# Anthropogenic phosphorus input

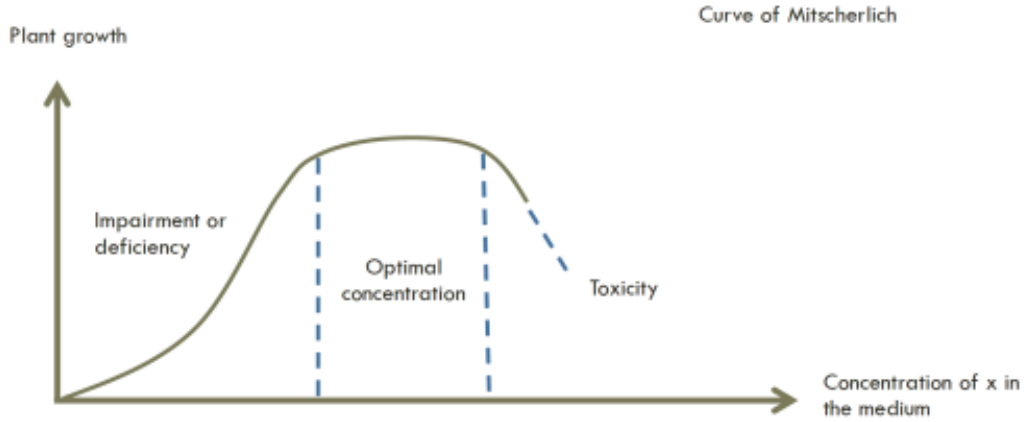
## 1. Why phosphorus became toxic ?

An ever increasing amount of phosphorus in ocean.

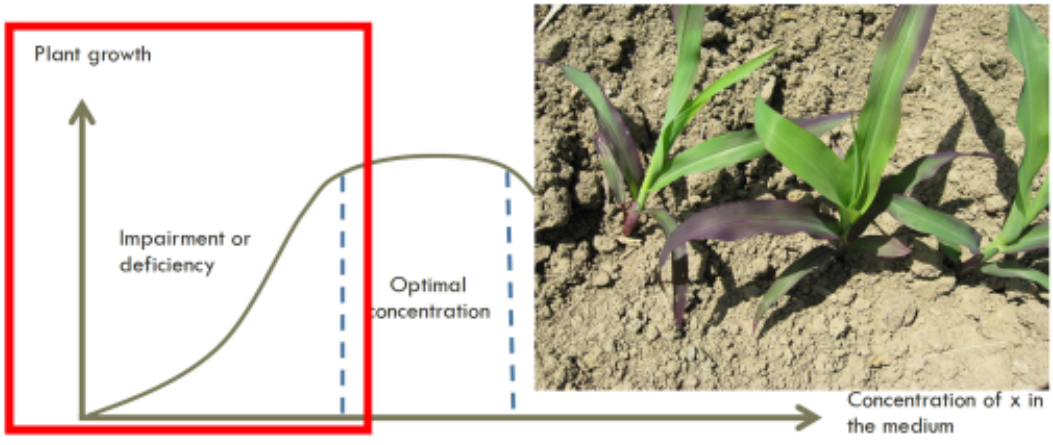
**Table 2.** Forms of present-day and preanthropogenic phosphorus supply into the World Ocean, Mt/yr (Compton *et al.*, 2000)

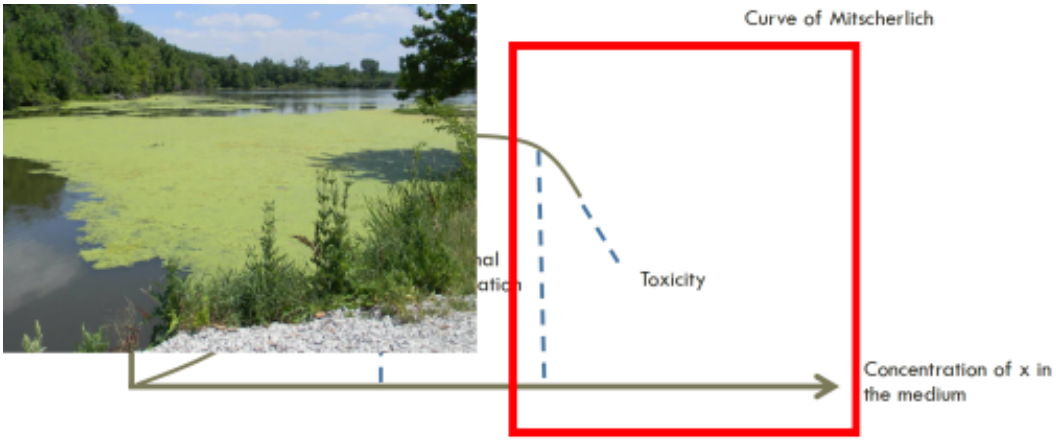
| Phosphorus sources and species | Preanthropogenic supply | Present-day supply |
|---|---|---|
| 1. River runoff | | |
| Dissolved P: | | |
| inorganic | 0.3–0.5 | 0.8–1.4 |
| organic | 0.2 (maximum) | 0.2 (average) |
| Suspended P: | | |
| organic | 0.9 (maximum) | 0.9 (average) |
| inorganic | 1.5–3.0 | 1.3–7.4 |
| detrital | 6.9–12.2 | 14.5–20.5 |
| 2. Eolian | 1.0 (including 20% of reactive P) | 1.05 (including 20% of reactive P) |
| Total | 10.8–17.8 | 18.7–31.4 |
| Reactive | 3.1–4.8 | 3.4–10.1 |

(Baturin, 2003)

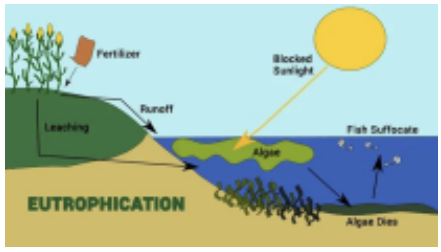



(Gaujous, 1995)






Eutrophication phenomenon




(Pinay, 2018)

Social consequences :

- Crystalization of social tensions
- Agricultural world, local elected officials and environemental protection associations
- DIfferent environement conceptions of public action, social responsability and scientigic knowledge

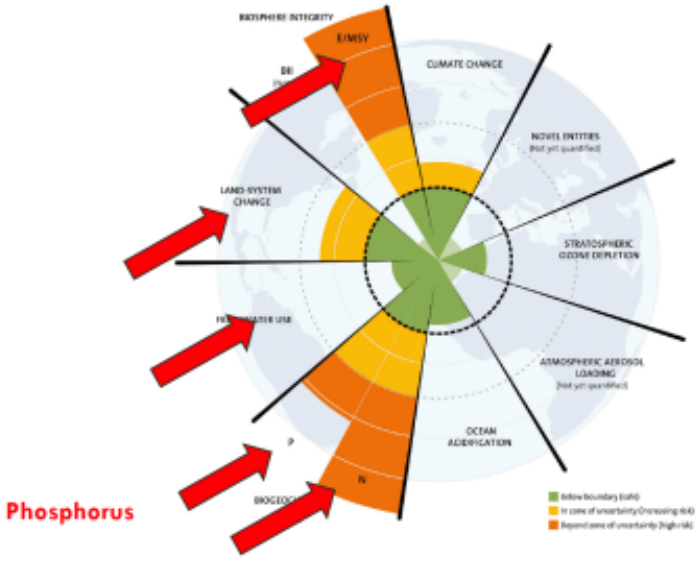
## 2. Why is it important ?

**According to you, is this phenomenon reallyimportant ?**

**A. I guess, otherwise this course wouldn't exist**

B. It is important but there are bigger issues

C. Not important, it is nothing in front of other issues



(Steffen, 2015)


## 3. Current phosphorus dependency

Rapid food demand to rapid population growth

Rectification of phosphorus deficiency of soils

Saving people from starvation

*« 90% of global demand for phosphorus is for food production, currently around 148 million tonnes of phosphate rock per year (Smil, 2000a, Smil, 2000b, Gunther, 2005) »*

(Cordwell, 2009)

**Phosphorus peak**

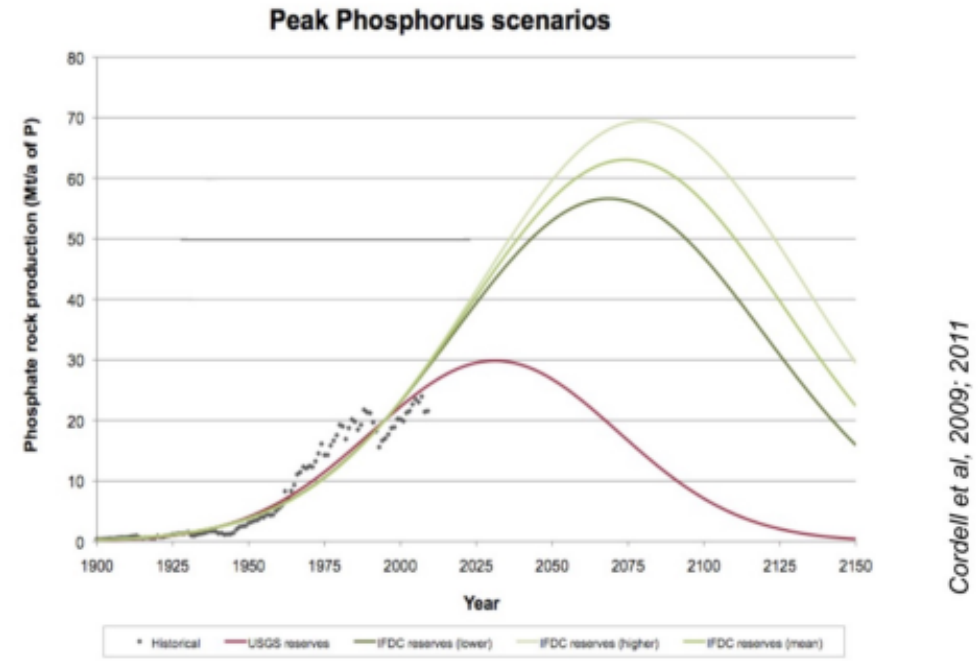



Figure 1. Peak phosphorus curve, indicating that production will eventually reach a maximum, after which it will decline. Red line indicates the original 2009 analysis based on USGS reserve data (Cordell, Drangert & White, 2009), while the green curves were updated with IFDC 2010 phosphate rock reserve data.

(White, s.d.)

# 4. Prospective of phosphorus demand

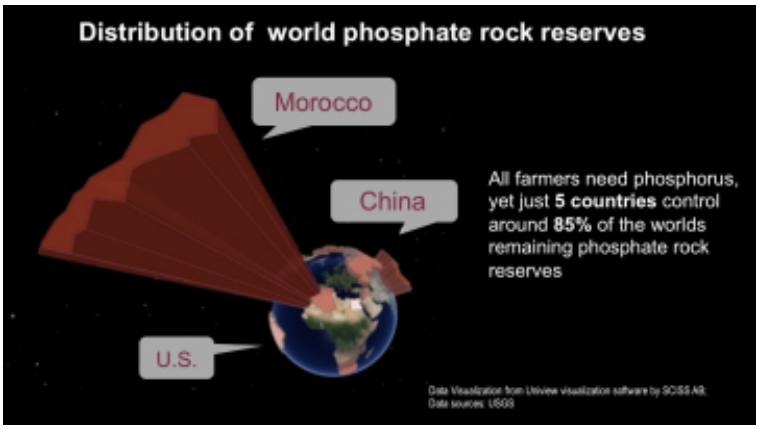
*« Following more than half a century of generous application of inorganic high-grade phosphorus and nitrogen fertilizers, agricultural soils in Europe and North America are now said to have surpassed 'critical' phosphorus levels »*

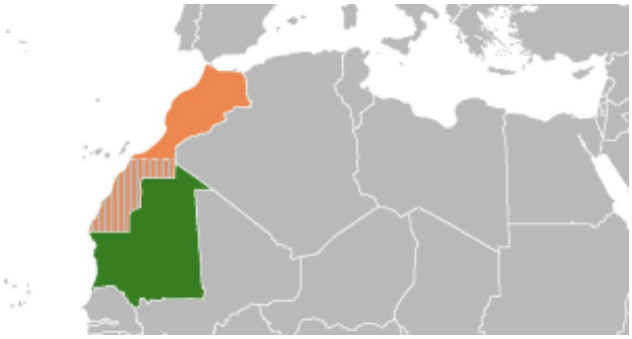
*« Consequently, demand for phosphorus in these regions has stabilized or is decreasing. »*

*« However in developing and emerging economies the situation is different. Global demand for phosphorus is forecast to increase by around by 3–4% annually until 2010/11 »*

=> high demand and an approaching peak...

# 5. A new war on phosphorus ?





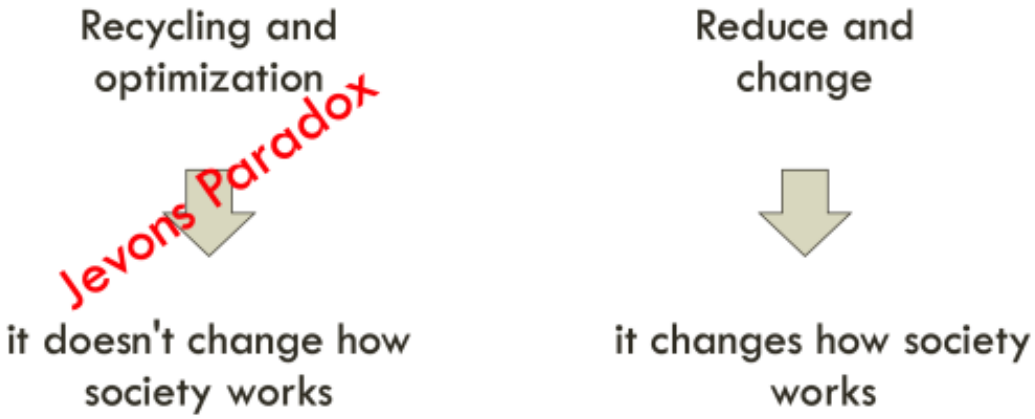
(Wikipedia, s.d.)

## 6. How can we ensure the safety of phosphate supplies?

Phosphorus security goals might therefore include:

1. "Increase number of people fed per tonne phosphorus input, or, reduce total phosphorus demand while maintaining food/agricultural output;
2. Reduce dependence on phosphorus imports (to reduce vulnerability to geopolitical dynamics and thereby increasing long-term access to phosphorus);
3. Ensure healthy soils (no phosphorus-deficiency, no phosphorus accumulation, balanced nutrition and presence of organic matter);
4. Ensure farmers needs are met (e.g., maintaining or increasing productivity; ensuring access to phosphorus fertilisers);
5. Reduce losses and wastage where avoidable;
6. Reduce eutrophication and pollution by preventing phosphorus from the food system from entering waterways."

- 4/5 phosphorus mined for food production never actually reaches the food on our forks
- Existence of a whole toolbox of phosphorus recycling and efficiency
- Low tech and high tech phosphorus recovery in the sanitation sector to changing diets




## 7. Sustainable management of phosphorus

Possible solutions for the management of phosphate nutrition of tropical crops in the context of ecological intensification :

1. Making better use of the diversity of the plant world and genetic resources
2. Greater use of species assemblages in time and space

3. Make more efficient use of mineral and organic inputs
4. Assessing the potential of microbial inoculants and bio-effectors
5. Maintain and promote the activity of the soil's macrofauna
   earthworms = ver de terre

(Hinsinger, 2015)