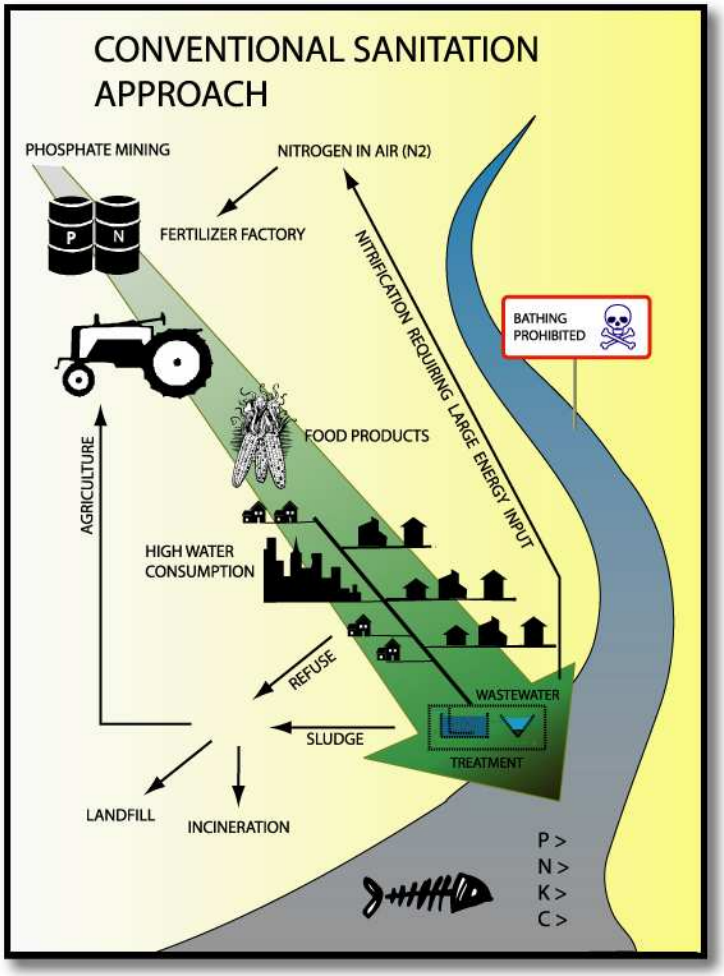
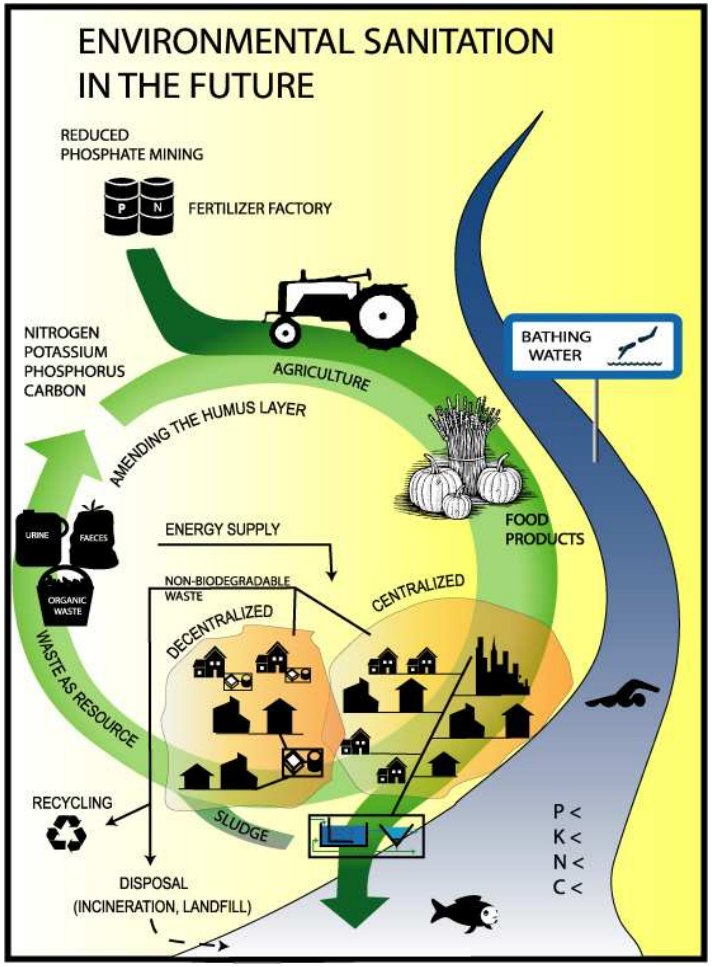
A tool to support the planning of closed-loop environmental sanitation systems

Agnès Montangero, Roland Schertenleib, Chris Zurbrügg, Le Ngoc Cau, Nguyen Viet Anh, Vu Dinh Tuan, Pham Thuy Nga, Hasan Belevi

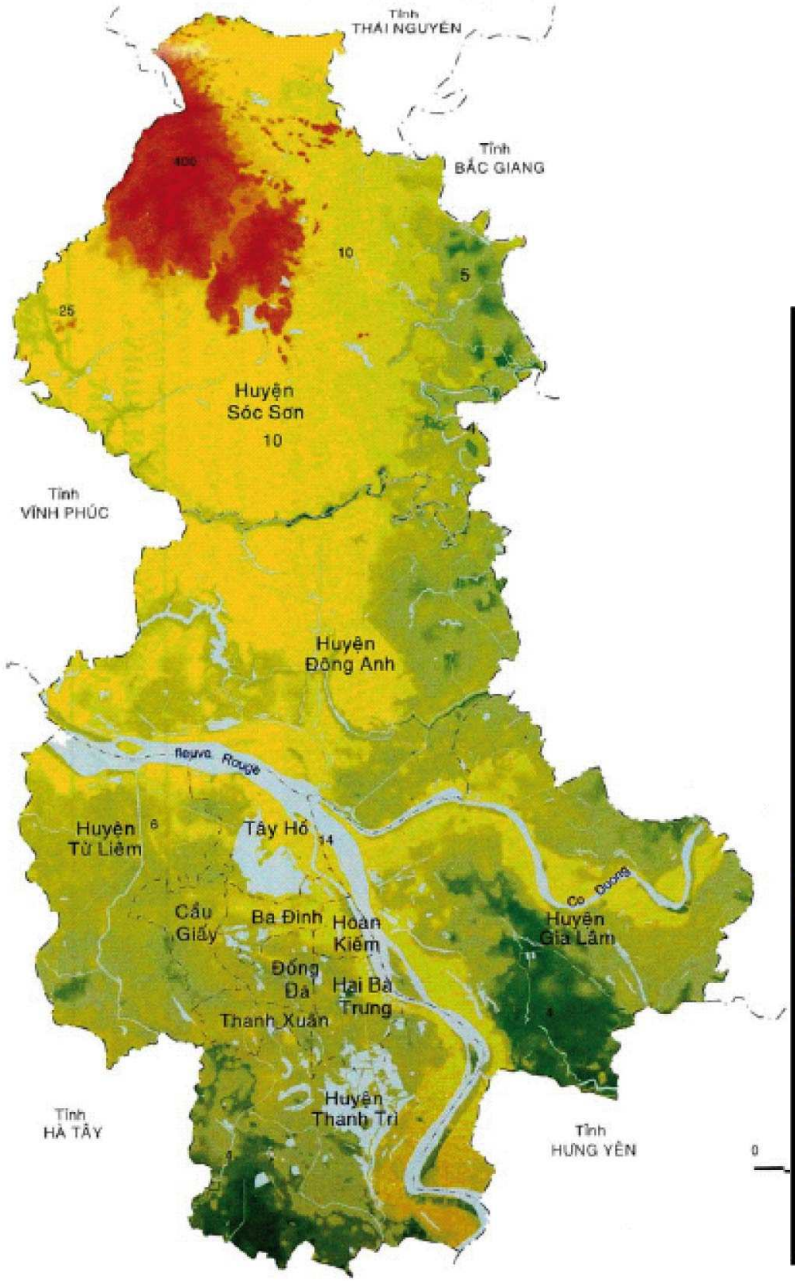
The Sanitation Challenge, Wageningen, May 19-21, 2008

Closing the loop: one basic objective

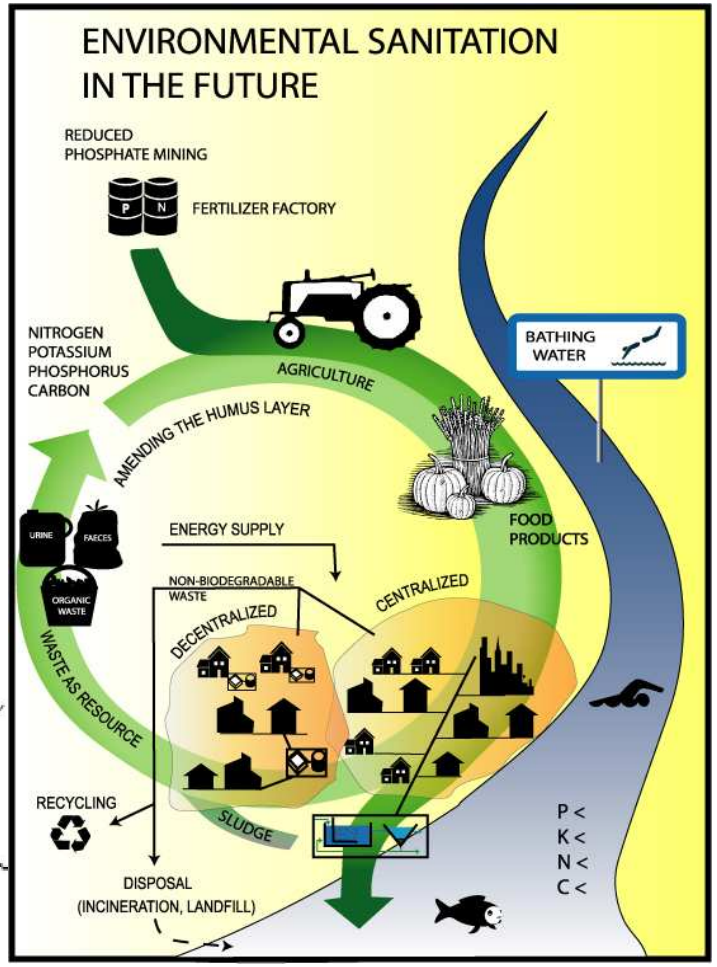




Case study in Hanoi, Vietnam



Tool to reduce resource use and water pollution



Case study in Hanoi: the team

This is a partnership project between

- Sandec/Eawag
- Hanoi University of Civil Engineering (CEETIA)
- Asian Institute of Technology Center Vietnam (AITCV)
- National Institute for Soils and Fertilizers (NISF)

What is MFA?

- The method of “Material Flow Analysis (MFA)” describes the fluxes of resources used and transformed as they flow through a single process or via a combination of various processes (e.g. region, industry)

- Integrated approach
- Early recognition of problems
- Evaluation of measures, new concepts
- Data intensive

What is MFA?

Material Flow Analysis

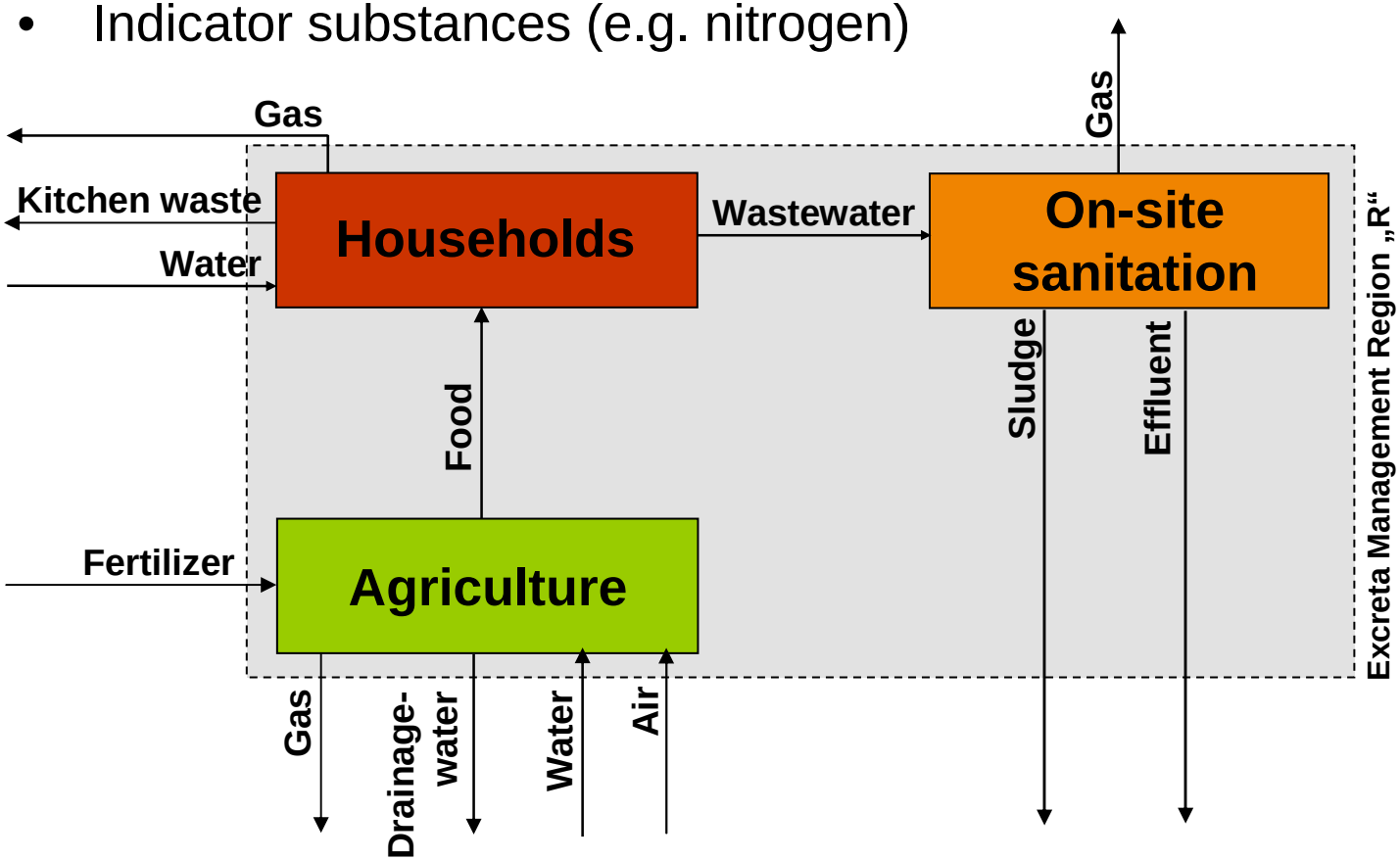
- System analysis
- Quantification of good and substance flows
- Identification of problems
- Development and assessment of scenarios

Baccini and Brunner, 1991; Baccini and Bader, 1996

What is MFA?

System analysis

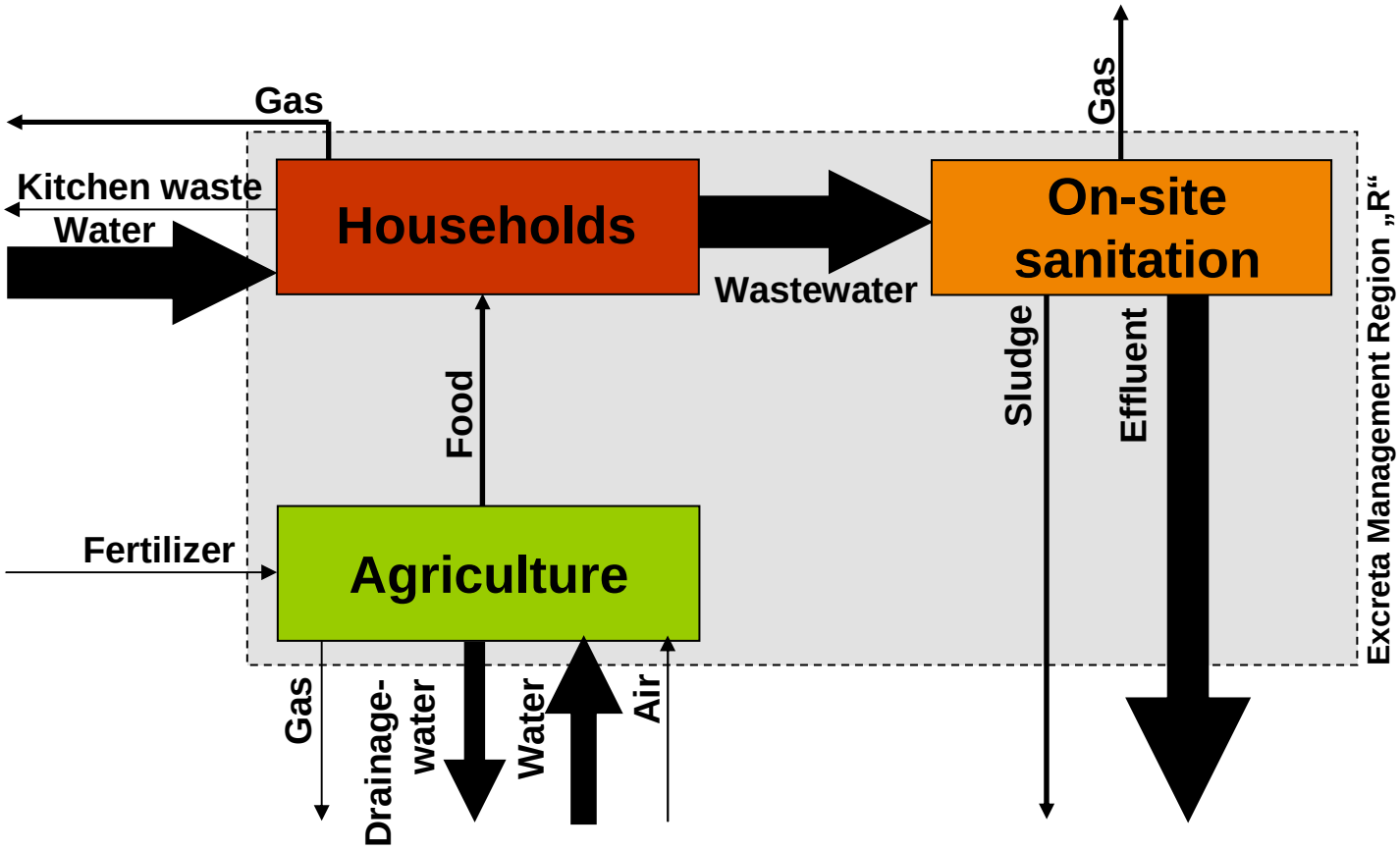
- Processes
- Goods
- System border
- Indicator substances (e.g. nitrogen)



What is MFA?

System analysis

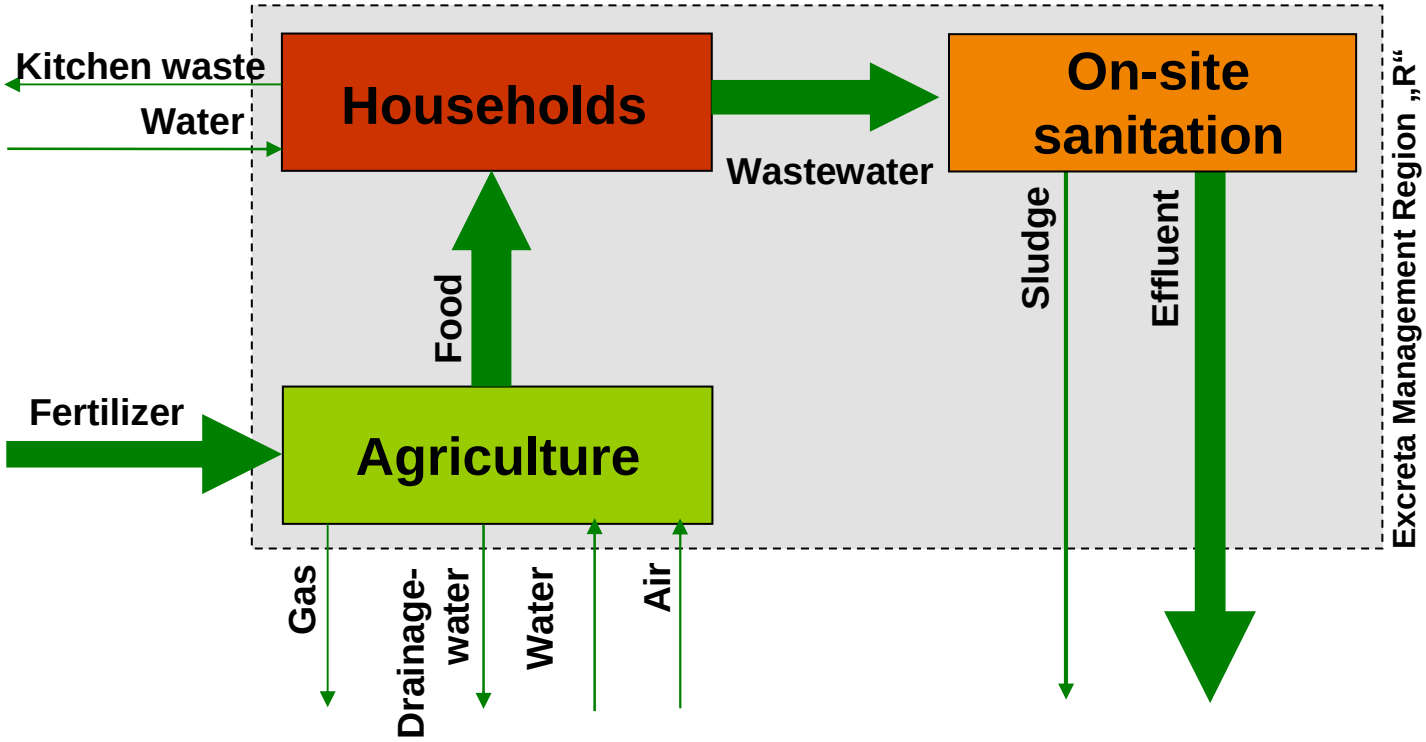
Quantification of good flows



What is MFA?

System analysis

Quantification of good and **substance flows**

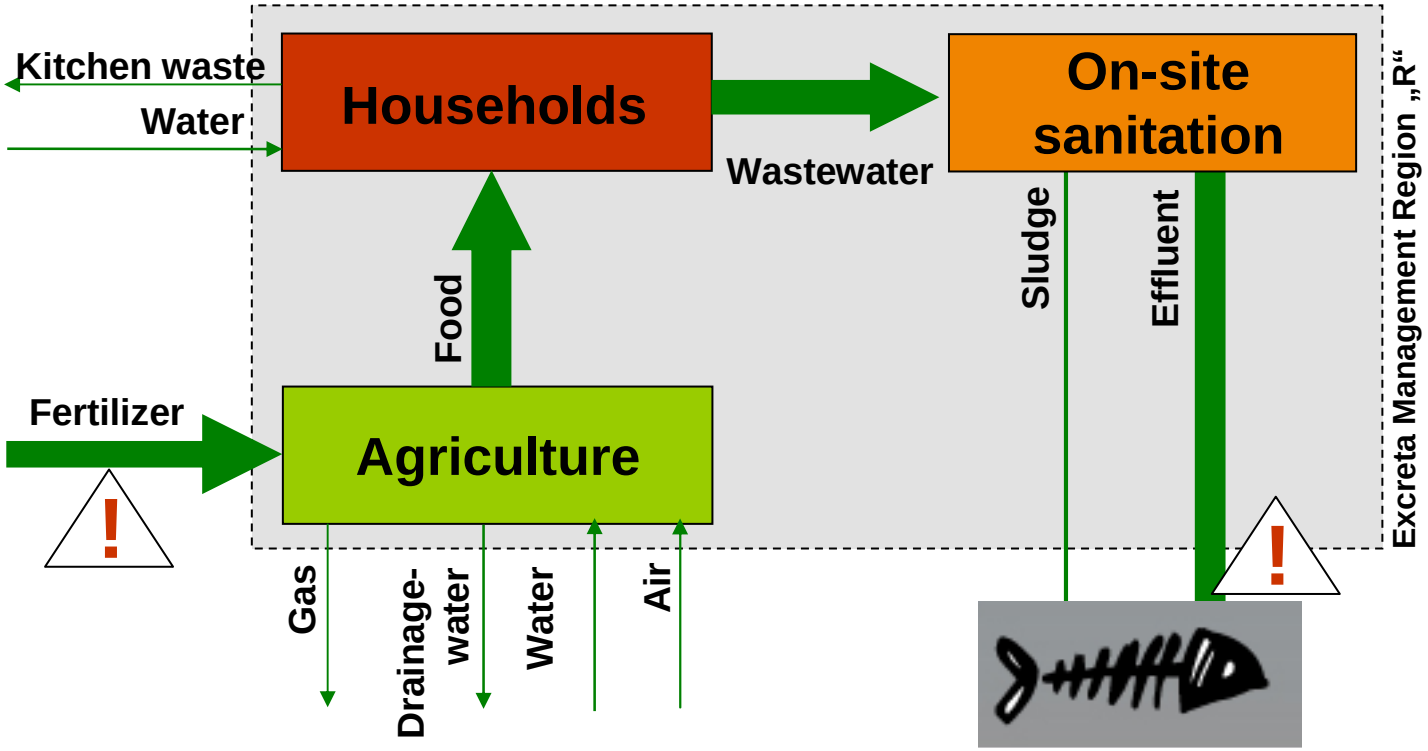


What is MFA?

System analysis

Quantification of good and indicator flows

Identification of problems



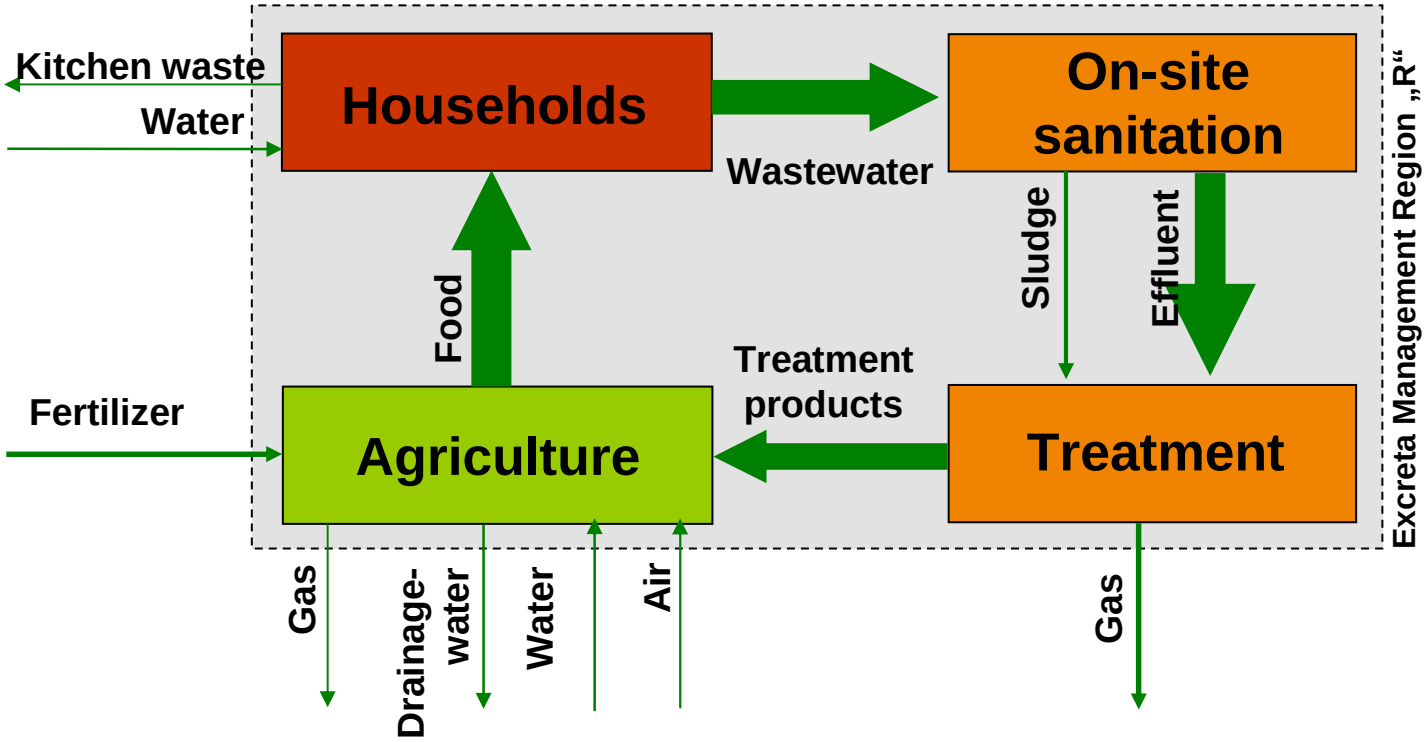
What is MFA?

System analysis

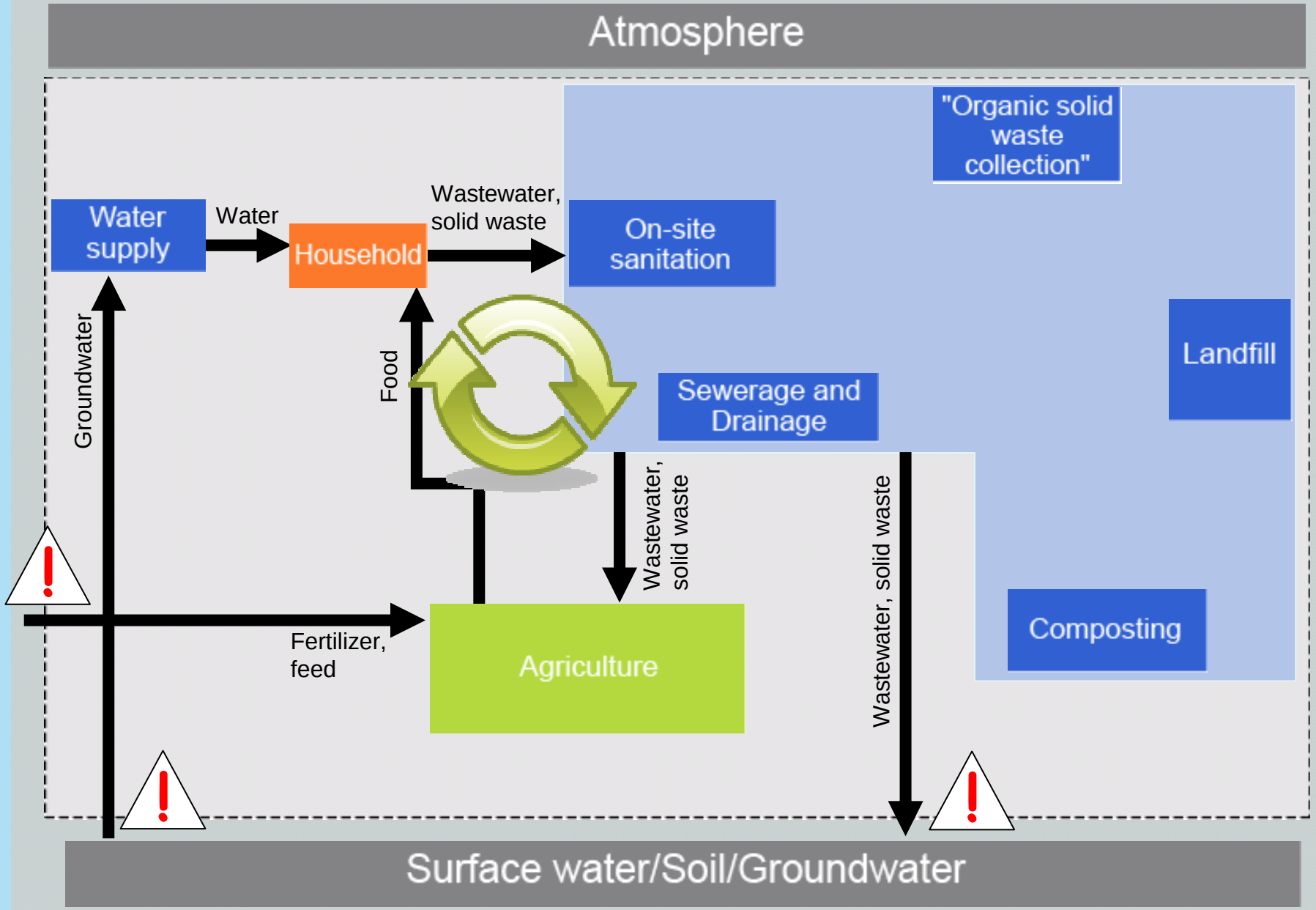
Quantification of good and indicator flows

Identification of problems

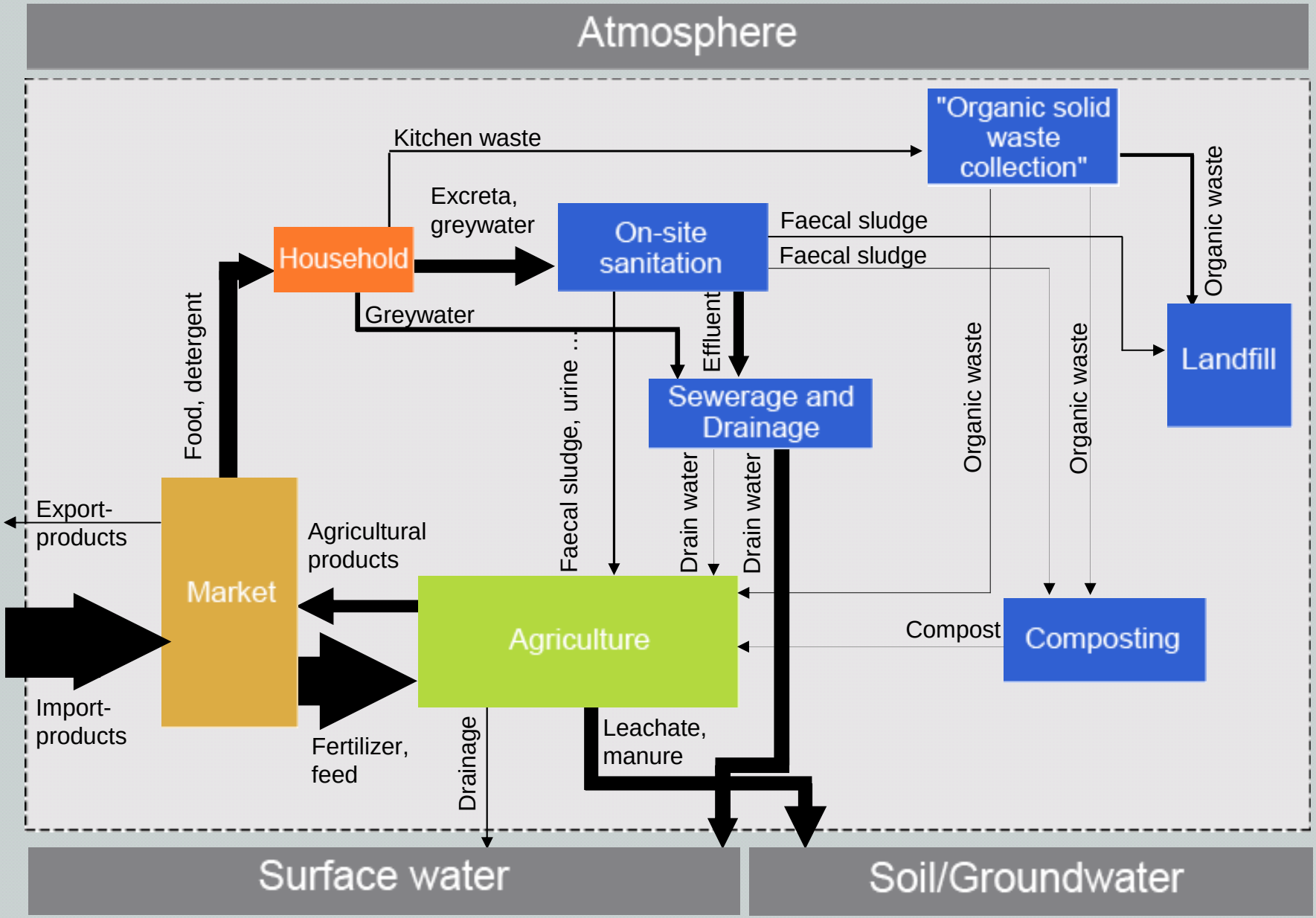
Development and assessment of scenarios



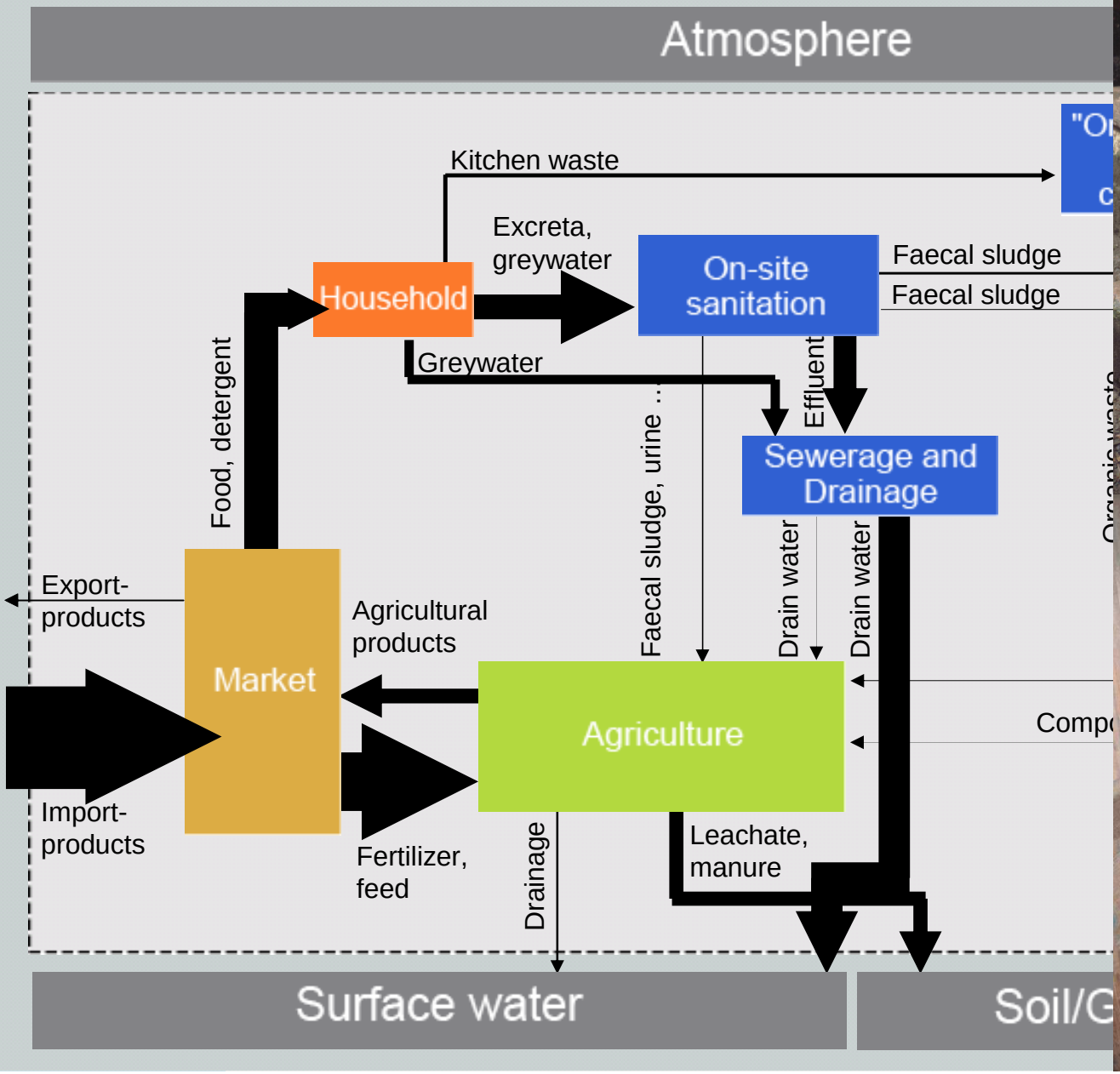
System analysis: Water, N and P in Hanoi



P flows


Atmosphere
"Organic solid waste collection"
Kitchen waste
Excreta, greywater
On-site sanitation
Faecal sludge
Faecal sludge
Household
Organic waste
Greywater
Effluent
Landfill
Food, detergent
Faecal sludge, urine ...
Sewerage and Drainage
Organic waste
Organic waste
Drain water
Drain water
Export-products
Agricultural products
Market
Agriculture
Compost
Composting
Import-products
Fertilizer, feed
Drainage
Leachate, manure
Surface water
Soil/Groundwater

P flows 2015


Atmosphere
Kitchen waste
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Effluent
Food, detergent
Faecal sludge, urine ...
Sewerage and Drainage
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Export-products
Market
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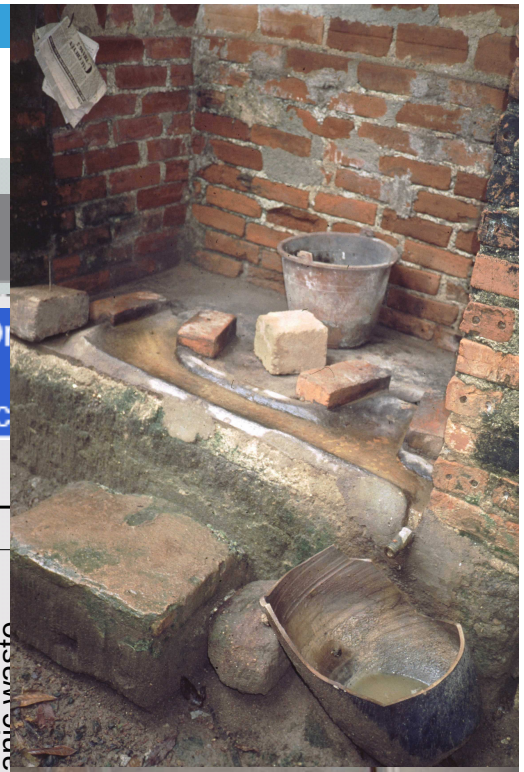
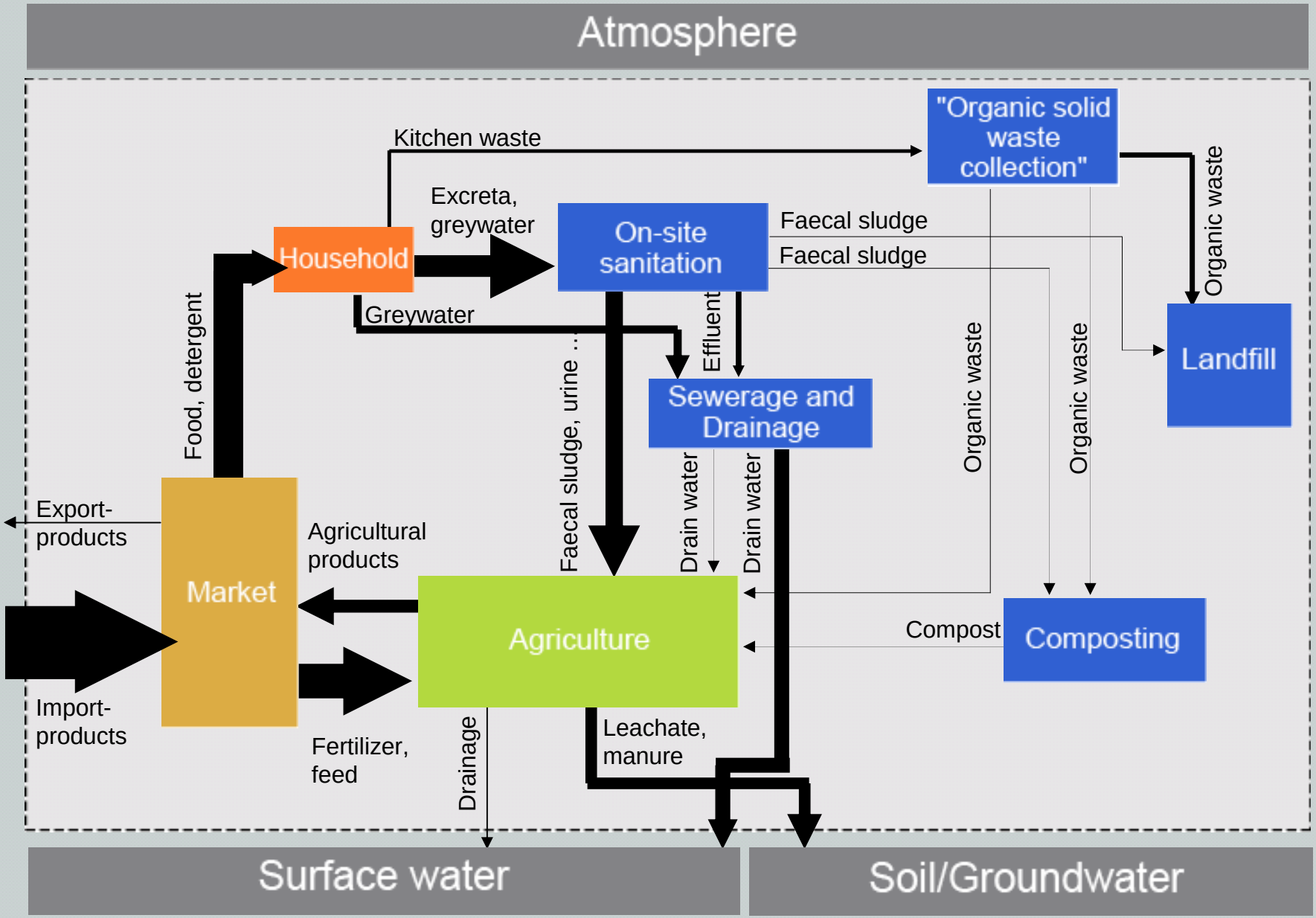
Import-products
Fertilizer, feed
Drainage
Leachate, manure
Surface water

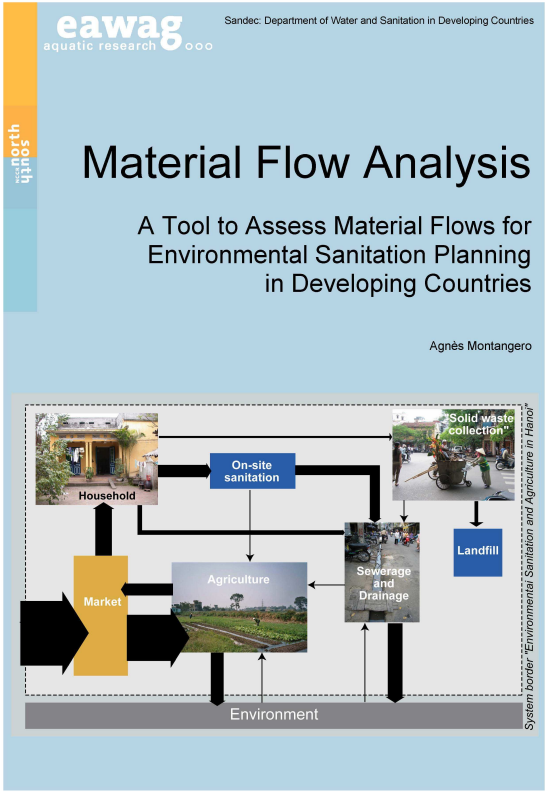


P flows 2015 Urine diversion



Conclusions & Outlook

- **Key processes, key factors, evaluation of potential options**
- **How to deal with limited data availability**
- **Integration in planning process and testing**



eawag
aquatic research

Thank you very much for your attention !!!

Conclusions

- **Key processes**: household, on-site sanitation, agriculture
- **Key factors**: number of inhabitants, type of sanitation facilities, use of P detergent, agriculture (type and extent crop, animal), fertilizer strategy

- **Replacing septic tanks by urine diversion latrines:**

→ Reduction P flows to surface water: 45±11%

→ Reduction P flows in fertilizers: 57±16%

- **Urine diversion & „vegetarian society“**

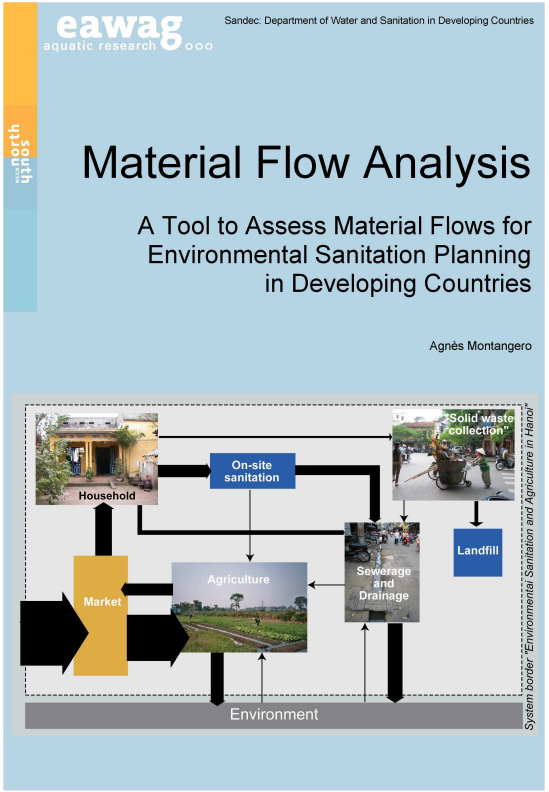
→ Reduction P flows to surface water: 73±15%

→ Reduction P flows in fertilizers : 60±16%

Conclusions
How to deal with limited data?

- Characterize uncertainty
- Bayesian view
- Expert knowledge (probability distributions)
- Iterative procedure
- Plausibility assessment
- Sensitivity analysis
- Database

⇒ **MFA procedure for the context of limited data**



Conclusions & Outlook

- **Expanded model**
- **Sustainability indicators**
- **Strengthening capacity**
- **Integration in planning process and testing**