

# From scientific MFA to routine monitoring schemes

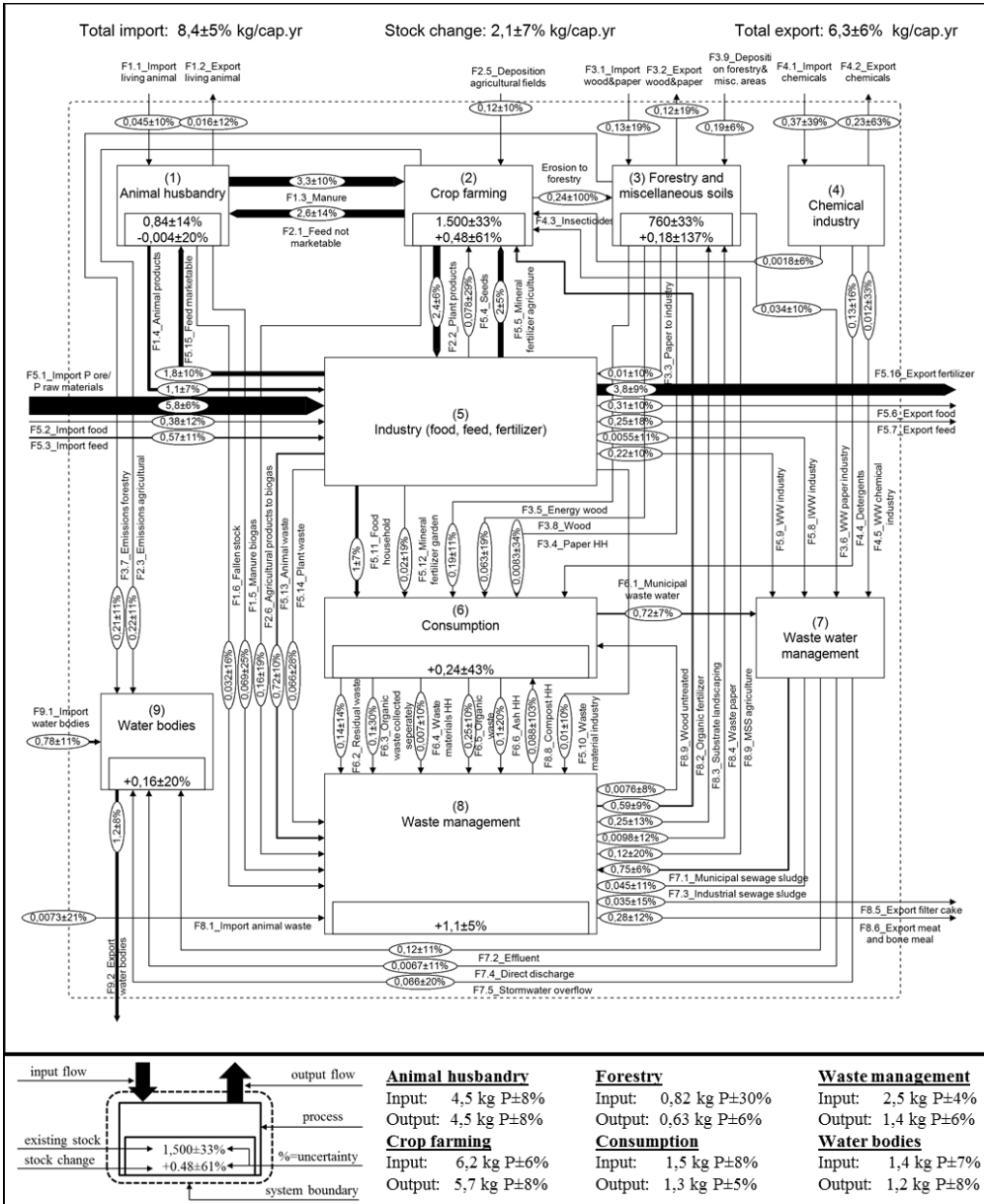
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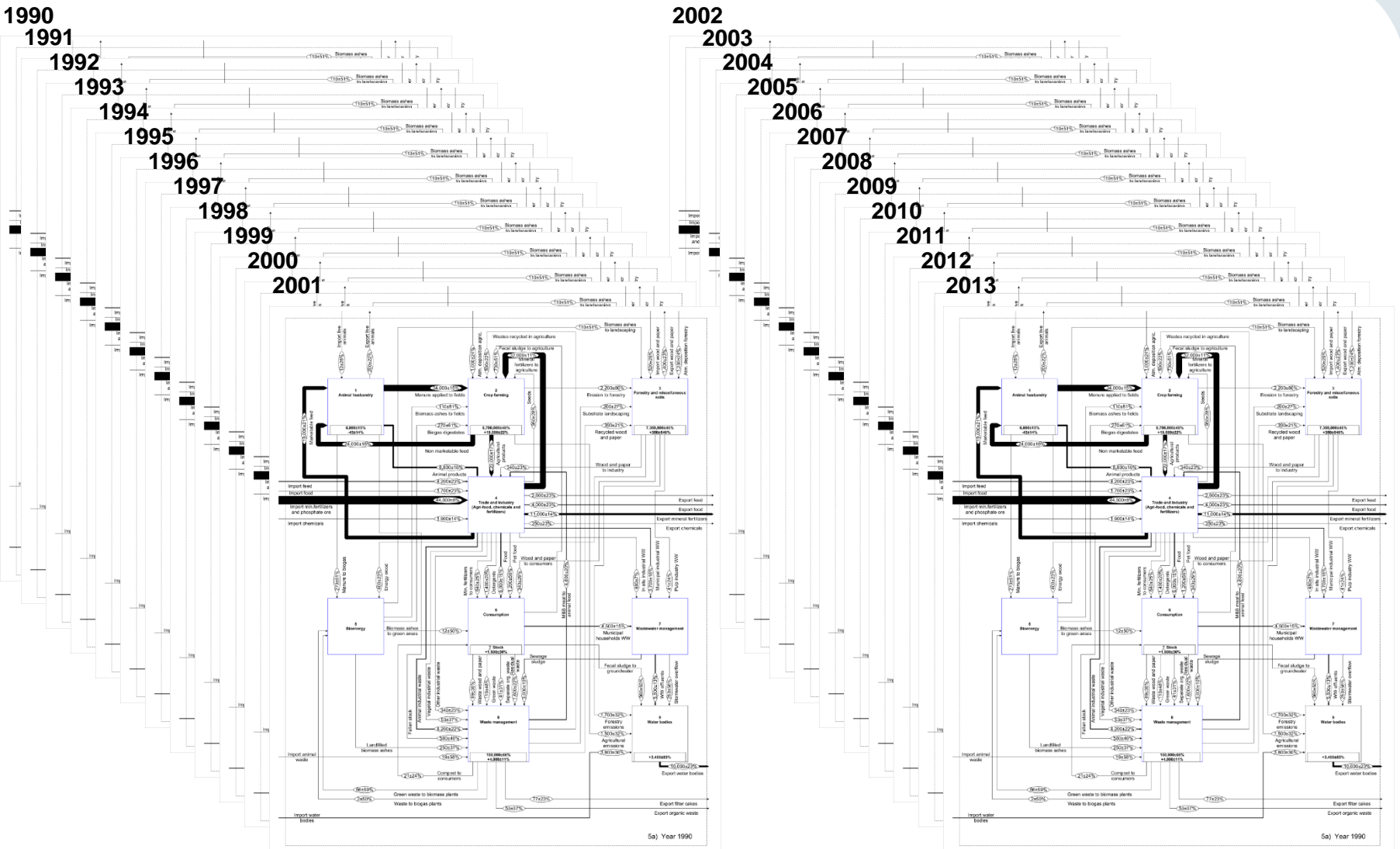
- MFA under development since early 1990s
- Economy-wide MFA mature and integrated in national statistics
- MFA of substances left to research initiatives
- Decision making based on static snapshots of average years, often old
- Is it sufficient?

# From static P Austrian budget avg. 2004-2008



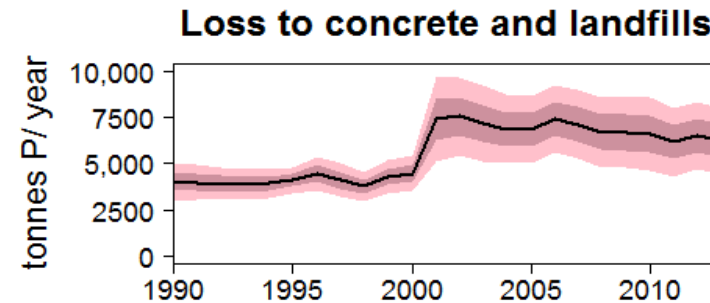
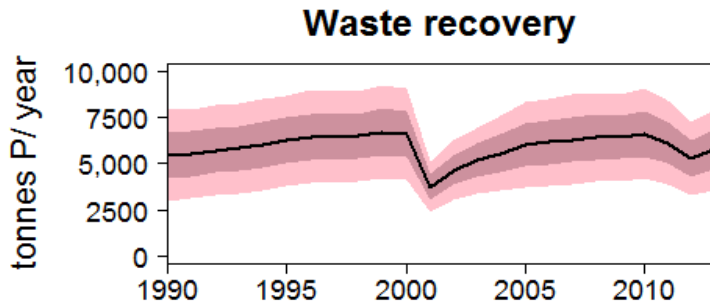
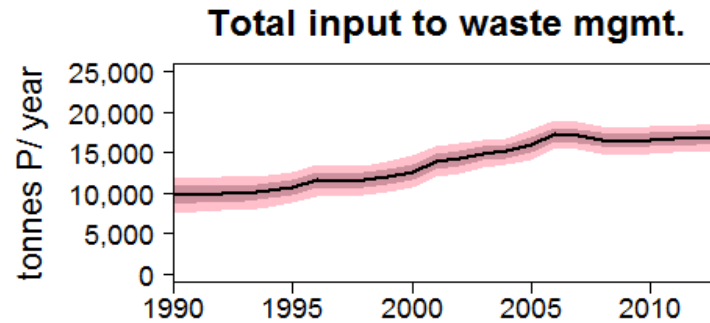
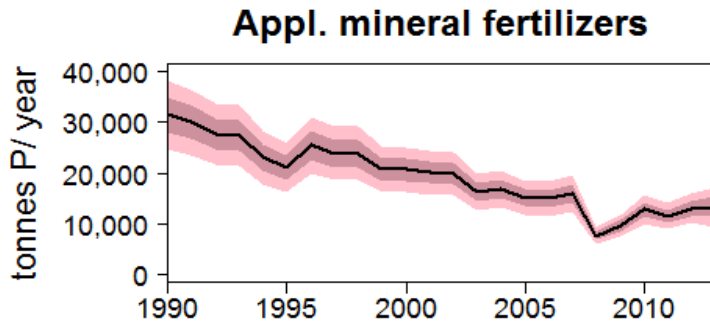
Egle et al. The Austrian P budget as a basis for resource optimization. *Resources, Conservation and Recycling*; 83(2014): 152–162.

# To multiple-year Austrian P-budget 1990-2013



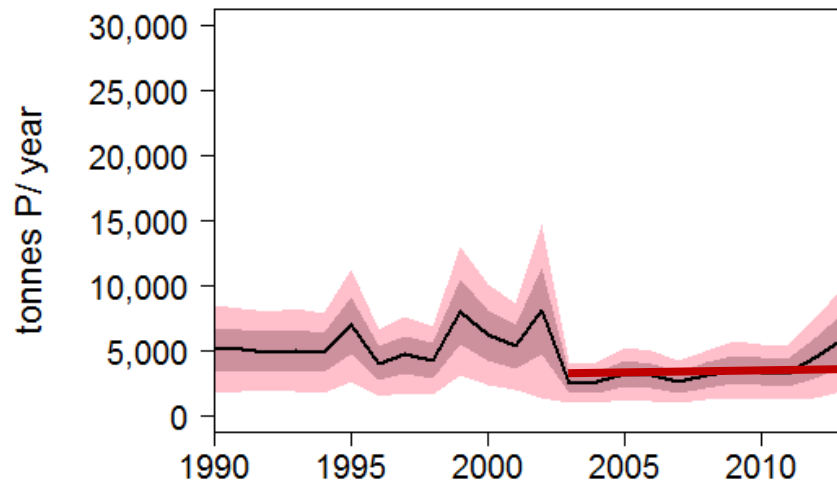
## Yes, the balance has undergone significant changes in the past 20 years

- More than half of the flows at least doubled or halved their value compared to 1990
- One third of changes are still extreme if neighbouring years are considered. This means that changes do not appear always steadily but also abruptly

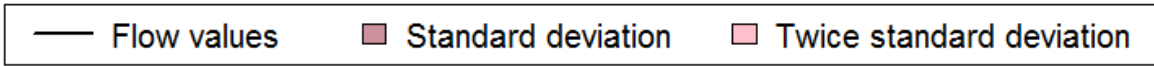
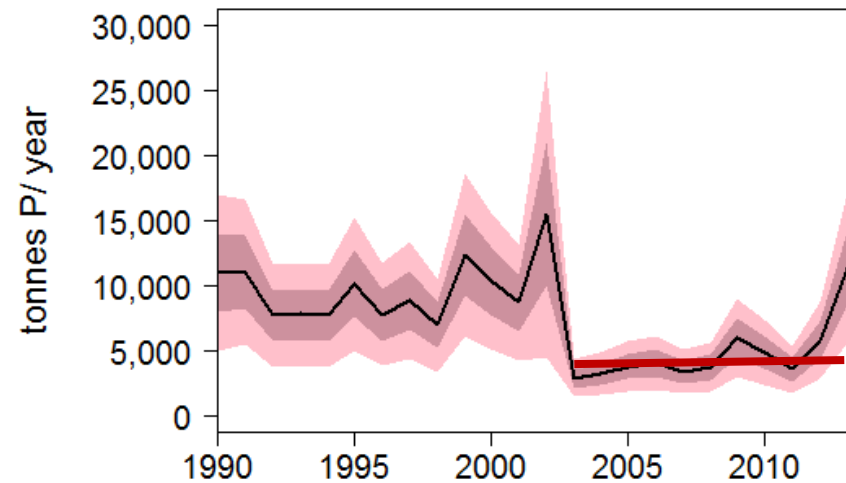


— Flow values    ■ Standard deviation    ■ Twice standard deviation

### Import through Danube

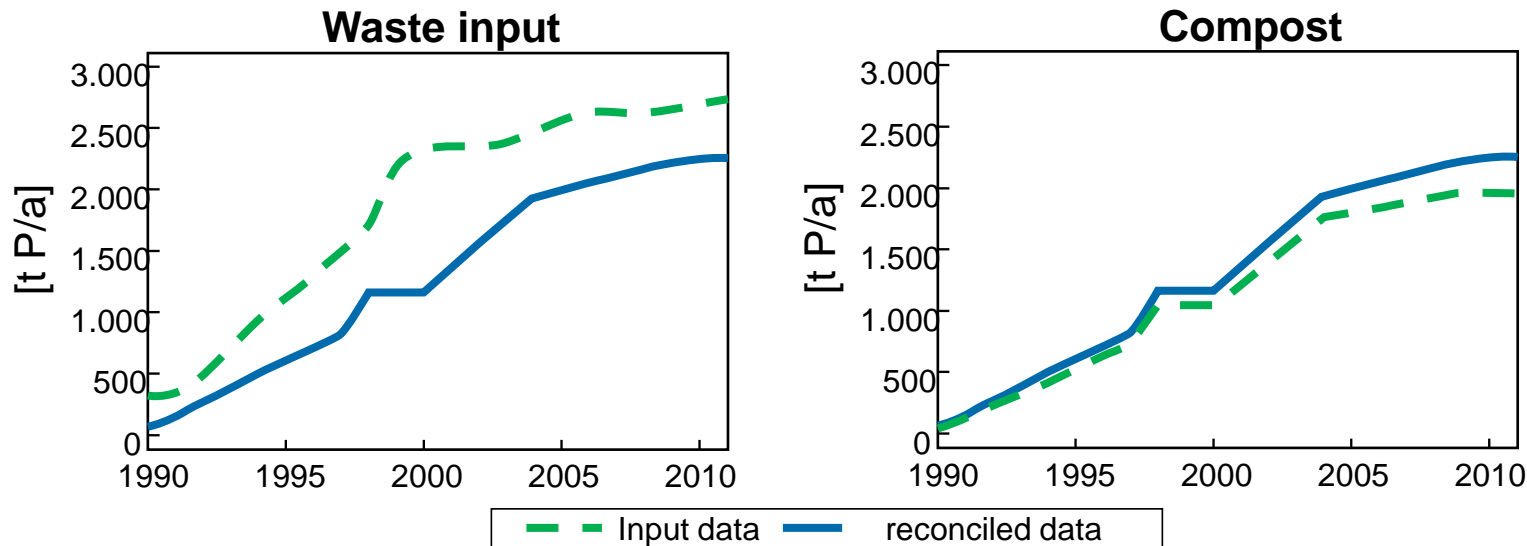


### Export through Danube



Zoboli et al. **Impact of reduced anthropogenic emissions and century flood on the phosphorus stock, concentrations and loads in the Upper Danube**  
*Science of the Total Environment* 518-519 (2015) 117-129

- Model itself had to be modified
- Data quality improved, but not in all sectors and with fluctuations due to low frequency of data collection
- Reconciliation of input-output over the time series revealed systematic data problems



Zoboli et al. **Added values of time series in MFA: the Austrian phosphorus budget from 1990 to 2011**, Journal of Industrial Ecology (in press)

- **Benefits** of multiple-year MFA:
  - Detection of changes in time / trends of flows, efficiency or recovery rates (hints for decision-makers where action is required)
  - Monitoring of performance of measures / programmes
  - Deeper understanding of the system and improvement of the model
  - Identification of systematic inconsistencies in the data
  - Interdependencies among sectors due to the system perspective
- Detailed multiple-year accounting is **feasible** and the most time consuming task is the initial model design
- MFA is a mature methodology and **STAN** is free and easy software

*Material accounting can and should be integrated within routine institutional monitoring (higher chance of harmonization and coherence)*



***Thank you!***

