Monetary valuation of human impacts on the natural capital

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A shift towards sustainable and just economies can hardly be managed without quantified monetary values of environmental impacts. A logical consequence of the Brundtland definition of sustainable development, is that the natural capital that we leave to the next generation must not decrease. A good indicator for the environmental aspect of sustainable development is therfore ***the cost to preserve the natural capital, or a compensation to people who carry the consequences of the decreased capital***. The EPS methodology for valuing impacts was developed during the 1990ies and are based on these principles. It has been updated several times to account for new knowledge. The last update was published 2020. That update also included an adaption to the new ISO standard on monetary valuation of environmental impacts, ISO 14008.

The value of damage to the natural capital is equal to the costs to restore or preserve environmental goods or to compensate for loss and disability

Methodology

The EPS methodology, used for assessing monetary values of environmental impacts from economic activity includes five steps.

1. Define what is to be sustained. In this case it is human welfare, and thus the present satisfiers for human basic needs, i.e. air, food, water, wood, climate, fossil and mineral resources. These are called environmental goods.
2. Define indicators of human impacts on the environmental goods, e.g. crop loss
3. Chose a valuation methodology and use it for assessing monetary values of indicator units. We have chosen to use costs to prevent or restore environmental change or market values if the change is temporary.
4. Determine the monetary values of impacts caused by each emission and resource use. This is done by quantifying impact factors for all significant mechanisms for impacts on environmental goods. Adding them up results in monetary values for all environmental impacts from an emission or resource use.
5. Determine the monetary value of impacts from a product or service. This is done by using LCA methodology to determine how much of different emissions and resource flows there are and multiplying with their monetary values.

Results

Examples of damage cost from impacts on environmental goods

Environmental good	Impact indicator	Unit	Monetary impact value (€)	
			Best estimate	Uncertainty
Production capacity of crops	Decreased productioncapacity	kg	0.263	1.24
Production capacity for meat	Decreased productioncapacity	kg	2.35	1.32
Production capacity for fish	Decreased productioncapacity	kg	2.2	1.3
Production capacity for wood	Decreased productioncapacity	m3	65.5	1.2
Biodiversity, global	Share of threat to redlisted species	dimensionless	6.92E+10	1.5
Production capacity for drinking water	Decreased productioncapacity	m3	1.7	2.26
Clean air, clean water, uncontaminated food, and good climate	Years of lost life expectancy, YLL	personyear	9.73E+04	1.3
Clean air, clean water, uncontaminated food, and good climate	Working capacity	personhour	27.3	1.25
Clean air, clean water, uncontaminated food, and good climate	Undernutrition	personyear	5840	1.1
Clean air, clean water, uncontaminated food, and good climate	Diarrhea	personyear	10220	1.5
Clean air, clean water, uncontaminated food, and good climate	Malaria episodes	personyear	18590	1.1
Clean air, clean water, uncontaminated food, and good climate	Gravation of angina pectoris	personyear	5840	1.5
Clean air, clean water, uncontaminated food, and good climate	Cardiovascular disease personyear	personyear	9734	2.4
Clean air, clean water, uncontaminated food, and good climate	Infarcts personyear	personyear	7995	1.3
Clean air, clean water, uncontaminated food, and good climate	Asthma cases	personyear	4185	2

Examples of damage cost from emissions

Emission	Receiving media	Unit	Monetary impact value, €
Carbon dioxide, CO2	air	kg	2.88E-01
Carbon monoxide, CO	air	kg	1.08E+00
Nitrogen oxides, NOx	air	kg, as NO2	-2.37E+01
Nitrous oxide, N2O	air	kg	7.67E+01
Ammonia, NH3	air	kg	-4.34E+01
Sulphur oxides, SOx	air	kg	-8.45E+00
Hydrogen Fluoride	air	kg	-6.64E+00
Hydrogen Chloride	air	kg	-6.80E+00
Hydrogen Sulphide	air	kg	-1.97E+01
PM2.5	air	kg	2.32E+02

Examples of damage costs from processing materials

Material or process	Unit	Monetary impact cost, €/unit						
		Production	Incineration	Energy recovery	Material recycling	Composting	Landfill, municipal	Landfill, (C&D)
Cement	kg	0.276	0	0	0	0	0	0
Glass	kg	0.418	0	0	-0.335	0	0	0
Steel coil	kg	2.16	0	0	-0.9	0	0	0
Stainless steel	kg	14.1	0	0	-11.2	0	0	0
Aluminium	kg	3.27	0	0	-2.62	0	0	0
Corrugated board	kg	0.352	0.0003	-0.412	-0.106	0.0047	1.33	1.33
Polypropylene, PP	kg	1.37	0.905	-0.373	-1.05	0.00905	0.0726	0.0726
Polyurethane foam, PU	kg	3.47	-0.00808	-0.691	0	0.00693	-0.0076	-0.0076
Cotton&Polyester, 50/50	kg	2.96	0.565	0.0692	-0.888	0.155	1.76	1.76
Heavy truck transport	ton km	0.0579						
Ship	ton km	-0.000716						
Light duty vehicle	ton km	0.271						

Further reading

Bengt Steen, Monetary valuation of environmental impacts – Models and data. CRC press, 2019
https://www.taylorfrancis.com/books/9780429430237
Steen, B and Rydberg T, EPS weighting factors, version 2020d, Report nr 2020:6 From the Swedish Lifecycle Center, Chalmers University of technology, 2020.