Utilization and protection of sinks in modern waste management systems

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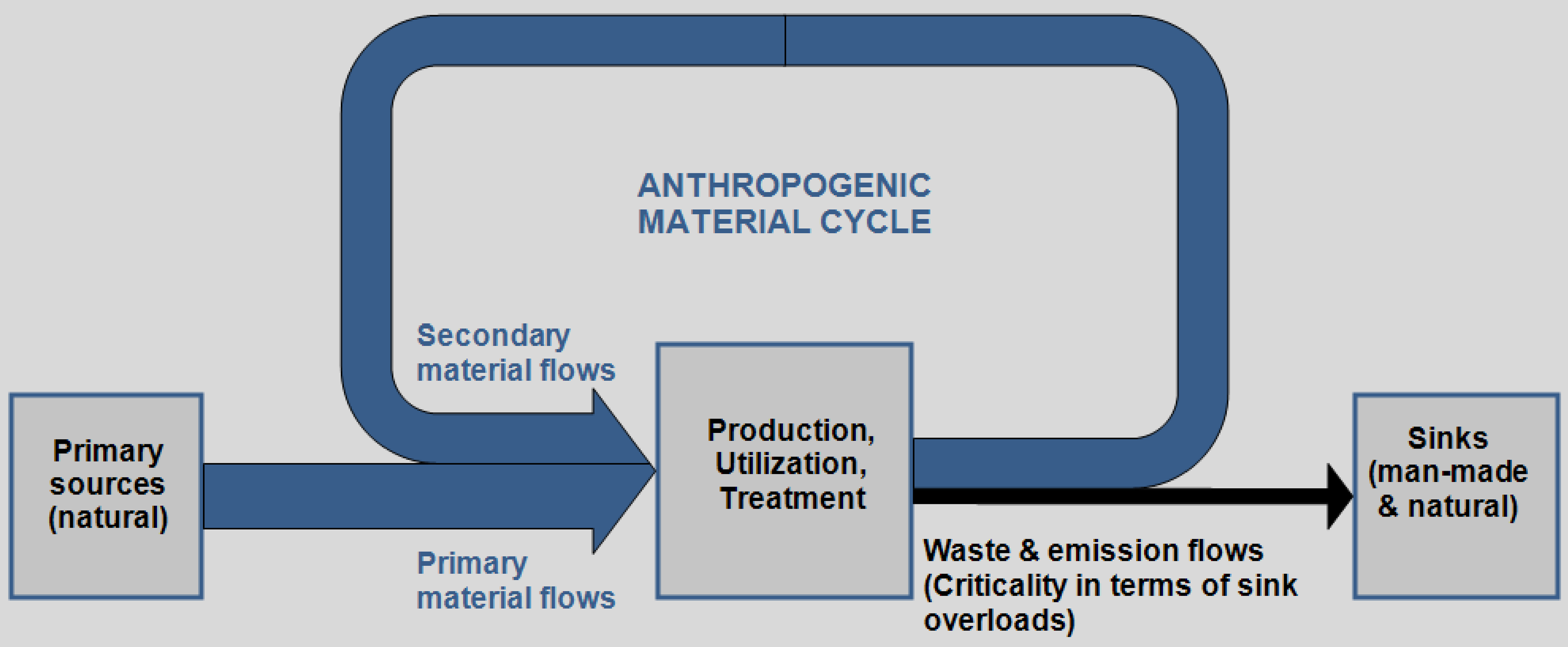
Despite recycling, material use inevitably results in wastes and emissions. In order to avoid harmful impacts on the environment and human health, appropriate sinks must be provided for these material losses. We present a case study from the Canton of Zurich (Switzerland) and demonstrate a monitoring concept for material flows to sinks as a basis to optimize the regional waste management.

Problem

The need for safe sinks.
After utilization, materials either become recycling products, or they leave the material loop as non-recyclable waste and emission flows. To accommodate these materials without jeopardizing human and environmental health, limited natural sinks like air, water and soil are available. Thus, appropriate man-made sinks (end-of-pipe technologies) have to be provided and utilized by the waste management sector, where natural sinks are missing or overloaded.

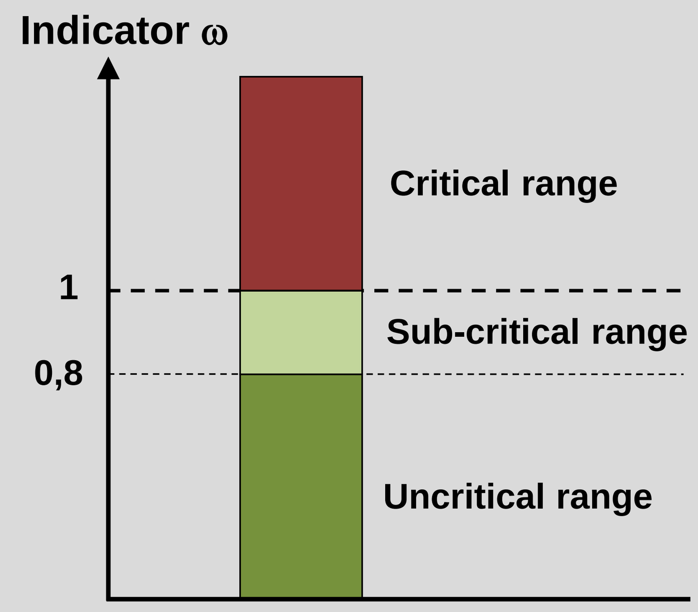


Method

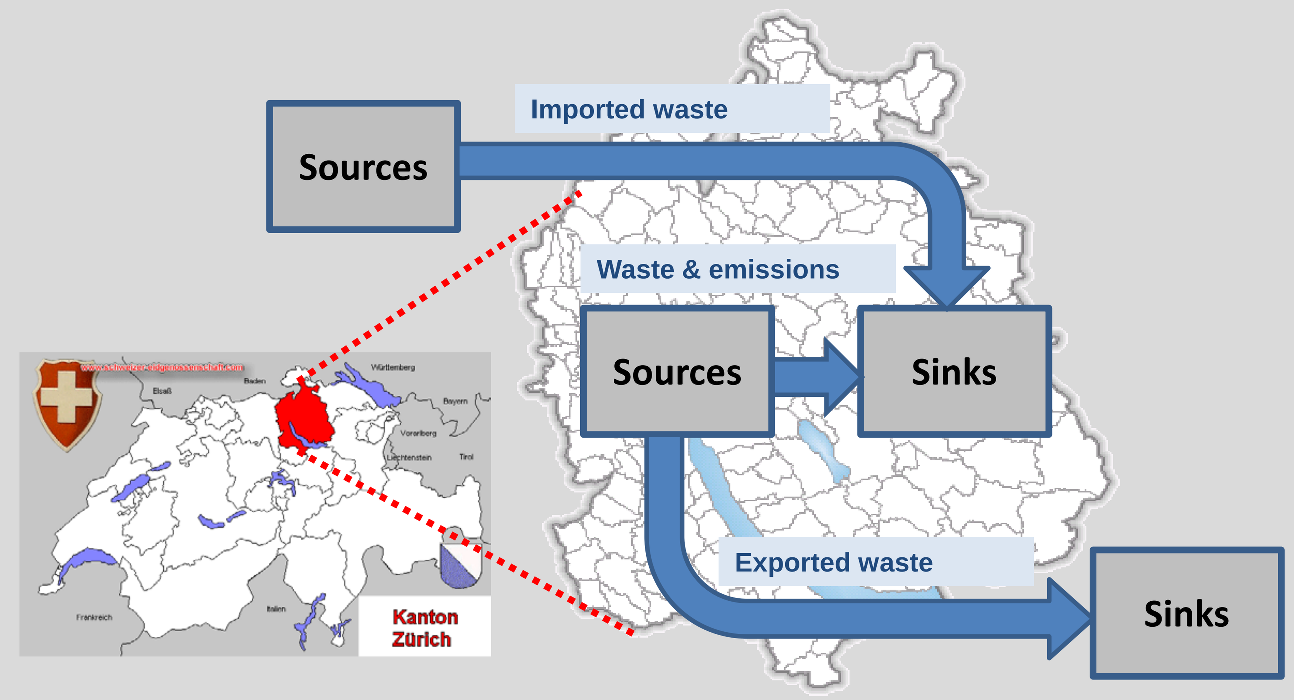
Analysis, evaluation, indicator and actions:

1. Substance flows into sinks are inventoried with the tool material flow analysis.
2. The substance flows are evaluated, based on a distance-to-target approach, with respect to environmental and resource oriented goals.
3. An indicator ω aggregates the results from the first two steps and indicates whether the current waste management practice overloads available sink capacities or not.
4. If constraints are indicated, measures are developed and evaluated to fulfill environmental and resource oriented goals.

$$\omega = \frac{\text{Actual flow [t/a]}}{\text{Critical flow [t/a]}}$$



Case study region: Canton of Zurich, 2013

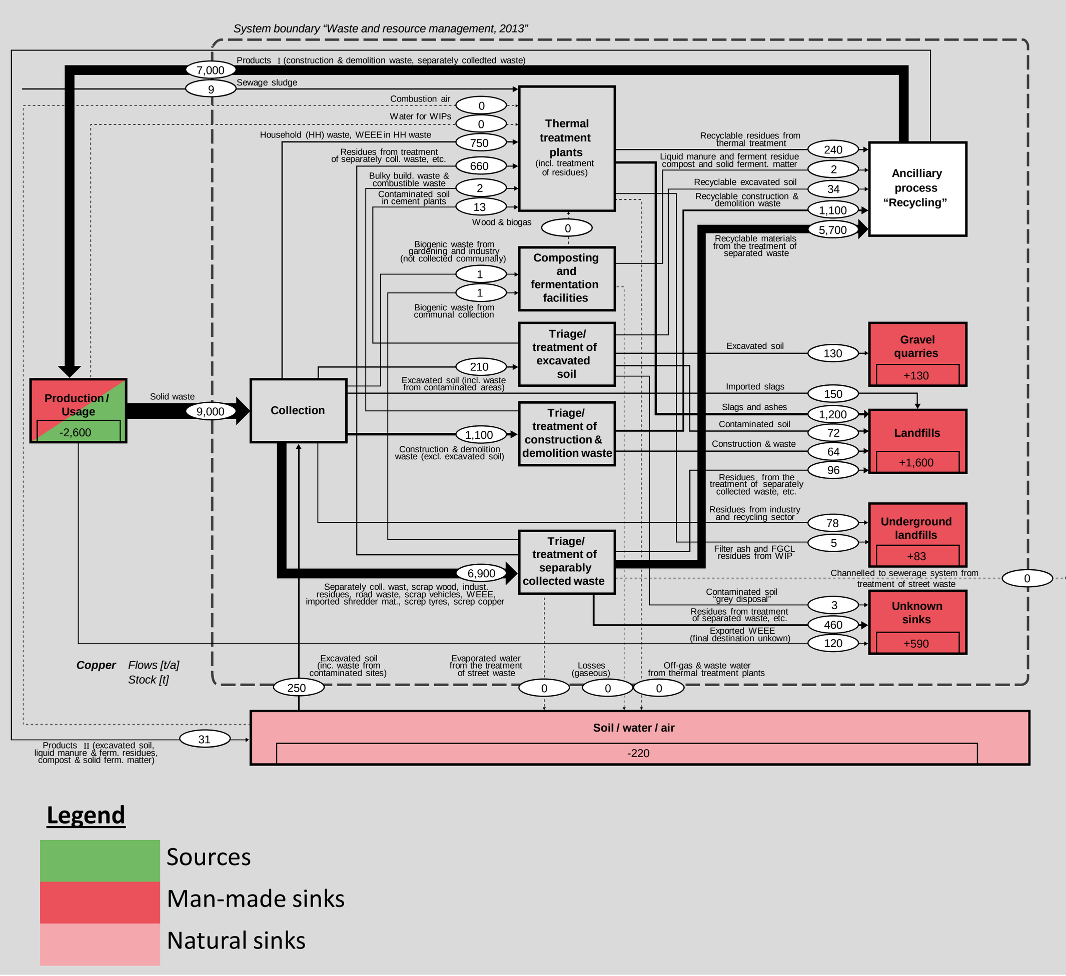


The waste sector directs 10 t/cap solid waste and 4 t/cap off-gas into sinks, including 6.5 kg Cu/cap, 2.8 kg Zn/cap and 0.1 kg PAH/cap.

Results

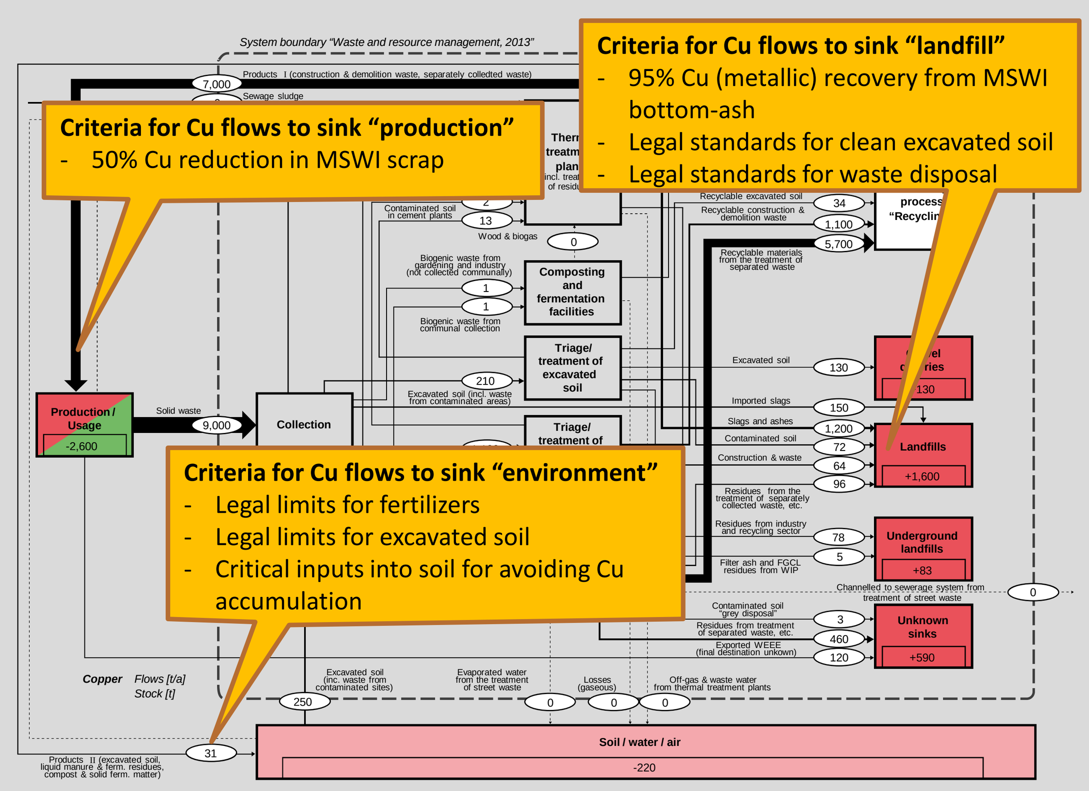
1. Analysis

Material flow analysis exemplified for Copper in the Canton of Zurich, 2013.



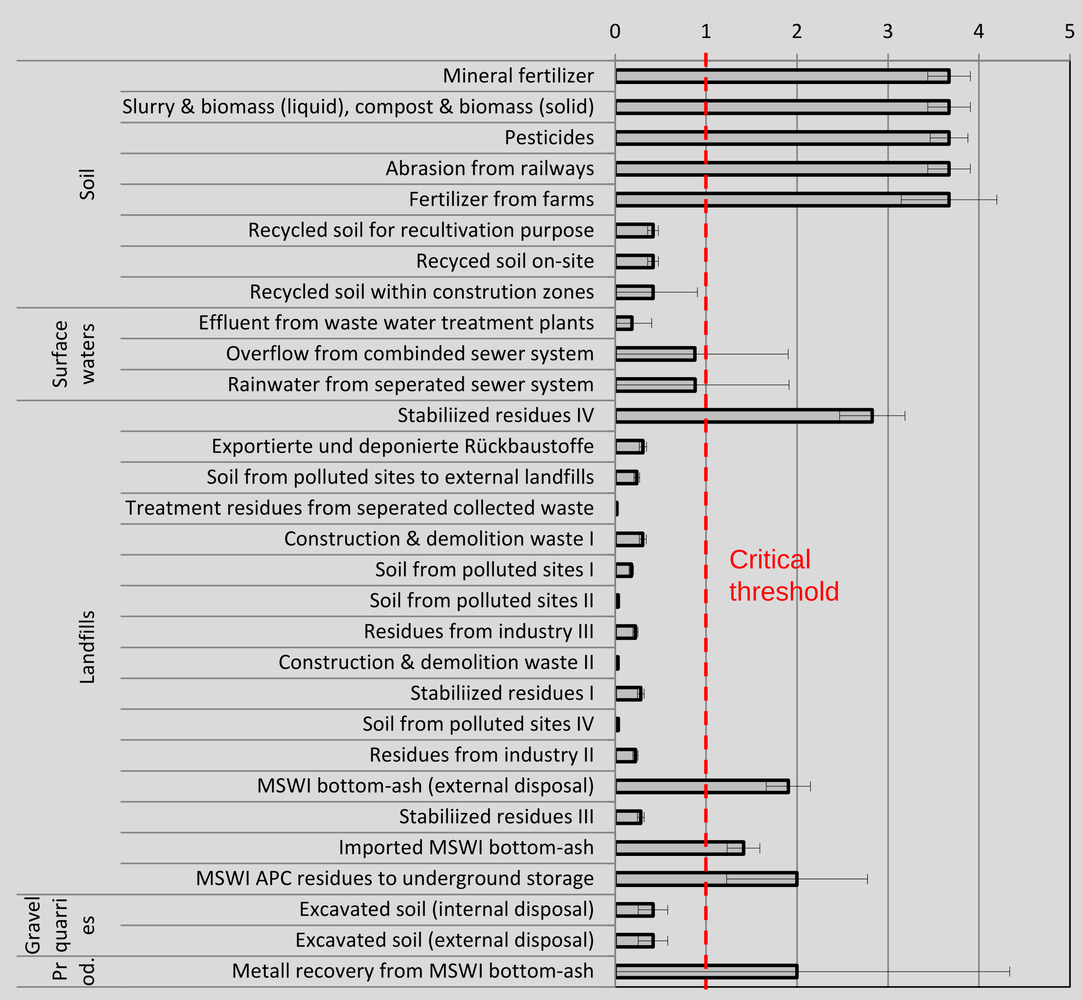
2. Evaluation

Evaluation criteria based on resource and environmental oriented goals



3. Indicator

The indicator relates the actual to the critical flow into the sink.



Actions

Goods

- Increasing the disposal capacity for excavated soil
- Increasing the recycling rate for construction & demolition waste

Copper

Research & development to

- increase metallic Cu recovery from MSWI bottom-ash
- separate copper from MSWI scrap.
- assess Cu inputs to soil

Zinc

Research & development to

- increase Zn recovery from MSWI APC residues
- increase Zn recovery from MSWI bottom-ash
- foster Zn recovery from MSWI residues into underground disposals

Polycyclic aromatic hydrocarbons (PAHs)

- Reduction of threshold values for the recycling and landfilling of waste asphalt
- Directing PAH contaminated waste asphalt to thermal treatment plants