Supplementary material

Table S1. Impact category indicators that were used for comparison, CFs and UCFs used for unit conversion to convert all impact categories to the same units (all from ReCiPe [1] if not otherwise specified)

Impact categories	Impact category indicator for comparison	CFs	UCF (derived from the CFs)
Climate change	kg CO_2-e	None	None
Depletion of stratospheric ozone	kg CFC-11-e	None	None
Acidification (only for MMG for "land and water"	kg SO_2-e	For mol H+-e: 1.37 SO_2/mol H+-e based on [2]	0.73 mol H+-e/SO_2
Eutrophication	€/kg PO_4 eq	3.03 PO_4-e/P	0.33 P/PO_4
Formation of tropospheric ozone	€/kg C_2H_4-e	0.070 kg C_2H_4/kg C_2H_2 0.496 kg C_2H_4/kg NMVOC 2.76 kg kgC_2H_4/NO_x (only based on ReciPe human health)	14.28 kg C_2H_2/kg C_2H_4 2.016 kg NMVOC/ kg C_2H_4 0.36 kg NO_x/C_2H_4
Abiotic depletion of non-fossil resources	€/kg Sb-e	None- some methods supplied only kg Sb-these were assumed to be the same as Sb-e	None
Abiotic depletion of fossil Resources	€/MJ	MJ/kg dependent on the caloric value from different energy carriers based on [3]	Kg/MJ dependent on the caloric value from different energy carriers based on [3]
Human toxicity cancer	€/CTUh (cancer) then transferred to DALY as explained in the section 2.2. of the main paper	1.81E-07 CTUh/kg 1,4-DCB to air (Usetox) 1.8E-07 CTUh/kg 1,4 DCB to soil	5524861 kg 1,4-DCB to air/CTUh 5555555 kg 1,4 DCB to soil/CTUh/

		9.26E-07 CTUh/ kg Vinylchloride to air 0.004076541 CTUh/ kg Benzo(a)Pyrene	1079913 kg Vinylchloride to air/CTUh 245 kg Benzo(a)Pyrene/CTUh
Human toxicity non-cancer	€/CTUh (non-cancer) then transferred to DALY as explained in the section 2.2. of the main paper	5.42E-08 CTUh/kg 1,4-DCB to air (UseTox) 7.06E-08 CTUh/kg 1,4 DCB to soil (UseTox) 2.67E-06 CTUh/ kg Vinylchloride to air	18450184 kg 1,4-DCB to air/CTUh 14164305 kg 1,4 DCB to soil/CTUh 374531 kg Vinylchloride to air/CTUh
Particulate matter	kg PM2.5 e	0.28 kg $PM_{2.5}$ e/kg PM_{10} .(based on TRACI [4]	3.57 kg PM_{10}/kg$PM_{2.5}$-e
Ionising radiation human health	kBq kg U235 e	0.01 kBq kg U235 e/ Bq C14 Based on [5]	100 Bq C14/kBq kg U235
Ecotoxicity terrestrial	kg 1,4 DB-e to industrial soil	1.023 kg 1,4 DCB to industrial soil/kg DCB to agricultural soil 0.0031 kg 1,4 DCB to industrial soil/kg TEG to soil (from IMPACT2002+ [6])	0.977 kg DCB to agricultural soil/kg 1,4 DCB to industrial soil/ 322.58 TEG to soil/ kg 1,4 DCB to industrial soil/kg
Ecotoxicity freshwater	CTUe	9.83E+02 CTUe/ kg 1,4 DCB to freshwater (UseTox) 9924279 CTUe/ kg Cu to freshwater (UseTox) 3.87E-01 CTUe/kg TEG to freshwater (UseTox)	0.001017 kg 1,4 DCB to freshwater/ CTUe 1.00763E-07 Cu to freshwater/ CTUe 2.58 kg TEG to freshwater/ CTUe
Ecotoxicity marine	1,4-dichlorobenzen emitted to seawater	None	None
Water scarcity	m^3 H_2O	None	None

Land use occupation	m²/a – no differentiation for different kinds of occupation	None	None
Soil organic matter	kg of C deficit	None	None
Land use transformation	m²- no differentiation for different kinds of occupation	None	None
Marine eutrophication	Kg N-e	0.23 kg N/kg NO_3	4,34 kg NO_3/ kg N

Table S2. Overview of established links between methods (per impact category) and AoPs; links in brackets are partially established

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
Bruyn et al. (2018)	**Climate change**	**x**		**x**	**x**					
Huijbregts et al. (2017)	**Climate change**	**x**		**x**						
Ecotax	Climate change									x
Ecovalue	Climate change	x	x	x		Working capacity (if based on FUND 3.3-3.9)				
MMG method	Climate change								x	
Environmental prices	Climate change								x	
Stepwise	Climate change	x	(x)- positive impact	x	x					

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
EPS	Climate change	x	x	x		x (working capacity, migration)	x			
EVR	Climate change								x	
Trucost	Climate change	x	x	x		(x) included in the FUND model which is also a basis in estimating SCC				
LIME3	Climate change	x		x						
According to Bruyn et al. (2018)	**Acidification**	**x**		**x**			**x**			
Huijbregts et al. (2017)	**Acidification**			**x**						
EVR	Acidification								x	
Ecotax	Acidification									x
MMG method	Acidification			x			x			
Environmental prices	Acidification	(x)	x	x			x			
Stepwise	Acidification			x						
EPS	Acidification		x	x			(x) (include only CO_2-			

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
							emissions of steel that has to be replaced due to corrosion)			
Trucosts	Acidification	x		x						
Ecovalue	Acidification			x			x	x		
Bruyn et al. (2018)	**Ozone Depletion**	**x**		**x**				**x**		
Huijbregts et al. (2017)	**Ozone Depletion**	**x**								
EVR	Ozone Depletion								x	
Ecotax	Ozone Depletion									x
MMG method	Ozone Depletion	x	x (including wood production)							
Environmental prices	Ozone Depletion	x	x	(x)						
Stepwise	Ozone Depletion	x				x				
EPS	Ozone Depletion	x								
Bruyn et al. (2018)	**POCP**	**x**		**x**			**x**			
Huijbregts et al. (2017)	**POCP**	**x**		**x**						

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
EVR	POCP								x	
Ecotax	POCP									x
MMG method	POCP	x								
Environmental prices	POCP	x		(x)			(x)			
Stepwise	POCP	x	x	x		x				
EPS	POCP	x	x (crops and wood)							
Trucost	POCP	x		x						
LIME3	POCP	x								
Ecovalue	POCP	x	x							
Bruyn et al. (2018)	**Eutrophication**			**x**				**x**		
Huijbregts et al. (2017)	**Eutrophication**			**x**						
Ecotax	Eutrophication									x
Ecovalue	Eutrophication		(x)	(x)				Partly (recreation value)		
Environmental Prices	Eutrophication			(x)						
EPS	Eutrophication		x	x						
EVR	Eutrophication								x	
MMG	Eutrophication			x				x	x	
Stepwise	Eutrophication			x						
Trucost	Eutrophication	x		x				x		
Ecovalue	Marine Eutrophication			(x)				x		

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
Environmental Prices	Marine Eutrophication			(x)						
EPS	Marine Eutrophication		x	x						
Stepwise	Aquatic Eutrophication			x						
Trucost	Marine Eutrophication	x		x				x		
Bruyn et al. [7]	**Particulate matter**	**x**					**x**			
Huijbregts et al. [1]	**Particulate matter**	**x**								
Ecovalue	Particulate matter	x								
Environmental Prices	Particulate matter	x					x			
EPS	Particulate matter	x								
EVR	Particulate matter								x	
MMG	Particulate matter	x								
Stepwise	Particulate matter	x				x (working capacity)				

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
Trucosts	Particulate matter	x								
LIME3	Particulate matter	x								
Bruyn et al. [7]	**Ionizing radiation**	**x**						**(x)**		
Huijbregts et al. [1]	**Ionizing radiation**	**x**								
Environmental Prices	Ionizing radiation	x								
EPS	Ionizing radiation	x								
Stepwise	Ionizing radiation	x				x (working capacity)				
MMG method	Ionizing radiation	x								
Huijbregts et al. [1]	**Water use**	**x**		**x**						
EPS	Water use		X (based on costs for drinking and irrigation water)							
EVR	Water use								x	
MMG	Water use								x	
Trucost	Water use	x		x						

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
Ligthart 2019 damage costs	Water use		x							
Ligthart 2019 abatement costs	Water use								x	
LIME3	Water use	X (induced by agricultural production loss and domestic water shortage)								
Bruyn et al. [7]	**Land use/ transformation**			**x**	**x**			**x**		
Huijbregts et al. [1]	**Land use/ transformation**			**x**						
Environmental Prices	Land use/ transformation			(x)				(x)		
EPS	Land use/ transformation	x (working capacity)	x (drinking water renewal)	x						
EVR	Land use/ transformation			x (take into account bio factor and scenic beauty)					x	
MMG	Land use/ transformation			x					x	

Methods	Impact category	Human health	Agricultural production	Ecosystem	Resources	Working capacity	Buildings and materials	Human wellbeing	Abatement costs	Societies WTP
Stepwise	Land use/ transformation			x						
LIME3	Land use			x	x (NPP)					

Table S3. Monetary values per impact category for all assessed methods

Impact categories	**Global warming**	**Acidification**	**Strat Ozone depletion**	**Freshwater Eutrophication**	**Marine Eutrophication**	**Photochemical oxidation**	**Mineral resources**	**Fossil resources**	**Human Toxicity**	**Ionizing radiation**	**Freshwater Ecotoxicity**	**Terrestrial Ecotoxicity**	**Marine Ecotoxicity**	**Particulate matter**	**Land use**	**Land transformation**	**Soil organic matter**	**Water use**
Unit	**2019 €/kg-CO_2-e**	**2019 €/Kg SO_2-e**	**2019 €/Kg CFC -11-e**	**2019 €/PO_4-e**	**2019 €/ kg NO_3-e**	**2019 €/ kg C_2H_4-e**	**2019 €/ kg Sb-e**	**2019 €/MJ**	**2019 €/DALY**	**2019 €/ kg kBq U235-e**	**2019 €/CTUe-e**	**2019 €/ kg1,4 -DCB emitted to soil**	**2019 €/ kg 1,4-DCB emitted to marine water**	**2019 €/ kg PM 2.5 -e**	**2019 €/m^2/a**	**2019 €/m^2**	**2019 €/Kg C-e**	**2019 €/m^3**
Stepwise	0.107281697	0.19388	129.25506	1.5510607	0.572	0.7238283		0.005170	19542.42	0.0025	2.371346e-05	0.45889487		87.89344	0.1551			
LIME3	0.00745					0.000004201402	821.3	0.0011						7.71	0.00322			0.00153

Impact categories	Global warming	Acidification	Strat Ozone depletion	Freshwater Eutrophication	Marine Eutrophication	Photochemical oxidation	Mineral resources	Fossil resources	Human Toxicity	Ionizing radiation	Freshwater Ecotoxicity	Terrestrial Ecotoxicity	Marine Ecotoxicity	Particulate matter	Land use	Land transformation	Soil organic matter	Water use
Environmental Prices	0.059316800	7.8390400	128.904	0.6432624	3.2592800	2.3185484			42054.7257	0.0483128	3.848708e-05	9.10712000	7.744720e-03	146.72000	0.132			
EPS	0.137288000	0.0056	11.74808	0.0128904	0.0138336	1.330960e+00	19063	Various 0.0105 (max) 0.00525 (min)		0.000587				160.34	3.7 (max-industrial use) 0.00019 (min meadow)			0.0021 (drinking water) 0.001 (irrigation water)
MMG (max, central, andmin value)	0.106873343 0.053436671 0.026718336	0.9404854 0.459555 0.2351214	106.8734 52.47481 26.71834	64.1240057 21.3746686 7.0536406		7.0536406 0.5129920 0	6.658209 1.667224 0	0.0069 0 0	Non-cancer: 285156 57031 11406 cancer:	0.00309 0.001037 0.000342	1.977157e-04 3.954314e-05 7.897940e-06			90.84234 36.33694 13.57291	2.5 (max) 0.0000587 (min)	117.56 28.85 7.37 (all tropical rainforest)	6.412401e-06 1.496227e-06 3.633694e-07	0.2137 0.0716 0.0235

Impact categories	Global warming	Acidification	Strat Ozone depletion	Freshwater Eutrophication	Marine Eutrophication	Photochemical oxidation	Mineral resources	Fossil resources	Human Toxicity	Ionizing radiation	Freshwater Ecotoxicity	Terrestrial Ecotoxicity	Marine Ecotoxicity	Particulate matter	Land use	Land transformation	Soil organic matter	Water use
									247243 61810 15452									
Ecotax 2002 (max, min)	0.062312593	1.7803598	118.69065	2.8258266		763.2839382 76.3283938		0.01480	65629.48		1.251404e-02 6.123697e-03	17.04950718	1.318455e-06 5.993878e-02					
Ecovalue14 (max, central, min)	0.480907426 0.244747529 0.008587633	2.5762898		57.5371384	7.729	55.2259331 37.2775049 19.3290766		0.0206 0.0103 0.00034	188578.36 108365.07 771.28				1.030516	83.72				
Ligthart 2019		-															1.068733e-01	5.428 (damage)

Impact categories	Global warming	Acidification	Strat Ozone depletion	Fresh water Eutrophication	Marine Eutrophication	Photochemical oxidation	Mineral resources	Fossil resources	Human Toxicity	Ionizing radiation	Freshwater Ecotoxicity	Terrestrial Ecotoxicity	Marine Ecotoxicity	Particulate matter	Land use	Land transformation	Soil organic matter	Water use
																	(abatement) 3.056578e-02 (damage)	33.91 16.58 (both abatement)
EVR	0.119441934	9.0096286	0	4.2937316		9.3082334	8.169192	Various 0.0179 (max) 0.0062 (min)	82452.42		3.527596e-05			36.038	6.17 (max-heterogeneous agriculture) 0 (min, e.g. natural forest)	7.72 (max in countries with high biodiversity) 0.1544 (min in countries with low biodiversity)		Various 1.029 (max) -1.029 (min)

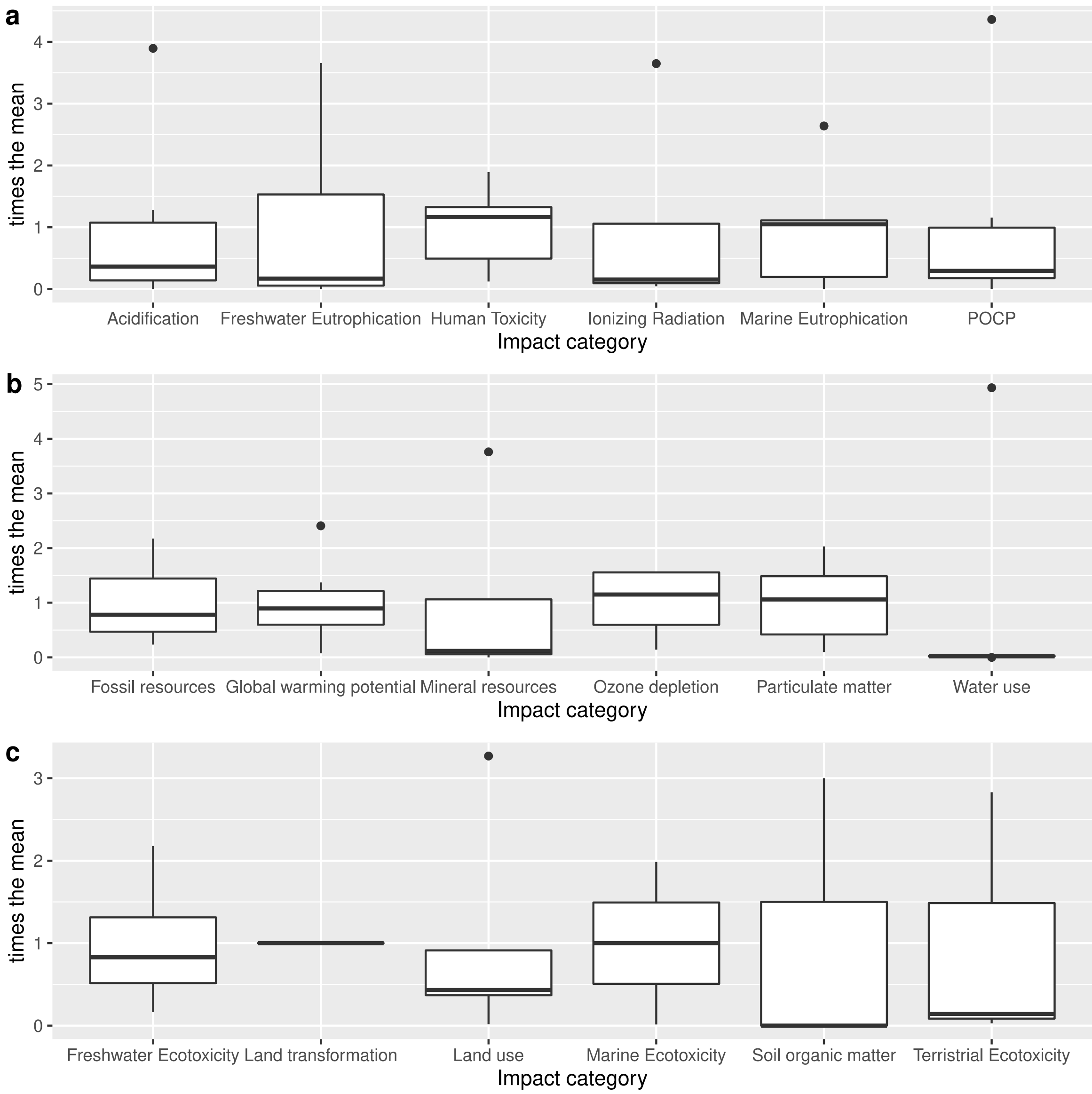

Figure S1. Distribution of monetary values per impact category without Ecotax and EVR

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