The search for a final sink – key issue for environmental management

Paul H. Brunner, Ulrich Kral, and Katharina Kellner
Vienna University of Technology, Austria

This research has been funded by the Austrian Science Fund (FWF): I 549-N21

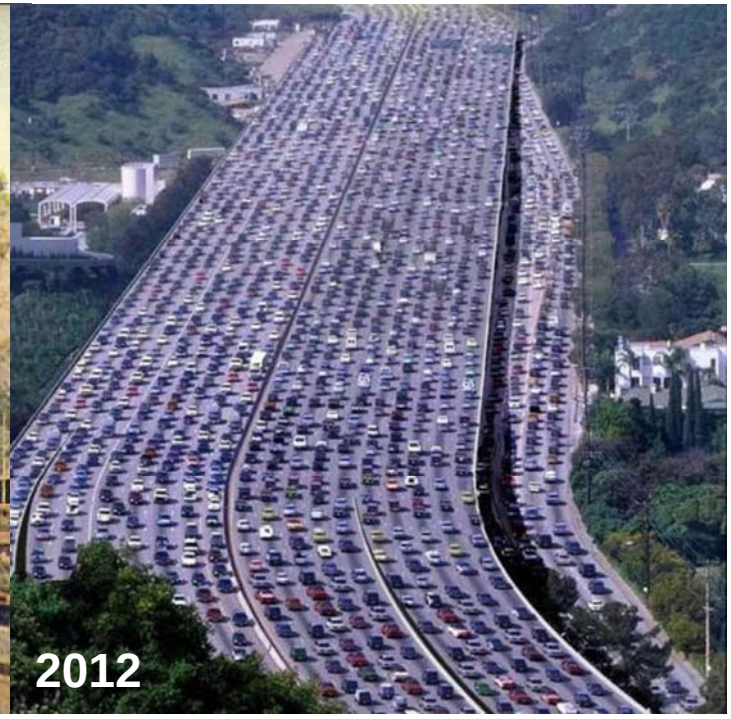
Content

- Large flows and stocks
- Fate of flows and stocks?
- Examples of copper and NP
- Conclusions : *Make „sinks“ an issue,*

  particularly for design and disposal

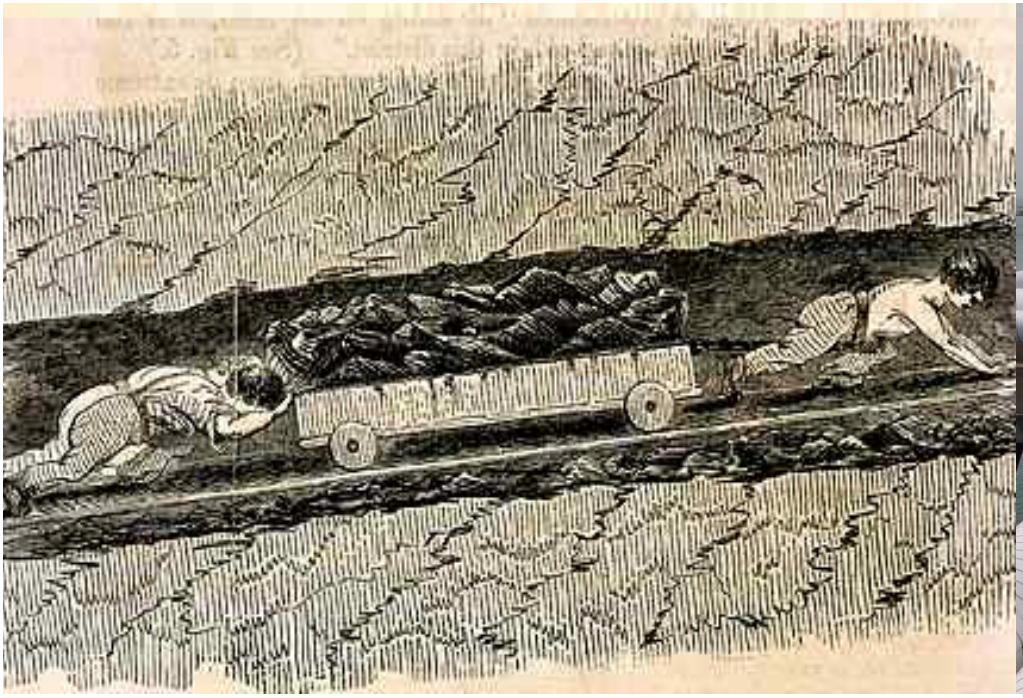
The last 100 years: unprecedented growth

Meiringen: where Martin began …



Asia: … where his career will end?

The growth of material turnover …



England 1840

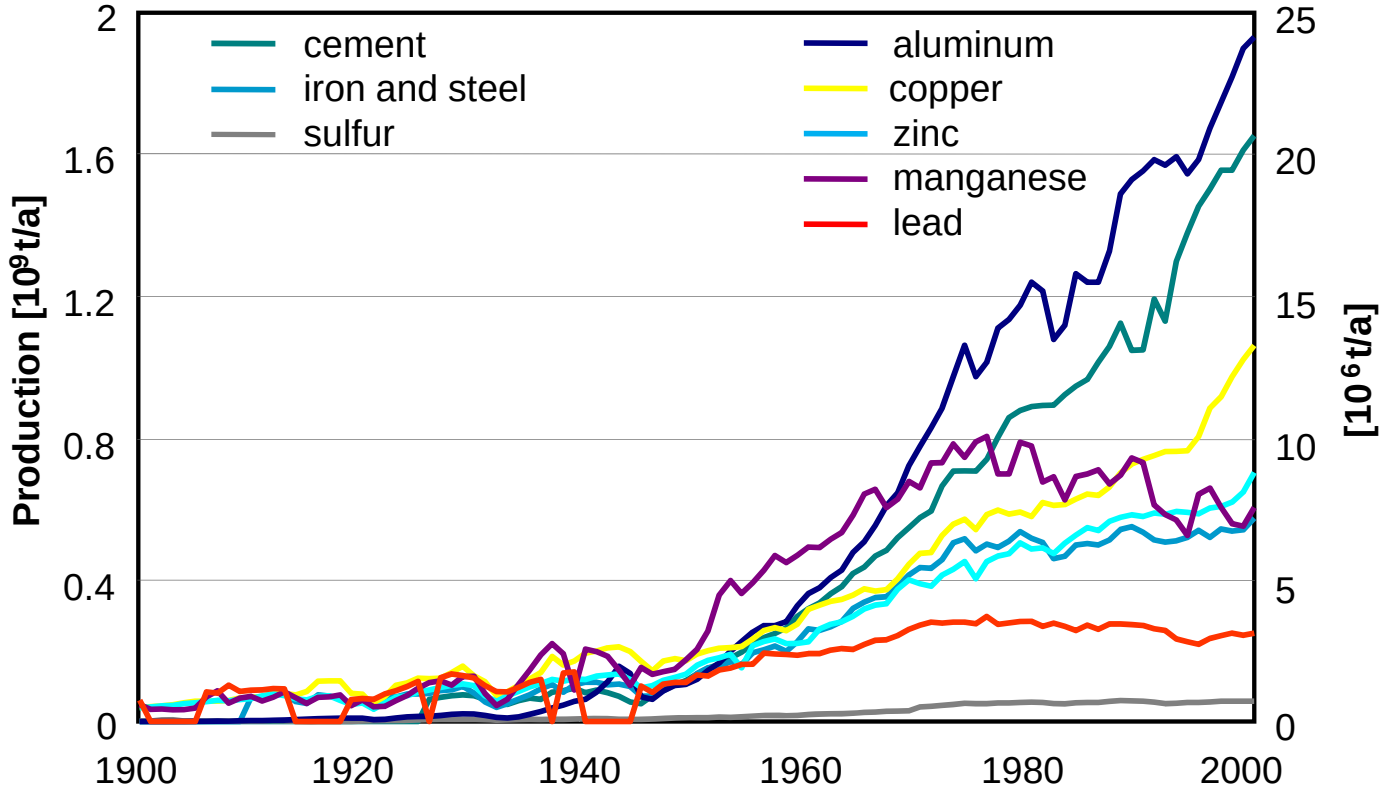
China 2010

… and sea level rise is not a threat anymore

Photo: William Field/ Bruce Molnia

Muir und Riggs Gletscher

Global growth in metal production



source: Brunner & Rechberger 2004

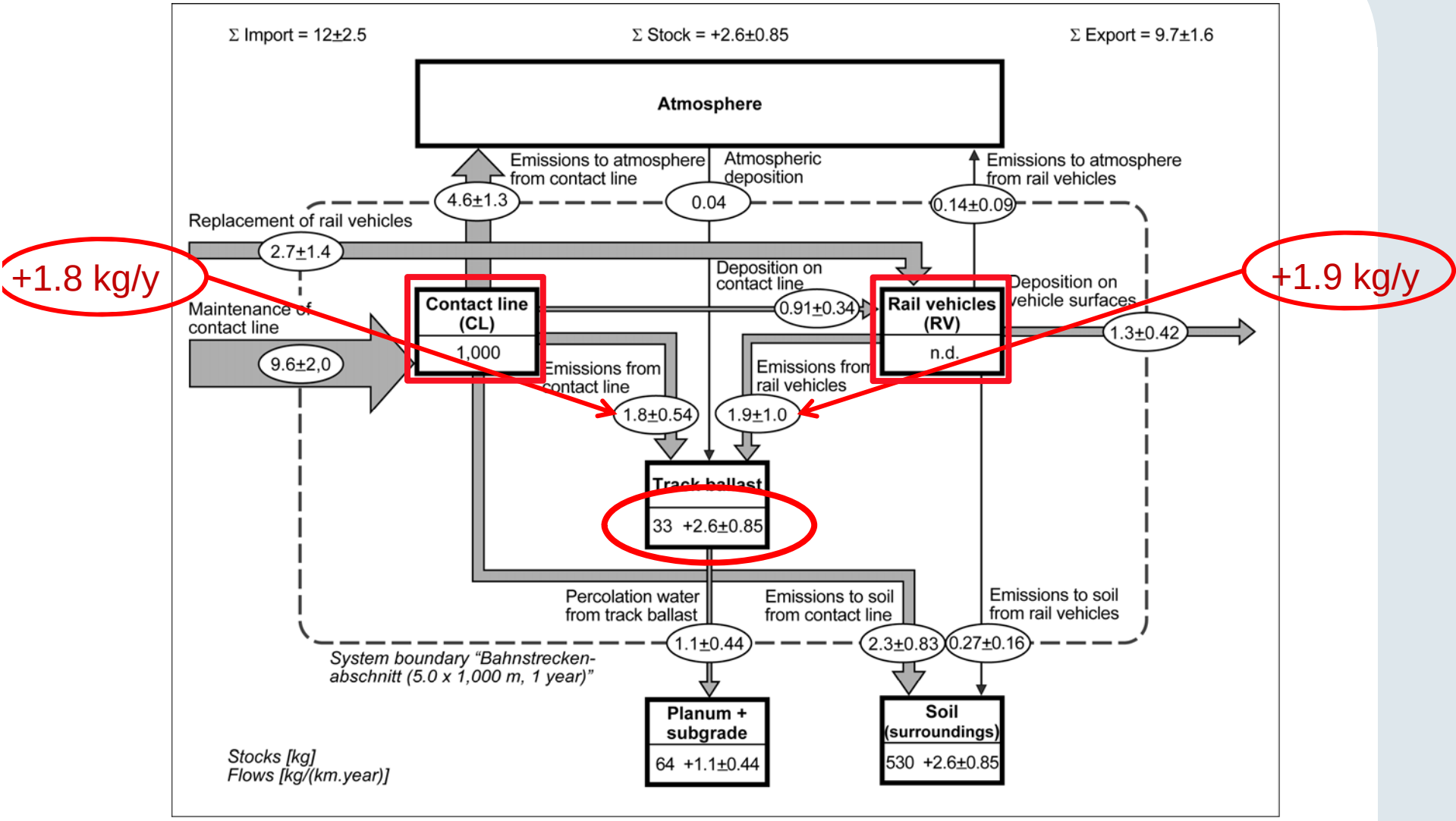
Where have all the metals gone?

zinc

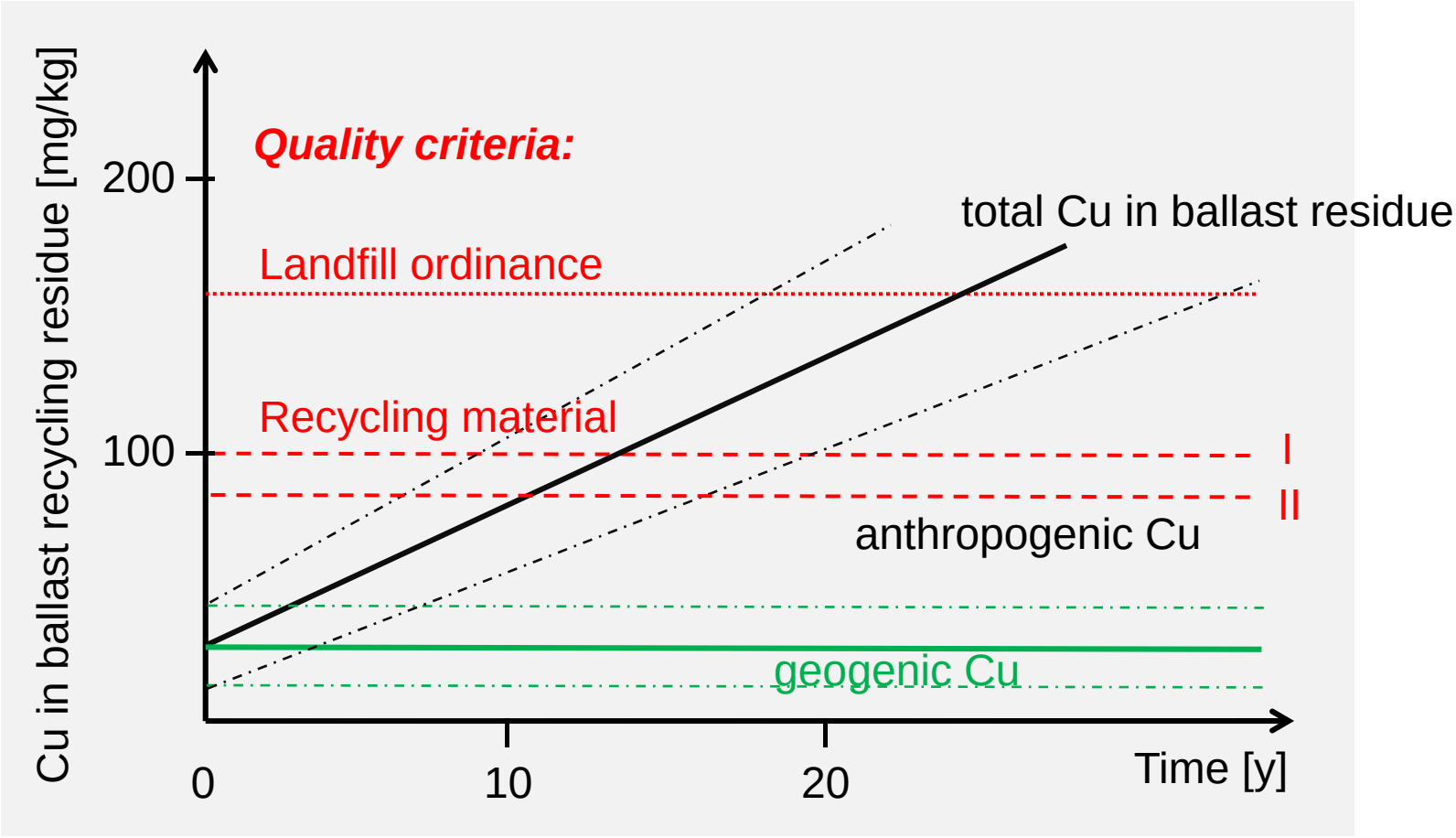
copper

Looking for copper …

Copper sources and sinks for ballast

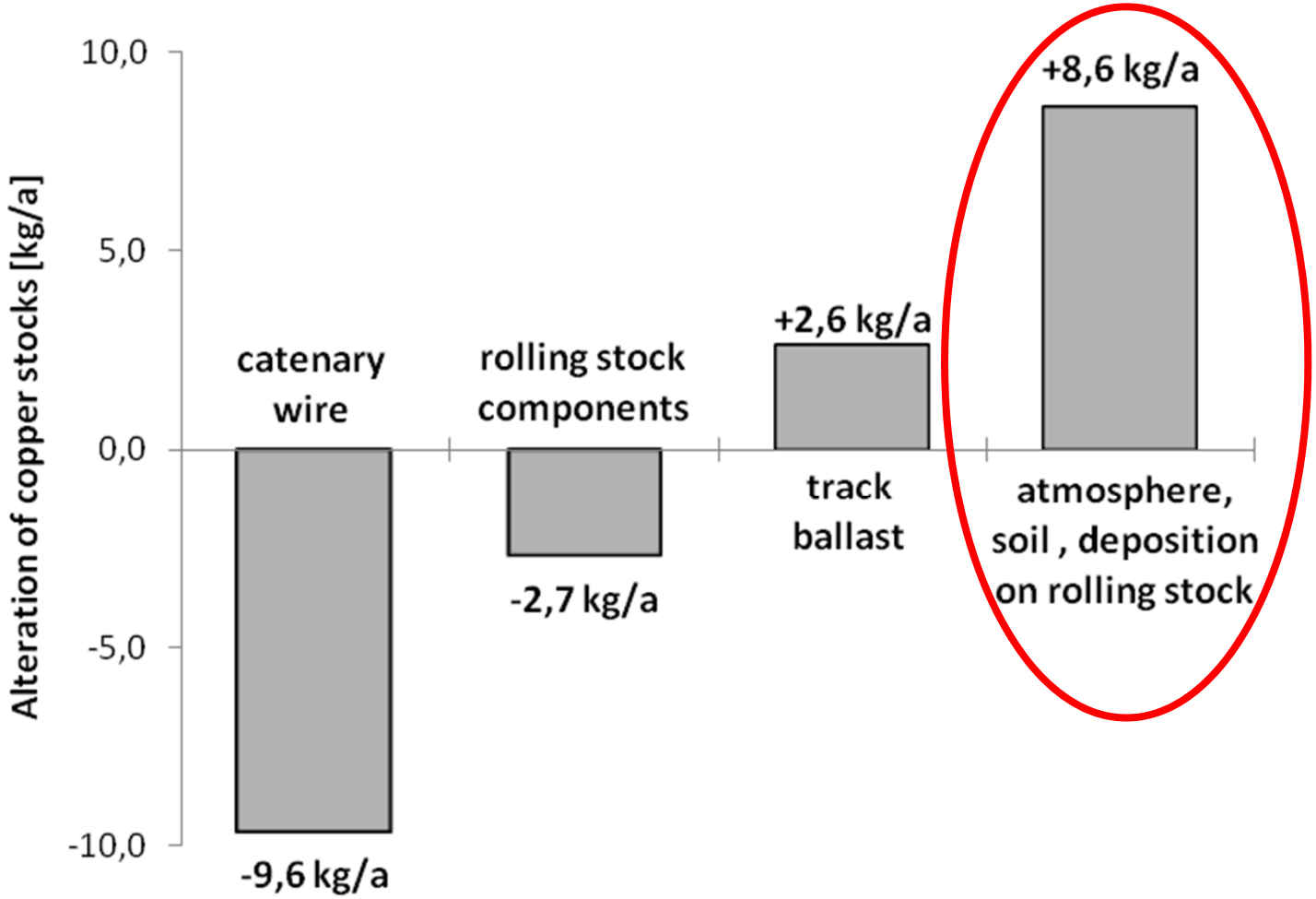


Limits to recycling and disposal

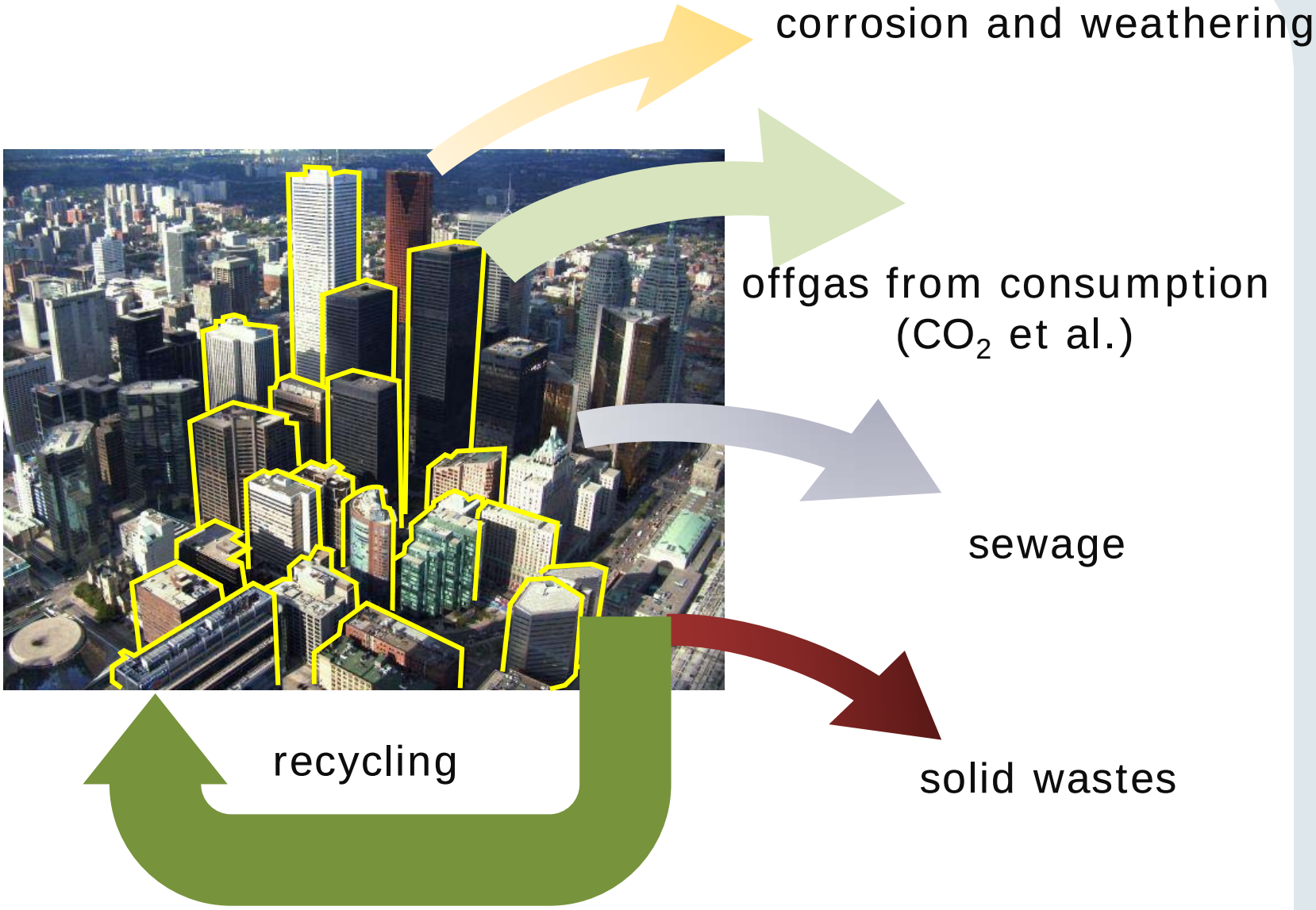


Changes in copper stocks

~ 75 % of Cu flow uncontrolled into the environment

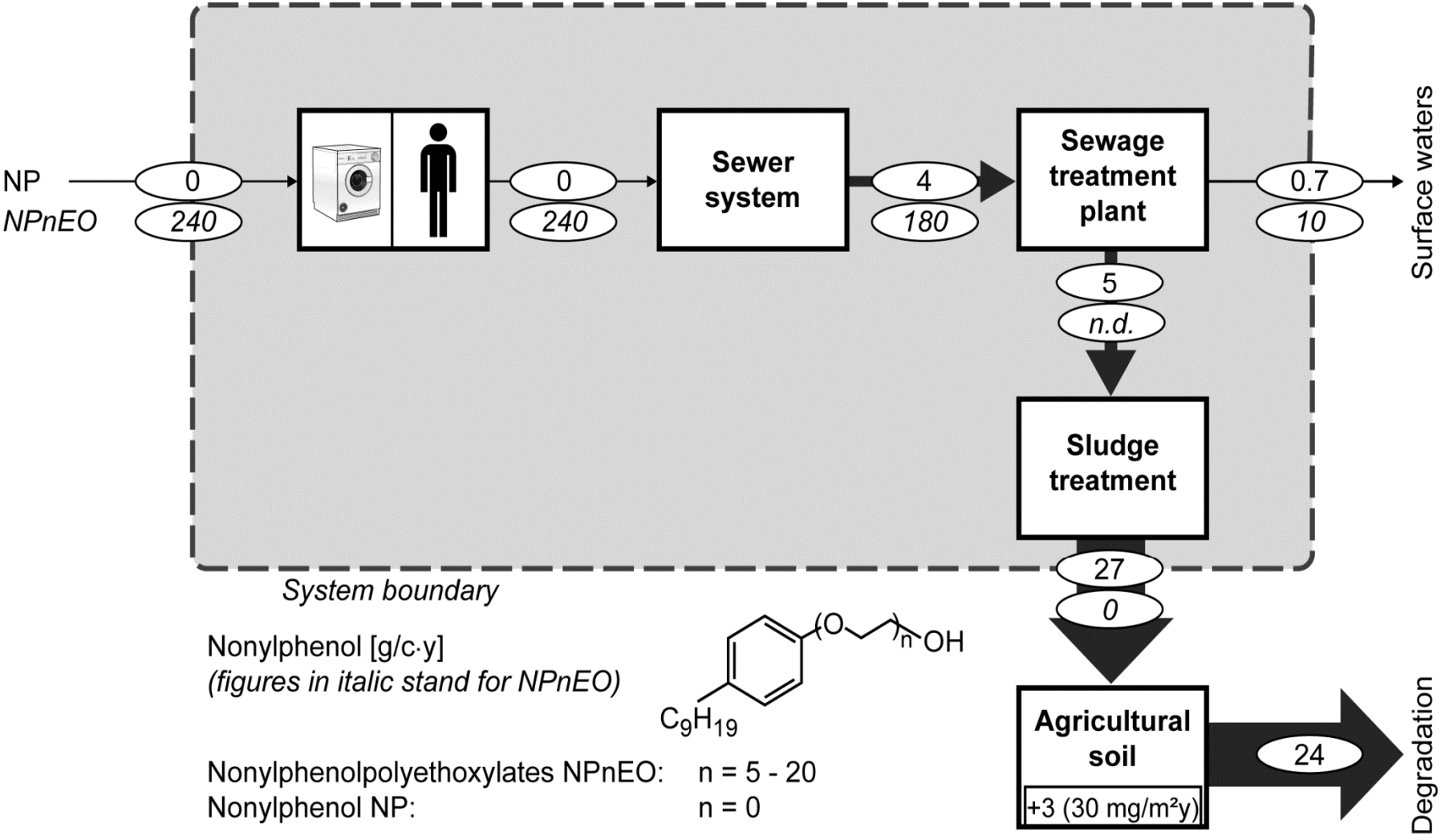


Sinks are required for all off-flows!



50 % of NPnEO end up as NP in the environment

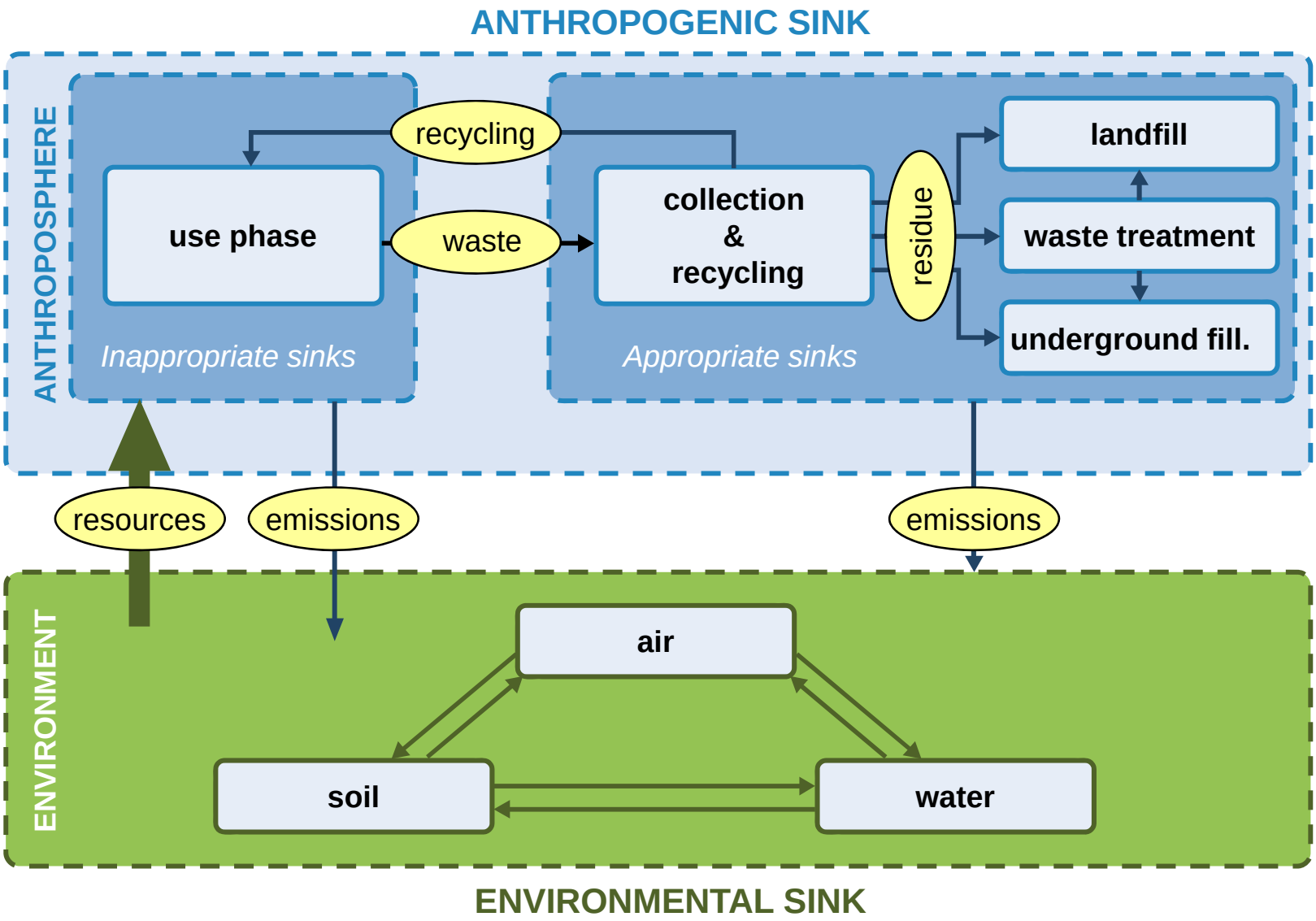
Needed: Product design in view of final sinks



Nonylphenol [g/c·y]
(figures in italic stand for NPnEO)

Nonylphenolpolyethoxylates NPnEO: n = 5 - 20
Nonylphenol NP: n = 0

Sinks and final sinks

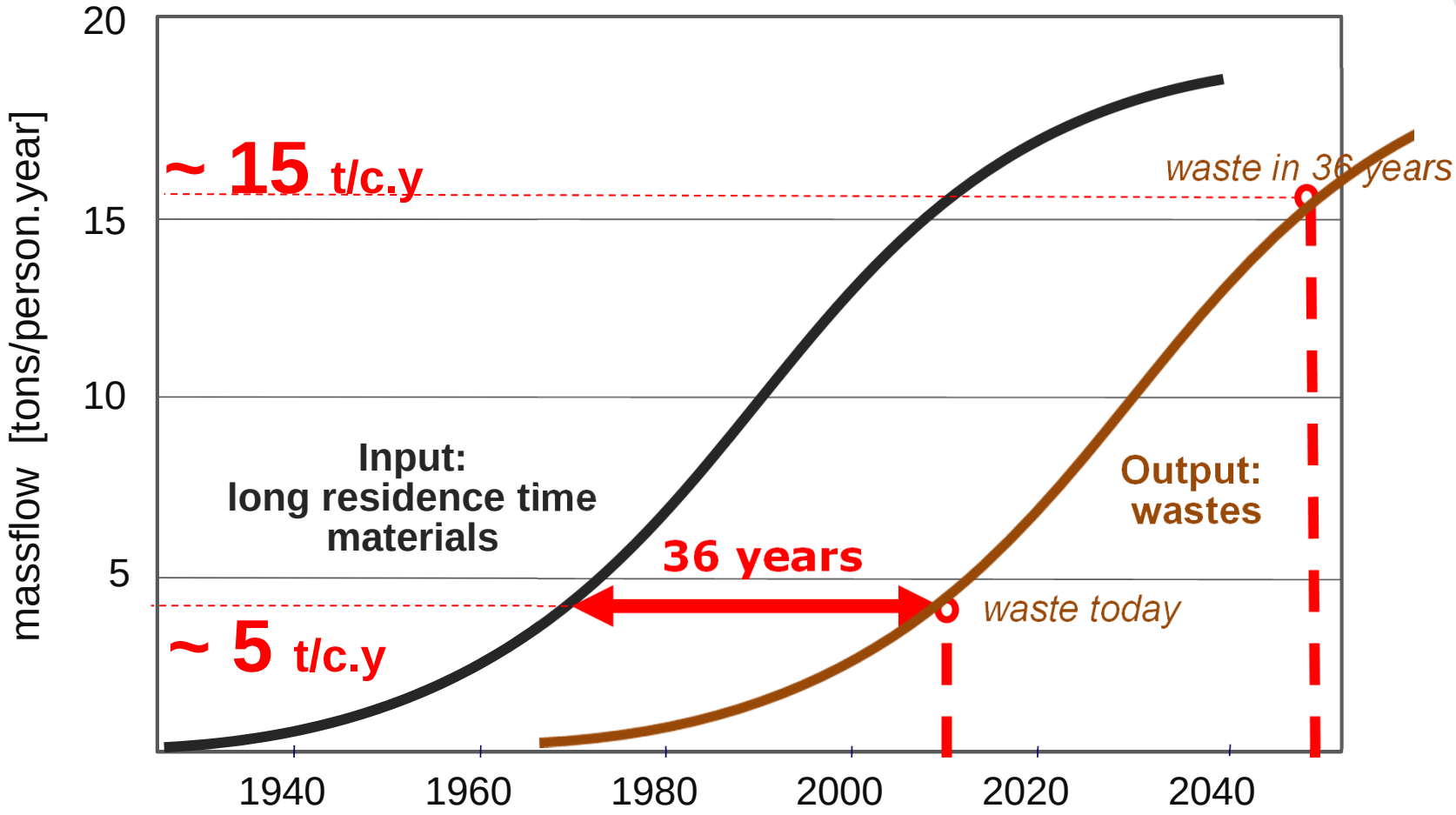


Conclusions

- economic activities require sinks
- overloading of sinks has been observed for some substances
- the loading of sinks should be monitored -> early recognition
- waste management has a key role in sink management:
  -> *transformation and final storage*
- research needs:
  - sinks – the ultimate resource?
  - terminology and methodology: sinks, final sinks, appropriate sinks, and sink capacity
  - linking resources with appropriate final sinks
  - product design should include sink issues
  - governance (REACH)?

This research is funded by the Austrian Science Fund (FWF): I 549-N21

Stocks of today are tomorrows wastes and resources



mean residence time of 36 years
(= Martin at Stanford)

Sinks and final sinks

A "*sink*" is defined as a process that receives and stores or transforms anthropogenic material flows that have no positive value for mankind.

Examples

- water -> lakes/oceans -> sediments
- atmosphere
- pedo- & lithosphere

Transformations as sinks for organic substances:

- biogeogenic transformations (e.g. mineralization)
- anthropogenic transformations (e.g. thermal, biochemical))

A "*final sink*" is a sink that either destroys a substance completely, or that holds a substance for a very long time period.