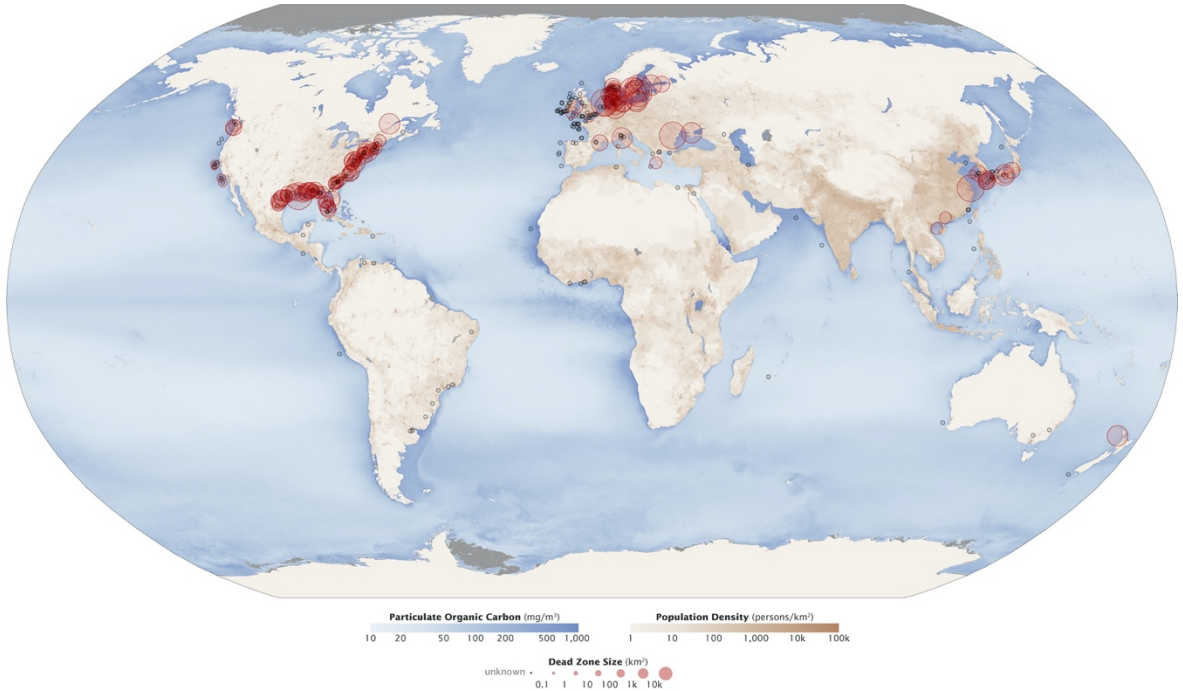




NEXT STEPS: ENVIRONMENTAL IMPACT



Source: UNEP 2019



Source: NASA 2010

DISCUSSION

- Significant differences in demand for P between regions, this is expected to further grow in the coming decades to 2050;
- Sub-Saharan Africa accounts for a most of the population growth but it has extremely low P consumption and demand is not expected to take-off – most of the world's undernourished people here;
- S. Asia and LAC to lead the increase in P demand, but overwhelmingly dependent on imports;
- Fertilizer production is slower than demand but more calibration is needed & the market feedback has to be included;
- Phosphate rock mining will double by the 2050, due to an increase in the amount of mined PR per unit of produced fertilizer. This is due to declining ore quality. Environmental impact expected to increase.

CONCLUSION

Food security a challenging aspect in S Asia, LAC and SSA, where most of the population growth is predicted to take place, yet where nations are dependent on P imports;

Increase in fertilizer demand and production will lead to a higher rate of PR mining;

Environmental cradle-to-grave effects with regard to climate change and eutrophication can be expected to increase, particularly in certain ”hotspots”;

THANK YOU

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