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# peepoo bag

Self-sanitising, single use,  
biodegradable toilet

*Sanitation Challenge, Wageningen 20-05-2008*

**Annika Nordin, Björn Vinnerås, Mikael Hedenkvist, Anders Wilhelmson**



Swedish University of  
Agricultural Sciences

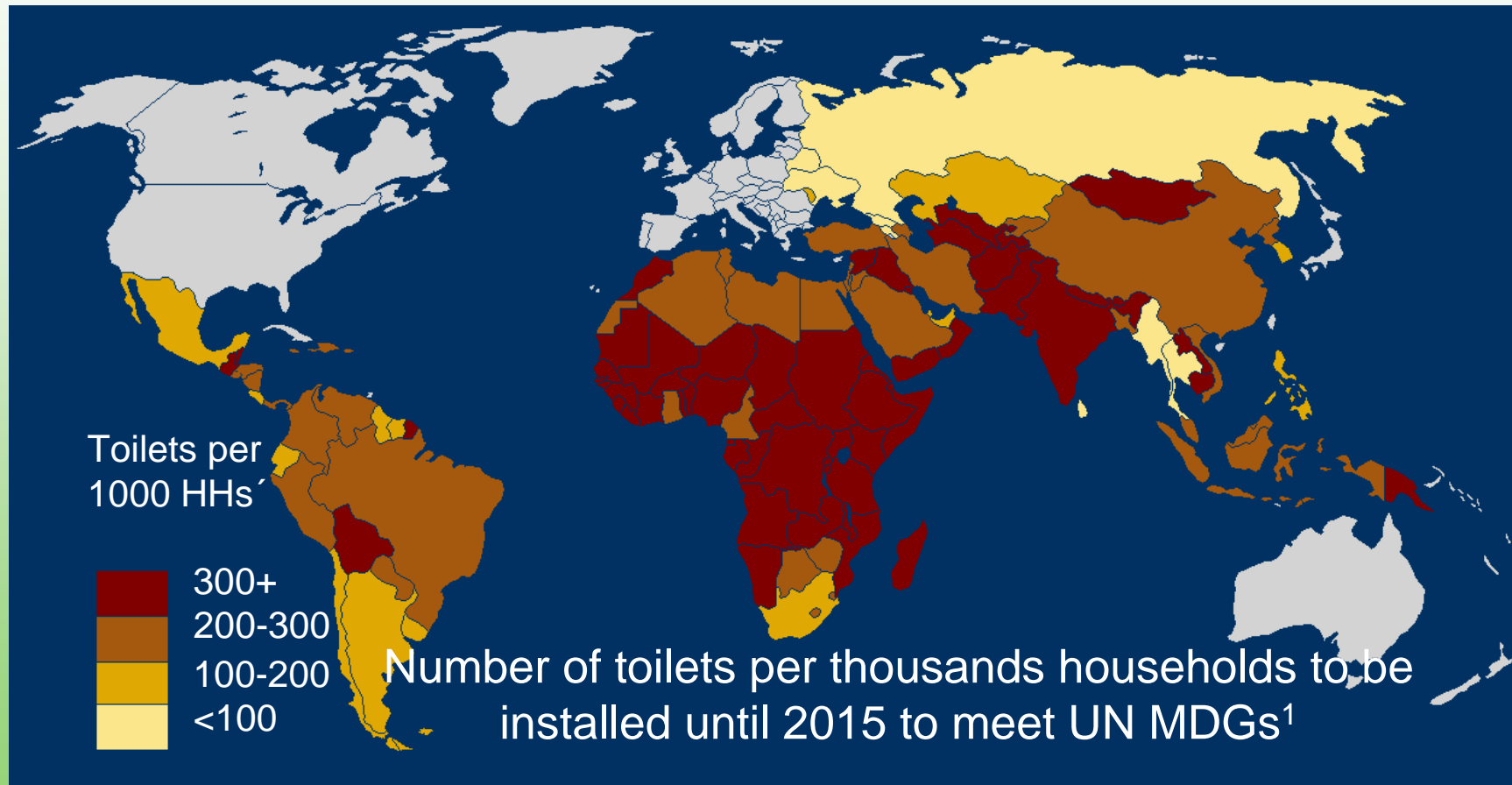
Wilhelmson architects  
**PEEPOOPLE AB**



Royal Institute of Technology

# SANITATION CHALLENGES

2.8 billion people live without adequate sanitation



1.) Rockström et al. 2005 Sustainable pathways to attain the millennium development goals

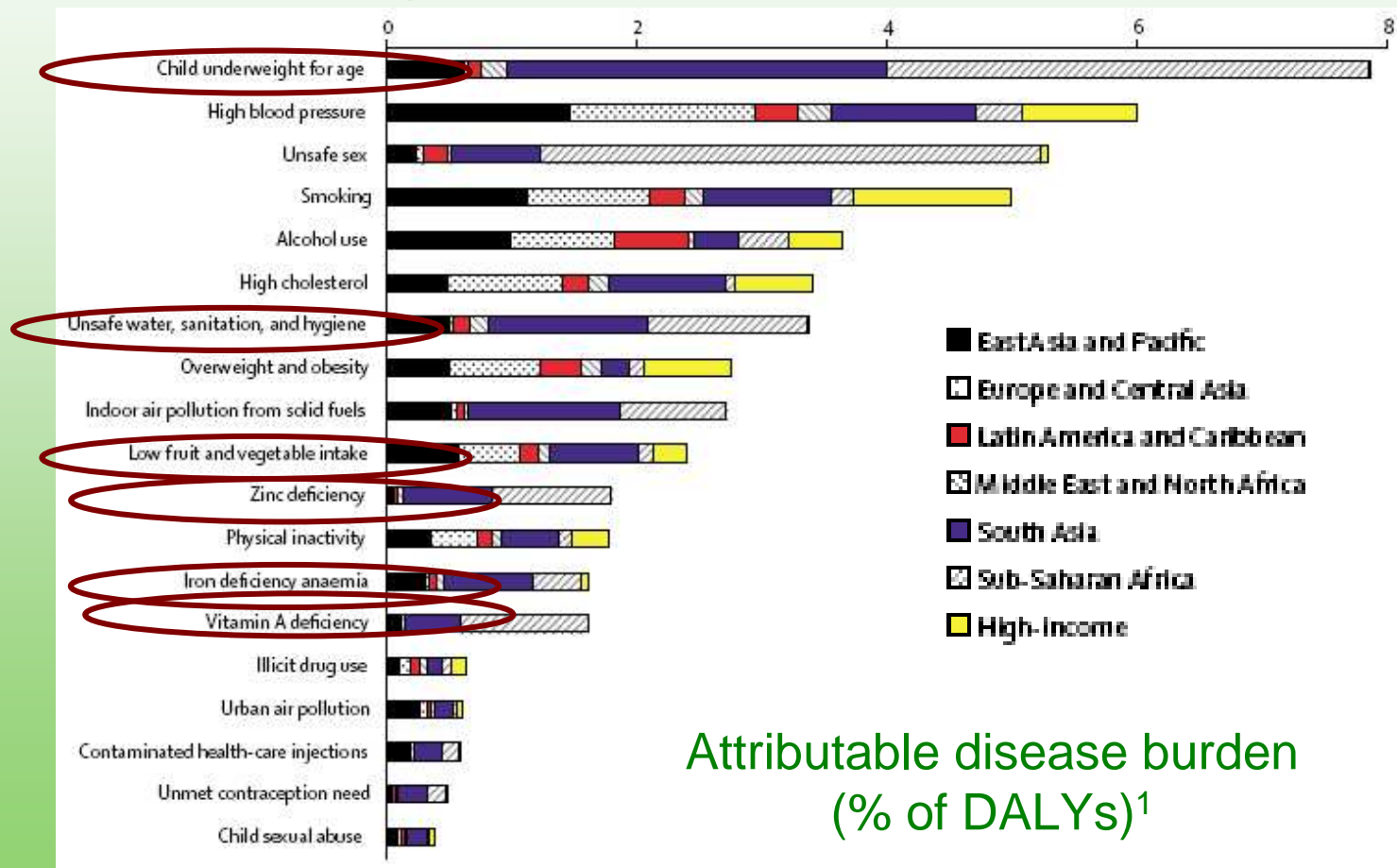
# SANITATION CHALLENGES

1 billion of urban habitant live in slums



# SANITATION CHALLENGES

Malnutrition and lack of sanitation contribution to global health burden



Attributable disease burden  
(% of DALYs)<sup>1</sup>

1.) Lopez et al. 2006 Global and regional burden of disease and risk factors, 2001

# THE SANITATION – POLLUTION LADDER

The desirable toilet often associated with status...



Photos: Camilla  
Wirsen



...rather than health and environmental pollution

# THE SANITATION – POLLUTION LADDER

The desirable toilet often associated with status<sup>1</sup> ...



Photo: Camilla Wirsen

- flushed porcelain toilets
- VIP
- Pit latrine
- open defecation

# THE SANITATION – POLLUTION LADDER

- Ecological sanitation
- Advanced treatment
- Primary treatment
- Collection
- Open/delayed open defecation



...rather than health and environmental pollution<sup>1</sup>

1.) Matusi 2002 The potential of ecological sanitation

# THE PEEPOO BAG



At lower rungs of the sanitation ladder - but  
at top level of the pollution ladder



# QUALITIES OF PEEPOO BAG



- Odourless initial storage 24h
- Cheap 0.025 USD
- Self sanitising within 2-4 weeks
- Bio degradable
  - durable for sanitation then degraded
  - 100% renewable\*
- Allow nutrient reuse

\* future goal

# FUNCTION

User aspects in  
Sweden and  
Kenya, 25 µm  
Ecovio bag

- Easy to use
- Odourless 24h
- Hand cover appreciated



Photos: Camilla  
Wirsén



**SEC Soweto East**

# BIODEGRADABILITY

PE + pro-oxidant  
urine or faeces +  
2% urea 24 or  
37°C

- No degradation in
  - Air
  - Water
  - compostfor 2 months
- Durable for sanitation



# WHY SANITISE

Potential pathogen load in faeces:

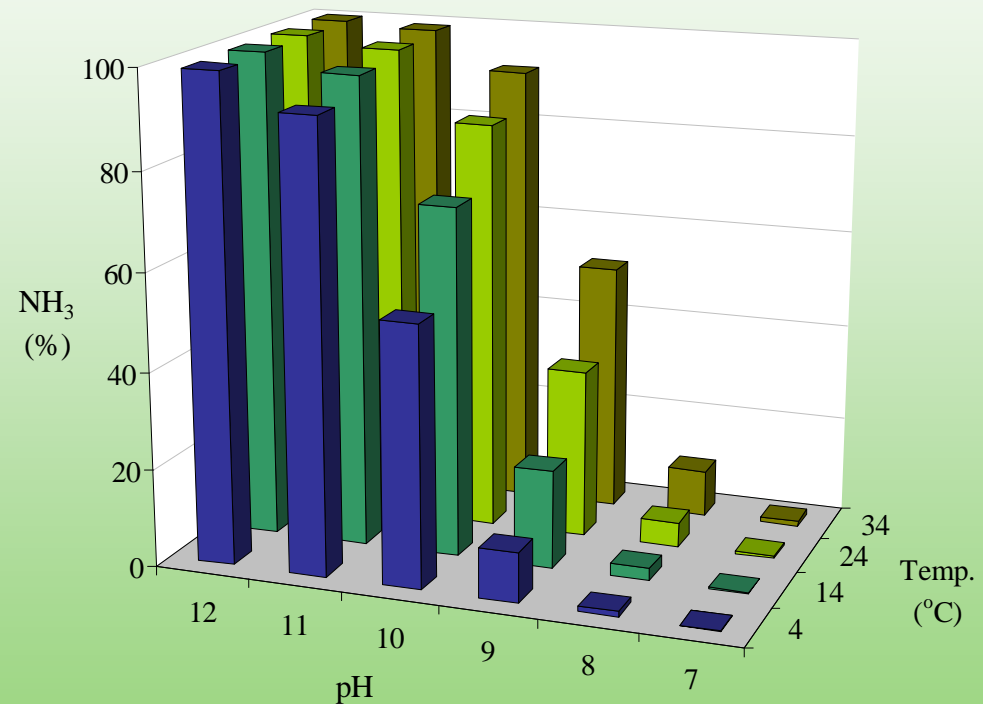
- Bacteria  $9 \log_{10} \text{g}^{-1}$
- Virus  $9 \log_{10} \text{g}^{-1}$
- Parasites  $4 \log_{10} \text{g}^{-1}$
  
- Peepoo bag - No dilution!



# HOW SANITISE

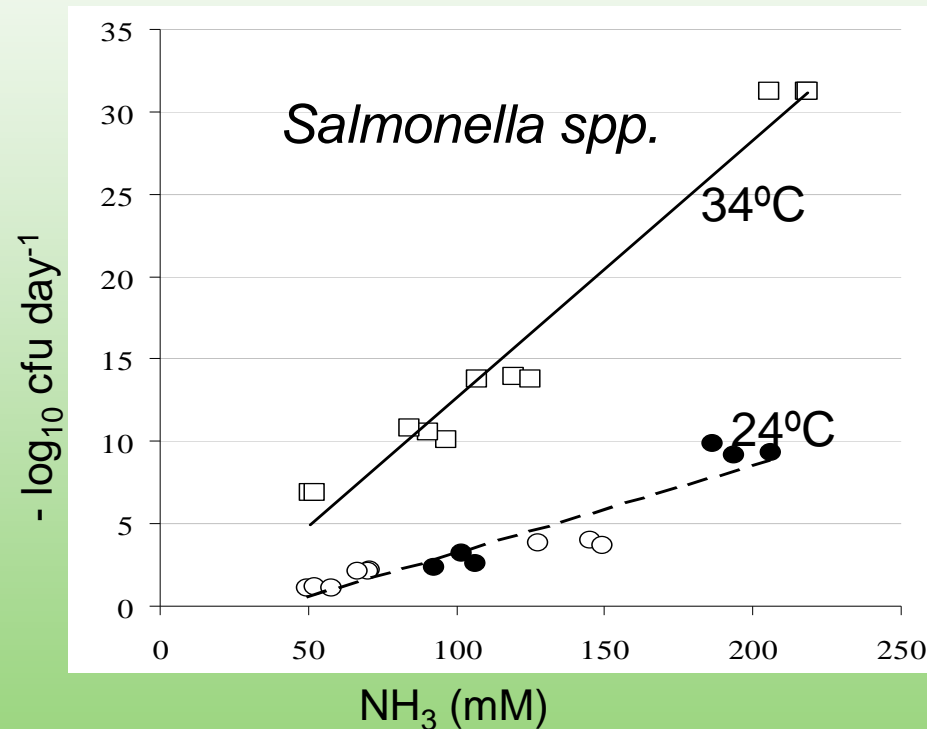
## Ammonia based sanitation

- $\text{NH}_3$  biocidal
- Urea 4g bag
- Low pH - 9



# SANITISATION

## *Salmonella*, *Ascaris*, and phage (MS2 and $\Phi$ X)



Inactivation of *Salmonella* spp. in faeces (●) and urine (○/□) plotted against concentration of  $\text{NH}_3$  (aq) at 24 and 34°C

1.) Nordin et al. 2008, Vinnerås et al 2008

- Linear correlation
- *Salmonella*
  - Inactivated in 2 weeks
- *Ascaris* & phages
  - Inactivated at 34°C
- Temperature

# SANITISATION

$\text{NH}_3$  horizontal migration from 2% urea in faeces (2, 5, 10 or 15% TS)



- Urea degraded in hrs
- Higher temperature – faster migration
- Lower TS - faster migration
- $2.5 \text{ cm h}^{-1}$

# REUSE OF PLANT NUTRIENTS

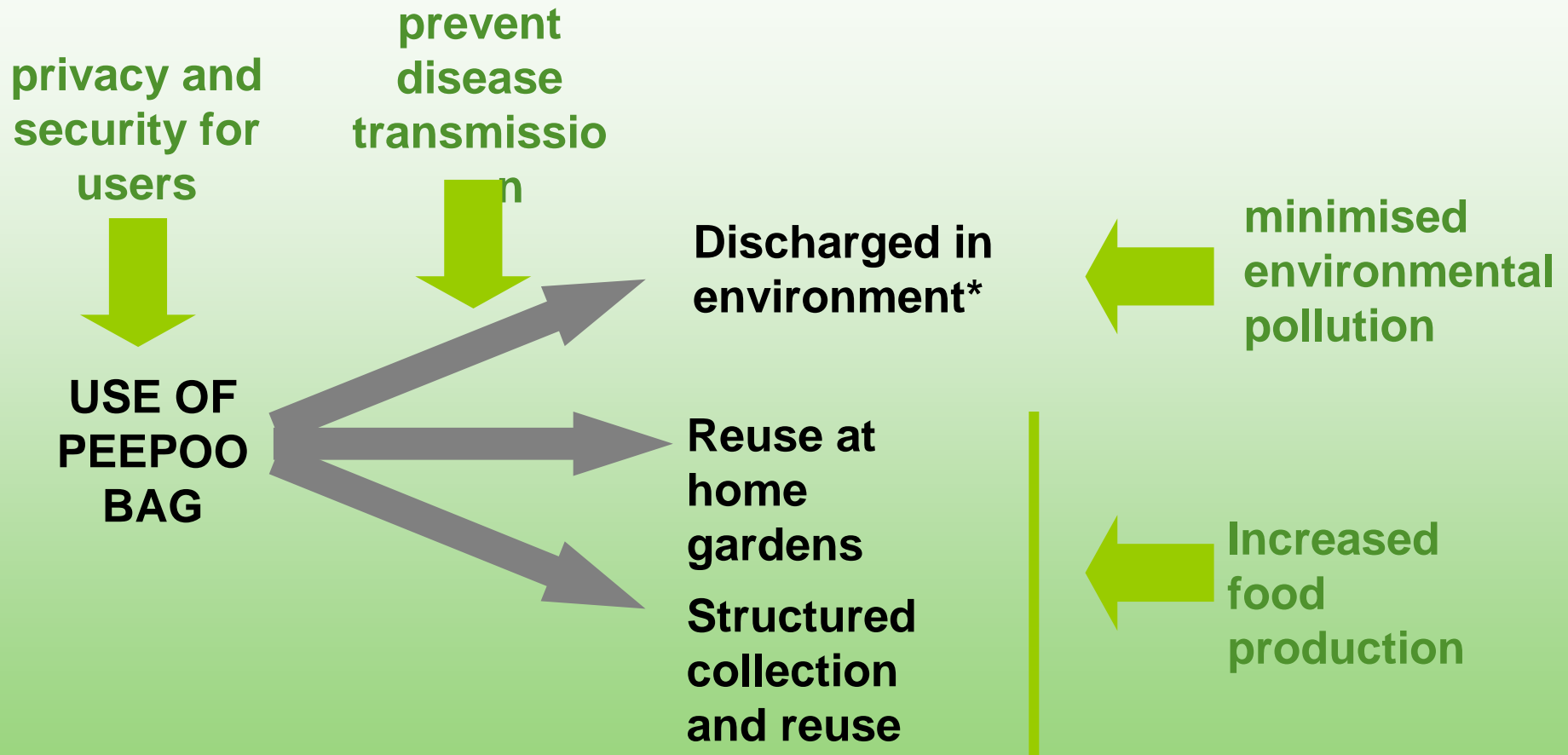
- Enhanced fertiliser
- 5-10 bags to m<sup>2</sup>
- Soil properties
- Interest for reuse in Kibera



Photo: Peter Morgan



# PEEPOO BAG LIFE CYCLE



\*Plant nutrients can cause eutrophication

# CONCLUSIONS

- Bacterial pathogens (Salmonellosis, Typhoid fever, Cholera etc) inactivated with great margins
- Ascaris and virus requires 34°C
- Pathogen inactivation shortened by temperature
- With diarrhoea faster  $\text{NH}_3$  distribution
- High user acceptance

# NEXT STEP

- Summer 2008
  - degradation/crop field-studies
- August 2008
  - Up-scaling of user test, 1000 persons 3 month, Nairobi, Kenya
- Continuous development of the plastic material



Photo: Björn Vinnerås



## The peepoo bag - a solution to meet MDGs on:

- sanitation
- clean water
- nutrition
- health