UNIKASSEL VERSITÄT | ÖKOLOGISCHE AGRAR WISSENSCHAFTEN

Challenges concerning reactive nitrogen (N_r) in the feed chain

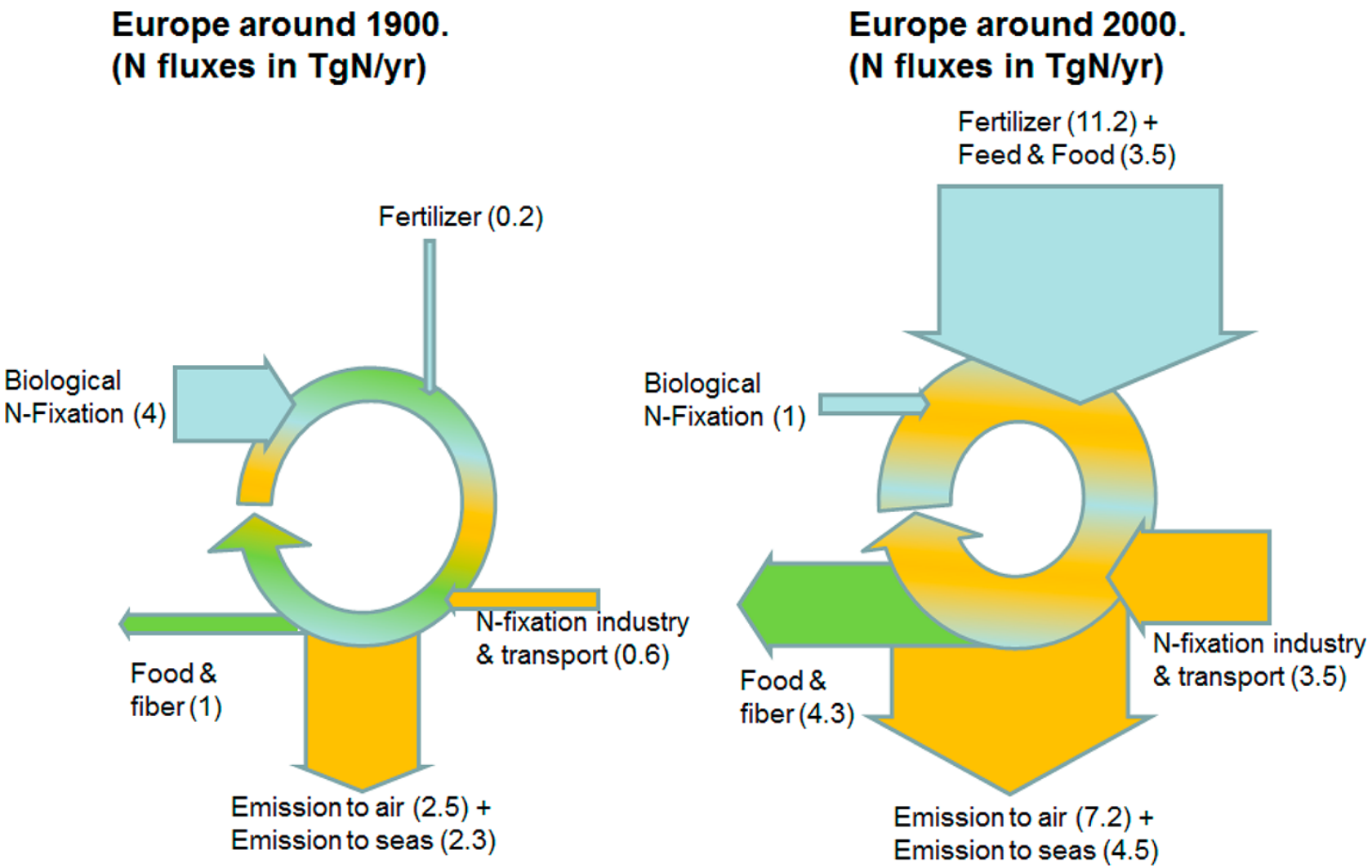
Prof. Dr. Albert Sundrum

Workshop: Smart mitigation of GHG emissions from livestock production

Department of Animal Nutrition and Animal Health
organicagriculturalsciences UNIKASSEL

Simplified N cycle for EU-27 in 1900 and 2000

(fluxes in Tg per year of reactive N)



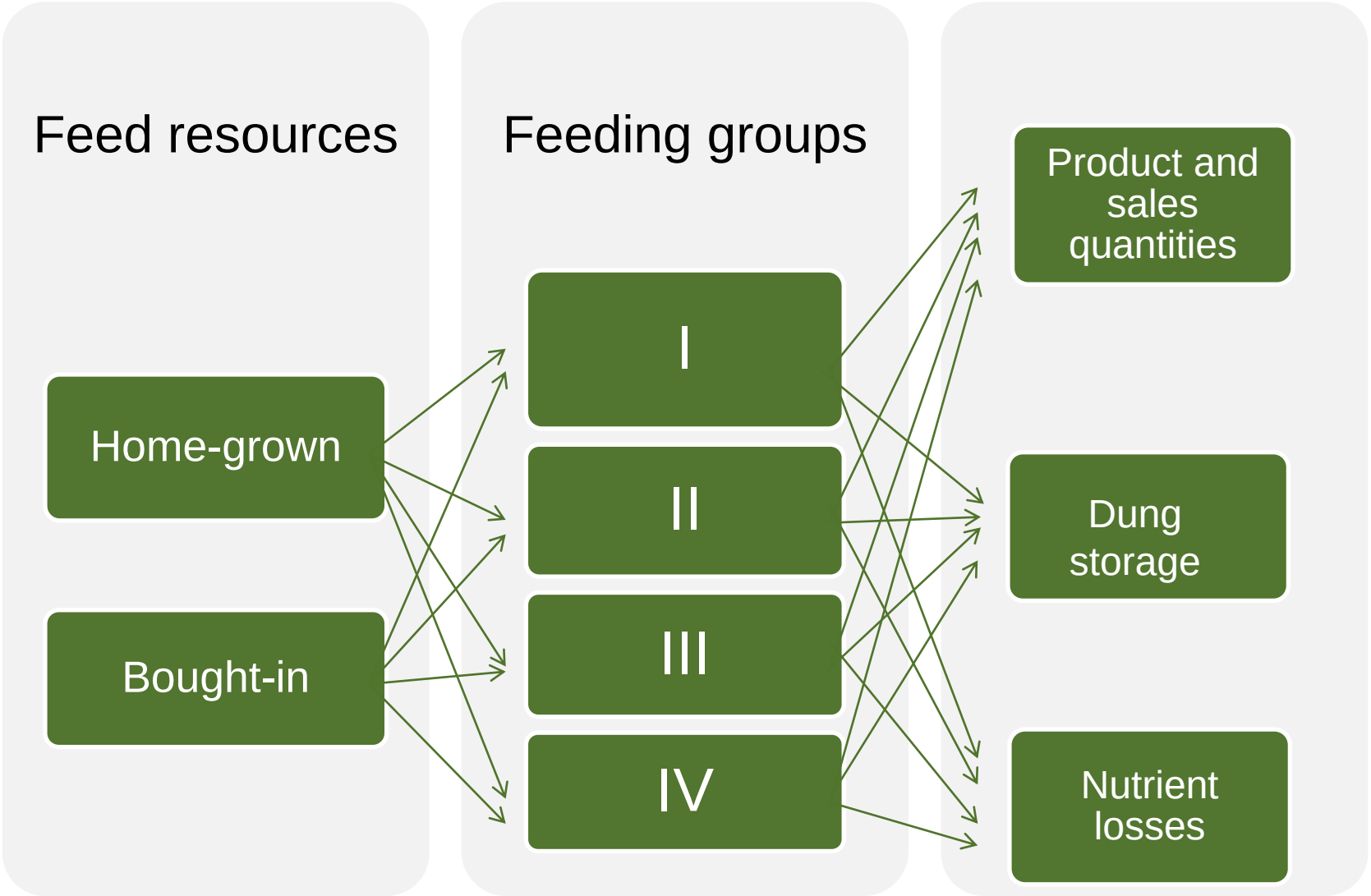
Fluxes in blue are intentional anthropogenic fluxes, those in orange are unintentional anthropogenic fluxes, fluxes in green refer to beneficial outputs

(Source: van Grinsven et al., 2013)

What are the implications?

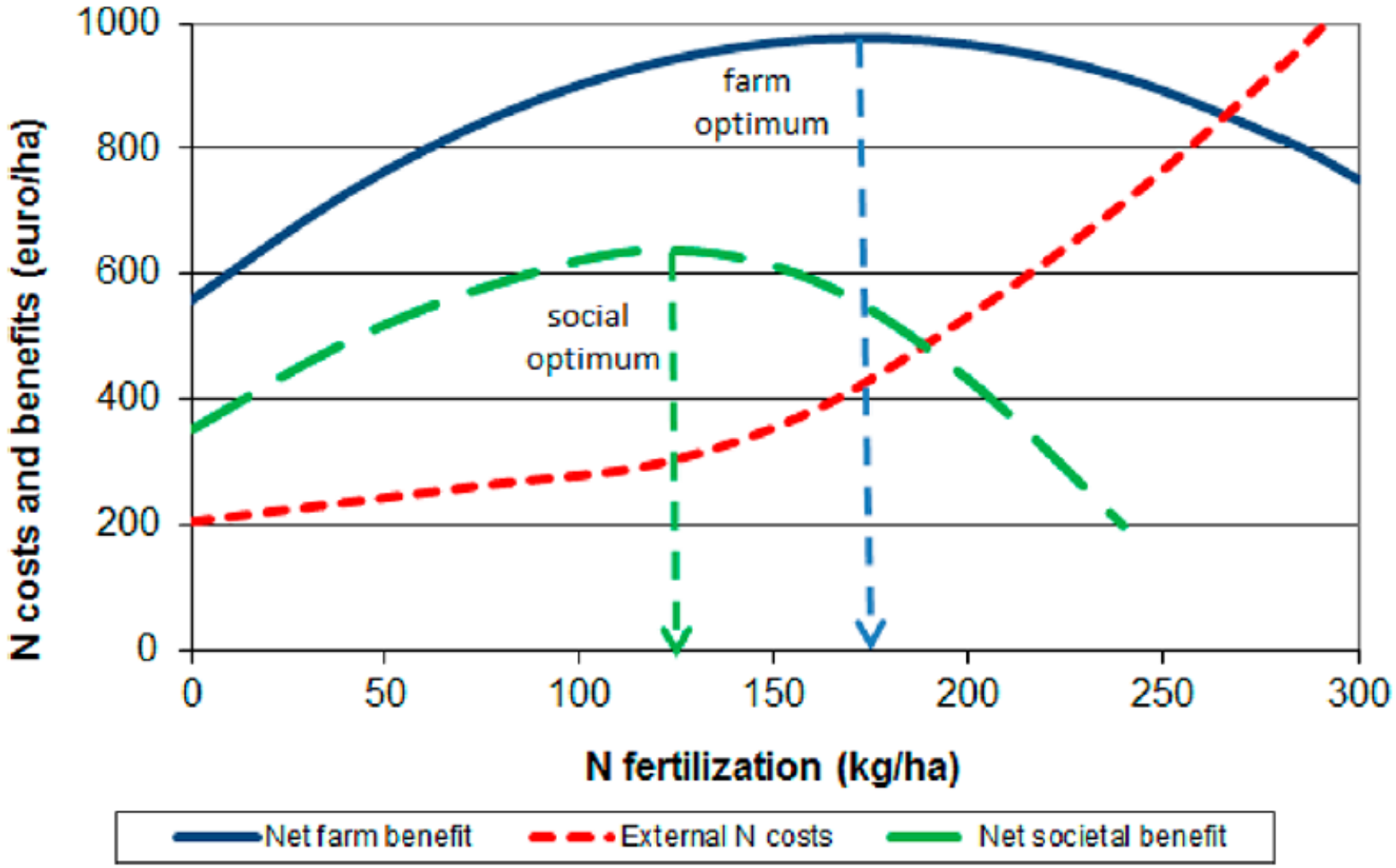
- Decrease in the utilization efficiency of N_r over time
- Livestock production is driven by the goal to increase output quantities and to reduce production costs
- Emissions are not part of cost-calculations nor considered to improve allocation of feed resources
- Reduction of emission is not driven by market demand, technologies & best practices are seldom cost-effective
- Increasing feed conversion rates are often interpreted as an indicator of an environmentally friendly production
- This disregards preceding and subsequent areas of the feed chain and shifts the responsibility to others

Impacts of the distribution of feed resources on utilization efficiency



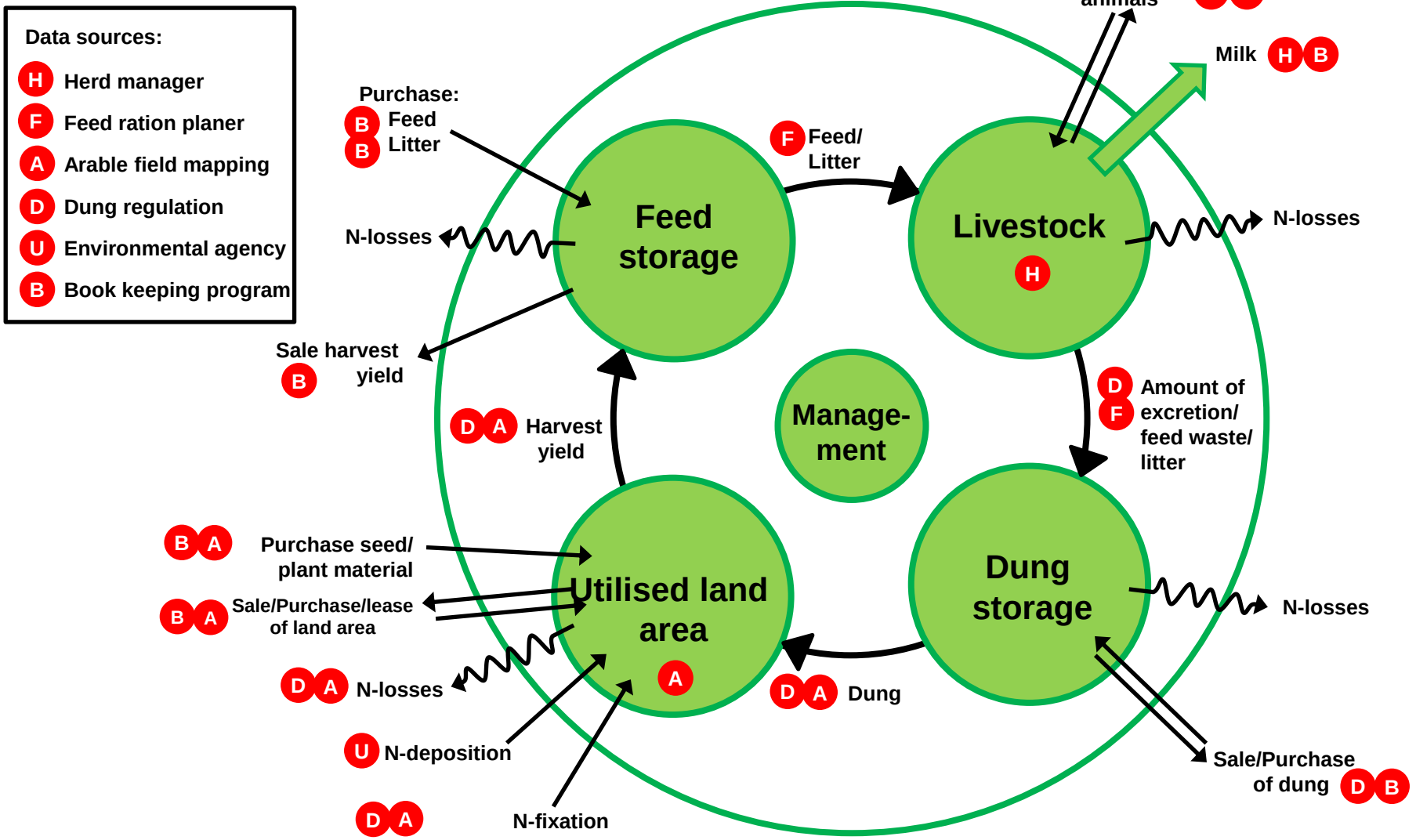
Benefits, costs and marginal productivity of N_r

(Explained by N fertilization on wheat under German conditions)



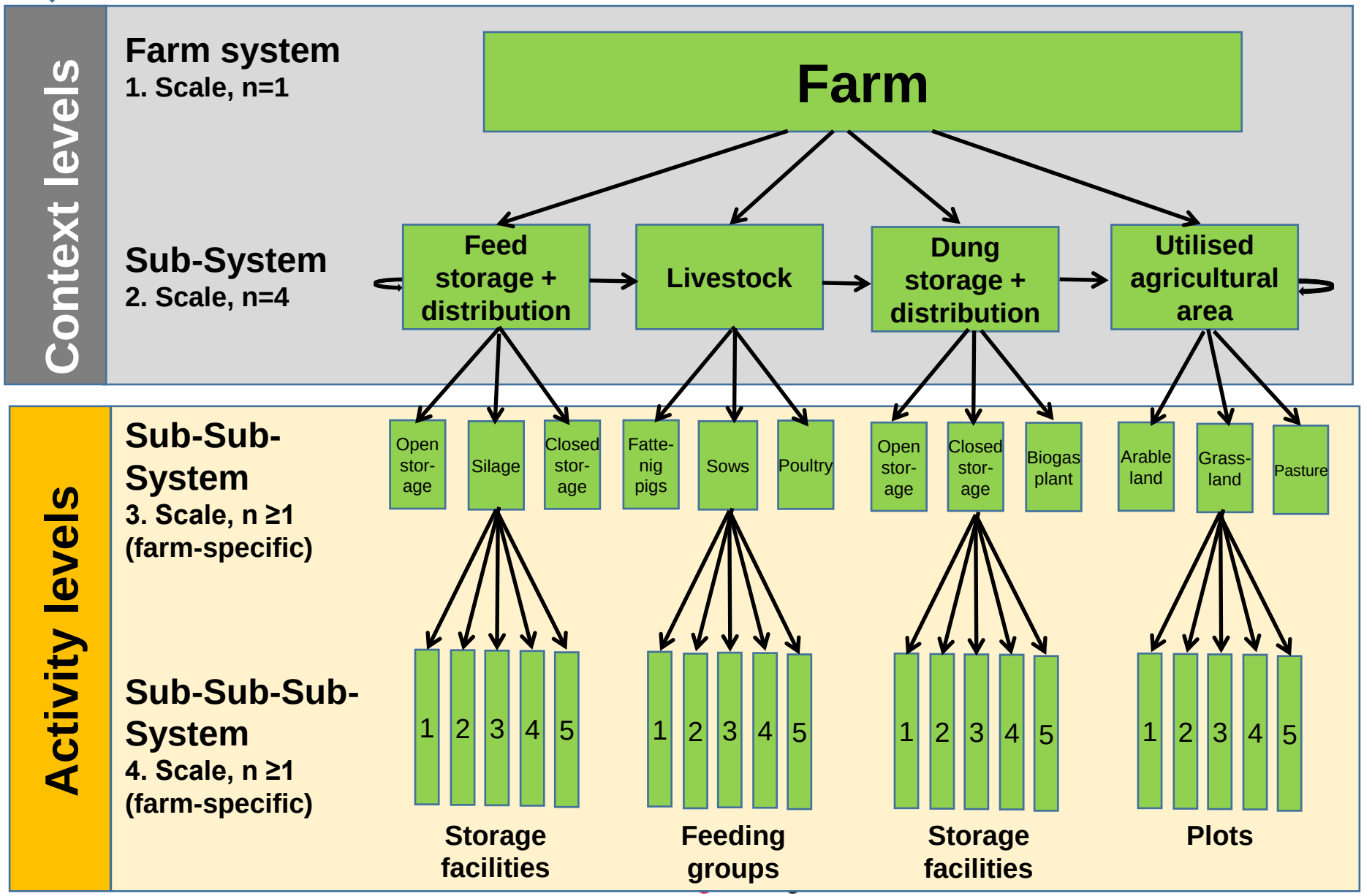
(Source: van Grinsven et al., 2013)

Distribution & flow of N_r across sub-systems



(Source: Machmüller & Sundrum, 2017)

Distribution & flow of N_r across sub-systems



Conclusions

- Increasing efficiency in the use of N_r requires quantification
  - Downward distribution of N_r in the various sub-systems
  - Horizontal distribution of N_r within each sub-system
  - Degree of recycling of N_r between the sub-systems
  - Efficiency in the use of N_r in feeding groups
- Efficient resource allocation within farm systems is key to reduce N_r losses and to realise win-win options
- Recycling rate of manure is key to counteract competitive benefits through externalisation of societal costs
- Benchmarking of N_r efficiency rates at different scales are recommended as a 1st step to prevent unfair competition