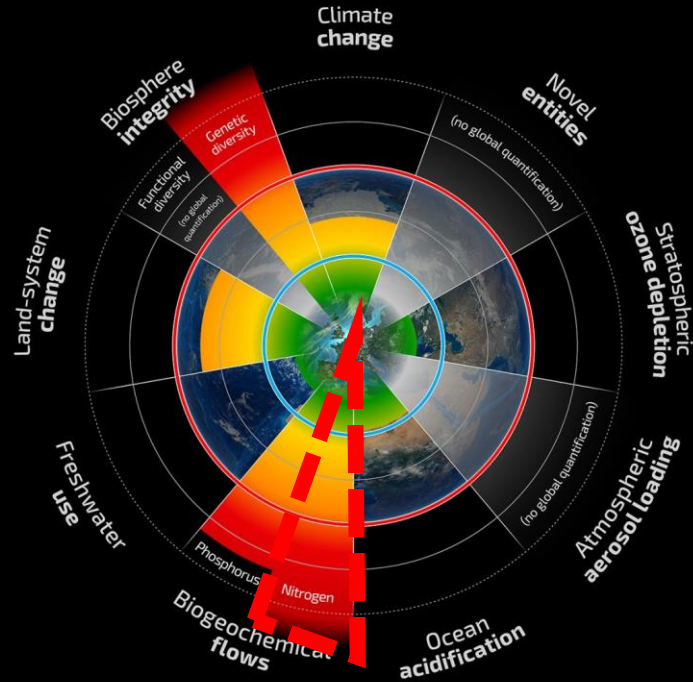
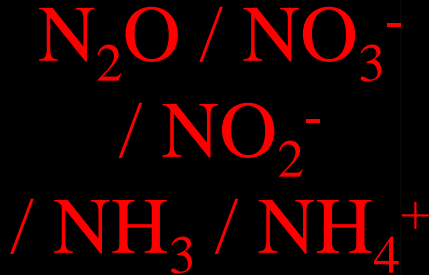
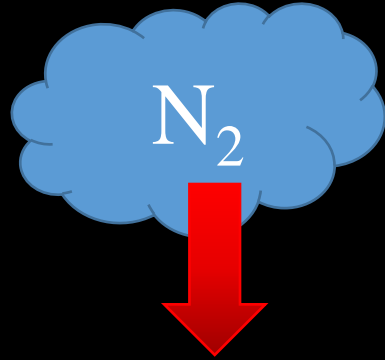


# Urintorkning, framtidens gödsel



# Planetary Boundaries

A safe operating space for humanity



- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not yet quantified

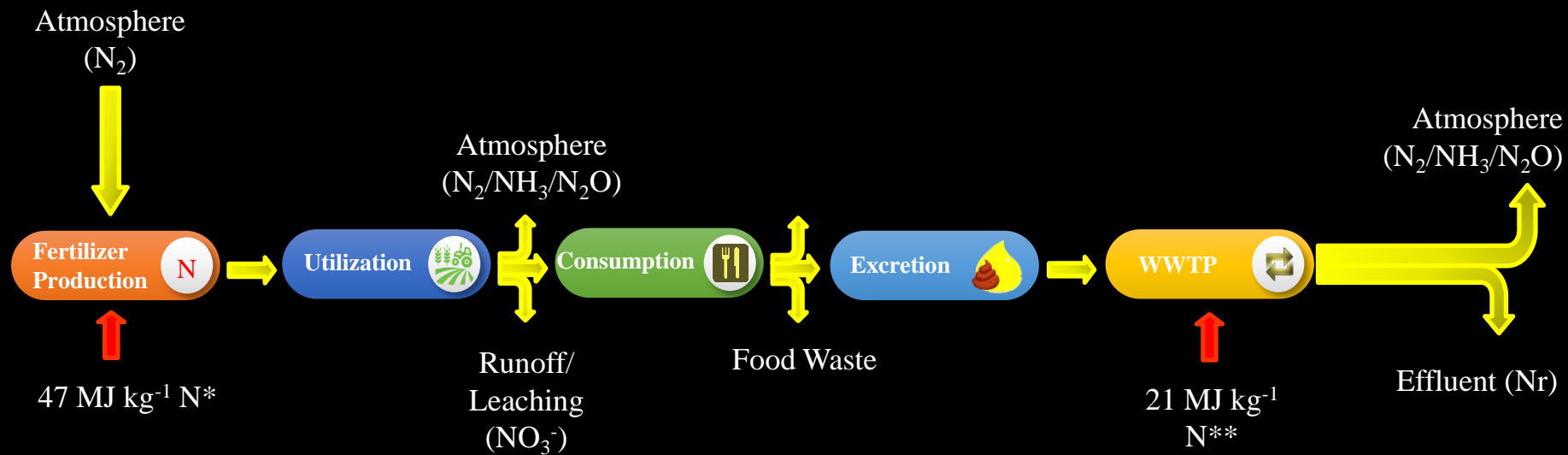
Source: Steffen et al. Planetary Boundaries: Guiding human development on a changing planet, Science, 16 January 2015.  
Design: Globalia

## Reactive Nitrogen Pollution:

Drinking water quality  
Air quality  
Eutrophication  
Hypoxia  
Climate change

Source:

Agriculture  
Industry  
Going to the bathroom



\*BABOO, P. 2015.

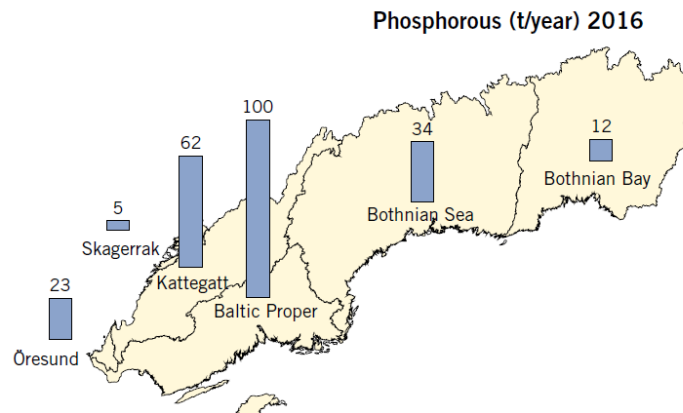
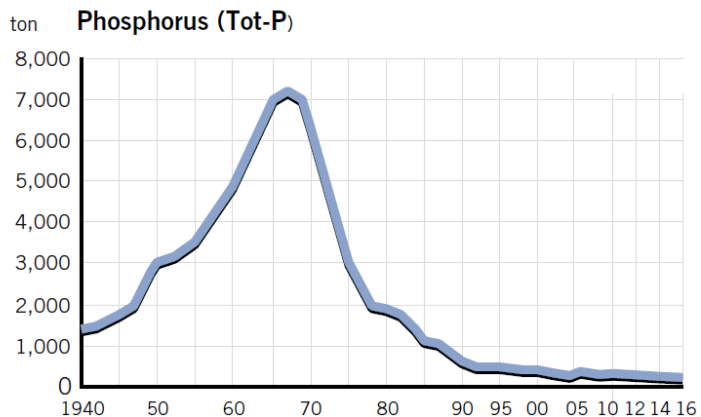
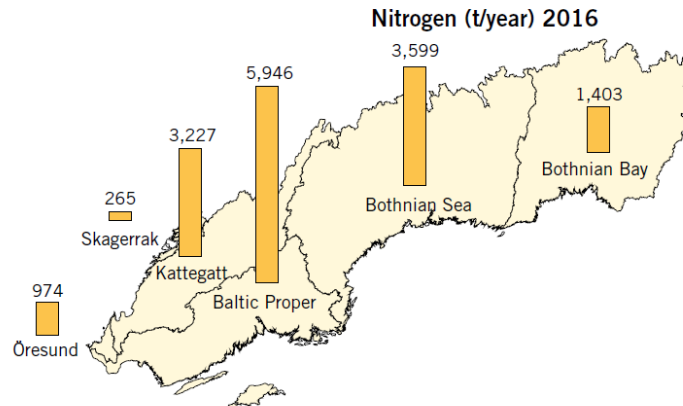
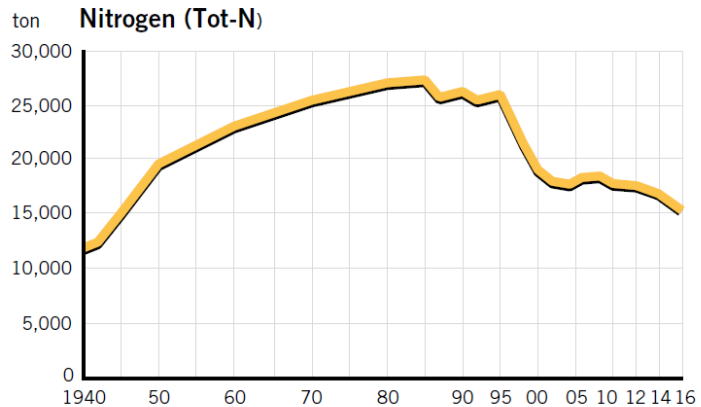
\*\* SPÅNGBERG, J., TIDÅKER, P. & JÖNSSON, H. 2014.



Energy inputs



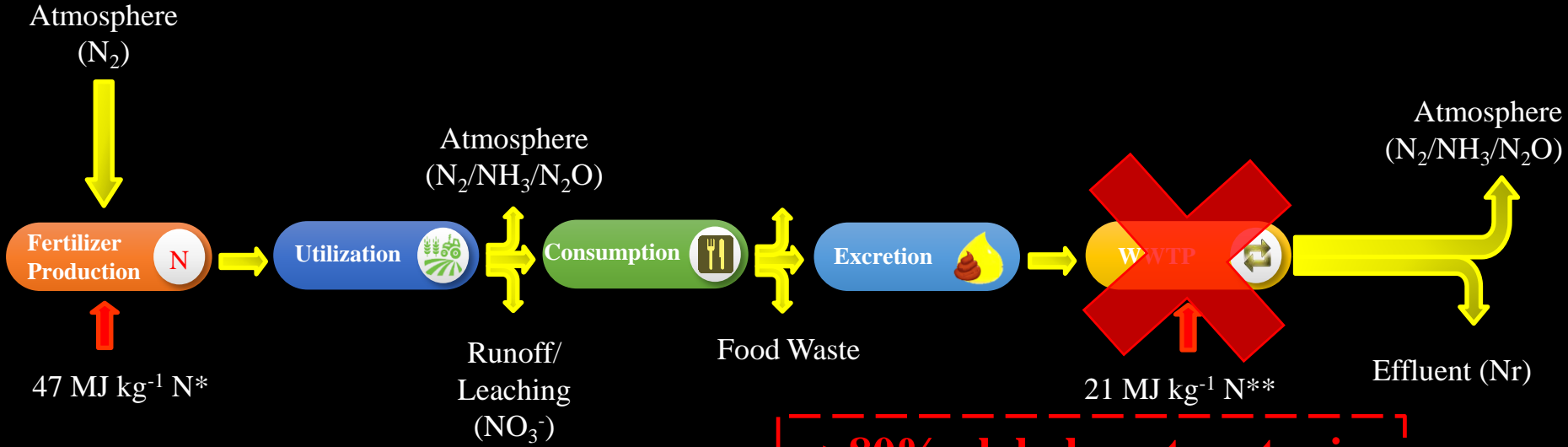
Nitrogen flow



**The discharge statistics for nitrogen and phosphorous from wastewater treatment plants to the larger seas.**

Source: Swedish Environmental Protection Agency and SCB (2018).

**7% global municipal wastewater  
Advanced nitrogen treatment**



**>80% global wastewater is not treated**

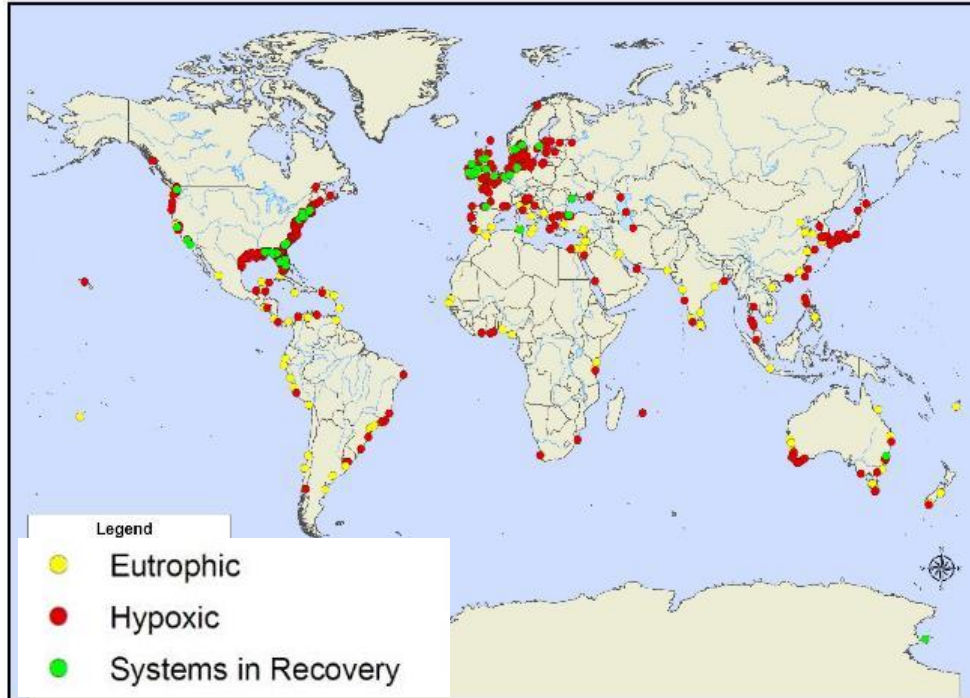
\*BABOO, P. 2015.

\*\* SPÅNGBERG, J., TIDÅKER, P. & JÖNSSON, H. 2014.

↑ Energy inputs     
 → Nitrogen flow

# Hypoxia ('Dead Zones')

World Hypoxic and Eutrophic Coastal Areas



Map from World Resources Institute  
(data from 2010)

<http://www.wri.org/resource/world-hypoxic-and-eutrophic-coastal-areas>

“Hypoxic events in the tropics ... have likely been **underreported**, perhaps by **an order of magnitude**, because of the **lack of ... capacity** for their detection.

Altieri et al., 2017, PNAS 114(14), 3660–3665



# The Baltic Sea suffers from eutrophication

Eutrophication = **Eutrofiering**

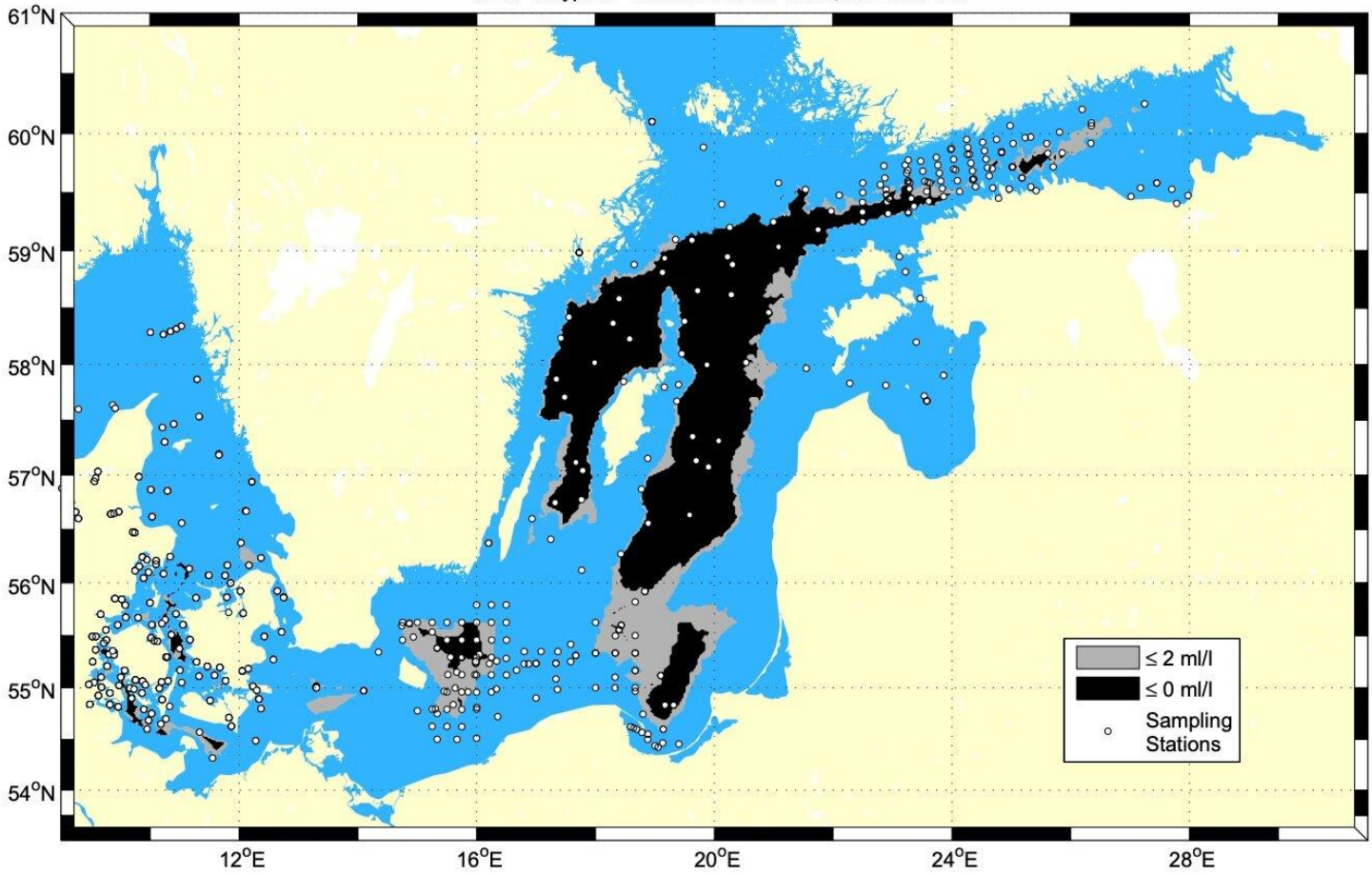
Algal blooms = **algblooming**

Dead zones = **Döda zoner**



SMHI:s satellitbild visar hur algbloomingen ser ut i Östergötland. Foto: SMHI

Extent of hypoxic & anoxic bottom water, Autumn 2019

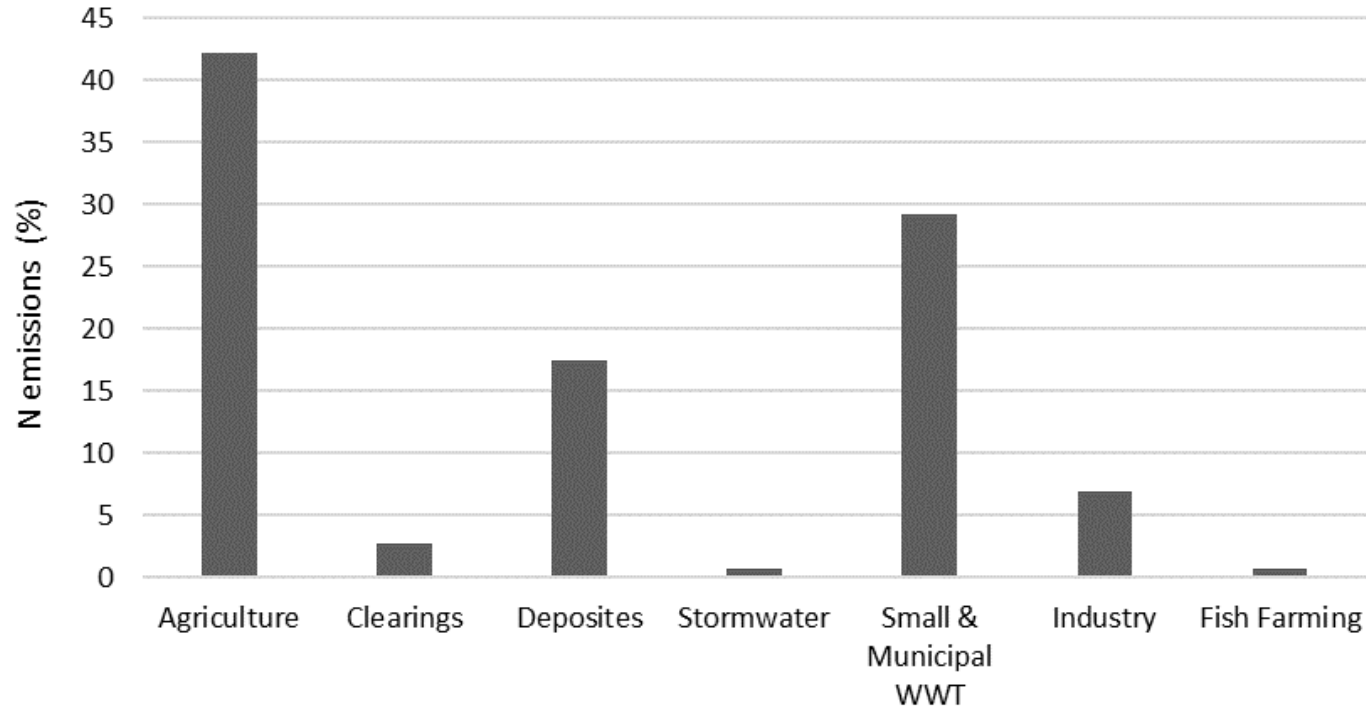


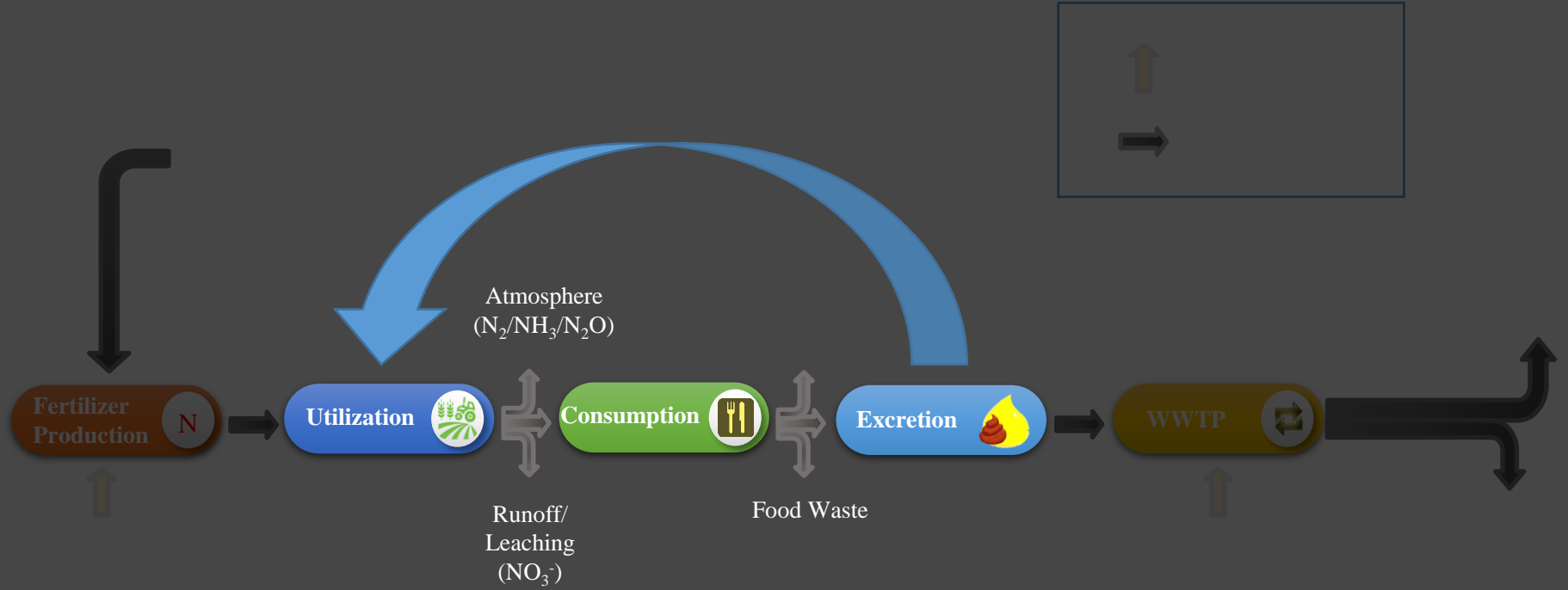
[Source: SMHI, Oxygen Survey in the Baltic Sea 2019](#)

Created:  
January 2020



# Sweden anthropogenic nitrogen emissions 1994-2013





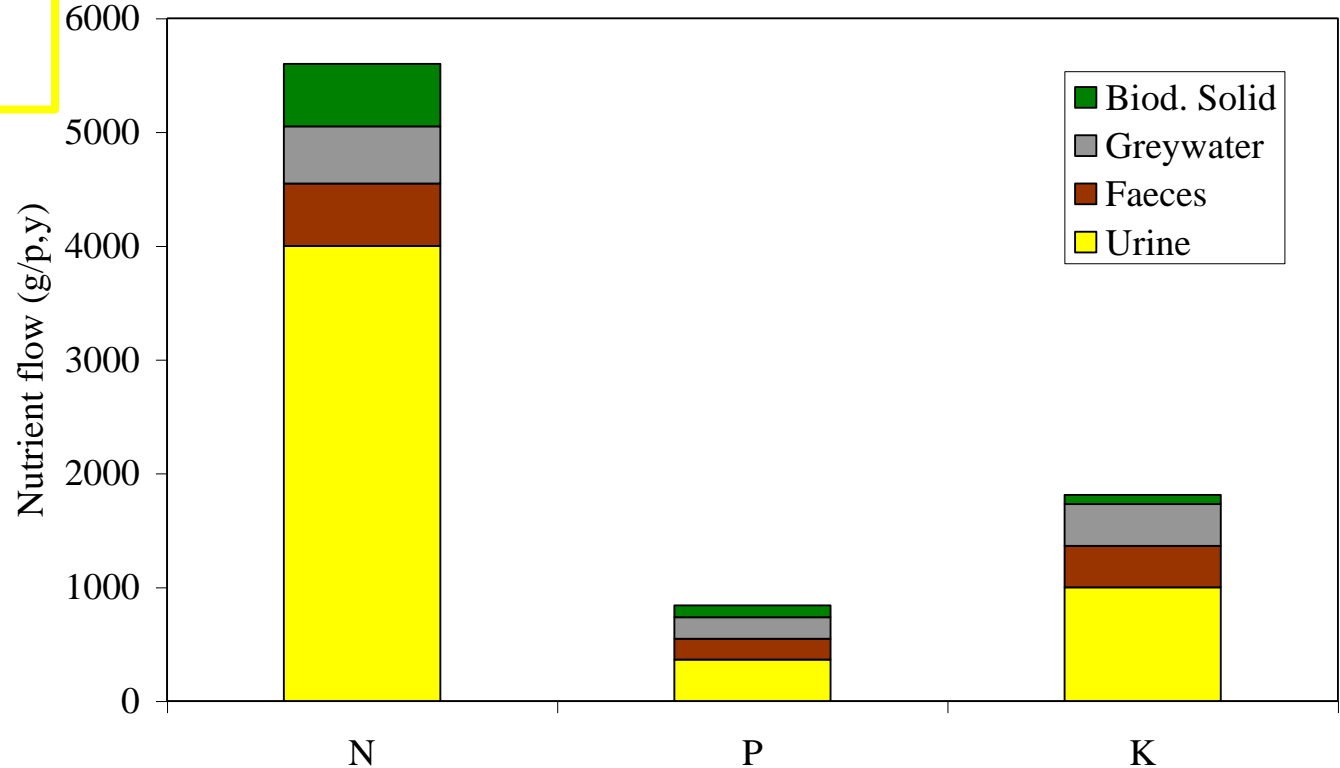
\*BABOO, P. 2015.

\*\* SPÅNGBERG, J., TIDÅKER, P. & JÖNSSON, H. 2014.

# Plant nutrient flow at the household

Urine =

- Majority of plant-nutrients
- 1% (v/v) of wastewater



## Challenges with urine as a fertiliser:

1. Large volumes:  $0.8\text{-}3\text{ L person}^{-1}\text{ day}^{-1}$
2. Low nutrient concentration

➤ 0.6 % N in urine to 34% N in

Fertiliser application of  $90\text{ kg N ha}^{-1}$

- Urine ( $\text{N}_{0.6}\text{P}_{0.07}\text{K}_{0.16}$ ) =  $15\,000\text{ kg ha}^{-1}$
- Commercial fertilizer ( $\text{N}_{18}\text{P}_2\text{K}_5$ ) =  $488\text{ kg ha}^{-1}$

Urine = 1 % wastewater (v/v)  
60-80 % of N in HH wastewater

Fertilizer  
Production

N

# OUR SOLUTION

is **preventing** urine from entering wastewater and **converting** the urine into a dry fertilizer.



- Based on >20 years of research at SLU
- Convert waste (urine) into a valuable product (solid fertilizer)
- Enabling a circular economy around our urine

building resilient  
communities



# CURRENT INSTALLATIONS

## SKÅNE (REWAISE Project)

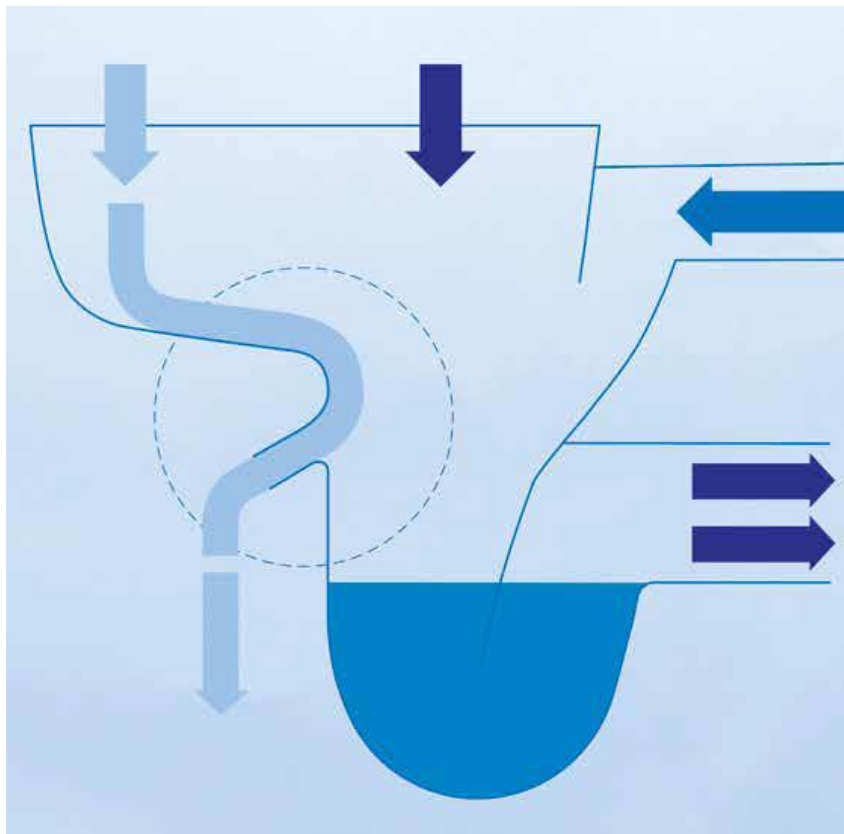
Installation at **VA SYD** office in Malmö  
with two more installations to come

## GOTLAND (N2 Brew + P2GreenN Projects)

Full-cycle implementation project in  
partnership with local toilet rental  
company and drink producer



# Ny urinsorteringstoalett



Designed by:



Sold by:

**LAUFEN**  
bathrooms

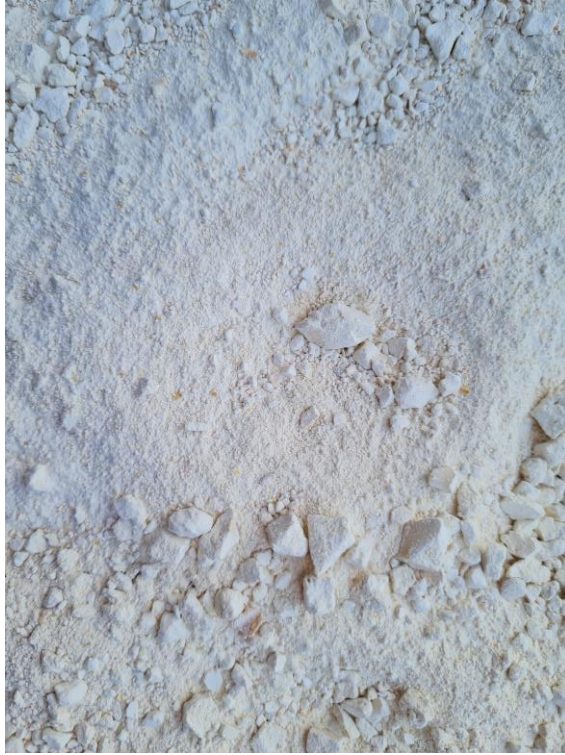
# Gotland System

For mobile and multi-tenants



**Sanitation360** is enabling a circular economy to be built within our sanitation sector

# SOLID URINE FERTILIZER



## Nutrients

Liquid urine: 0.6% N, 0.06% P, 0.3% K

(or 6 g N per liter of urine)

Dry urine: 8.2% N, 0.7% P, 2.5% K

- Reduced to 6% the original volume;
- Currently reaching >20% N

## Hygiene & Pharma

- Meets USEPA and WHO Guidelines
- Pharma to be removed during treatment

# Fertilizer Trial 2021

## Hallfreda, Gotland



Barley Harvest 2021 (kg/ha, adjusted)

|                    |       |
|--------------------|-------|
| Mineral Fertilizer | 3 626 |
| No fertilizer      | 2 383 |
| Dried Urine        | 3 476 |



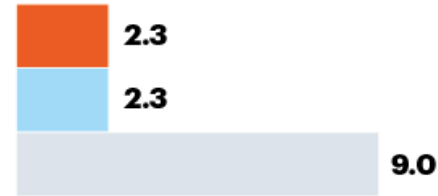
# The world starting to listen and is going to change.

## WHAT'S IN URINE

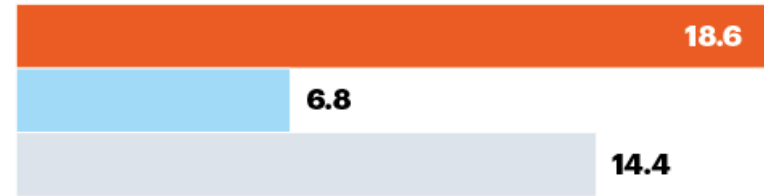
A study of urban waste water globally suggests it holds enough nitrogen, phosphorus and potassium to offset more than 13% of the agricultural fertilizer demand. The value of those recovered nutrients would equal US\$13.6 billion annually.

- Potassium
- Phosphorus
- Nitrogen

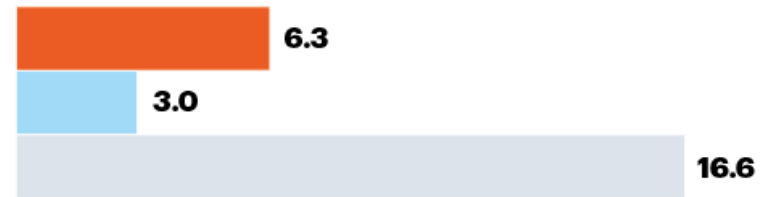
Potential revenue per year (US\$ billion, 2018)



Global fertilizer demand (%)



Nutrients in waste water (teragrams)



By Richard Monastersky and Chelsea Wald  
Design by Jasiak Krzysztofciak  
Data source: M. Qadir et al. Nat. Resour. Forum 44, 40-51 (2020)



©nature



# Thank you!



Do you have any questions?

jenna@sanitation360.se  
+46 700 960 668



## Awards & Publications



# nature

## Funders & Incubators



BILL & MELINDA  
GATES *foundation*



## Collaborators

**EOOS NEXT**

