Biodiversity footprint of hydropower : introducing aquatic pressures into the Product Biodiversity Footprint (PBF)

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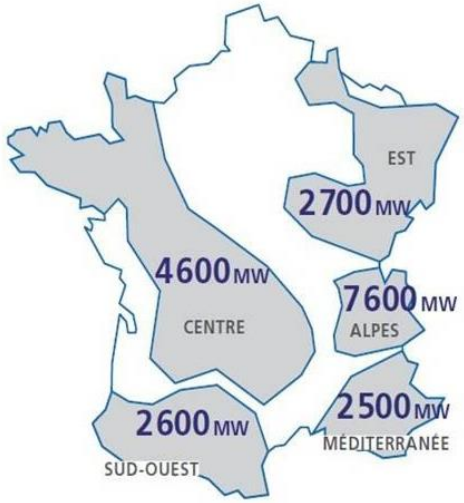
[3] EIFER
[4] I-CARE

SUSHP 2023

CONTEXT & OBJECTIVES

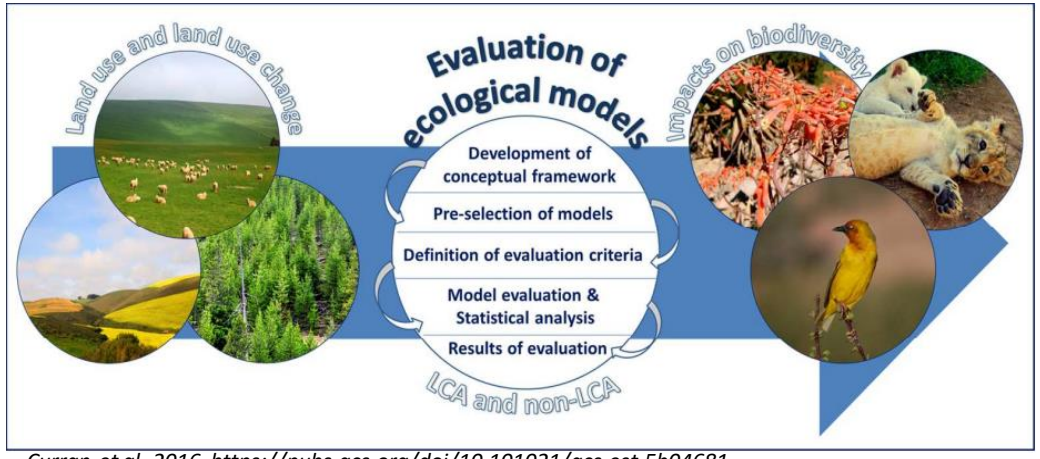
- **EDF hydro** : 20 GW ; 450 HPP ; many small units, some big ones; many different environmental contexts
- **Hydro** : Renewable energy, low carbon footprint, but :
  - Life-cycle HP GHG emissions quite variable depending on many factors
  - LCA approach for biodiversity needs to be improved
  - **No available biodiversity footprint method as reference nor standardization**



French EDF Hydro capacity

➢ From assessment to action :

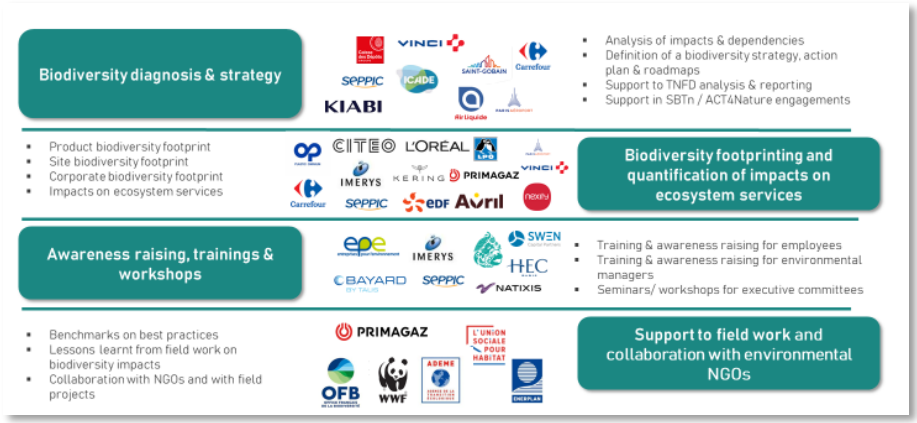
- Introducing **eco-conception approach** in new projects, refurbishment or maintenance of HPP
- Exploring the value of a **Life-cycle biodiversity footprint** indicator, beyond environmental LCA



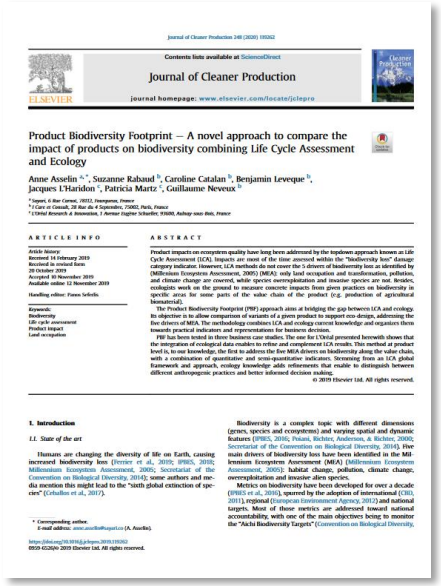
Curran et al, 2016, https://pubs.acs.org/doi/10.101021/acs.est.5b04681

CONTEXT & OBJECTIVES

- **I Care** : Consulting agency specialised in environmental topics, esp. biodiversity impact assessment and methodology development
  - 10+ biodiversity impact assessment through PBF methodology for corporates
  - Involved in the development of assessment methodologies at site, building, product, commodity and corporate level



- **PBF (/SBF)** : Product (/Site) Biodiversity Footprint
  - Based on LCA, solid scientific basis
  - www.productbiodiversityfootprint.com (Asselin et al, 2020)
  - Mainly terrestrial biodiversity


Journal of Cleaner Production

Product Biodiversity Footprint – A novel approach to compare the impact of products on biodiversity combining Life Cycle Assessment and Ecology

Anne Asselin, Suzanne Rabaud, Caroline Catalan, Benjamin Leveque, Jacques L'Haridon, Patricia Martz, Guillaume Neveux

ARTICLE INFO

ABSTRACT

1. Introduction

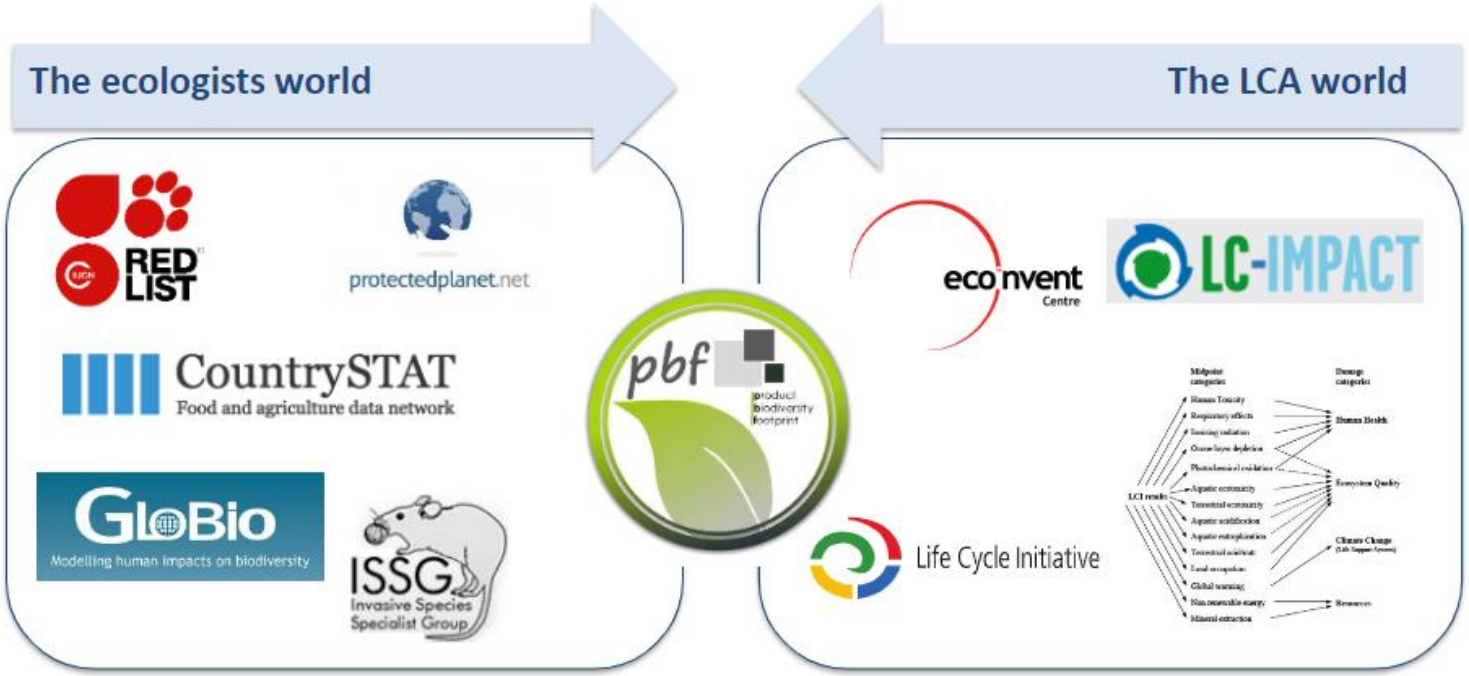
1.1. State of the art

➢ Introducing aquatic biodiversity into the PBF

- Via Adaptation to Hydropower specificities
- And test on a dam modification case *(work in progress)*

CHALLENGES

- Speak the language of ecologists and LCA specialists
- Make connections

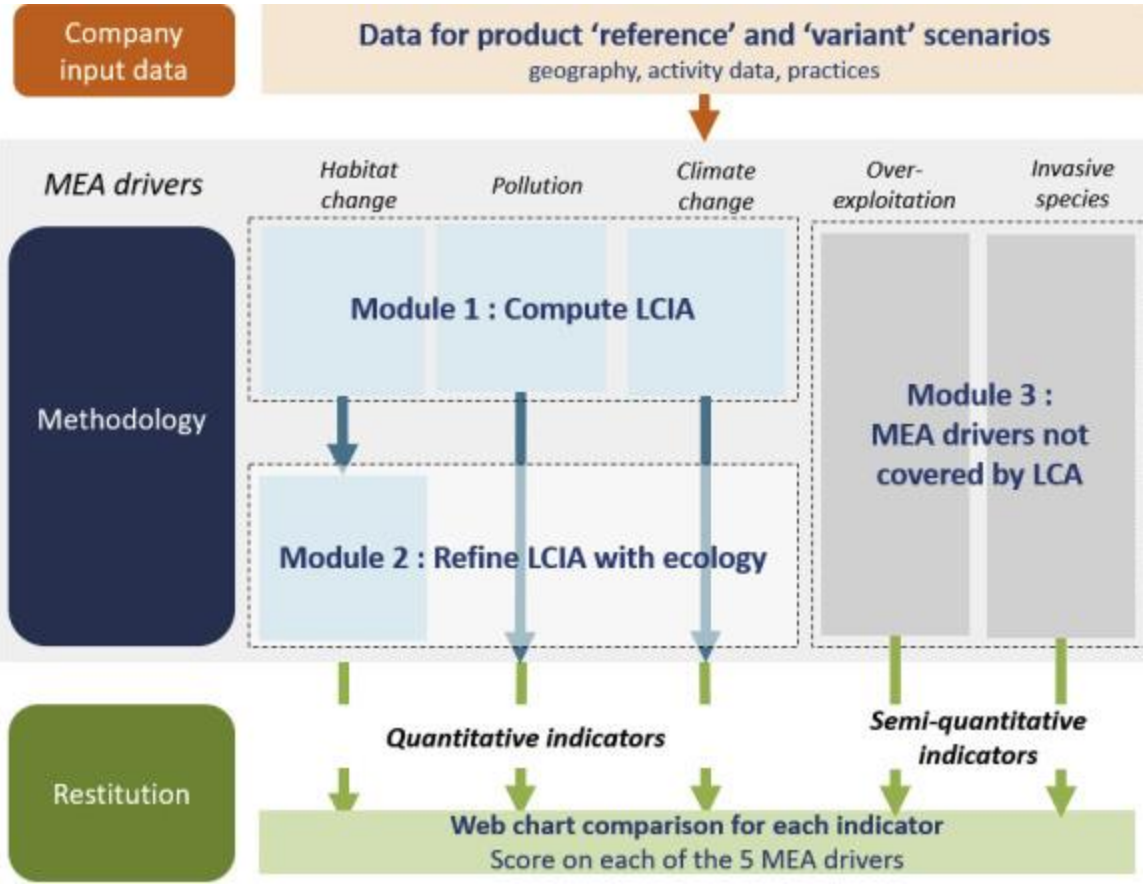


- Integrate the wide variability of hydropower impacts and environmental types

HOW DOES PBF WORK ?

- Considers **5 main drivers on biodiversity identified by IPBES and MEA**
- Based on **LCA databases/EF whenever possible**, and standard qualitative analysis grid if not
- Captures geographical specificities:
  - Through LCA when chararacterisation factors are available at local scales
  - Through ecological literature review to complement LCA characterisation factors to take into account projects' or sites' specificities
- **Compares** a variant product *vs* a reference on whole life cycle and value chain

➢ Is expressed in pdf.yr (**Potentially Disappeared Fraction of species, over a year**) and **Qualitative indicators**



www.productbiodiversityfootprint.com (Asselin et al, 2020)

HOW DOES PBF WORK ?

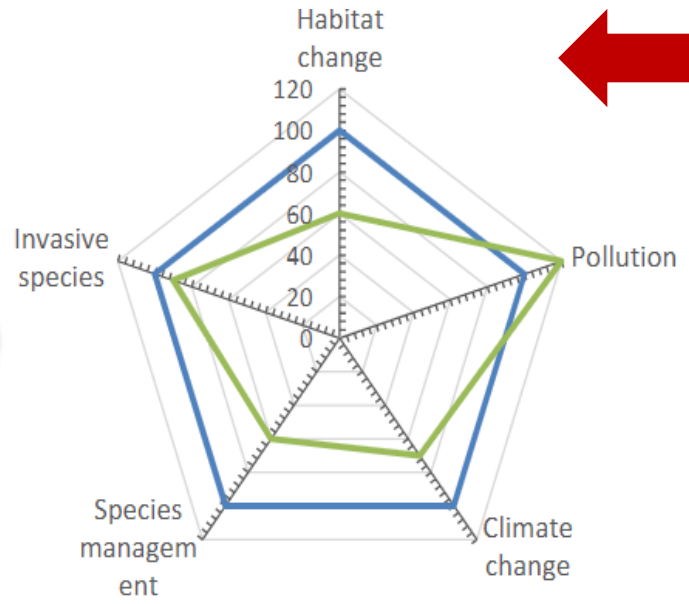
Freshwater sp. not included

std qualitative analysis grid

Non-LCA

LC-Impact

- Habitat Change
  - *Land use*
  - *Land transformation*
  - *Water stress*
- Pollution
  - *Acidification*
  - *Eutrophication*
  - *Photochemical oxydation*
  - *Freshwater ecotoxicity*
- Climate change
- Invasive species
- Species management



(100% is the value of the indicator for the reference product)

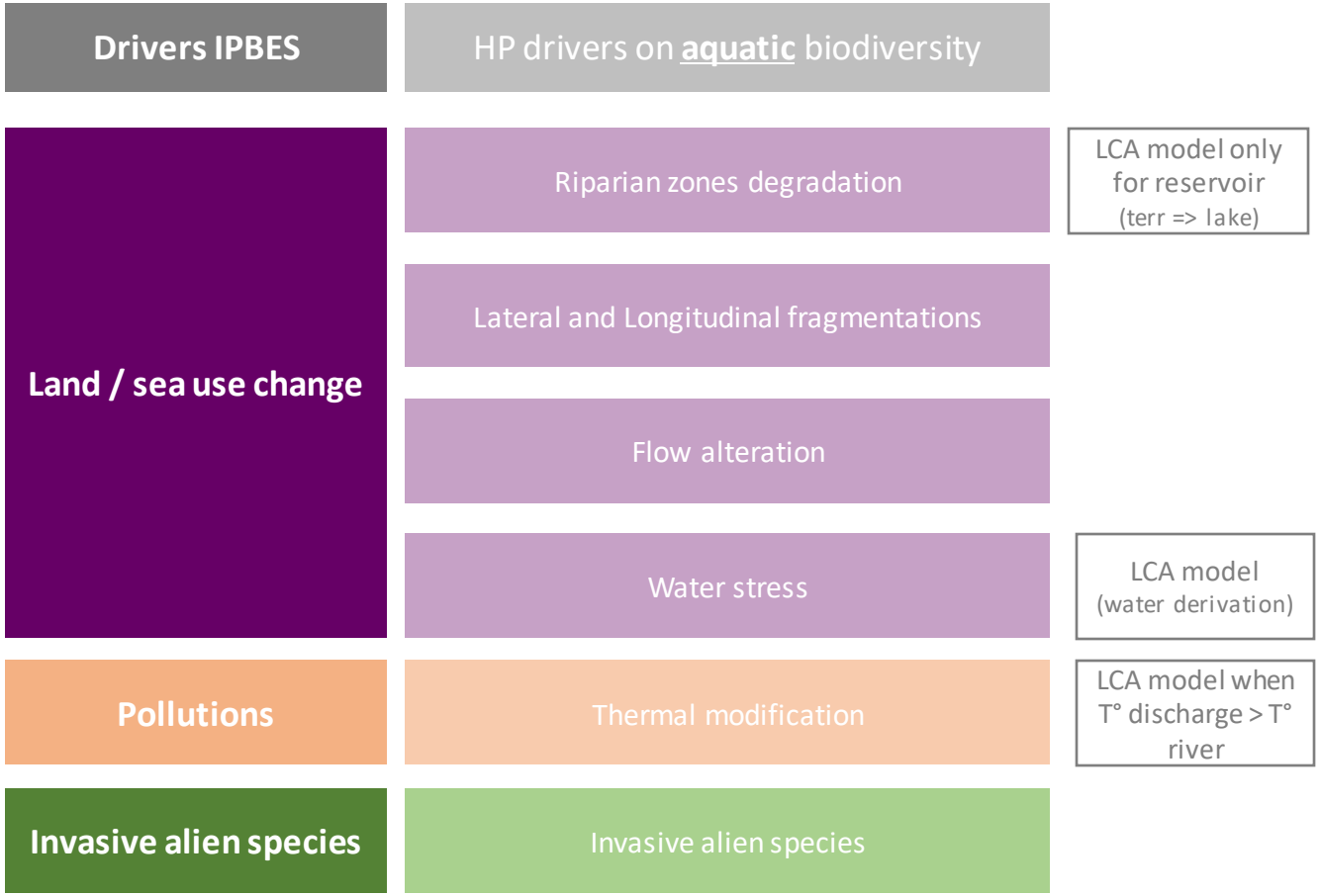
Freshwater habitats and freshwater species not included

INTRODUCING FRESHWATER BIODIVERSITY AND HYDROPOWER PRESSURES

- **Literature review** to identify :
  - Anthropic pressures on aquatic biodiversity
  - HP pressures on whole biodiversity (terrestrial and aquatic)
  - Available LCA quantification, useful for HP

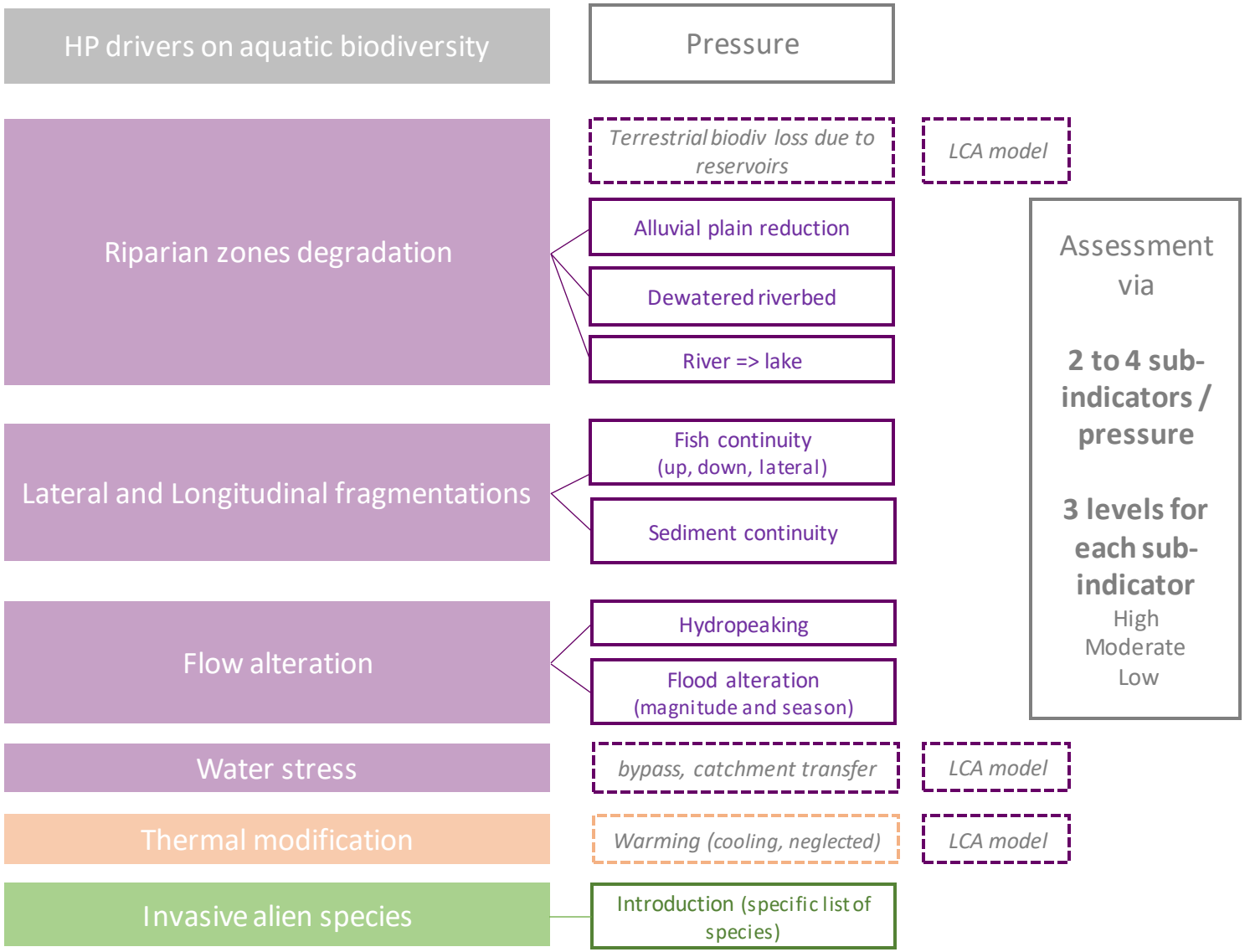
    ➢ 6 main HP pressure on aquatic biodiversity linked to 3 IPBES drivers

    ➢ 3 HP pressure quantifiable via LCA models



INTRODUCING FRESHWATER BIODIVERSITY AND HYDROPOWER PRESSURES

- LCA and HPP experts collaboration to determine
  - A standard analysis grid for the remaining pressures (parameters, indicators)
  - Thresholds (semi-quantitative assessment) – based on literature review and ecologist expertise (for temperate European rivers, at this stage)
  - Combinations of sub-indicators to note the global driver and
  - Local correcting factors for good practices



EXAMPLE FOR FLOW ALTERATION

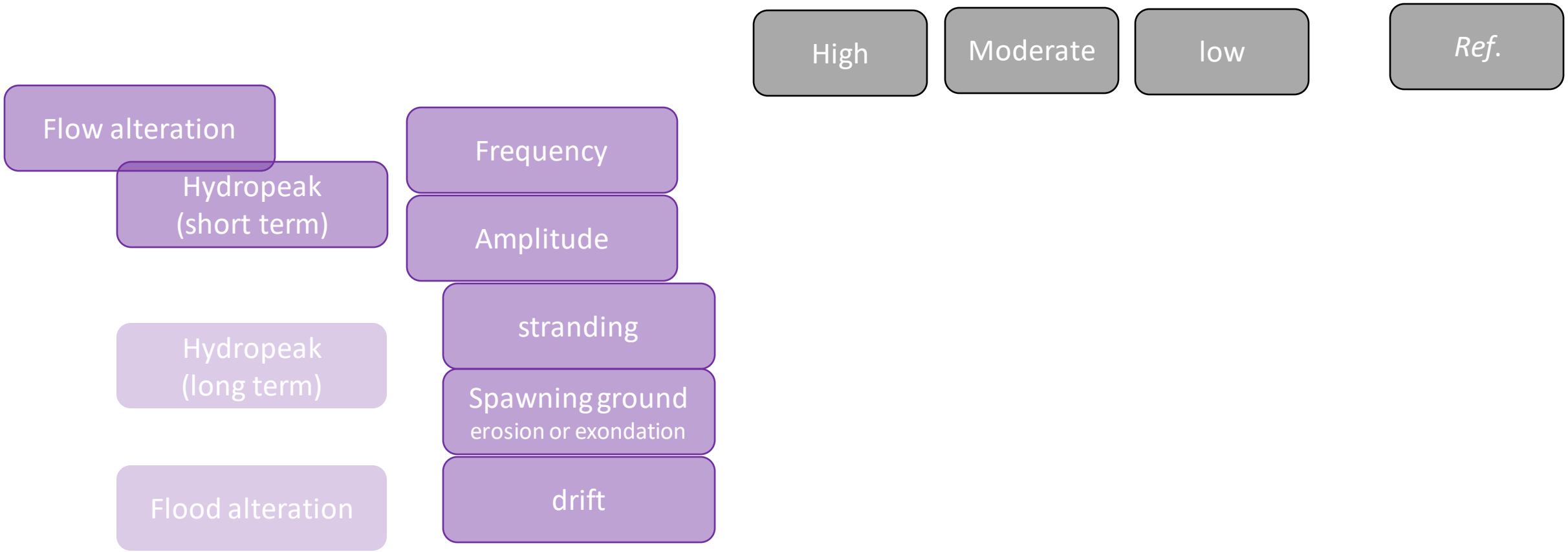
Flow alteration

Hydropeak
(short term)

Hydropeak
(long term)

Flood alteration

EXAMPLE FOR FLOW ALTERATION



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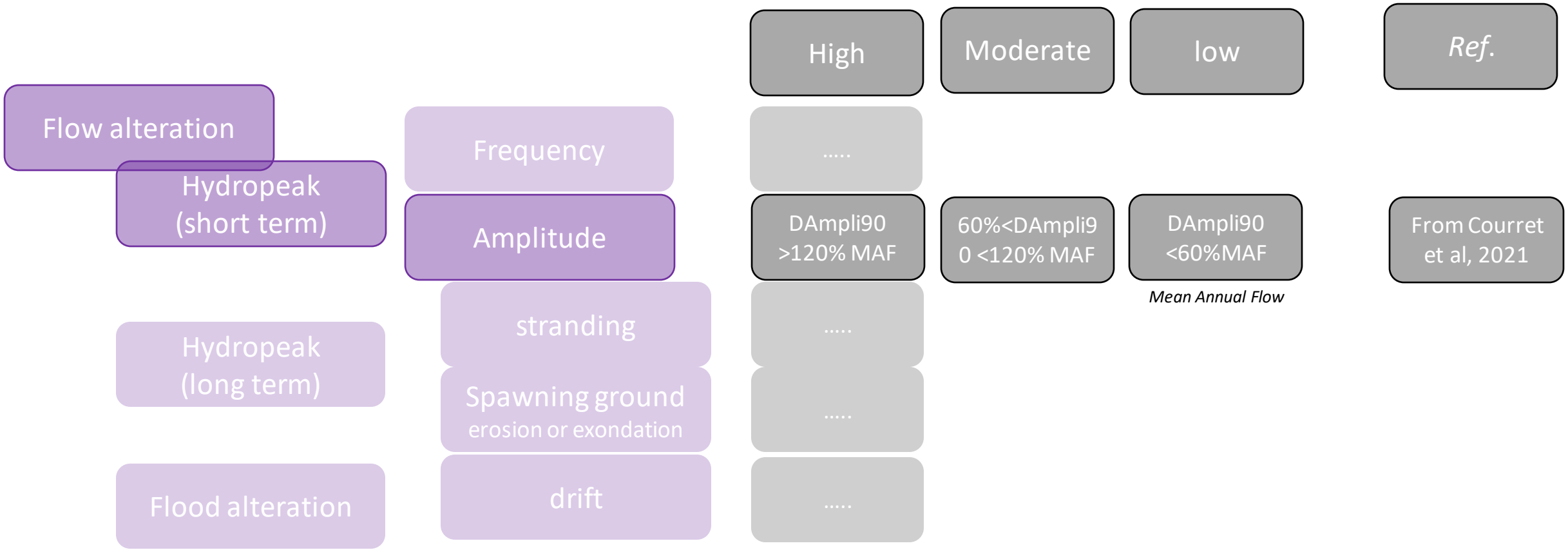

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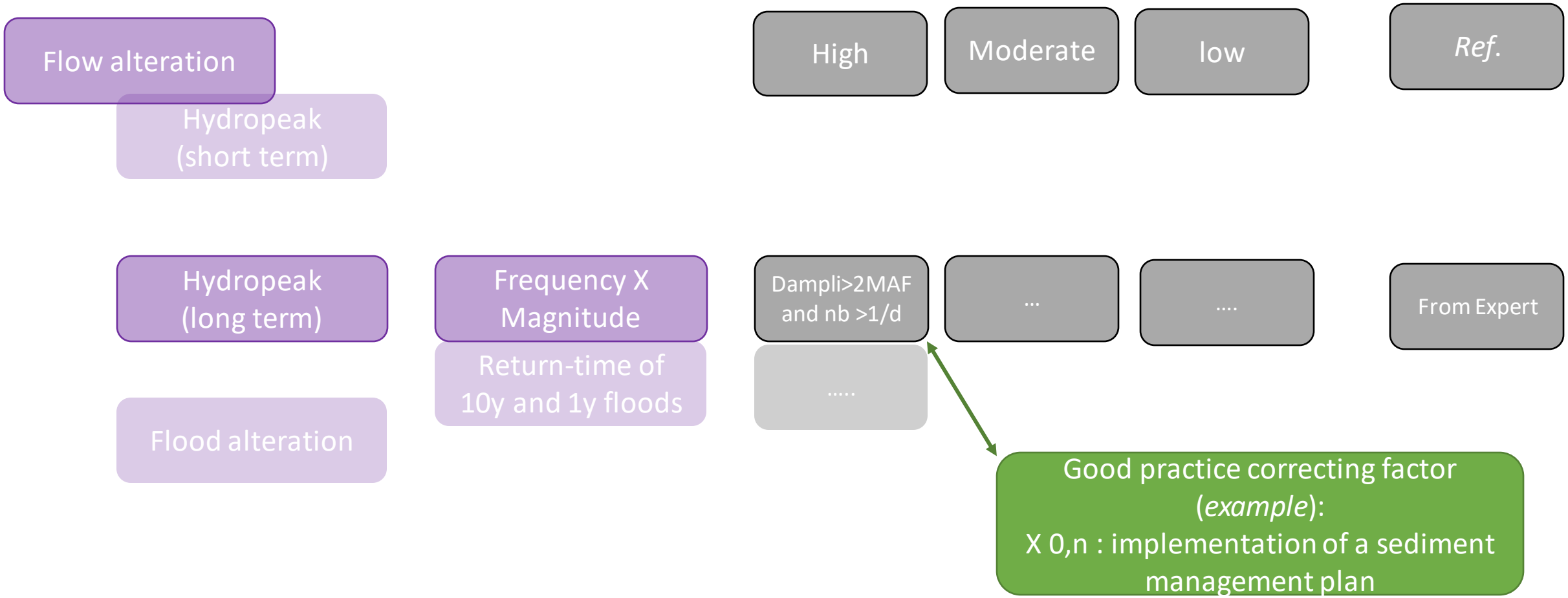
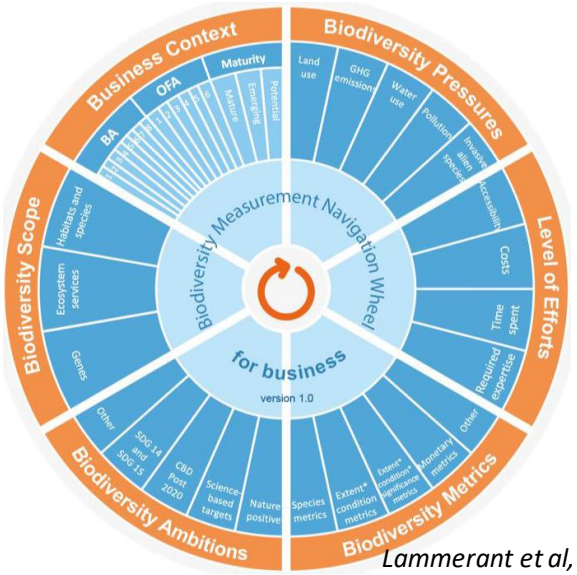
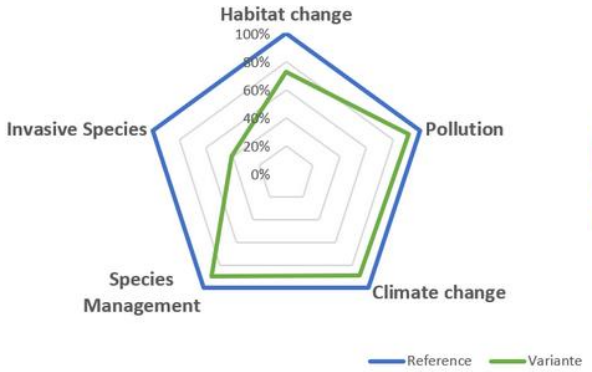


CONCLUSION - PERSPECTIVES

- Many biodiversity footprint methods in development for companies (organizations)
- PBF, based on LCA (robust and standardized approach) and on local ecosystem processes (innovative approach)
- Allows for eco-conception of projects or works or energies (comparison of solutions on the whole life-cycle)
- First integration of aquatic biodiversity combined with LCA (still under development, with prospects for improvement)



Lammerant et al, 2018



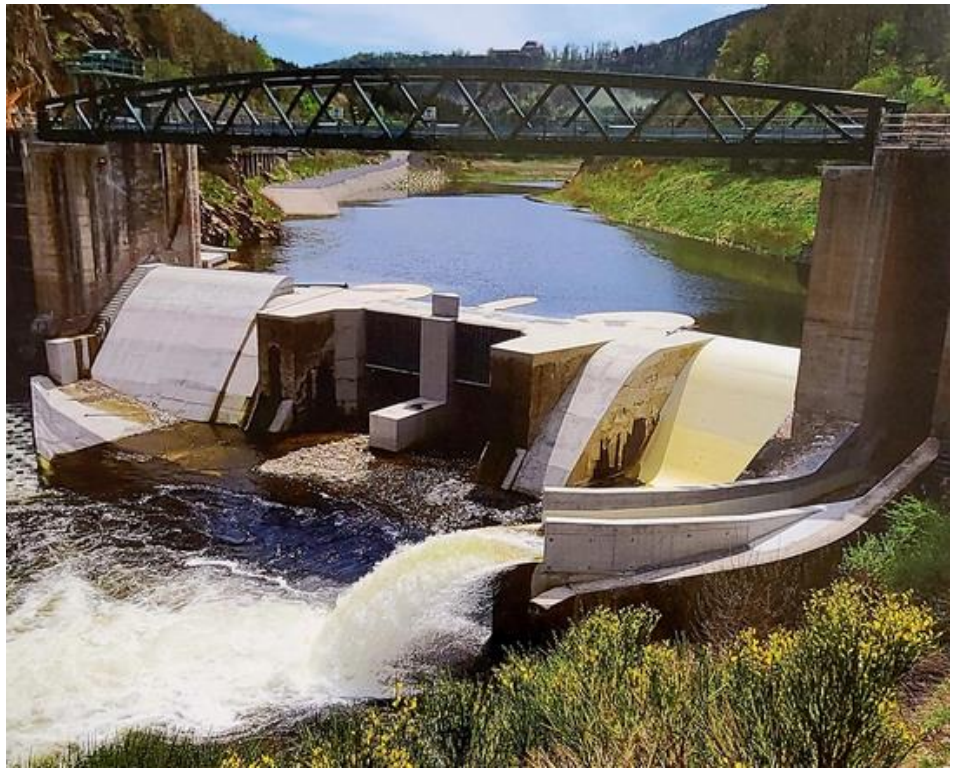
LCA

CONCLUSION - PERSPECTIVES

- On-going test, adaptation and improvement of PBF_{HP} using Poutes dam case data

Dam and reservoir : 17.7 m; **39 ha; 1.7 millions m³**

- Sub-optimal fish continuity (salmon)
- Sub-optimal sediment continuity
- Residual flow and hydropeaking all year
- 33.2 GWh



Dam and reservoir : 8 m; **1 ha; 0.025 millions m³**

- fish continuity (salmon) ok – fish pass and dam transparency 3 month/y
- Sediment continuity ok
- Increased flow and run-off-river
- 23.6 GWh

Thank you