

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

Agnès Barillier¹, Magdalena Czyrnek-Deletre², Véronique Gouraud³, Till M. Bachmann⁴ & Vincent Morisset⁵

¹EDF-CIH, La Motte-Servolex, France

²I-Care by Bearing Point, Paris, France

³EDF R&D LNHE - Laboratoire National d'Hydraulique et Environnement, Chatou, France

⁴ElfER, Karlsruhe, Germany

⁵EDF-R&D-TREE, EDF Lab Renardières, Ecuelles, France

Email corresponding author: agnes.barillier@edf.fr

ABSTRACT: Hydropower is a renewable energy whose interest lies in its flexibility and its low carbon footprint compared to other energy sources. However, hydropower generates impacts on biodiversity. These impacts are generally assessed through a "Pressure - State - Response" model, which allows for quantifying local impacts on biodiversity and related mitigation measures, focused on the direct and indirect impacts of the works and the operation of the facilities.

In order to go further and reduce its impact on the entire value chain, EDF is developing an eco-design process based on the principles of Life Cycle Assessment (LCA) approach. The objectives are to reduce the environmental footprint of its facilities by re-examining the organization of worksites or the electricity production as well as the techniques and processes used to manufacture materials (concrete, for example) and equipment. The main indicators considered are climate, natural resources and land use change.

However, this approach does not consider aquatic biodiversity and therefore remains insufficient to assess the biodiversity footprint of hydropower. One of the methods under development is the Product Biodiversity Footprint (PBF), proposed by I-Care and Consult and Sayari, and its related Site Biodiversity Footprint (SBF). PBF and SBF are able to consider local impacts on biodiversity using a LCA-based approach. However, so far, PBF and SBF only focussed on terrestrial biodiversity.

To include biodiversity impacts in its eco-design approach, EDF decided to collaborate with I-Care to adapt the PBF (Product Biodiversity Footprint) to hydropower specifications.

First, the specific pressures of hydropower dams and plants on aquatic and terrestrial biodiversity were identified and assigned to the 5 major pressures of the IPBES (land use change, direct exploitation, climate change, pollution, invasive alien species). Based on a literature review, methods compatible with LCA were identified that allow quantifying pressures currently missing in the PBF, i.e. down- vs upstream temperature change, water stress and degradation of riparian zones. Finally, a semi-quantitative approach is under development and tested to characterize the

remaining pressures for which no LCA models exist yet, i.e. fragmentation, flow alteration, invasive aquatic alien species, and riparian area dewatering.

The communication will present the different steps in the development of the method as well as the data required for its use. The benefits and limits of the approach, as well as the implementation challenges will be discussed.