SUSTAINABILITY IN BUSINESS

72nd LCA Discussion Forum

Comparison of different Ecofactor sets: The 'ecological scarcity' Ecofactors for Switzerland and for the EU

1. The Question, and Why Now?
2. Basic Methodologics
3. Comparing EF Set calculations
4. How to compare EF Sets
5. Conclusions & Outlook

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1 The Question, and Why Now?

We know the «Swiss Ecofactors». Good to have, even if «just Swiss».

What if there are other ecofactor sets?

Ecofactor sets for the EU area published:
.. Ahbe et al., for DE (2014, VW)**, and for EU** (2018, VW)
.. Muhl et al., for EU (3 versions; 2019, IJLCA)

- **How to assess?**
  ('Quality'? Data?)
- **How to use?**
  (Select? Combine? Mix? …)

Study 6/19 for BAFU: "Beurteilung der EU-weiten Ökofaktoren nach der Methode der ökologischen Knappheit (MöK) aus Schweizer Sicht"

2 Basic Methodologics

- **Ahbe et al. & Muhl et al. used the same approach as Swiss BAFU**
- **Ahbe & Muhl refer to ISO 1404x, arguing for neutral single score; Muhl also EU-PEF**
- **Ahbe contacted authorities; Muhl didn't. But no explicit support by authorities.**

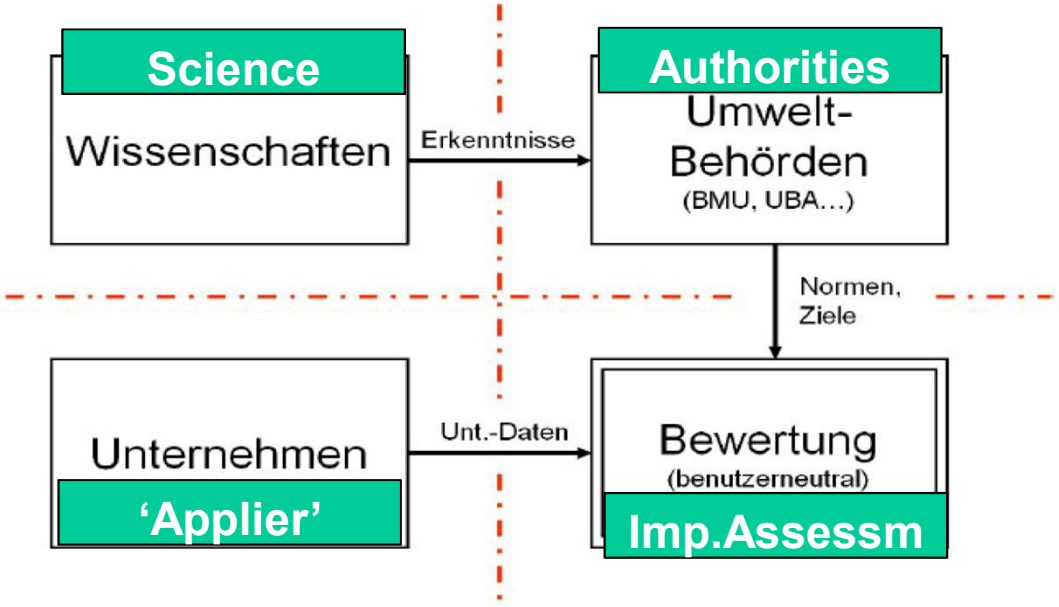


Abb. 1: Die "Gewaltentrennung" bei der Gewichtung in Ökobilanzen gemäss Ahbe (Ahbe et al. 2014, S. 18, und analog Ahbe et al. 2018, S. 16)

3 Comparing ecofactor set calculations

e.g. CO2 : Ahbe and Muhl use same target definition (“-80% by 2050 compared to 1990”), but different statistical base years

ecofactors vary slightly (0,0033 vs 0,00359 EU-UBP’18/g)

e.g. Cd to air:
.. BAFU- CH: Scarcity via concentrations vs. limits
.. Ahbe - EU: Cd to air not considered
.. Muhl - EU: Scarcity F=Fk; reference to water protection ordainance (?); statistical data seem to differ from EEA database (62 vs 71 t p.a.)

3 Comparing ecofactor set calculations (ff)

e.g. N to water:
.. CH & Ahbe: (see below)
.. Muhl - EU: not considered

Datenpunkte	**bei BAFU 2013** (S. 114-118)		**bei Ahbe et al. 2018** (S. 40/41)		**bei Muhl et al.** (3.1., 3.3)
	Stickstoff (N)	Phosphor (P)	Stickstoff (N)	Phosphor (P)	N und P
Fn	36,20 kt	1,85 kt	6387 kt	327,4 kt	-
Emission pro Person+Jahr	4,5 kg	0,23 kg	12,5 kg	0,64 kg	-
F	28,66 kt	- (*)	6387 kt	327,4 kt	-
Fk	19,88 kt	- (*)	5831 kt	130,1 kt	-
F/Fk	2.08 (1/69,4 %)^2	1.65	1.20 (1/91,3 %)^2	6,34 (1/39,7%)^2	-

Tab. 3: Vergleich der Daten für die EU-Ökofaktoren für N und P in Wasser
(= Anmerkung: Das Verhältnis von F zu Fk für Phosphor in Gewässer (Schweiz) wird aus den P-Konzentrationen der Schweizer Seen errechnet, ohne Jahresfrachten zu bestimmen; vgl. Text.)*

3 Comparing ecofactor set calculations (ff)

e.g. Heavy Metals to water: Selection differs between studies

Die Einwirkung ↓ hat einen Ökofaktor in →:	BAFU (CH)	Ahbe et al. 2014 (DE)	Ahbe et al. 2018 (EU)	Muhl et al. (EU-I)
Arsen	x			
Chrom	x			
Blei	x	x	x	x
Nickel	x	x	x	x
Cadmium	x	x	x	x
Kupfer	x	x	x	
Zink	x	x	x	
Quecksilber	x			x

.. Values of F and Fk in Ahbe et al. / Muhl et al. vary substantially:

Stoff	**BAFU (2013; CH; S. 123)**	**Ahbe et al. (2018; EU; S. 44/45)**	**Muhl et al. (2019b; EU-I; S. 18)**
Blei	Fn / F: 27,4 t/a Fk: - Knappheit (F/Fk): 33%	F (Fn): 2469 t/a Fk: 617,1 t/a Knappheit (F/Fk): 25%	F (Fn): 267,5 t/a Fk: 267,5 t/a Knappheit (F/Fk): 100%
Cadmium	Fn / F: 0,66 t/a Fk: - Knappheit (F/Fk): 41%	F (Fn): 79,55 t/a Fk: 19,91 t/a Knappheit (F/Fk): 25%	F (Fn): 35,35 t/a Fk: 35,35 t/a Knappheit (F/Fk): 100%

4 How to Compare Ecofactor Sets

- **Support by relevant Authorities**
- **Selection of Flows**
- **Quality of Data Sources**
- **Data Quality (Correctness)**

4 How to Compare Ecofactor Sets: The three EF sets

- Selection of Flows: Calculated Ecofactors

In der Publikation ..... (→) werden beurteilt (↓):	CH' 13	EU'14 (Ahbe)	EU-I-'14 (Mu) *)	CH'97	CH'90
Anzahl Emissionen in Luft	14	6	10	15	6
Anzahl Emissionen in Wasser	21	9	9	18	6
Anzahl Emissionen in Boden	5	0	0		0
Anzahl Ressourcen & Abfälle	9	5	5	5	3
Anzahl Emissionen Lärm	3	0	0	0	0
Anzahl Ökofaktoren	**52**	**20**	**24**	**38**	**15**

with characterization:

Bereich	BAFU 2013	Muhl et al.[38]
Anzahl Emissionen in Luft	153	110
Anzahl Emissionen in Wasser	226	9
Anzahl Emissionen in Boden	388	0
Anzahl Ressourcen & Abfälle	436	42
Anzahl Emissionen Lärm	6	0
Anzahl Ökofaktoren	**1209**	**161**

4 How to Compare Ecofactor Sets: The EF values

	CH'13 (BAFU)	DE'13 (Ahbe)	EU'14(Ahbe)	EU-I (Muhl)
CO2e to air (kg)	460	15.0	3.59	3.30
SO2 to air (g)	21.0	4.24	0.49	1.17
PM to air (g)	140	17.79	0.98	2.06
Cancerogenic subst. to air (CTUh)	2.70E+12	-	-	1.70E+10
Pb to air (g)	22'000	-	-	519
N to water (g)	57.0	2.13	0.19	-
P to water (g)	890	285.20	19.34	-
Cd to water (g)	250'000	1'730'000	200'700	28'300
PAK to water (g)	14'000	985'000	160'000	33'100
Cd to soil (g)	270'000	-	-	-
Energy, non-renew. (GJe)	3'400	506	22	30
C to landfill (kg)	5'500	-	-	-
Waste non-hazardous (kg)	-	7.30	1.12	1.12

EFs can’t be combined across EF sets!

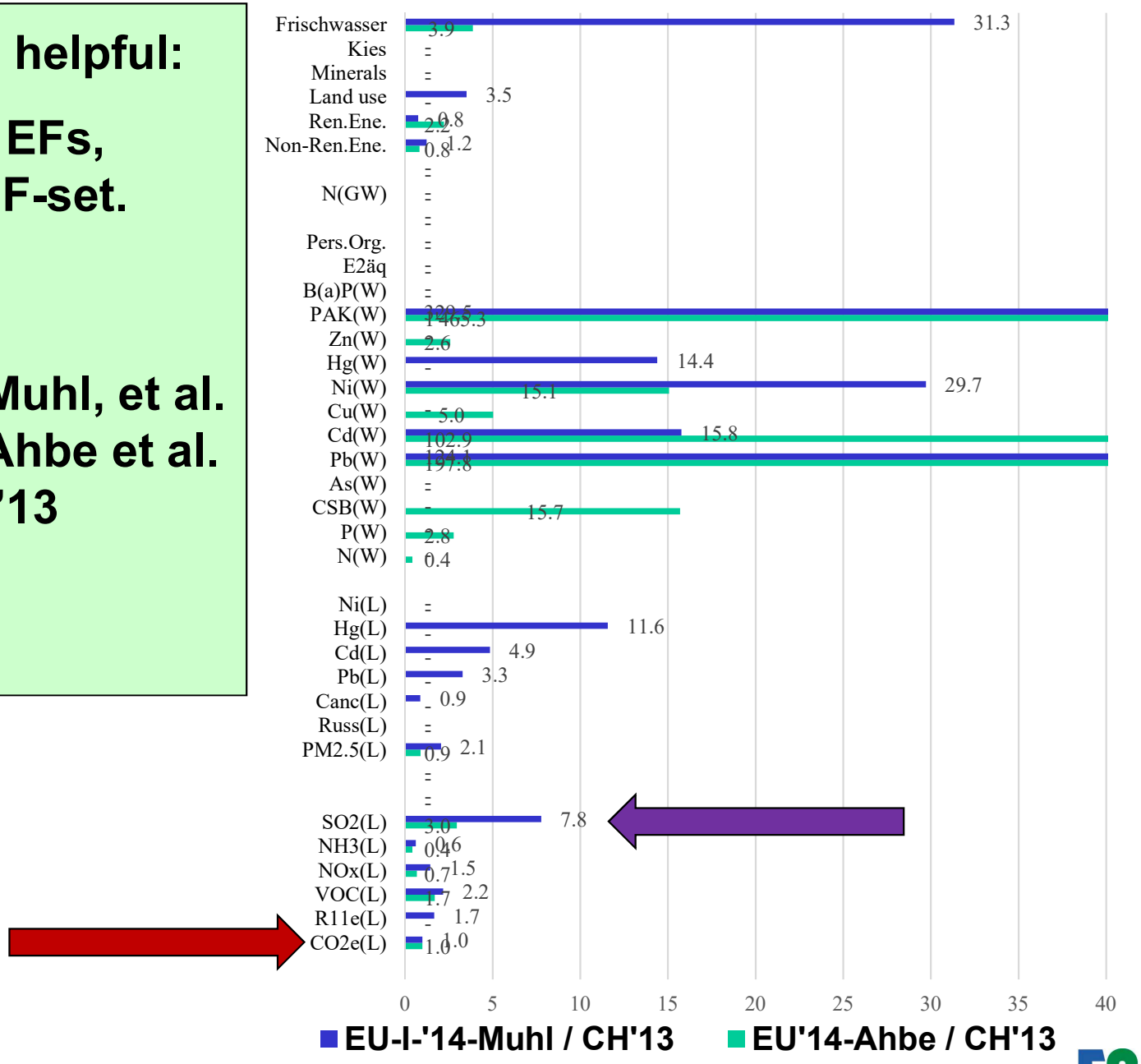
4 How to Compare Ecofactor Sets: Relative EF values

Relative comparison is helpful:

e.g. relative weights of EFs, EF(CO2e) = 1 in each EF-set.

Ex. SO2eq to air (Luft):
7,8 x more relevant in Muhl, et al.
3,0 x more relevant in Ahbe et al.
, compared to CH-UBP'13

(next to other relative comparisons)



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5 Conclusions & Outlook

- New EU Ecofactor Sets show
  (a) interest in method (industry; PEF; academia), and
  (b) do-ability
- Eco-scarcity Ecofactors need authorities' explicite support/authorship (academia & industry are important, but can't replace)
- It is possible to discuss plausibility and quality of ecofactor's base values.
- EF sets shall not be mixed in an application (e.g. mixing ecofactors from various sets).
- Other joint uses, e.g. filling gaps, haven't been studied yet. Before drawing conclusions, we need authorized EF sets from more countries/areas.

Thanks to BAFU, and thank you

Annex (not shown in presentation)

Annex – ad 2 Methodology (not shown in presentation)

Factors influencing the Ecofactors:

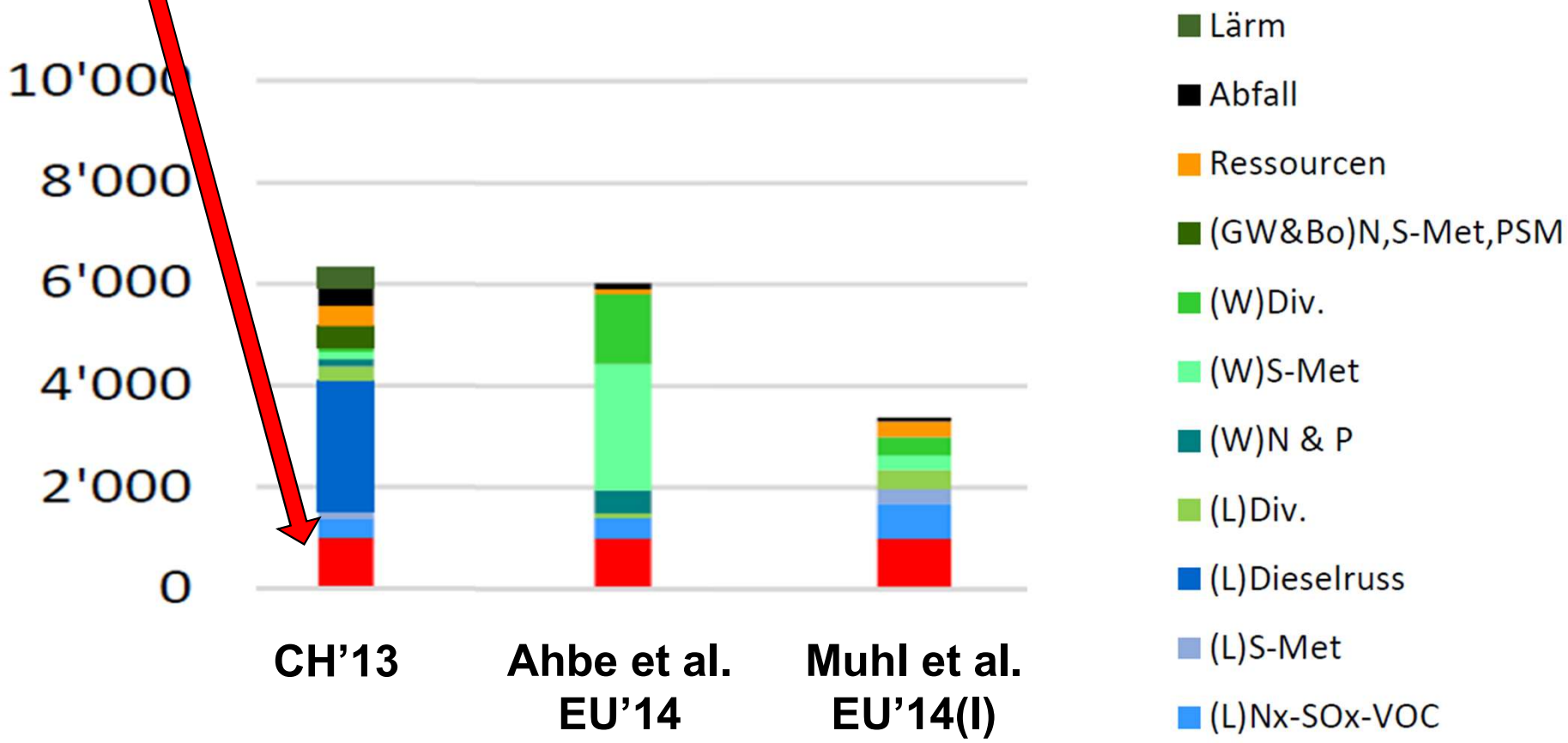
- **Reference area (e.g. EU/US/..; country; region) ***
- **Selection of ecofactors ***
- **Ecological frame: Precautionary Principle vs. Scientific Principle ***
- **Grouping of impacts ***
- **Time horizon for critical flows ***
- **Other**

- *** : need for said 'separation of powers'**

Annex – ad 4 Compare …: The area's total Ecobalance

Relevance of each flow: Σ (F(n) * EF)

Again with CO2e as relative measure (here = 1000)



EF Sets show very different environmental situations!