Decentralised Nature Based Wastewater Treatment Systems:

The Role of Urine Separation Pedestals

International Virtual Conference – Earthworms, water fleas and algae: the future of wastewater treatment?

17 November 2020

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17nd November 2020

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INNOQUA
innovation for wastewater treatment

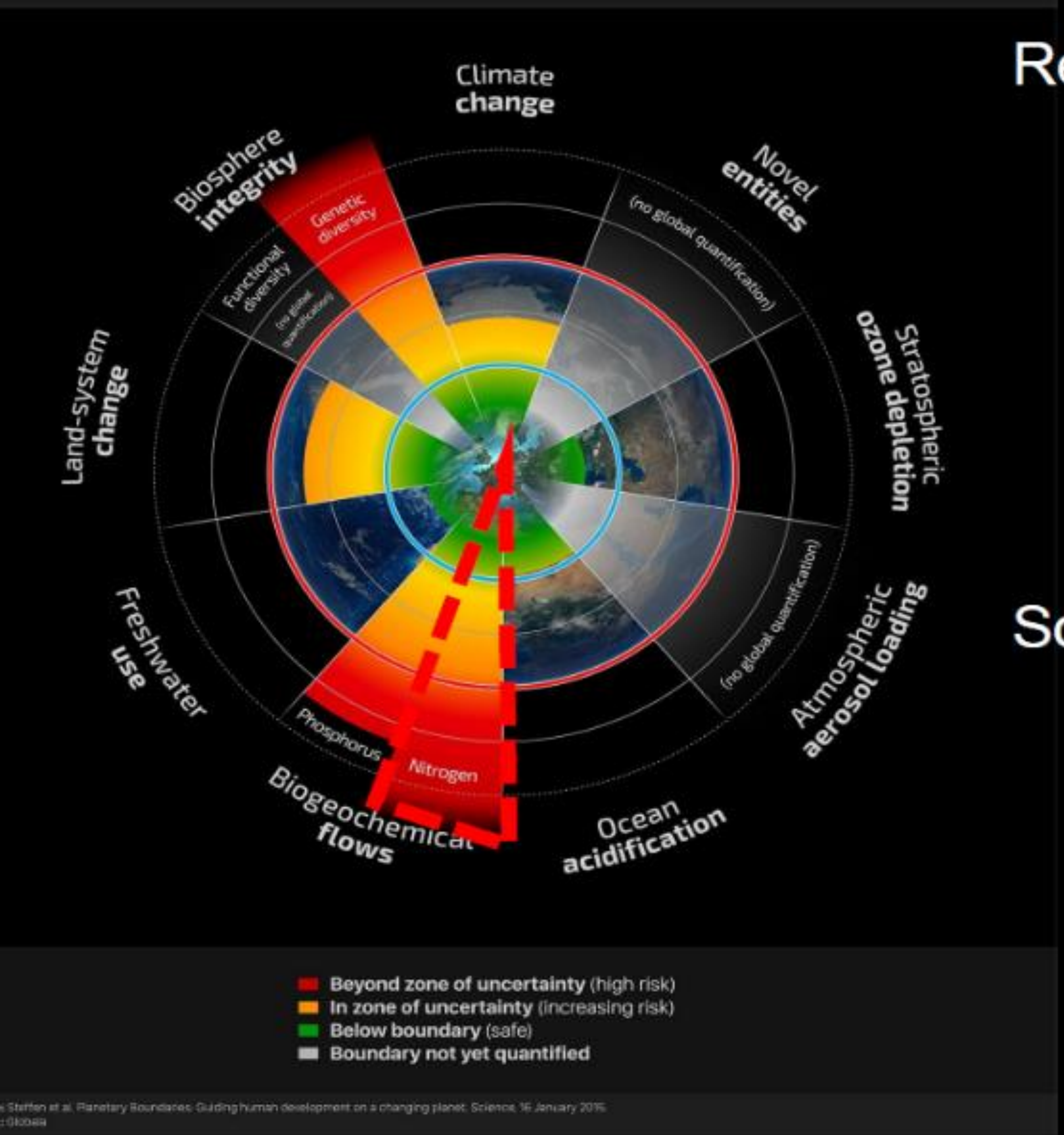
PRG
pollution research group

UNIVERSITY OF KWAZULU-NATAL

Topic

- Humans and environmental pollution
- Wastewater Treatment
- Circular Economy
- Urine Resources
- Separation
- Impacts

Planetary Boundaries



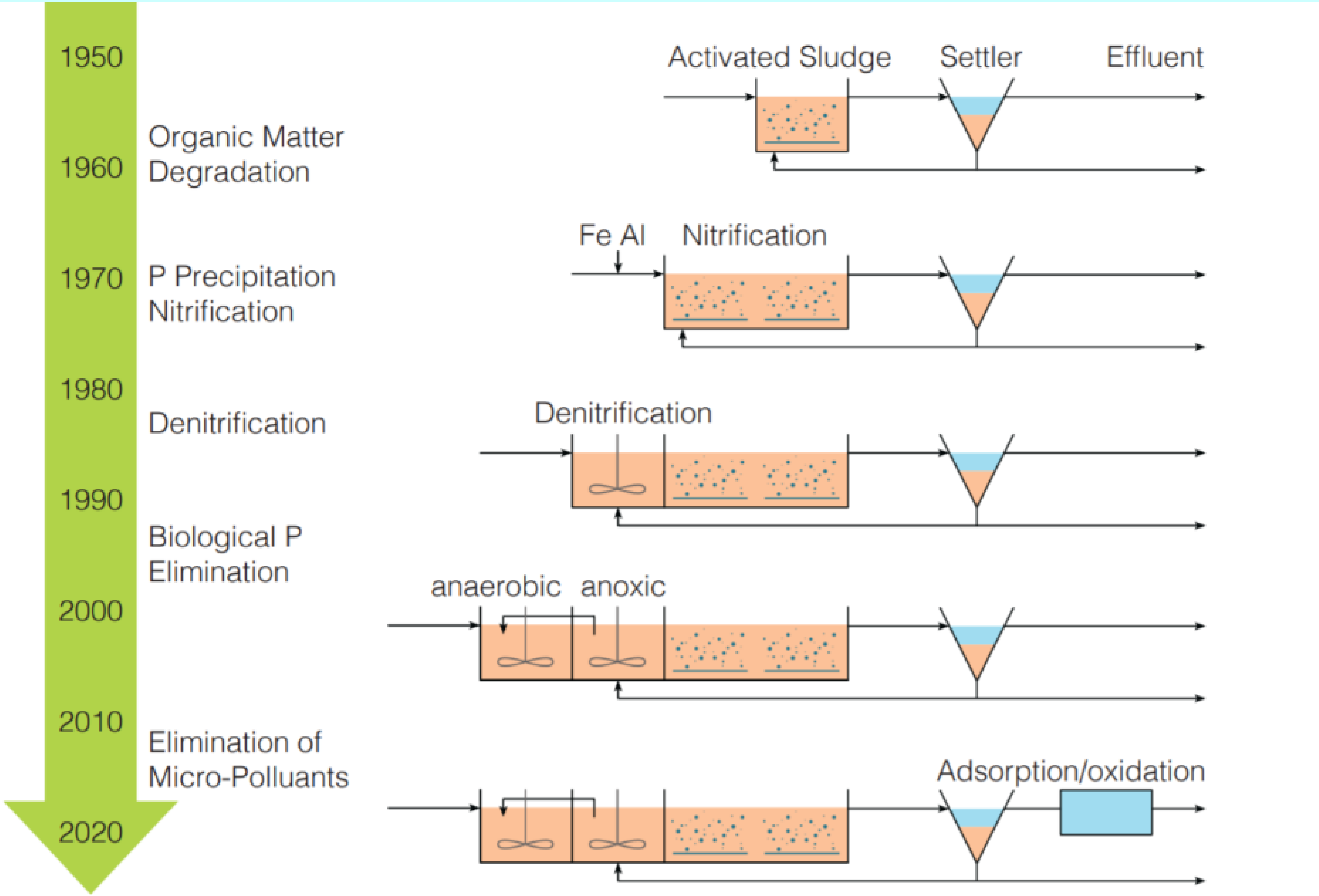
Reactive Nitrogen Pollution:

- Drinking water quality
- Air quality
- Eutrophication
- Hypoxia
- Climate change

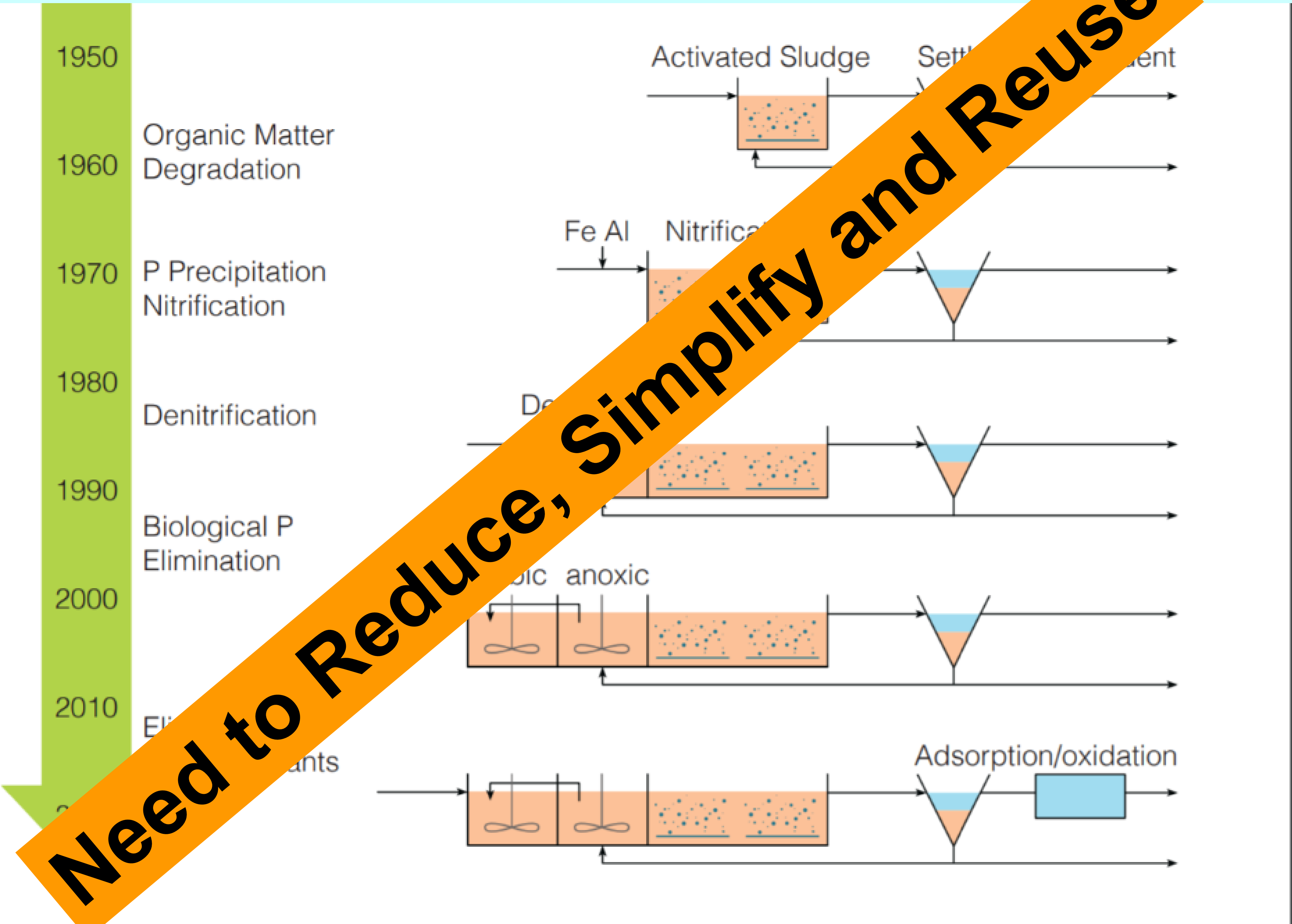
Sources:

- Agriculture
- Industry
- Going to the bathroom

History of Wastewater Treatment



History of Wastewater Treatment



No Electricity, Passive Treatment, low skills, Irrigation

BORDA

Bananas and Taro

Hydroponics

VFCW Performance (Oct-Nov 2017)

Table 1: VFCW performance data after modifications

	Inlet (Siphon Chamber)	Effluent	Discharge limit	% Removal
CODt (mg/l)	276.6 (± 4.8)	73 (± 1.8)	**75**	73.6
NH_4-N (mg/l)	57.7 (± 0.9)	21.5 (± 0.5)	**6**	62.7
NO_2-N (mg/l)	0.5 (± 0.0)	0.6 (± 0.0)		
NO_3-N (mg/l)	0.3 (± 0.1)	15.6 (± 0.3)	**15***	
PO_4-P (mg/l)	18.2 (± 0.2)	5.4 (± 0.1)	**10**	70.3
TSS (mg/l)	82 (± 2.0)	34.7 (± 2.2)	**25**	57.7
pH	7.2-7.4	6.7-7.3	**5.5-9.5**	
EC (mS/m)	93.2 (± 0.8)	77.2 (± 0.8)	**70 mS/m above intake up to a max of 150 mS/m**	
DO (mg/l)	1.4 (± 0.1)	3.6 (± 0.1)		
Alkalinity (mmol/l)	7 (± 0.2)	2.7 (± 0.1)		61.4

* VFCWs are nitrifying beds

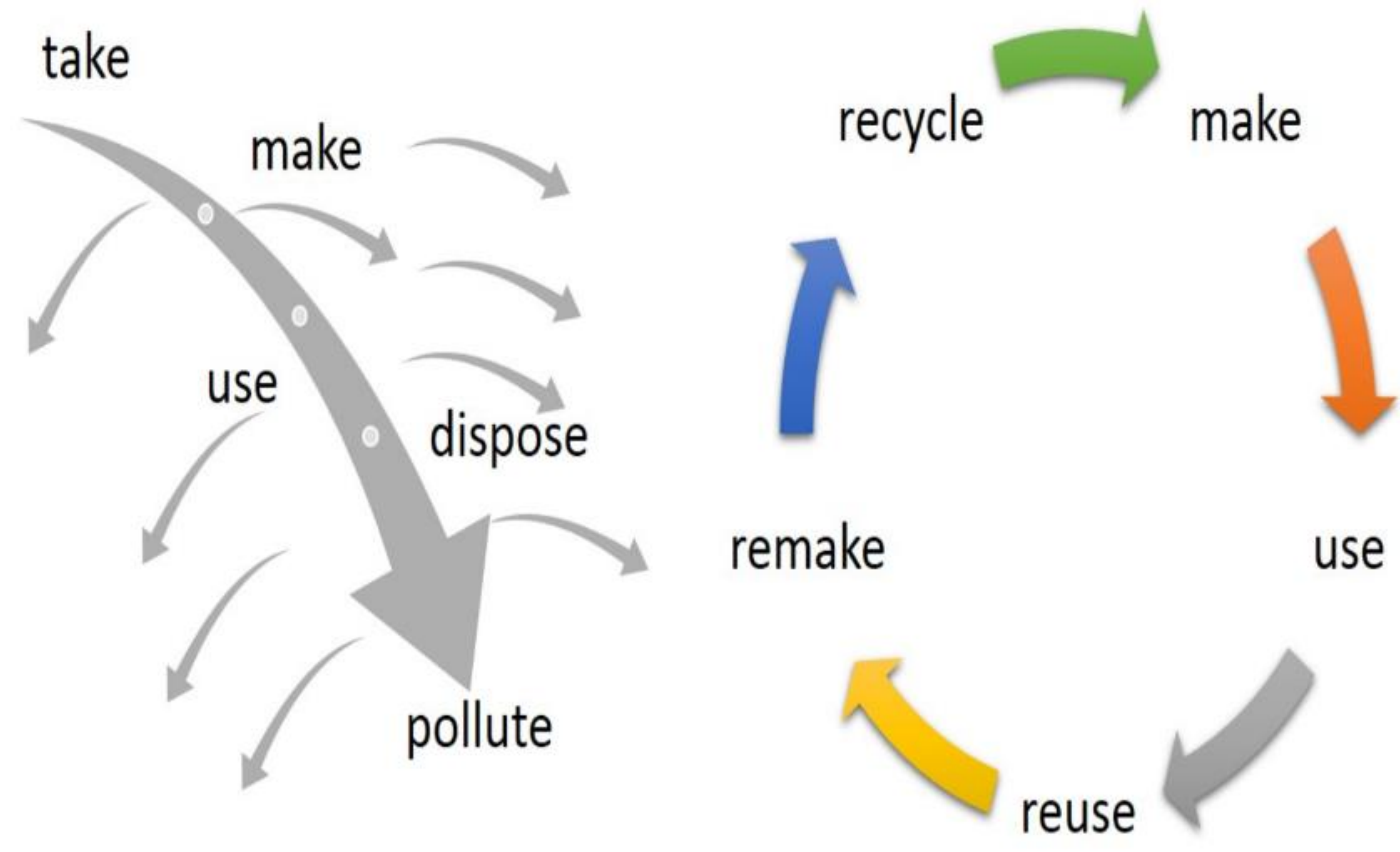
High Nutrient Loads and Nature Based Systems

- Nature based systems scale with volume

- Factor 10 water reduction pedestals
  - reduced water demand
  - reduced volume of contaminated wastewater
  - reduced area for nature based system

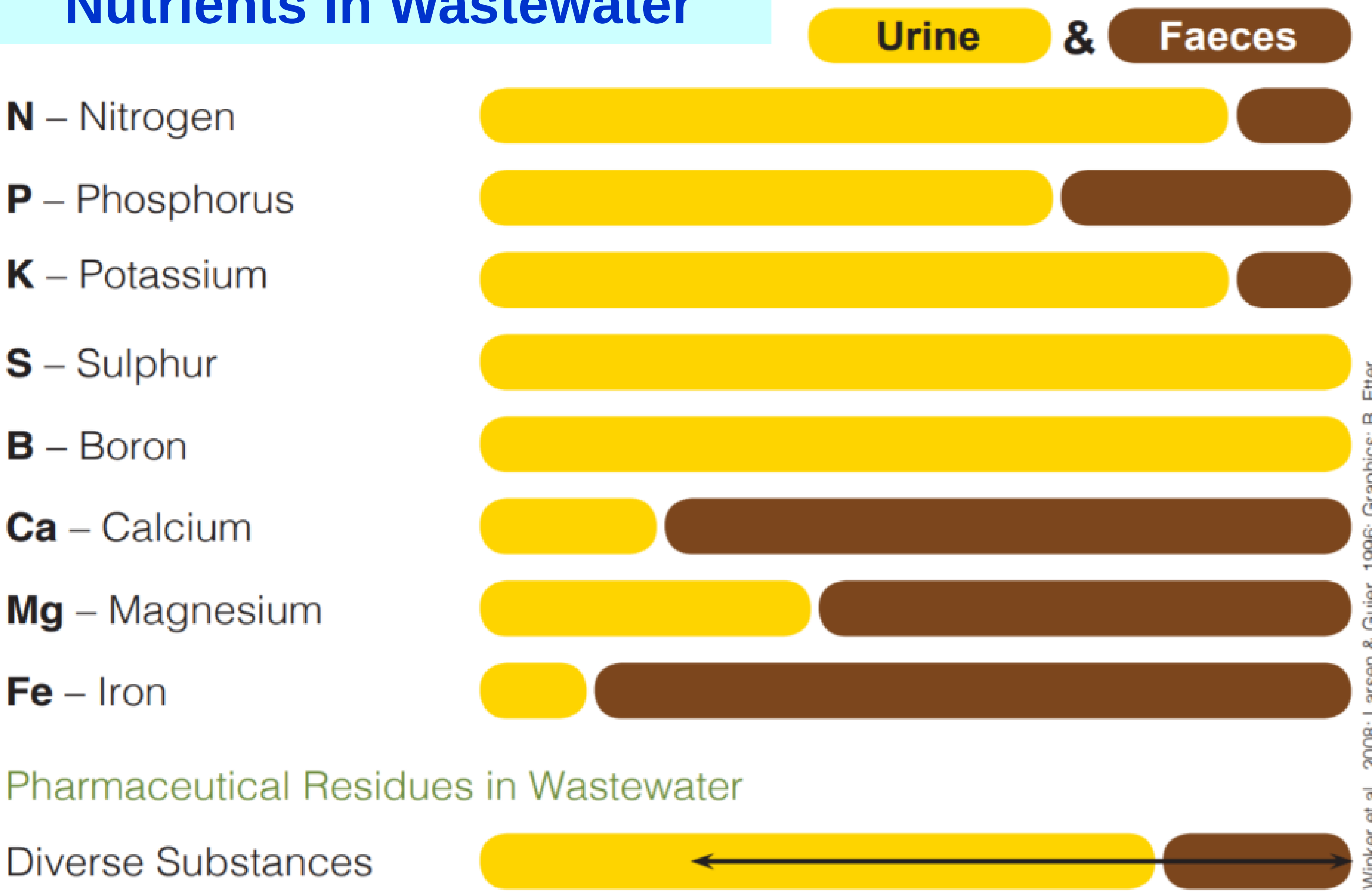
- Separate urine from faeces
  - remove the nutrients from nature based systems
  - potential for nutrient reuse

Linear vs the Circular Economy



CC 3.0 Catherine Weetman 2016

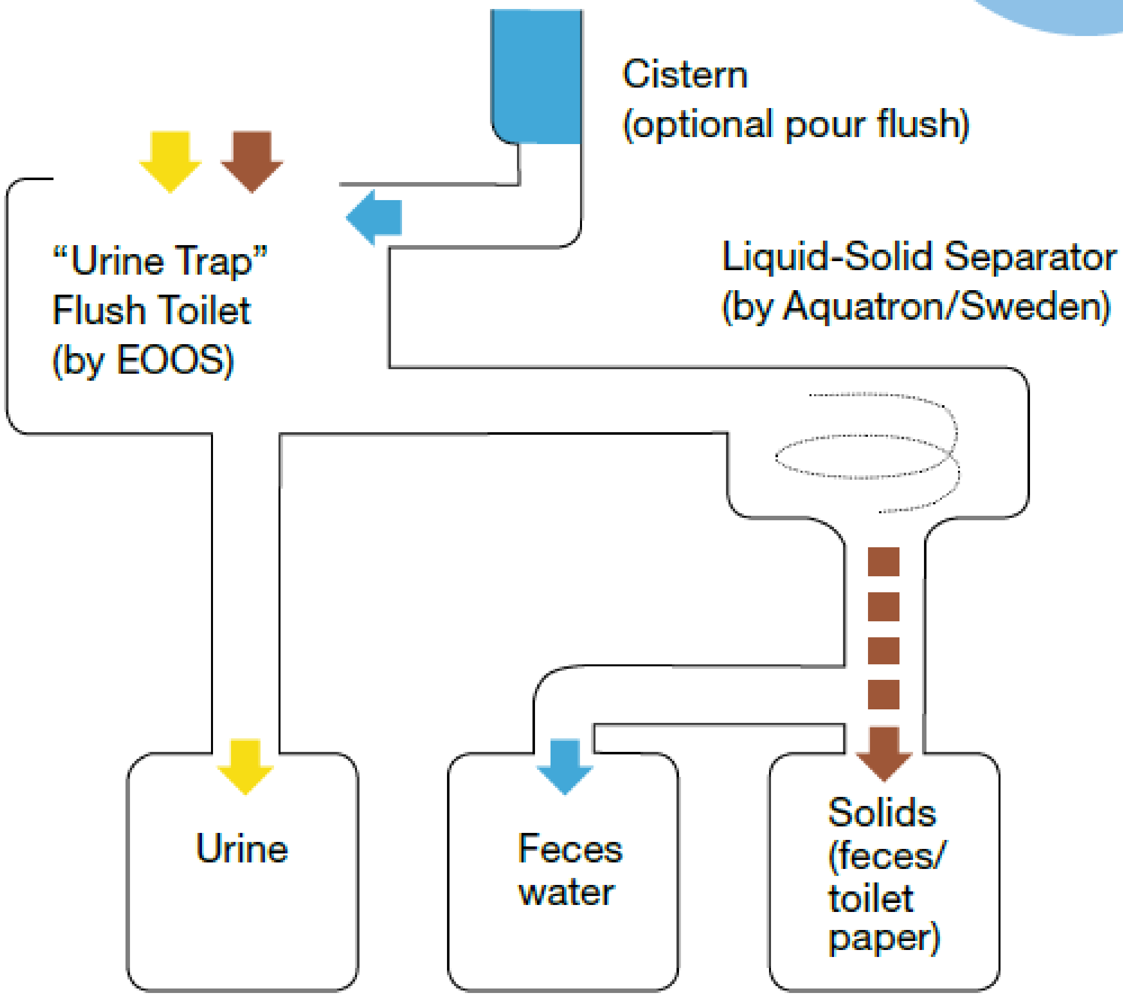
Nutrients in Wastewater



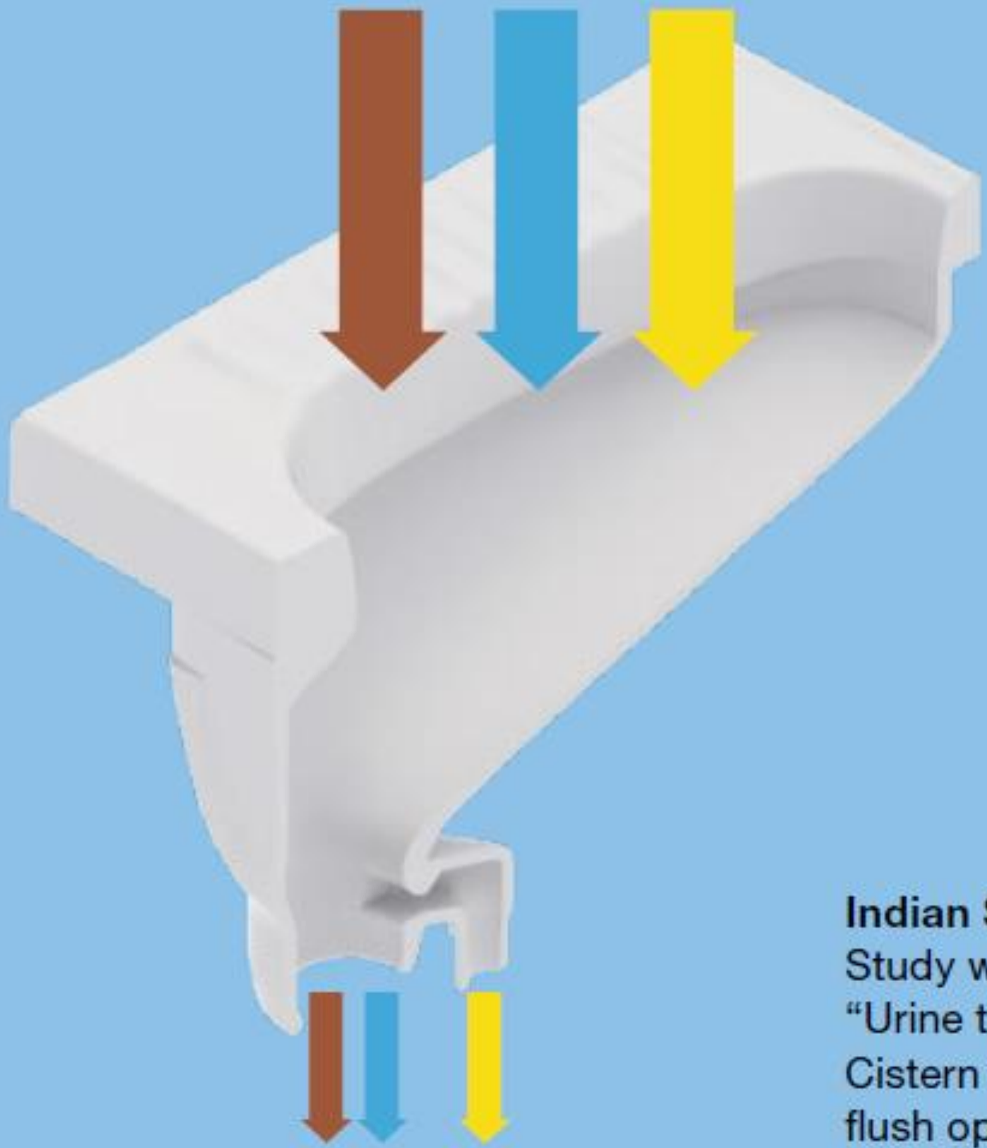
Urine trap

by: EOOS

Patent pending



"A breakthrough technology for urine diversion in flushing toilets"



Indian Squat Pan
Study with integrated "Urine trap".
Cistern flush or pour flush operation.

EOOS Laufen Pedestal (€ 1,500.00)

Scenario concentrations

Scenario		Ammonia mg N/L		Nitrate mg N/L		Phosphate mg P/L	
Wetland	**UD**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
No	No	40.0	80.0	-	-	4.0	12.0
Yes	No	-	-	16.0	32.0	4.0	12.0
No	Yes	16.5	33.0	-	-	2.3	6.8
Yes	**Yes**	-	-	**6.6**	**13.2**	**2.3**	**6.8**
Discharge limits		6.0		15.0		10.0	

UD + wetlands are required to meet standard.

Separated urine mustbe dealt with separately (1.5 – 3.5 m^3/d).

What to do with urine?

- Direct agricultural reuse
  - urban agriculture
- Nitrification and concentration

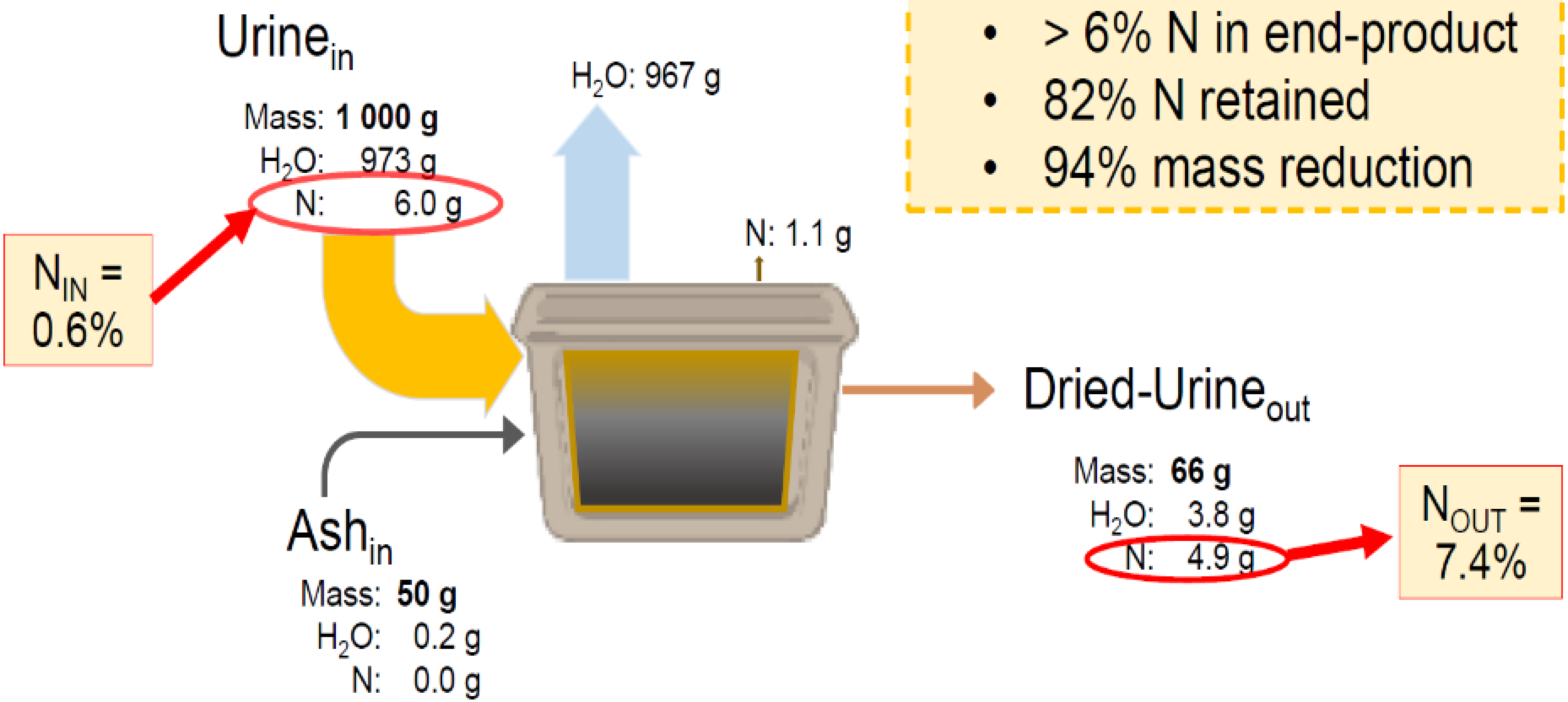
Direct Urine on Lime

Results - Mass Balance at 35 °C

Dose - Drying Technology

ACHIEVED:

- > 6% N in end-product
- 82% N retained
- 94% mass reduction



Partnership / References

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