peepoo bag

Self-sanitising, single use, biodegradable toilet

Sanitation Challenge, Wageningen 20-05-2008

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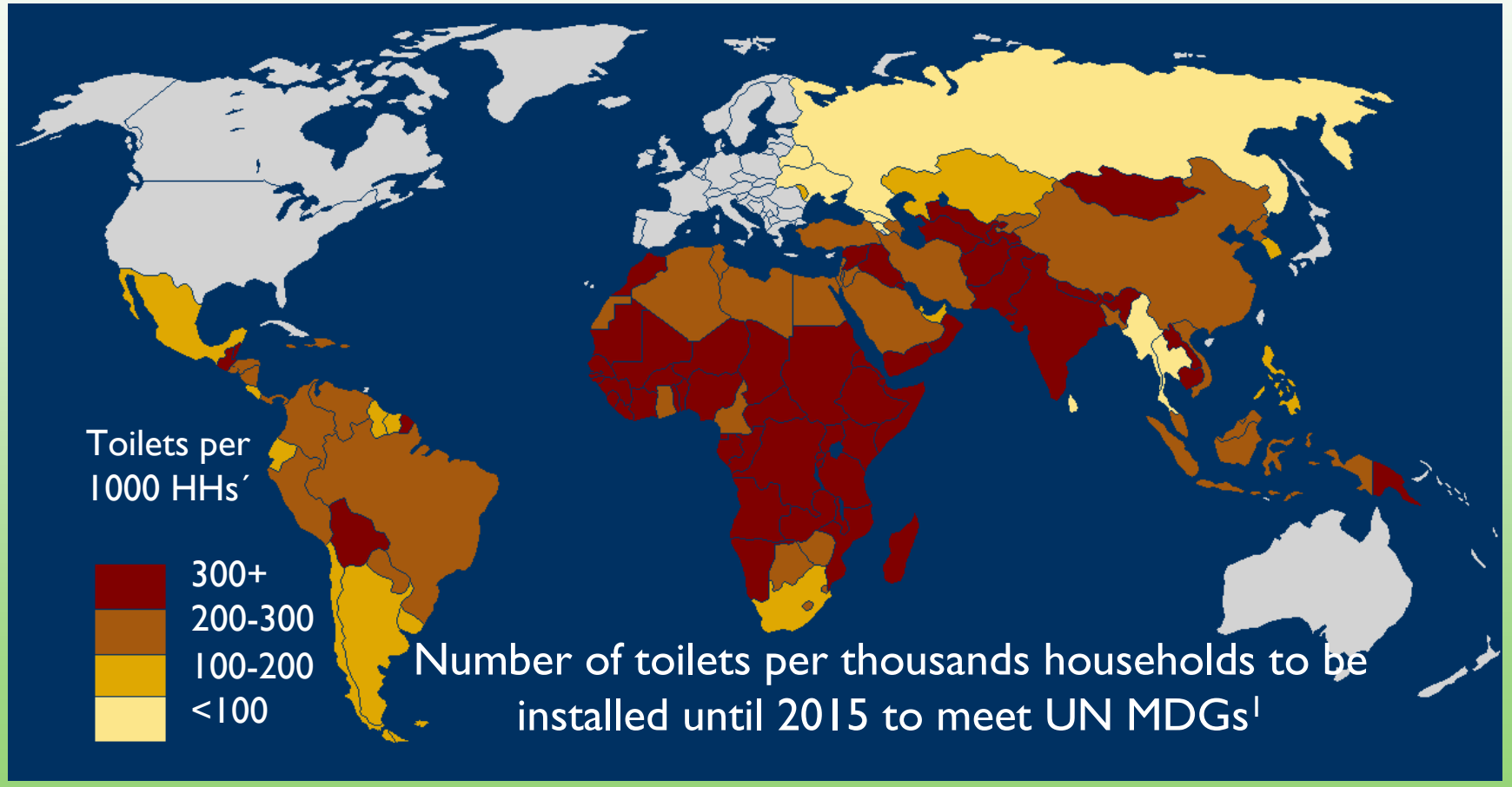
SANITATION CHALLENGES

2.8 billion people live without adequate sanitation



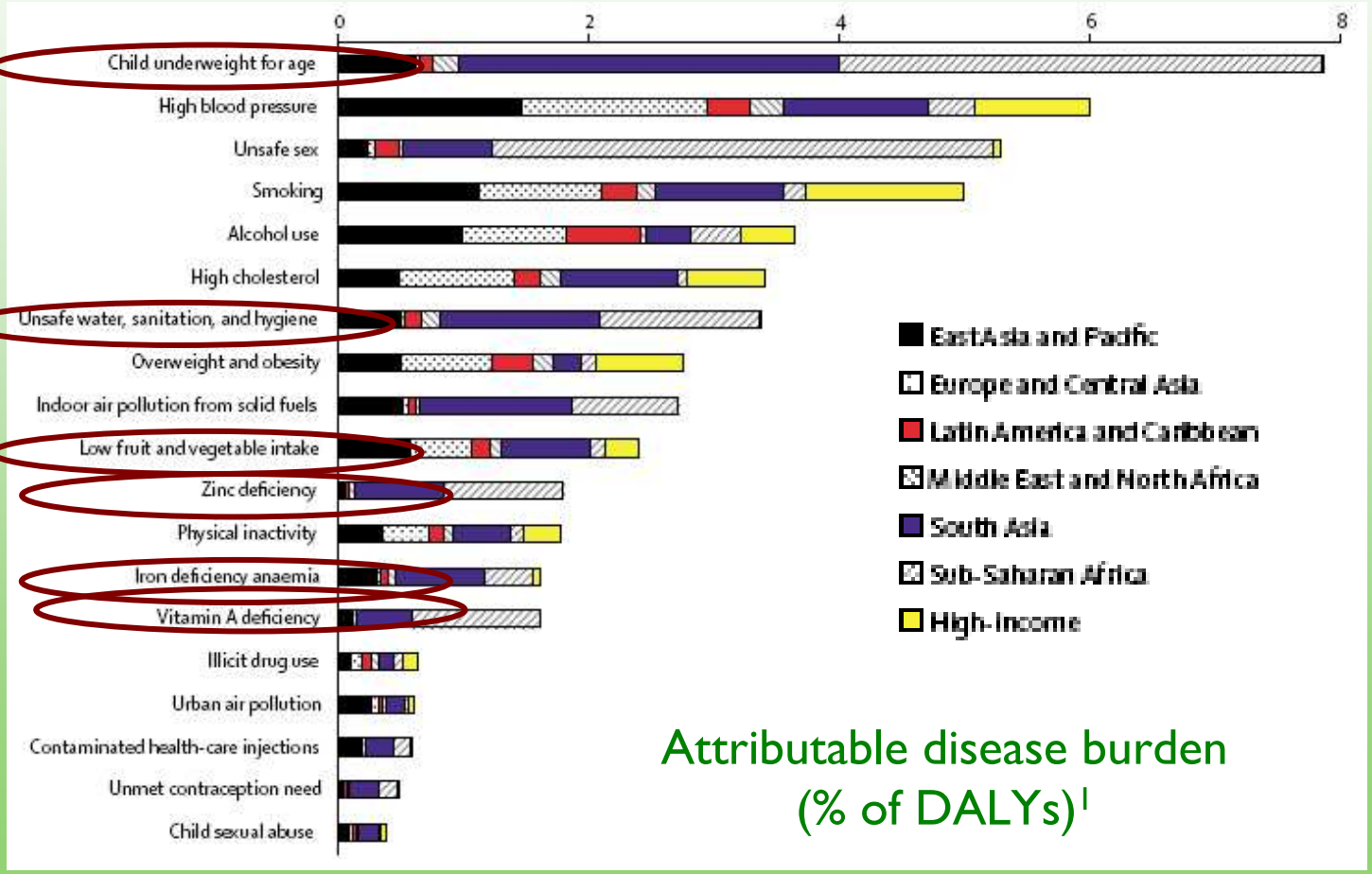
1.) Rockström et al. 2005 Sustainable pathways to attain the millennium development goals

SANITATION CHALLENGES

1 billion of urban habitant live in slums

SANITATION CHALLENGES

Malnutrition and lack of sanitation contribution to global health burden



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[1]…


Photo: Camilla Wirsen

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

1.) COSI 2008 The sanitation ladder

THE SANITATION – POLLUTION LADDER

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

…rather than health and environmental pollution[1]

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 Wirsen

SEC Soweto East

BIODEGRADABILITY

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

- No degradation in
  - Air
  - Water
  - compost

  for 2 months
- Durable for sanitation

WHY SANITISE

Potential pathogen load in faeces:

- Bacteria 9 $\log_{10} g^{-1}$
- Virus 9 $\log_{10} g^{-1}$
- Parasites 4 $\log_{10} g^{-1}$

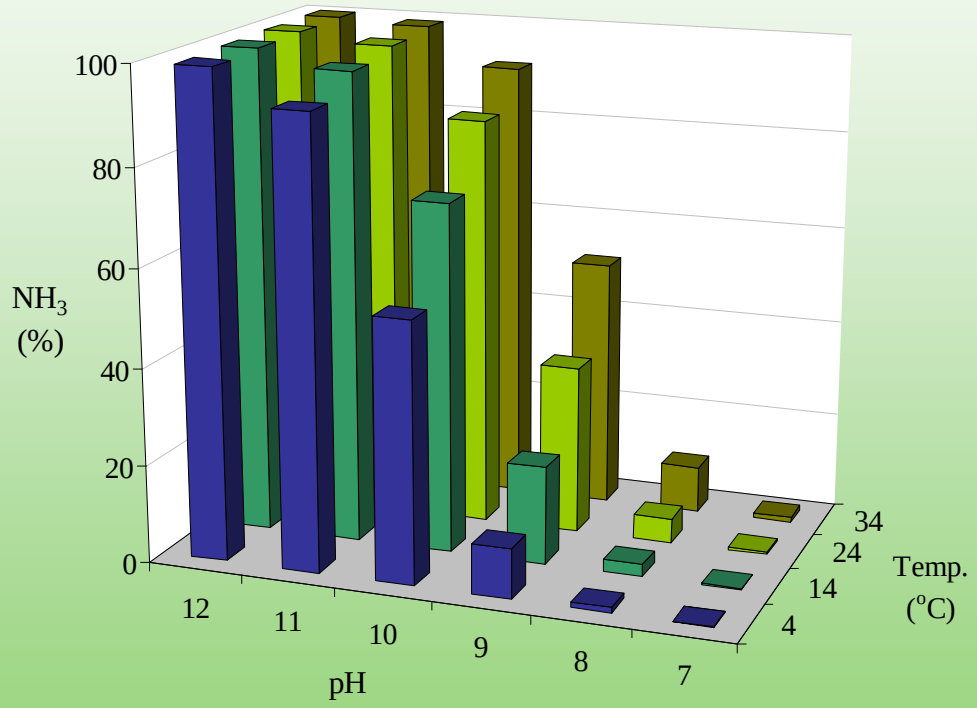
- Peepoo bag - No dilution!

1.) Westrell, 2006

HOW SANITISE

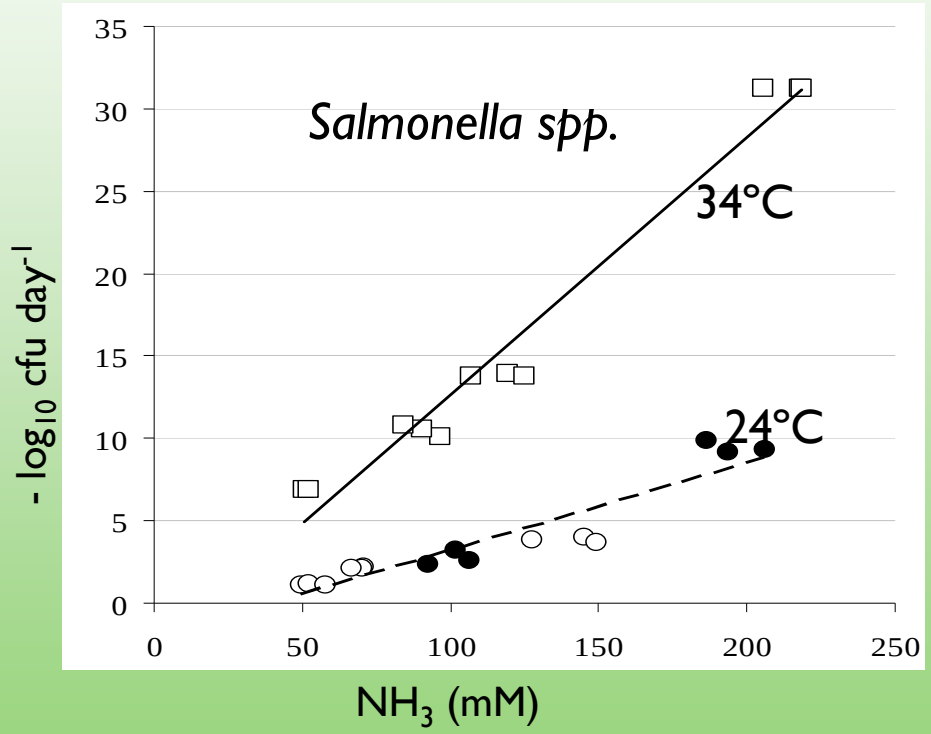
Ammonia based sanitation

- NH_3 biocidal
- Urea 4g bag
- Low pH - 9



SANITISATION

Salmonella, *Ascaris*, and phage (MS2 and ΦX)



Inactivation of Salmonella spp. in faeces (●)and urine (○/□) plotted against concentration of NH_3 (aq) at 24 and 34°C

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

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

SANITISATION

NH_3 horizontal migration from 2% urea in faeces (2, 5, 10 or 15% TS)

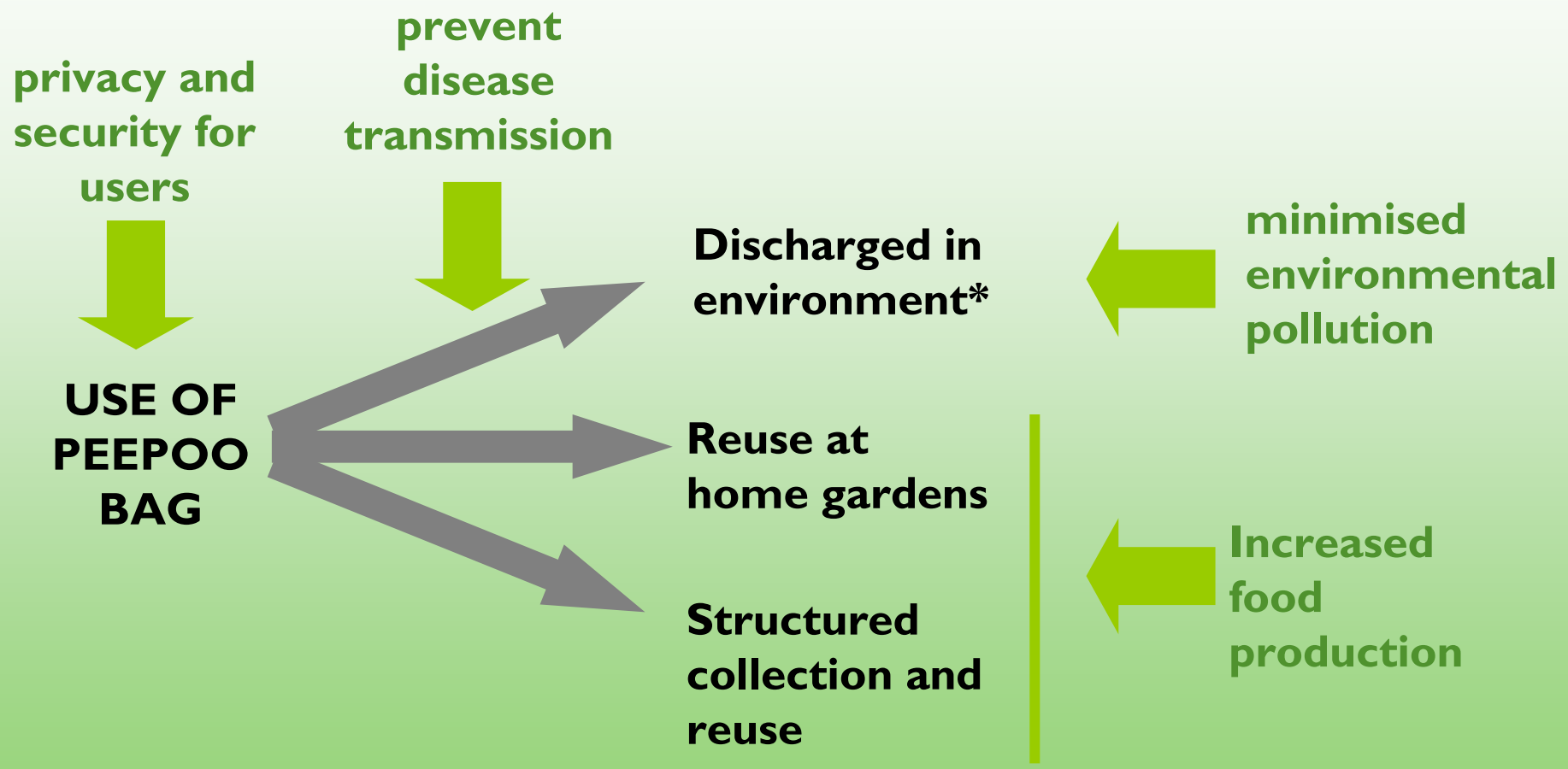
- Urea degraded in hrs
- Higher temperature – faster migration
- Lower TS - faster migration
- 2.5 cm h^{-1}

REUSE OF PLANT NUTRIENTS

- Enhanced fertiliser
- 5-10 bags to m^2
- Soil properties
- Interest for reuse in Kibera


Photo: Peter Morgan

PEEPOO BAG LIFE CYCLE



*Plant nutrients can cause eutrophication

CONCLUSIONS

- Bacterial pathogens (Salmonellosis, Thyphoid fever, Cholera etc) inactivated with great margins
- Ascaris and virus requires 34°C
- Pathogen inactivation shortened by temperature
- With diarrhoea faster 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