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# CLEAN CYCLES & FINAL SINKS

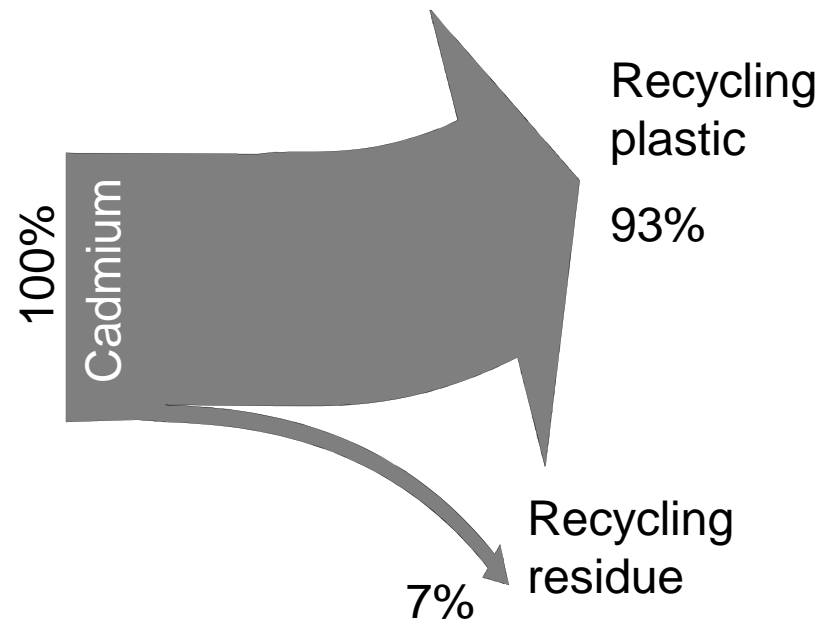
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EcoKnowledge 2010: Graduate School Course for PhD Students  
3. November 2010  
Lahti, Finland

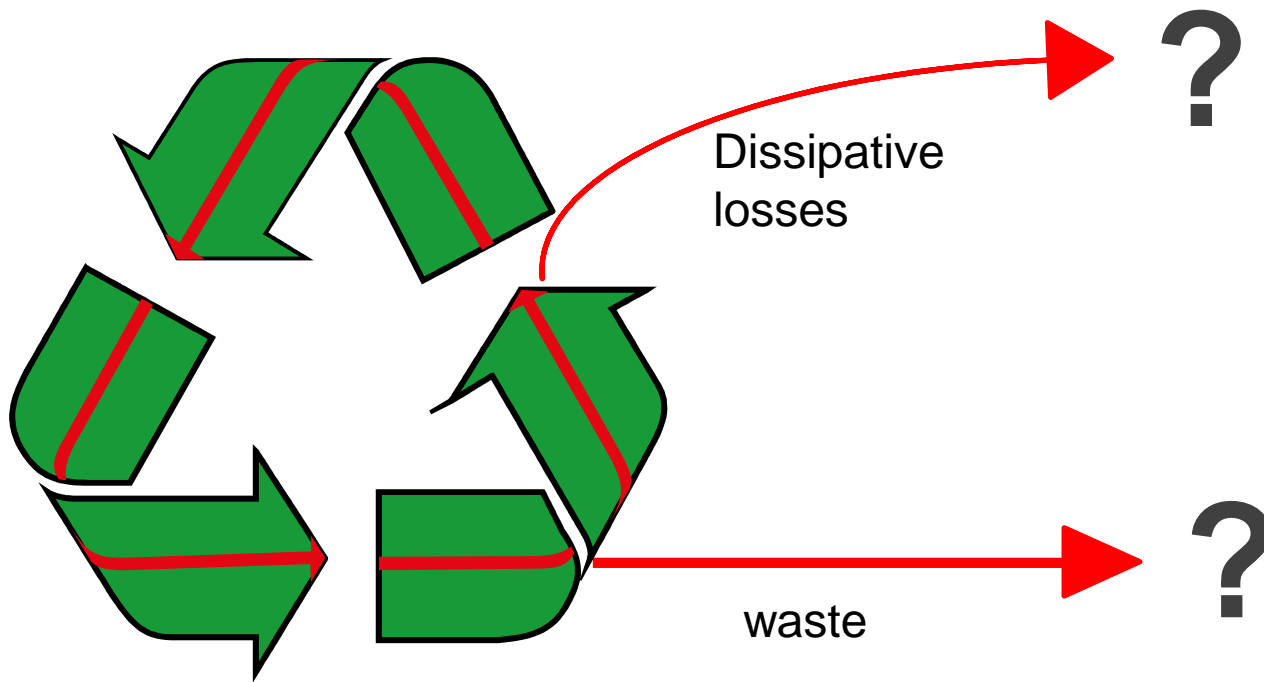
## clean cycles



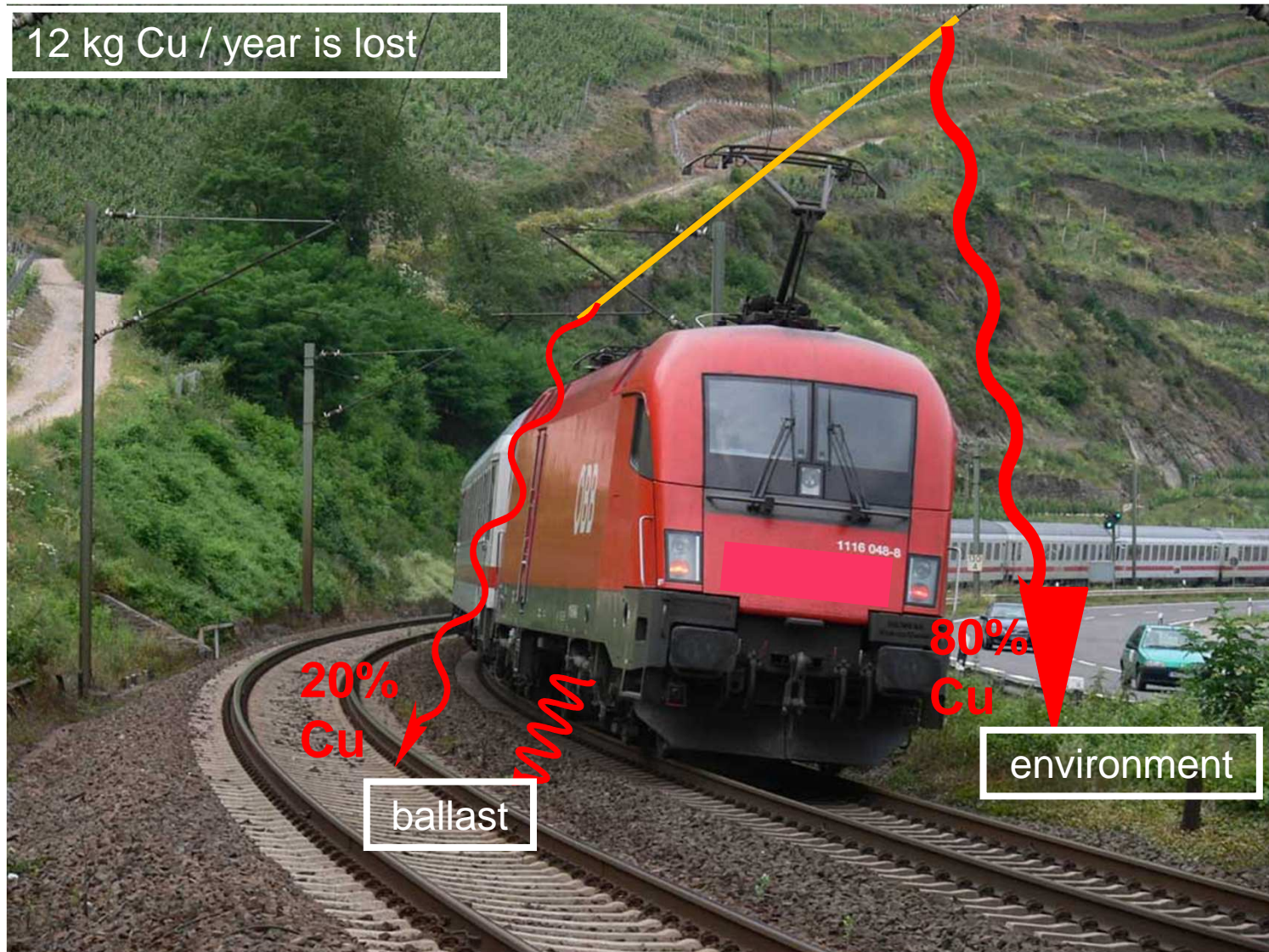
## Plastic recycling



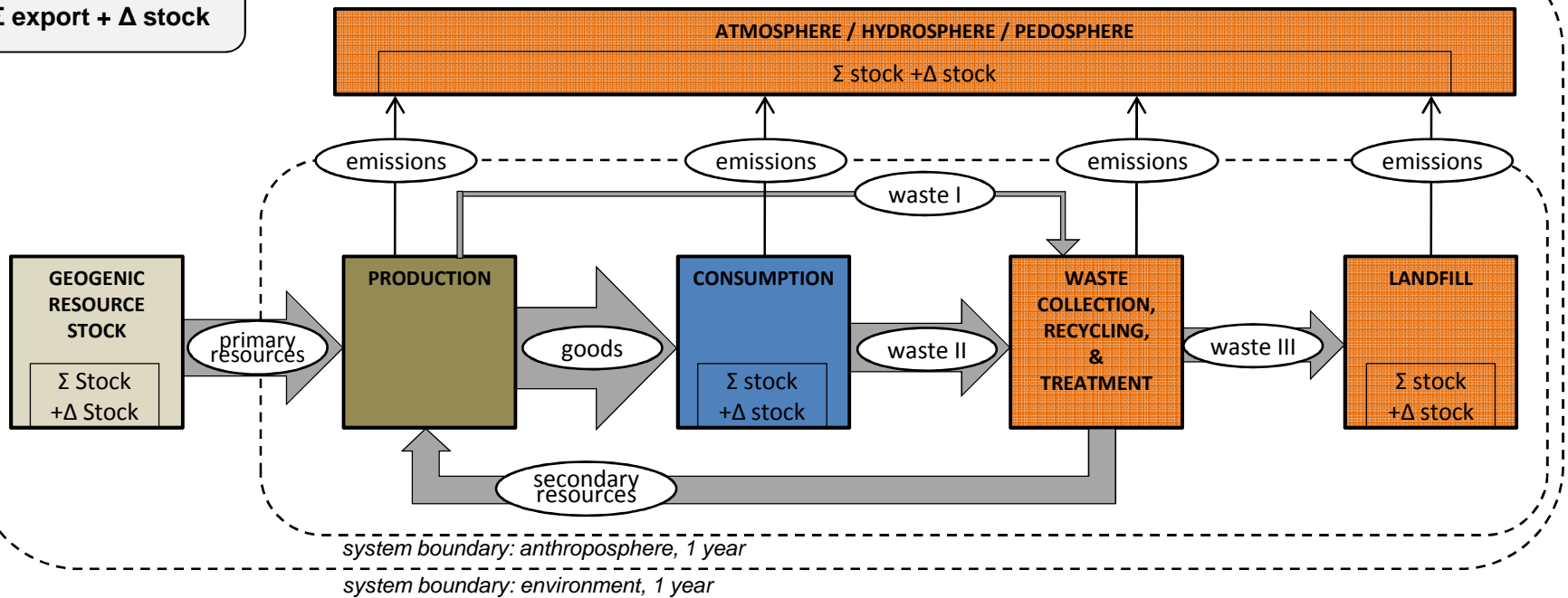
# Where do the off-flows end up?



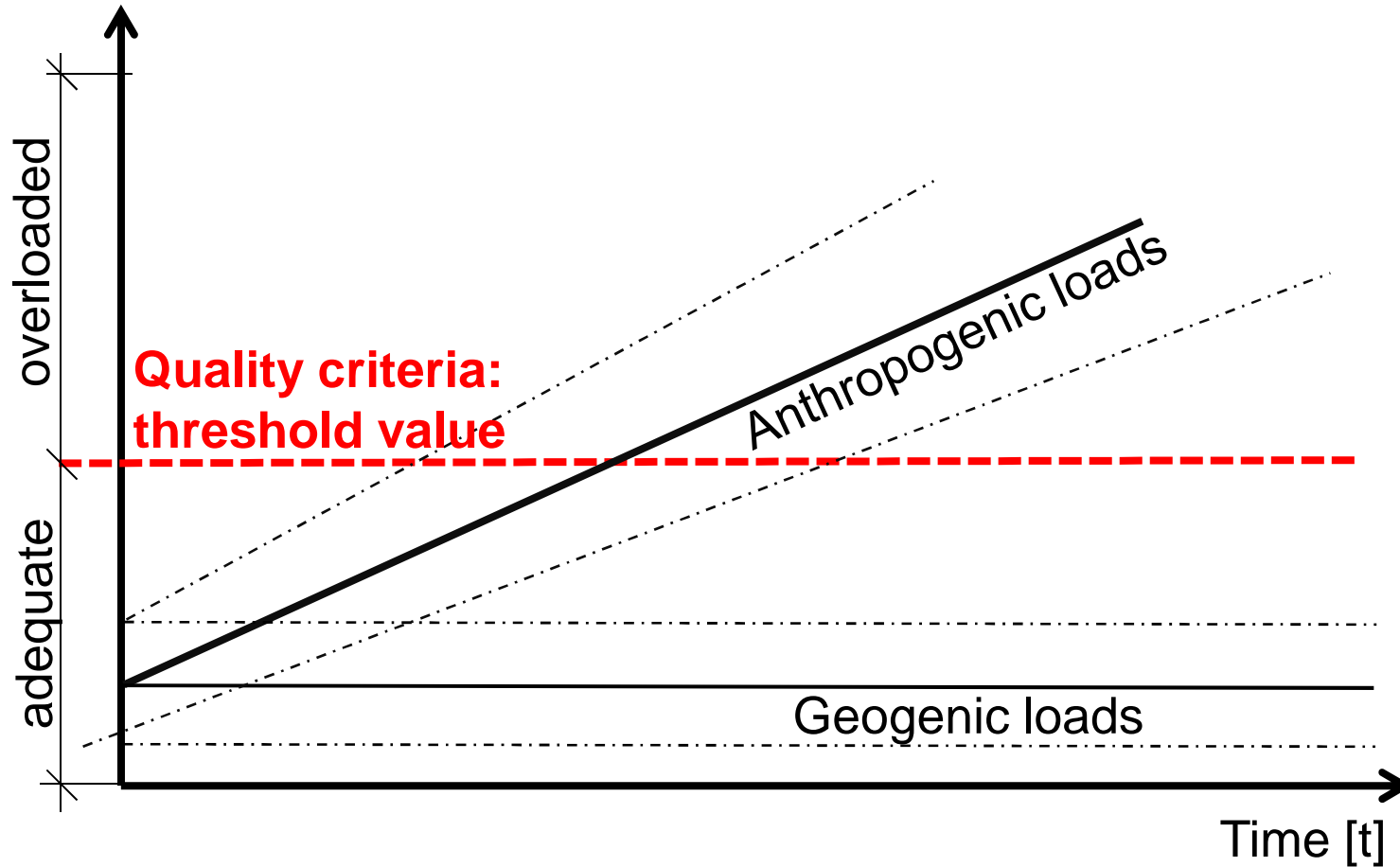
# Loss and dissipation



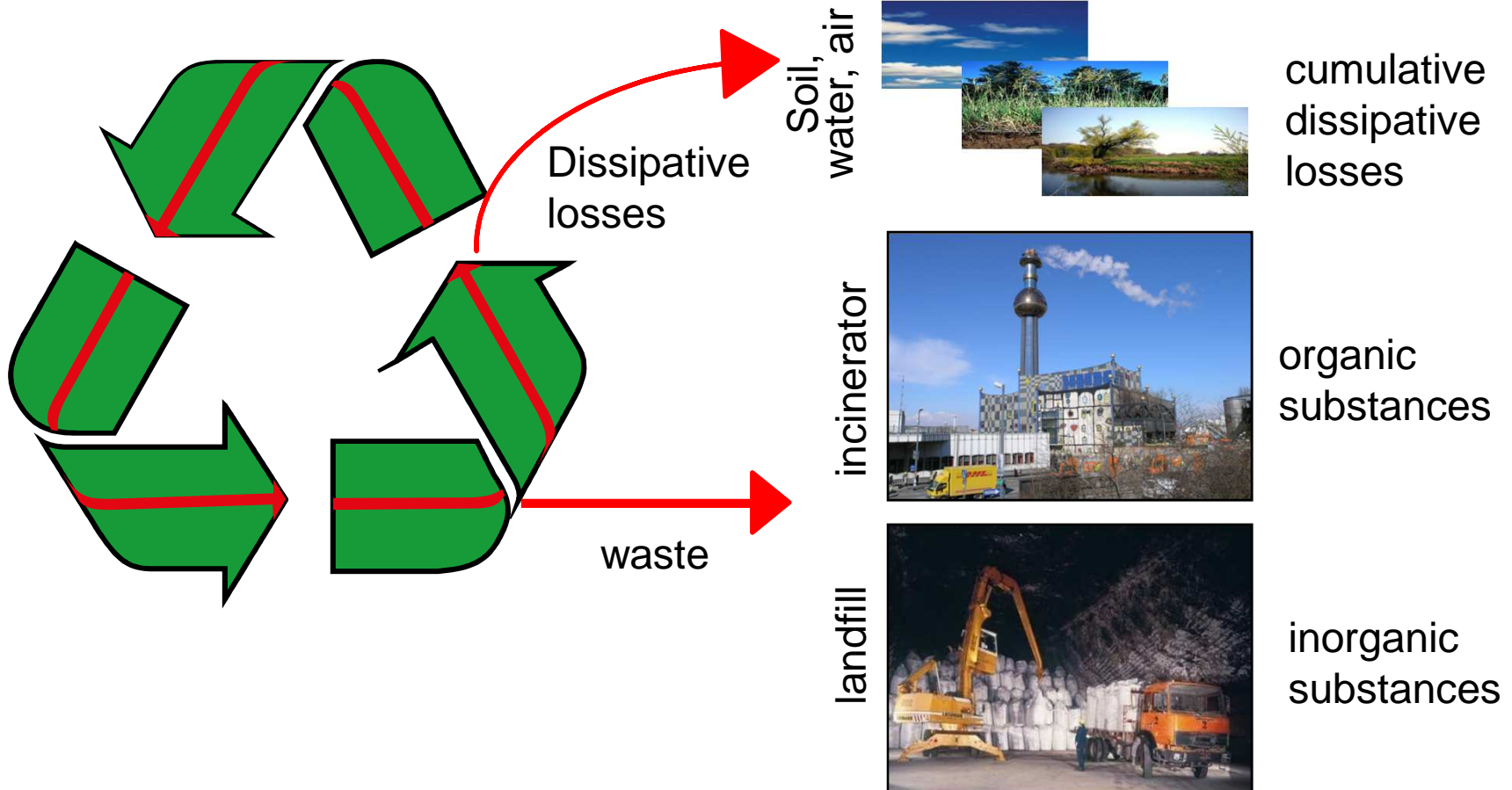
Mass conservation:  
 $\Sigma \text{ import} = \Sigma \text{ export} + \Delta \text{ stock}$



Sink capacity



## Providing safe sinks for all substances





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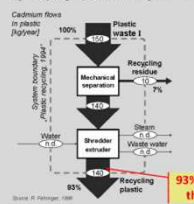
## CLEAN CYCLES & FINAL SINKS

Hazardous substances must be removed from cycles, and disposed of in safe final sinks. Since sinks are loaded from many sources, total flows to sinks must be controlled and adjusted to sink capacities in air, water, and soil.

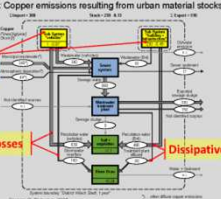
### Problem

Today's objectives of material management focus on quantitative recycling. Crucial effects are neglected: cycling of hazardous constituents, and loss and dissipation of substances during use phase.

#### Cycling of hazards e.g.: Recycling of plastic containing Cadmium



#### Loss and dissipation in soil and surface waters e.g.: Copper emissions resulting from urban material stocks

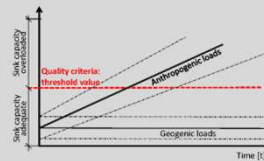
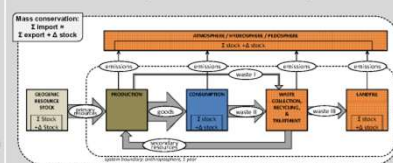


Both, residues from recycling and substance dissipation require appropriate sinks – are they available?

### Approach

#### 1. Definition of type and capacity of sinks available for substance flows from anthropogenic metabolism.

Potential sinks: waste mineralization (organic substances), landfill and environment (inorganic substances)



#### 2. Material flow analysis (MFA) of key substances through cities. Special emphasis is given on urban stocks and related off-flows.

#### 3. Assessment if total loadings of all relevant anthropogenic sources exceed capacity of sinks.

### Solution

Sustainable material management must provide safe sinks for all substances.



For organic substances, incinerators are appropriate sinks.



For inorganic substances, landfills are appropriate sinks.



Cumulative dissipative losses from anthropogenic sources must stay below threshold level.