

Ulrich Kral, Paul H. Brunner Vienna University of Technology





Austrian Science Fund (FWF):

I 549-N21



Kral, U., P. H. Brunner, P. C. Chen, et al. 2014. Sinks as limited resources? A new indicator for evaluating anthropogenic material flows. Ecol Indic 46(0): 596-609.



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Der Wissenschaftsfonds Austrian Science Fund (FWF): I 549-N21

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Indicator score

Inventory: It results the actual sink load in mass per time. First, the tool substance flow analysis (SFA) is applied to investigate regional substance flows. The software STAN is used for data reconciliation and error propagation in order to balance flows and stocks. Third, Sankeydiagrams are elaborated to present SFA results. Fourth, actual flows to sinks are summed up to result the actual sink load.



Copper in Vienna 2008



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Impact assessment: It results the acceptable sink load in mass per time. First, normative criteria (NC) and reference values are defined along the cause-effect chain. Criteria are derived from goal oriented frameworks with respect to waste and emissions such as regulations. Second, each actual flow is varied as long as the reference value is achieved, resulting the critical flow. flows Third, acceptable are determined and summed up to result the acceptable sink load.



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A new indicator...

...with respect to sink limitation

We propose to use a single score indicator λ on a substance specific base. It quantifies the environmental acceptable share of a substance to sink processes. It ranges from 0% to 100%. Either all actual flows are fulfilling criteria of acceptability (λ = 100%) or at least one flow is unacceptable (0% < λ < 100%).

Copper in Vienna 2008

 $\lambda = 99\%$

Measures to increase the indicator score:

- Elaborating legal limits for heavy metals in urban soils
 - Monitoring loads to urban soil and river Danube
 - Reducing airborne emissions





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Indicator score

A new indicator...

 $\lambda = -$

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Actual sink load

Lead in Vienna 2008

 $\lambda = 92\%$

Measures to increase the indicator score:

- Optimizing recycling rates
- Expanding landfill capacities

Impact assessment



Cu Pb PFOS



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Actual sink load

PFOS in Switzerland 2006

 $\lambda = 96\%$

Measures to increase the indicator score:

- Managing the stockpiles
- Minimize and eliminate emissions
- Conducting research regarding the cause of PFOS generation in waste water treatment plants





Pb PFOS