

A preliminary assessment on the effects of small hydropower schemes on the aquatic and riparian vegetation.

Some Portuguese case studies

M. Manuela Portela¹, M. Mendonça², Francisca C. Aguiar^{3,4}



INTRODUCTION & OBJECTIVES

Small hydropower schemes (SHPs) are often defined as having installed capacities up to 10 MW. Due to their small size and exploitation mode they are usually recognized as environmental-friendly renewable energy production technologies. However, they modify the river flow regime, especially along the river reaches between the water intakes and the powerhouse tailraces. Based on **twelve SHPs** located in Portugal, the study aimed at characterizing the alterations in the river flow regime due to those types of schemes and their effects on the aquatic and riparian vegetation.

CASE STUDIES

- Cabrum River:** Ovadas (1993), Freigil (1998) and Aregos (1958) SHPs
- Corgo and Sordo Rivers:** Terragido (1992) and Sordo (1995) SHPs
- Ouro River:** Cefra SHP (1995)
- Ave River:** Guilhofrei (1939), Ponte da Esperança (1942) and Andorinhas (1945) SHPs
- Mestre River:** Labruja SHP (1992)
- Coura River:** France SHP (1974)

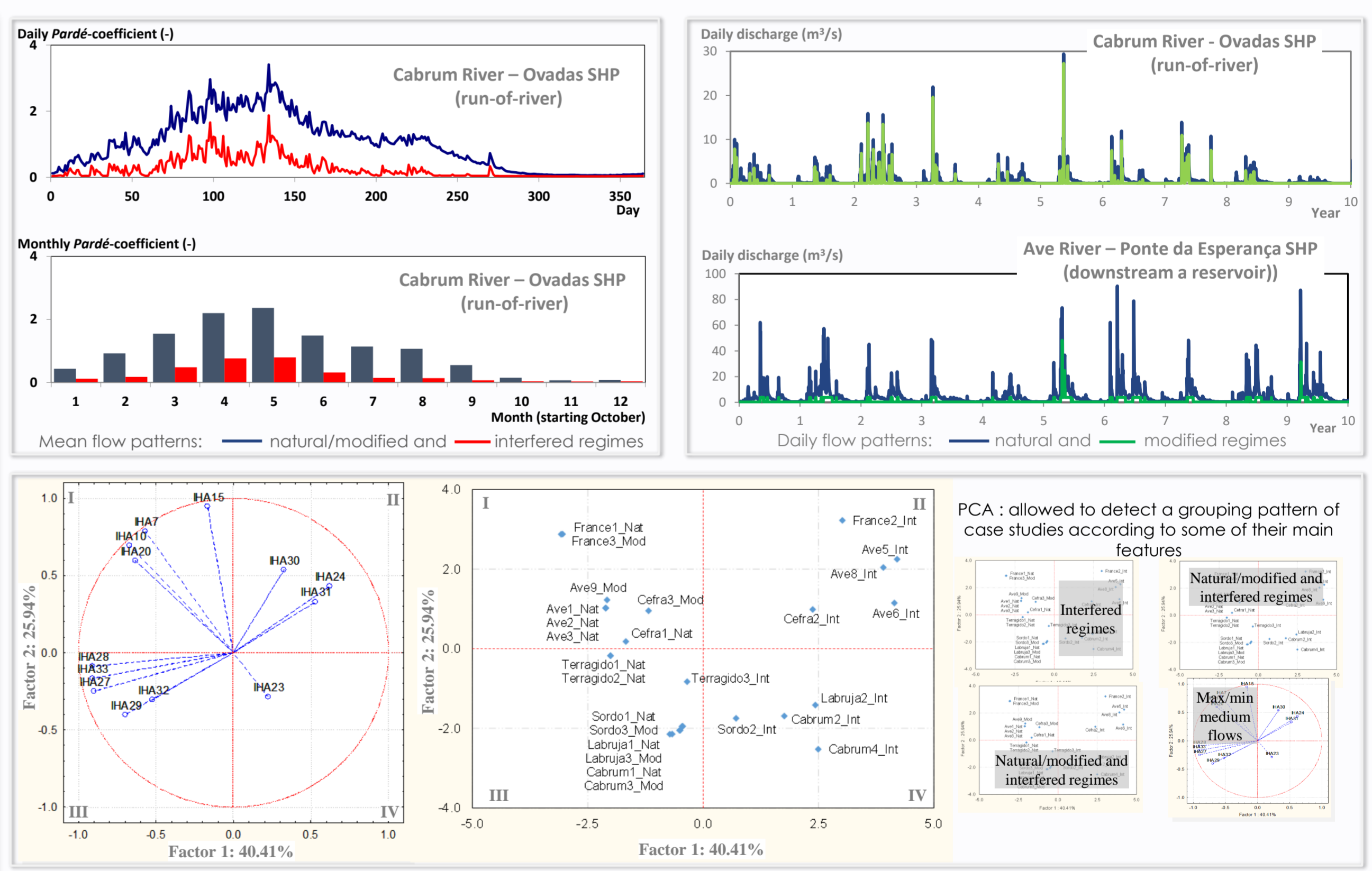
METHODS

For each SHP a comparison was done between the flow regime prior and after its construction, by means of **indicators of hydrologic (IHA)** applied to daily flows. Three river reaches were considered: the one upstream the **water intake** with **natural** flow regime; the **interfered** reach located between the **water intake** and the **powerhouse** which assumable will denote the most significant alteration; and the **modified** regime downstream **powerhouse** and which is most sensitive to the storage capacity of the **reservoir**. The natural flows were obtained by hydrological modelling and the interfered and modified by simulating the daily exploitation of the SHP. Information about the **riparian** and the **aquatic vegetation** was collected and summarized in the form of **metrics**. To identify relationships among the IHA and the **river regimes** a **Principal Components Analysis (PCA)** and **hierarchical clustering** were done.

Plant traits were assigned to each species and **functional, compositional and structural metrics**; metrics with expected responses to flow alterations were obtained and compared between monitoring locations and analyzed according to those responses.

RESULTS

In terms of flow pattern, there is **significant alteration** between the **natural** (upstream the water intake) and the **interfered** regimes (from the water intake to the powerhouse). A significant alteration also occurs between **natural** and the **modified** regimes if there is a **reservoir** (either in the scheme or upstream). Otherwise **little or no change** occurs between these two. A **small decrease** in the ecological quality of the **interfered and modified river stretches** was observed when compared to **natural conditions**. Most of the metrics based on plant traits displayed the expected responses to hydrologic alteration. However, given the small number of floristic surveys, the statistical significance of this variation is very small.



CONCLUSIONS

- River flow alterations due to SHP are **mostly relevant in the interfered** river reaches. A **decrease of the ecological quality** was observed in the **interfered and modified** river reaches, which might be indicative of the effects of hydrologic disturbance in the vegetation communities and in their lateral and longitudinal structure, making it deserving surveillance.
- The **magnitude of vegetation changes was small**, in comparison with the **magnitude of alterations in the flow regime**.
- Further **studies are required** in order to analysis the effects of the **sub daily flow variations** in the structure and composition of vegetation downstream of powerhouses.
- The methodology applied to the twelve case studies **can be replicated** for other SHPs, with the careful prior analysis of other environmental and habitat variables, so that the study of the disturbances due to river flow regime alterations is reliable.

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