Agricultural soil recovery using dredged fluvial sediments: Mont-Cenis hydropower plant experiment as a success to be replicated

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Introduction: Fluvial sediments are natural materials that are issued by the process of erosion.

Hydropower is today the first power renewables in the world, and also in France. The creation of a dam associated with hydropower is necessary for electricity generation. By trapping sediments in the reservoir, dams interrupt the continuity of sediment transport through rivers. Sedimentation thus affects the safety of dams and reduces energy production, storage, discharge capacity and flood protection capabilities. These sediments may also increase loads on it and its gates, damages equipment and creates a wide range of environmental impacts.
EDF is operating in France 433 hydropower plants totalling capacity of 20,000 MW with a CO2 electricity generation of around 50 TWh a year. These power plants were associated to 622 dams, including 150 more than 20 meters. The storage capacity of reservoirs created by these dams is 7.5 billion m³ of water, i.e. 75% of the surface water storage reserves in France.

EDF has to dredge sediments for several reasons: i/ Ensure sediment continuity (i.e. priority sediments stay in water); ii/ Ensure the safety of the operation/maintenance; iii/ Limit the loss of energy generated and/or loss of flexibility; and iv/ Maintain navigation. Sediment continuity is preferred as much as possible in France for EDF, according to our integrated sediment management. However sometimes sediments have to be dredged and remove from the water. These dredging sediments become waste by regulation (cf. Waste Framework Directive 2008/98/EC).

The soil is formed by the alteration of the underlying parent rock (pedogenesis): it is a non-renewable resource. In France the thickness of the soil is around one meter, for an average age of 10,000 years. Water erosion affects around 18% of the French territory. Landslides affect around 7,000 municipalities. 70% of French soils have a moderate to high susceptibility to landslides and runoff. Erosion, and to a lesser extent the mineralization of organic matter, lead to loss of carbon in soils. Soils have several roles and functions (memory of the past, landscape support, filtration and purification, support of vegetation, biodiversity reservoir, etc.).

Mont-Cenis hydropower plant (HPP) is an artificial lake created by a dam. It is located between France and Italy, in Les Alps. It was constructed between 1963 and 1968 (additional works date 1978-2015). The reservoir capacity, at a 2000m altitude, has a storage capacity of 320 hm^3.

Methods: This paper will present a methodology developed by EDF with several stakeholders, using dredged sediments of Mont-Cenis reservoir, to recover an agricultural land. First the context and main issues are presented. Then the method to address them, with the different stakeholders will be described (different preparations of the sediments, different seed species, a 5-year monitoring period, independent science analysis). Finally main results are exposed, highlighting the beneficial use of local sediment for soil restoration in the context of climate change mitigation and adaptation (rooting, flora development, water reserve, …). This experiment allows prospects to replicate this model elsewhere.

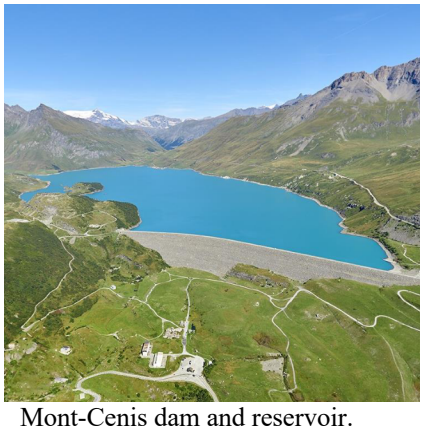

Fig. 1: Mont-Cenis dam and reservoir.

References: [1] CIS document. (2022) *Integrated sediment management - Guidelines and good practices in the context of the Water Framework Directive* ; [2] EDF (2022) *Retour d'expérience sur la renaturation pour un usage agricole du site de Mont-Cenis avec ses sédiments*.