

# A social aspect to planetary boundaries: Equity in access to resources for food

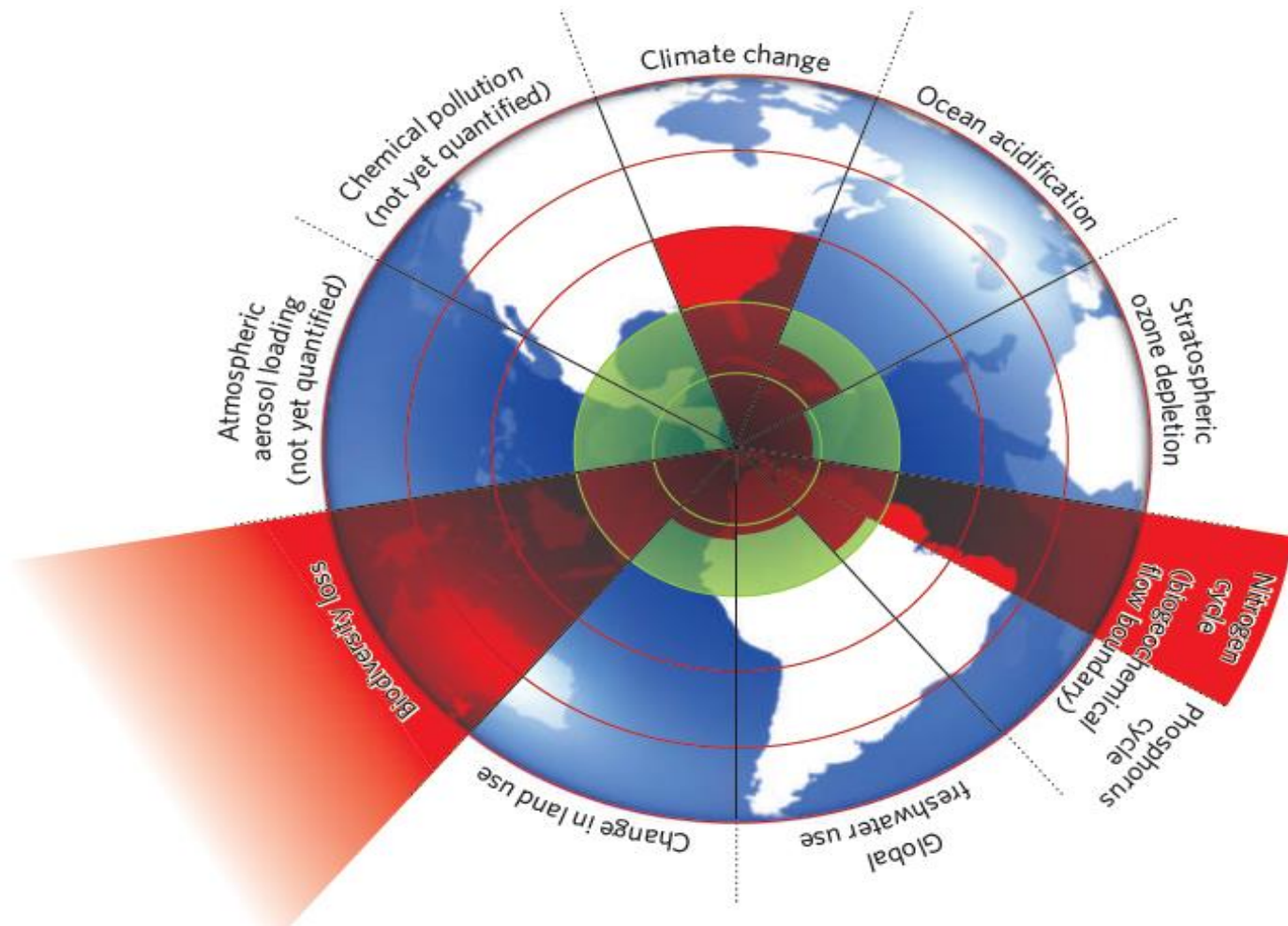
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# Planetary boundaries



**N: 25% of the current conversion to  $N_r$**   
**P: 10 \* pre-industrial P load to oceans**  
**24  $\mu\text{g l}^{-1}$  in freshwaters**

Rockström et al. 2009a,b  
Carpenter and Bennett 2011

# Scarcity of resources

- **N**: fossil fuel, peak oil – renewable energy sources
- **P**: limited reserves – not replacable

7900 Mt P technically and economically exploitable

9.7 billion people by 2050, 10.9 billion by 2100

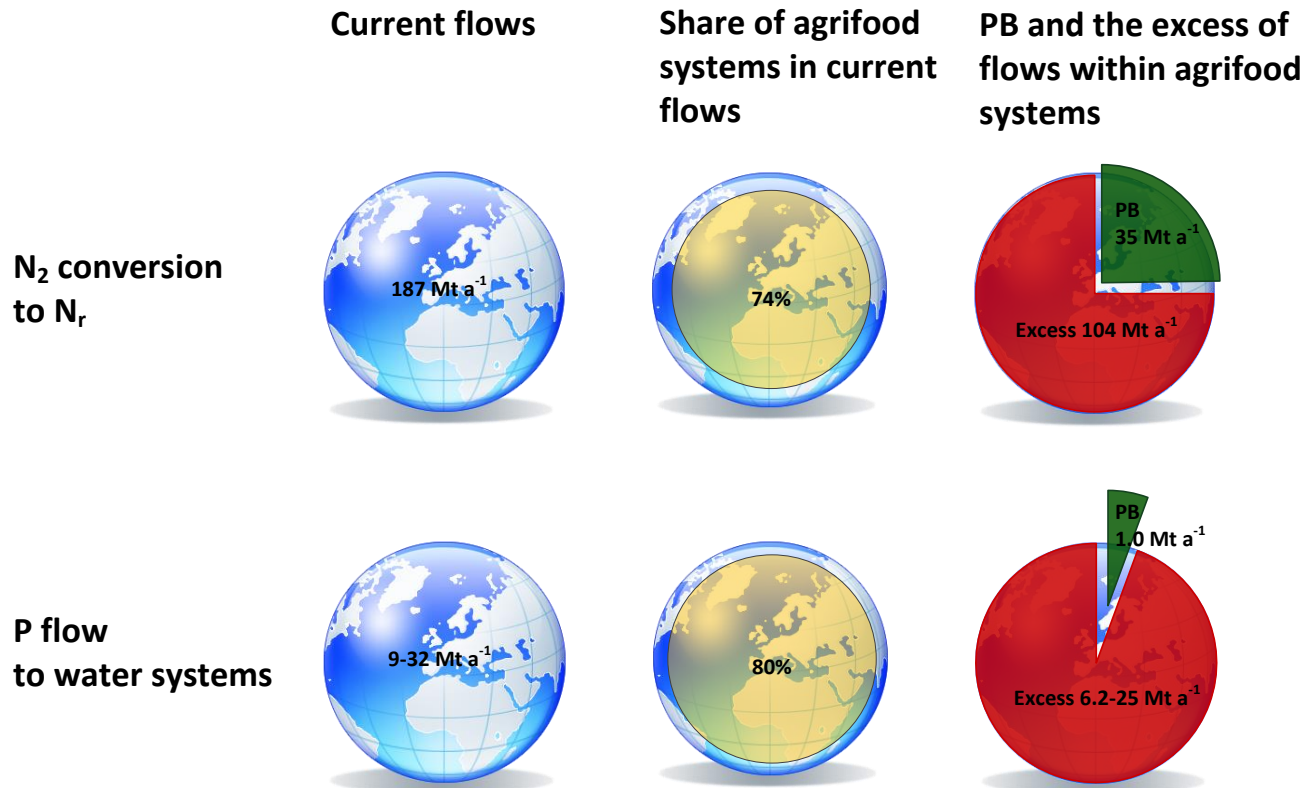
2.4 kg cap<sup>-1</sup> a<sup>-1</sup> → **74% left by 2100**

Cordell et al 2011;  
Dawson and Hilton 2011;  
UN 2011

# The questions

- Is food security possible within the boundaries?
- Does the gap (excess) vary in space and time?
- How to ensure right to nutrients and food?

# Share of agrifood systems



The share of agrifood systems (yellow) in the needed reduction (red) of current nutrient flows to return to within the planetary boundaries (green).

PB = planetary nutrient boundaries, N<sub>r</sub> = reactive nitrogen, P = phosphorus.

# Shifts in agrifood systems

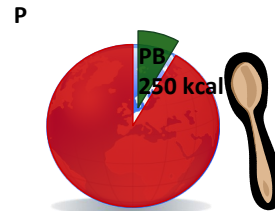
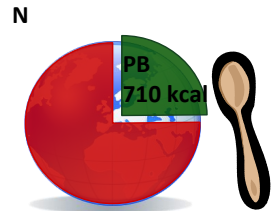
Current food supply



Food supply within PB

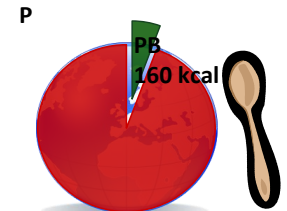
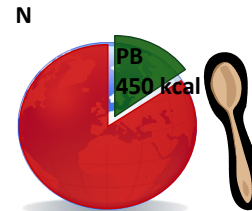
*Shifts in agrifood systems*

*Current diet*

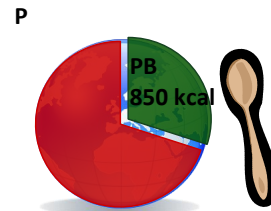
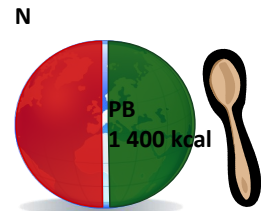


*Population growth*

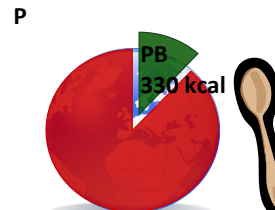
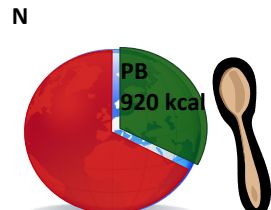
*Current diet*



*Vegetarian diet*

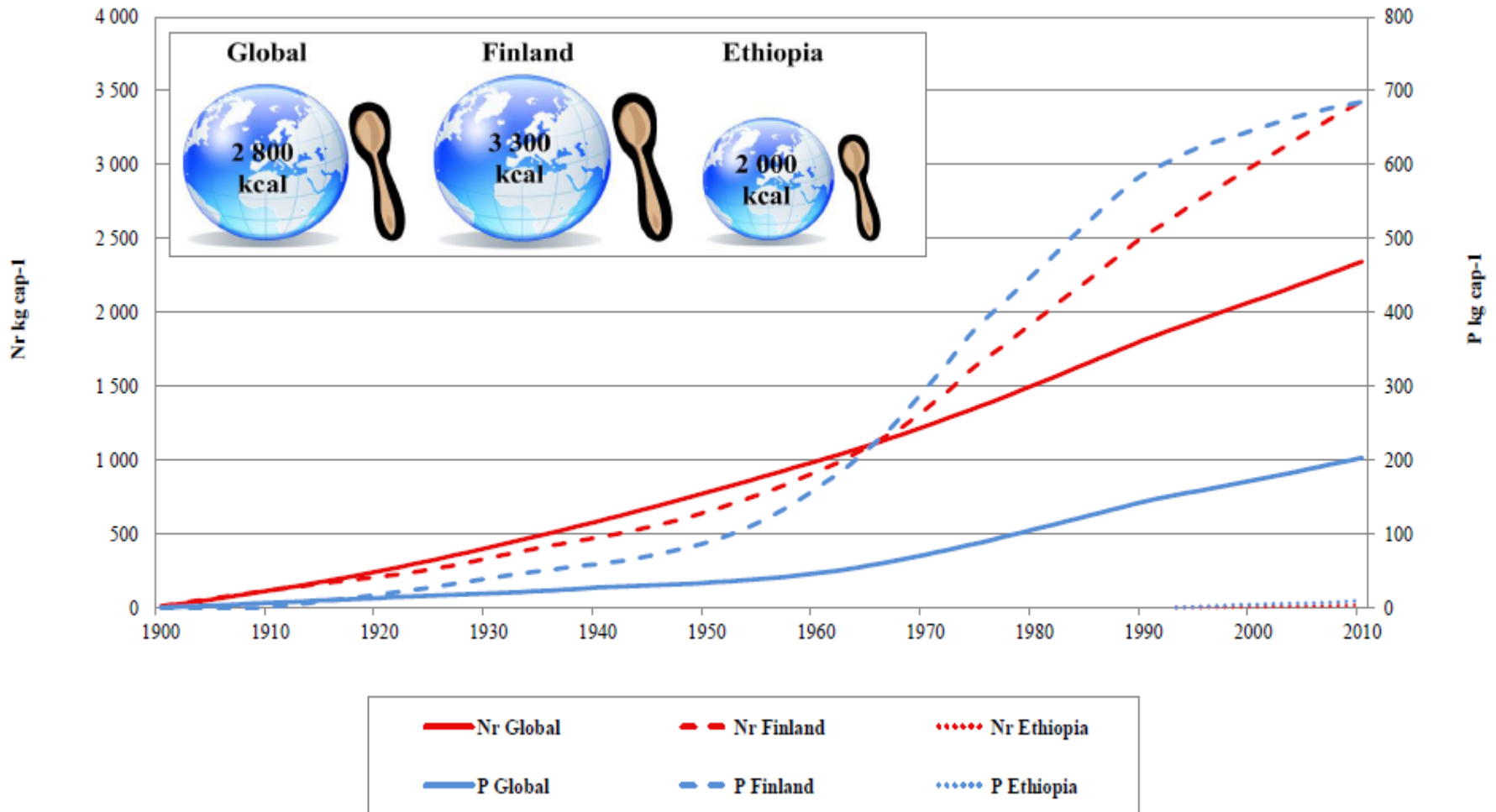


*Current diet without food waste*



Food supply within the planetary nutrient boundaries (PB) (green) affected by the projected population growth and shifts in agrifood systems ( $\text{kcal capita}^{-1} \text{d}^{-1}$ ). The deficit in comparison with current food supply is shown in red.

# Spatial inequity



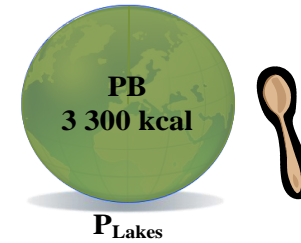
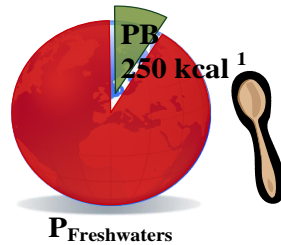
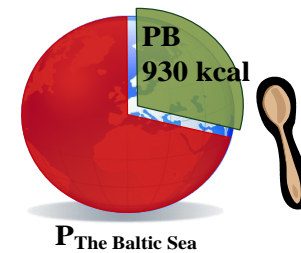
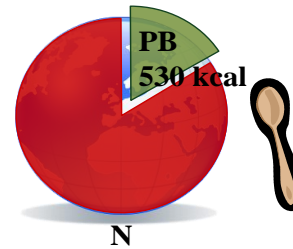
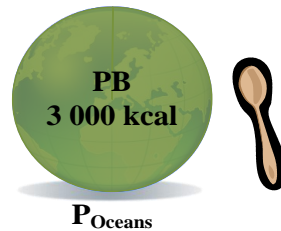
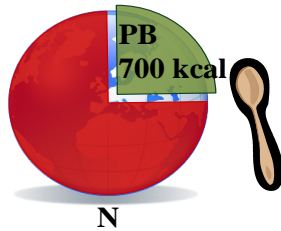
Accumulated nitrogen ( $N_r$ ) and phosphorus (P) use ( $\text{kg cap}^{-1}$ ) and the current food supply ( $\text{kcal cap}^{-1} \text{d}^{-1}$ ) (FAO, 2014) globally and in Finland and Ethiopia. Kahiluoto et al 2015 (in revision) 7

# Variation in PBs and in the excess

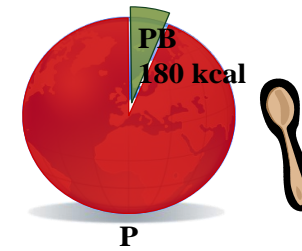
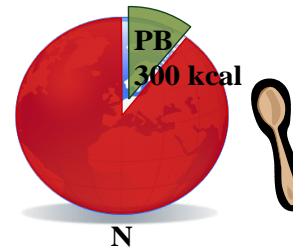
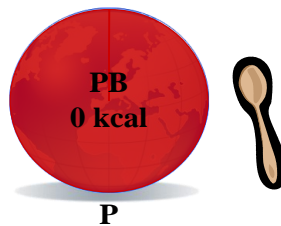
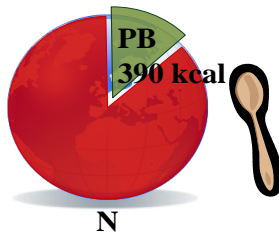
## Global

## Local - Finland

### *Current flow*



### *Accumulated 1900-2010*



Food supply within the planetary nutrient boundaries (PB) (green) ( $\text{kcal cap}^{-1} \text{d}^{-1}$ ). The deficit in comparison with the current food supply is shown in red.



# Conclusions

- Required reduction in nutrient flows striking
- Transformation of agrifood systems – many shifts
- Global equity a precondition for food security
- Spatial variation in excess due to inequity in past access

# Thank you!