Lost in translation?
Insights from the GLAD elementary flow mapping project
2022-05-16

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v1.1

Contributors and acknowledgements

- Databases, organisations, and people involved:
  - **IDEA Japan/TCO2 Ltd**: Koichi Shobatake, Selim Karkour
  - **LCDN/EC-JRC**: Simone Fazio, Antonio Valente + team
  - **Federal LCA Commons/U.S. EPA**: Wes Ingwersen, Ashley Edelen, and Troy Hottle *(until Dec 2020)*
  - **ecoinvent Association** (project coordination): Carl Vadenbo, Thomas Sonderegger, Gregor Wernet *(during project initiation)*

In addition to in-kind contributions by all database providers involved, ecoinvent and TCO2 Ltd received financial support from:

European Commission

Life Cycle Initiative

Project commissioned by:

UN environment programme

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The *Global LCA Data Access (GLAD)* network

www.globallcadataaccess.org

- Hosted by the UNEP under the Life Cycle Initiative

- A **directory of LCA datasets from independent data providers** (nodes) worldwide

  - Including datasets available for free and subjected to commercial licenses
  - Available to data providers and users free of charge

- Aim to advance use of LCA through better **accessibility** and **interoperability** of LCA data

> *BUT several different nomenclature systems exist in parallel in LCA databases and software tools…*

Recording from GLAD launch in June 2020: https://youtu.be/EorH7aO-Isc
How to use GLAD: https://youtu.be/IY_RBV05hAg
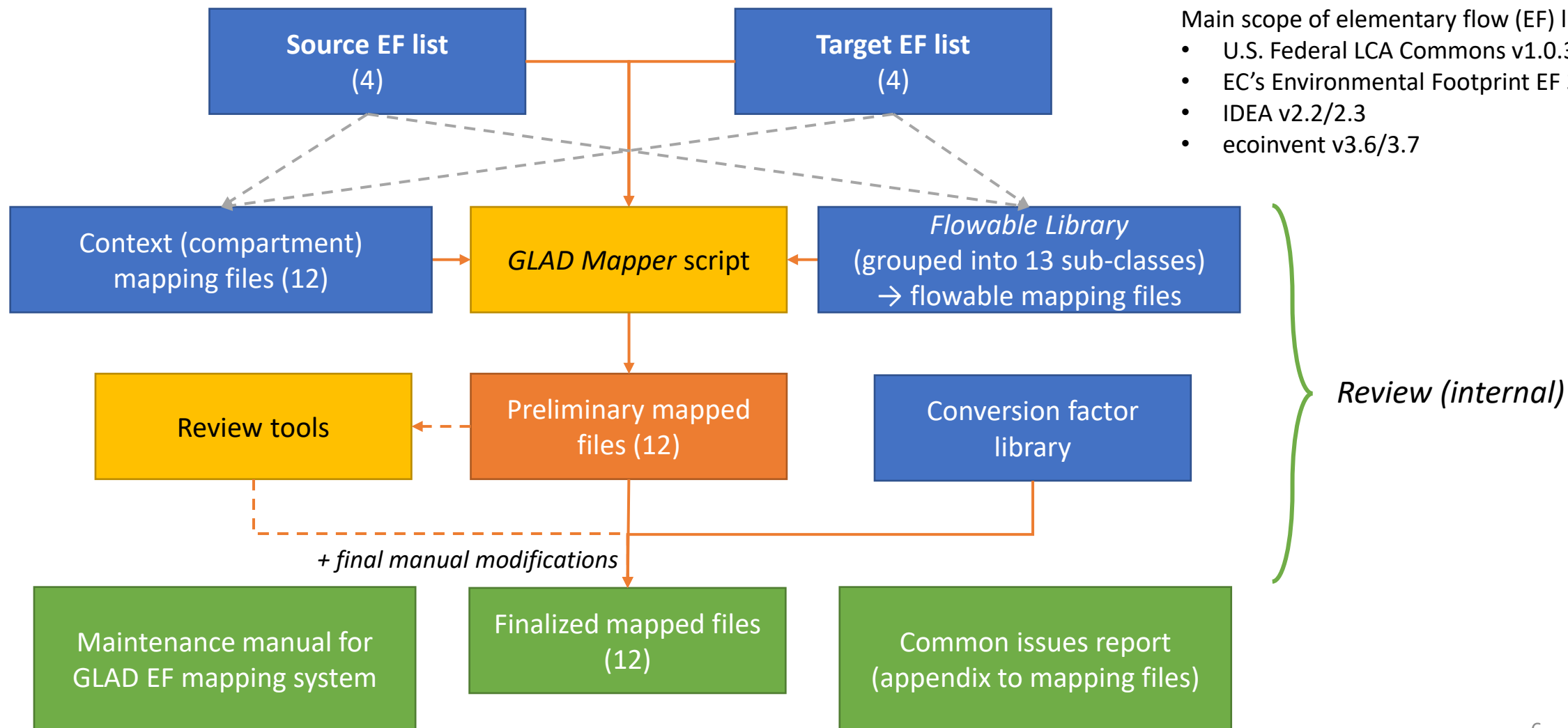
Goal and scope of GLAD EF mapping project

- A dedicated project under the GLAD Nomenclature Working Group
  - Duration: October 2020 – September 2021
- Aim: a **common system for mapping nomenclature** lists for **elementary flows (EFs)** among GLAD nodes
- Goals
  - To create mapped EF files between the nomenclature/EF lists of four major LCA database sources (GLAD nodes)
  - Documentation of common issues, and proposed or implemented solutions
- Limitations – *what was not included in the scope:*
  - Establishing a 'central' or 'universal' GLAD EF list
  - Imposing any modifications to the native EF lists
    (or otherwise ensuring 100% of EFs mapped)
  - Ensuring LCIA result consistency - *a general ambition*

What is an elementary flow (EF) anyway..?

- An (environmentally-relevant) interaction between the technosphere and the natural environment
  - Materials, energy, space, …

- 'elementary flow' = 'flowable' + 'context' + 'flow unit'
  - **flowable**: flow name, *e.g. "sulfur dioxide"*
  - **context**: environmental compartment + sub-compartment(s), *e.g., "emission/air/urban close to ground"*
  - **flow unit** and its associated flow property *e.g., "kg" for mass*

EF list	Flowables	Contexts	Flows
ILCD-EF 3.0	7'741	36	93'993
FEDEFL v1.0.3	5'933	114	278'602
IDEA v2.3	612	20	903
ecoinvent v3.7	1'404	22	4'310

(count of list items)

Approach of the GLAD EF mapping project

Main scope of elementary flow (EF) lists:
- U.S. Federal LCA Commons v1.0.3
- EC's Environmental Footprint EF 3.0
- IDEA v2.2/2.3
- ecoinvent v3.6/3.7

Source EF list (4)

Target EF list (4)

Context (compartment) mapping files (12)

GLAD Mapper script

Flowable Library (grouped into 13 sub-classes) → flowable mapping files

Review tools

Preliminary mapped files (12)

Conversion factor library

Review (internal)

+ *final manual modifications*

Maintenance manual for GLAD EF mapping system

Finalized mapped files (12)
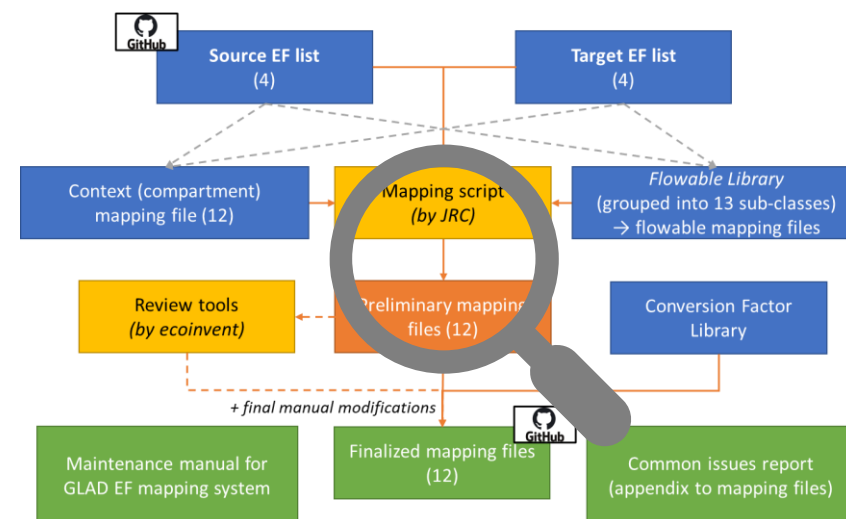
Common issues report (appendix to mapping files)

Approach of the GLAD EF mapping project
The *GLAD Mapper* tool

Outline of the mapping algorithm

1. Mapping (or not!) based on user-defined mapping inputs

2. Automated matching based on flow attributes
   i. By *CAS Registry Number,* for chemical substances
   ii. By flow name (flowable)
   iii. By flow name ↔ synonyms

3. Additional matching
   i. By secondary CAS number (sourced from PubChem)
   ii. Matching flowables of lower priority
       (more generic or acceptable proxies)

4. Drop unmatched items

5. Assign conversion factors (where available)

Approach of the GLAD EF mapping project
Context (compartment) mapping

Source-side context

Target-side context

IDEA/EF	ecoinvent/EF
Emissions/air/non-urban	air/non-urban air or from high stacks
Emissions/air/unspecified	air/unspecified
Emissions/air/urban high stacks	air/non-urban air or from high stacks
Emissions/air/urban air close to ground	air/urban air close to ground
Emissions/ground/unspecified	soil/unspecified
Emissions/water/sea water	water/ocean
Emissions/water/unspecified	water/unspecified
Resources/land use/land occupation	natural resource/land
Resources/land use/Land transformation	natural resource/land
Resources/air/Renewable element resources	natural resource/in air
Resources/air/Renewable energy resources	natural resource/in air
Resources/air/Renewable material resources	natural resource/in air

Both 'default' + acceptable 'proxy' options defined!

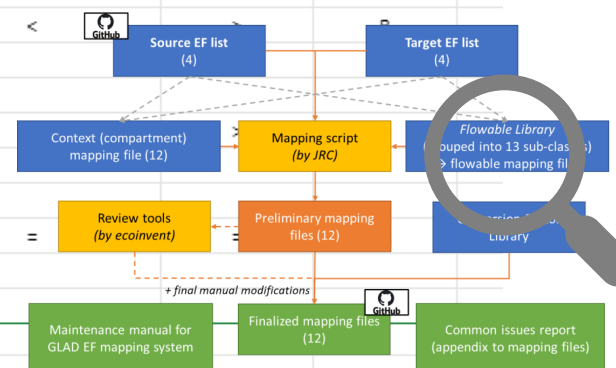# Approach of the GLAD EF mapping project
Flowable library

Indication of logical relationship
+ our (subjective) confidence in each match

GLAD_Flowable Library_online working version
ファイル 編集 表示 挿入 表示形式 データ ツール アドオン ヘルプ　最終編集: 数秒前

Source flowable　　**Target flowable**　　**Match condition/confidence level**

	SourceList	SourceFlowD	Sour	SourceFlowName	So	TargetList	TargetFl	Ta	TargetFlowName	Ta	Co	Match Condition Source	Match Conditio Target	ourceConfLev	Sour
2	EFv3.0	emission	air	particles (> PM10)	kg	ecoinventEFv3.6	emission	air	particulates, > 10 um	kg		=	=	A	
3	EFv3.0	emission	ground	particles (> PM10)	kg	ecoinventEFv3.6			N/A						
4	EFv3.0	emission	water	particles (> PM10)	kg	ecoinventEFv3.6			N/A						
5	EFv3.0	emission	air	Particles (PM0.2 - PM2.5)	kg	ecoinventEFv3.6	emission	air	particulates, < 2.5 um	kg		<	>	B	
6	EFv3.0	emission	ground	Particles (PM0.2 - PM2.5)	kg	ecoinventEFv3.6			N/A						
12	EFv3.0	emission	water	Particles (PM0.2 - PM2.5)	kg	ecoinventEFv3.6			N/A						
13	EFv3.0	emission	air	Particles (PM0.2)	kg	ecoinventEFv3.6	emission	air	particulates, < 2.5 um	kg		<	>	B	
14	EFv3.0	emission	ground	Particles (PM0.2)	kg	ecoinventEFv3.6			N/A						
15	EFv3.0	emission	water	Particles (PM0.2)	kg	ecoinventEFv3.6			N/A						
16	EFv3.0	emission	air	particles (PM10)	kg	ecoinventEFv3.6	emission	air	particulates, > 2.5 um,	kg		<			
28	EFv3.0	emission	ground	particles (PM10)	kg	ecoinventEFv3.6			N/A						
29	EFv3.0	emission	water	particles (PM10)	kg	ecoinventEFv3.6			N/A						
30	EFv3.0	emission	air	particles (PM2.5 - PM10)	kg	ecoinventEFv3.6	emission	air	particulates, > 2.5 um,	kg					
31	EFv3.0	emission	ground	particles (PM2.5 - PM10)	kg	ecoinventEFv3.6			N/A						
32	EFv3.0	emission	water	particles (PM2.5 - PM10)	kg	ecoinventEFv3.6			N/A						
33	EFv3.0	emission	air	particles (PM2.5)	kg	ecoinventEFv3.6	emission	air	particulates, < 2.5 um	kg		=			
46	EFv3.0	emission	ground	particles (PM2.5)	kg	ecoinventEFv3.6			N/A						
47	EFv3.0	emission	water	particles (PM2.5)	kg	ecoinventEFv3.6			N/A						

Source EF list (4)　Target EF list (4)
Context (compartment) mapping file (12)　Mapping script (by JRC)　Flowable Library (grouped into 13 sub-classes → flowable mapping file)
Review tools (by ecoinvent)　Preliminary mapping files (12)
+ final manual modifications
Maintenance manual for GLAD EF mapping system　Finalized mapping files (12)　Common issues report (appendix to mapping files)

Mapping outputs
Coverage of elementary flow map files

Final mapping coverage (7th iteration)					
Target / Source	ILCD-EF 3.0	ecoinvent EF v3.7	FEDEFL v1.0.3	IDEA v2.3	(IDEA v2.2)
ILCD-EF 3.0	X	23.5%	62.3%	17.3%	15.1%
ecoinvent EF v3.7	98.6%	X	94.5%	41.2%	31.3%
FEDEFL v1.0.3	89.4%	28.8%	X	20.7%	16.5%
IDEA v2.3	95.0%	68.0%	90.3%	X	X
(IDEA v2.2)	92.9%	89.8%	84.9%	X	X

Breakdown of total number of matches (over the four lists)
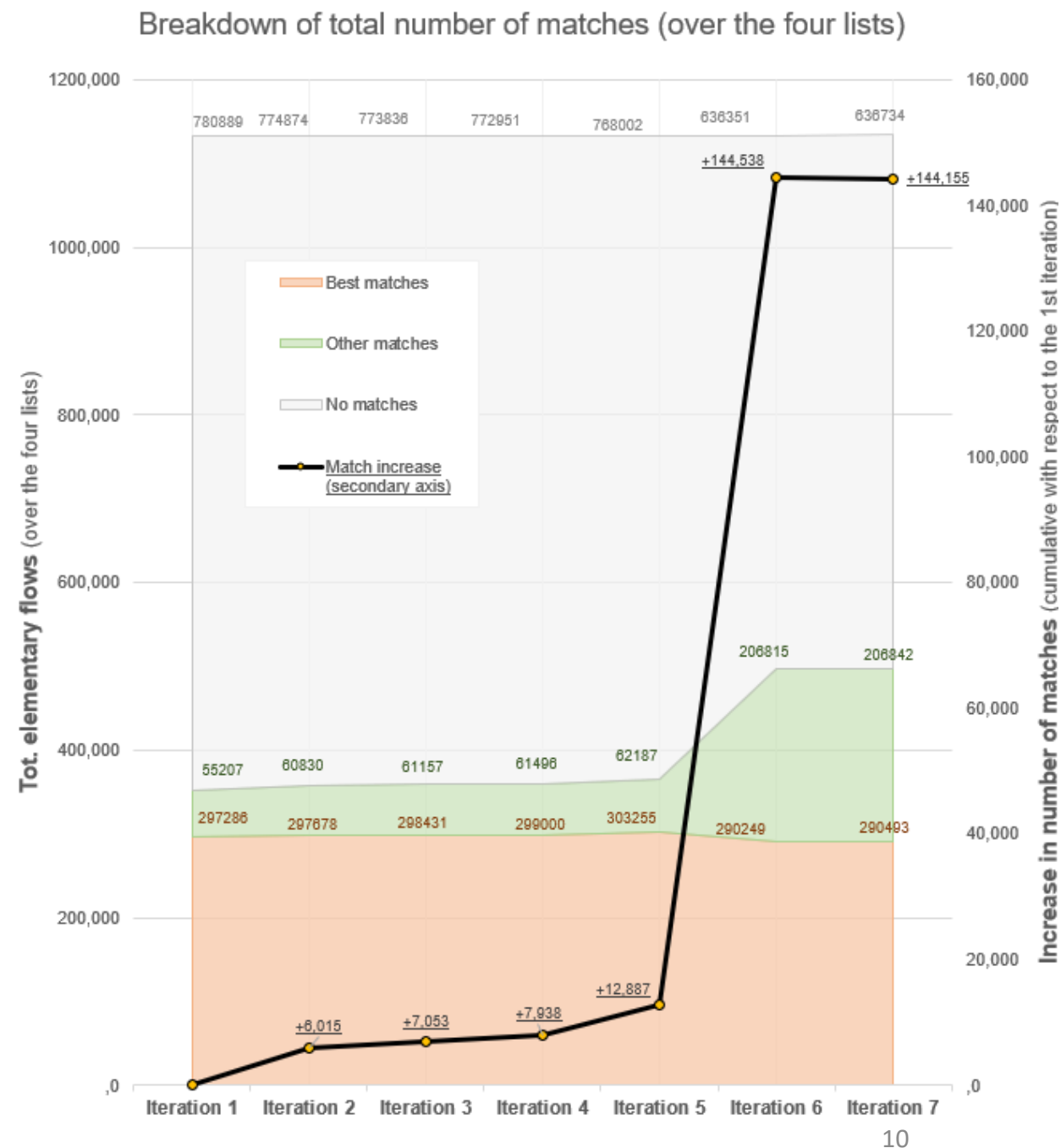
Discussion

- A learning process: unique opportunity explore similarities and differences between elementary flow lists

- A key limitation: focus on flow-level equivalence, largely disregarding:
  - Inventory modelling approaches
  - LCIA method implementations

  Highly important to ensure score consistency

- The trade-offs
  - Precision vs. coverage of mapped files
  - Mapping consistency across EF list combinations
  - Manual mapping+review vs. auto-generated matches and proxies
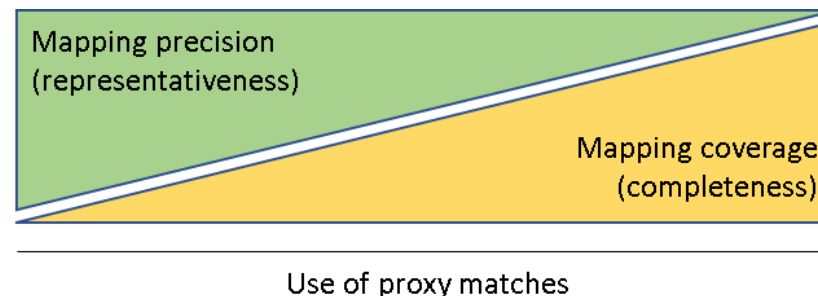
Outlook and ongoing work

- Test mapping outputs in data exchange format conversions
  - *GLAD Converter*
  - *Lavoisier Converter* (developed by UTFPR/IBICT for the *SICV* database in Brazil)
- Dissemination of project deliverables on UNEP's GitHub repository
  - Mapping scripts and mapped files   https://github.com/UNEP-Economy-Division
  - Guidance and documentation
- Release of *GLAD Mapper* tool by the EC-JRC *(freely available)*
- Underpin GLAD-GLAM* dialogue
- Scientific publication of GLAD EF mapping approach
  (in preparation)

: Global Guidance on Environmental Life Cycle Impact Assessment Indicators (GLAM)

Thank you for your attention!

www.globallcadataaccess.org