

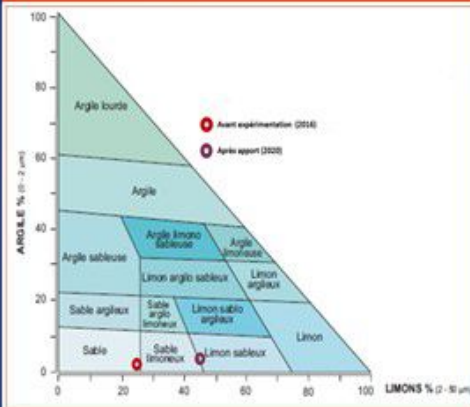
# Agricultural soil recovery using dredged fluvial sediments: Mont-Cenis hydropower plant experiment as a success to be replicated

*SEDNET Conference 2023 « Sediment continuum: applying an integrated management approach »*

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Emmanuel BRANCHE  
EDF Hydro / E&S



**Circular Economy -  
Sediment as a resource**



# Content



**1. EDF and sediment management in France**

**2. The Mont-Cenis experiment**

**3. Conclusions and perspectives**





# 1 - EDF and sediment management in France





# EDF Hydro and sediment management in France

## Key figures

- 10% (average annual power generation)
- 50 000 ha reservoirs
- 34 000 ha land property
- 433 hydropower generation units

## Sediment management issues

- *Ensure continuity*
- *Ensure safety to infrastructures*
- *Avoid generation losses*
- *Maintain navigation*
- *Manage flood (& droughts)*

## EDF hydro's missions

- *Renewable energy, CO2 free, flexible & storage*
- *Working with territories (manager of 75% of the surface water)*

## Sediment management

- *Priority continuity (i.e. leaving sediments in the watercourse) ...*
- *... otherwise land management (waste)*

## Main issues associated to dredged sediment

- *Waste status*
- *Regulatory changes (and more complex)*
- *Increased dredging and landing costs*
- *Difficulties to deliver industrial valorisation*

## Dredged sediments at EDF Hydro

- *~500 000 m<sup>3</sup>/year annually (main part gravels)*
  - *Main issues for fine (90% characterised as inert ; non-hazardous)*

# Sediment reuse: today's main ways experimented

## Mineral beneficial reuse

- Concrete
- Cement
- Clay (ceramic / raw earth)
- Road techniques

## Agricultural beneficial reuse

- Soil restructuring / soil construction
- Growing support / topsoil
- Amendment



## Hybrid beneficial reuse

- Filling quarries
- Backfilling civil works
- Covering waste disposal facility





## 2 – The Mont-Cenis experiment





# Context of the experiment

## ➤ What?

- Experiment with 400m<sup>3</sup> sediments (° + mix manure / compost)
- Agricultural amendment
- Area ~9500 m<sup>2</sup>

## ➤ Where?

- Mont-Cenis HPP
- French/Italian border
- ~2000 m (Beaufort area “French cheese”, AOP)

## ➤ Who?

- EDF
- Alpine pastures

## ➤ Why?

- Trying to recover sediments on site rather than disposal
- Setting up a pragmatic experimental project with local actors (taking into account a range of parameters and constraints) in a context of unclear regulation

## ➤ When?

2017-2022

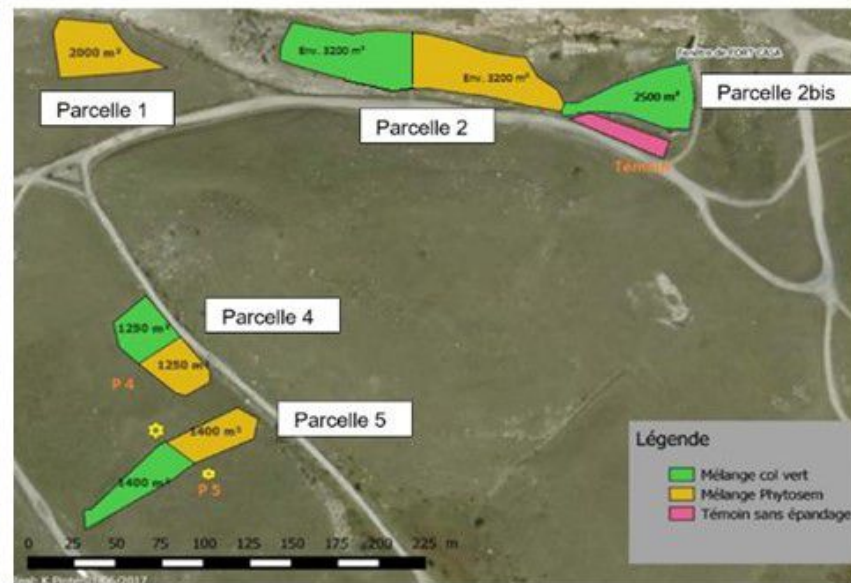


- Other key partners: CBNA + Chamber of Agriculture Savoie + French authority + AUREA

- Finding perennial & dense vegetation in degraded areas of the Mont-Cenis mountain pasture
- Increasing the yield of low pastoral value plots



# Implementation of the experiment



## Characterisation

- Sand-silt (particle size ~60% sand 35% silt and 5% clay).
- Low in organic matter
- Non-hazardous sediments



## Mix for good agronomic value

- Manure
- Compost



## 4 plots selected + sowing and monitoring

Mixture realization with a mechanical shovel

- 150m<sup>3</sup> manure
- 150m<sup>3</sup> compost
- 400m<sup>3</sup> sediments



# Implementation of the experiment



Spreading of the sediment/manure/compost mixture with 2 tractors, 1 loader and 1 manure spreader



Harrowing of the place, sowing of areas with ploughshare seeder



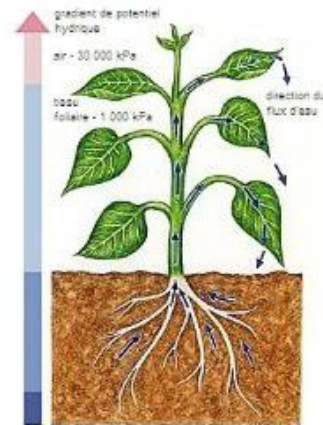
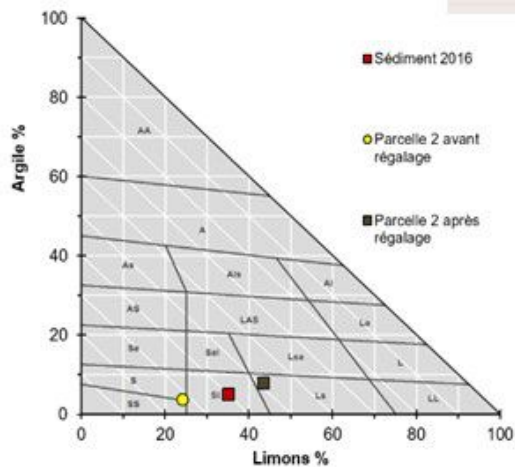
# Scientific monitoring



15 samples per plot 3 modalities 3 repetitions i.e. 400 samples (1400 analysis results)



- **Chemical fertility** (soil characterization, calcium state, organic matter, major elements, metallic elements, exchangeable metals, trace elements)
- **Physical fertility** (bulk density, porosity, water potential, aggregate stability)
- **Soil observations** (soil depth, presence of organic matter, root depth, presence of living organisms)
- **Biodiversity inventory** (different species: botanic/flora & fauna)







### 3 – Conclusions and perspectives





# **Beneficial use effects of this sediments' experiment**

- ❑ Improving the texture
  - ❑ Providing organic matter and nitrogen, e.g. from the compost
  - ❑ Contributing to P (phosphorous) and K (potassium) from the compost
  - ❑ Confirming absence of metallic trace and non-assimilable Ni (nickel has a natural presence in local soils)
  - ❑ Avoiding erosion (strong roots)
  - ❑ Improving the porosity
  - ❑ Increasing the usable water reserve (climate change issue)
- **Beneficial use was demonstrated (economical, social, environmental) : stakeholders' engagement and involvement is mandatory!**





# Perspectives

- ❑ A very positive experiment “demonstrator” for freshwater sediments to recover soil (from all stakeholders' perspectives) even if using wastewater treatment sludge approach (need to go beyond and increase thickness = the way forward)
- ❑ This experiment can be replicated in other places for other river sediments (... but adapted to local conditions: supply has to match the demand at proper place and time)
- ❑ Operators (hydropower/ canal) are awaiting for operational guidelines/guidance (validated by the French Ministry) to turn into practice (avoid carrying out experiments each time for all beneficial uses)
- ❑ Really consider sediments as a resource (freshwater sediments are the result of erosion → they should be fully integrated in circular economy).





# Thank you for your attention!



**Emmanuel BRANCHE**

*Expert Circular Economy*

*Senior Economist Engineer*

**Renewable Energy Division – EDF Hydro**  
Social and Environmental Unit  
4 allée du lac de Tignes – Savoie Technolac  
73290 La Motte Servolex - FRANCE

[www.edf.fr](http://www.edf.fr)

Mobile : +33 6 47 86 35 65

E-mail : [emmanuel.branche@edf.fr](mailto:emmanuel.branche@edf.fr)

To go further there is  
this scientific  
publication (in French)



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**Valorisation agro-écologique de sédiments lacustres en contexte de revégétalisation de pelouse subalpine (Barrage du Mont Cenis, Alpes, France)**

**Stéphanie Huc<sup>1</sup>, Gilles Friboulet<sup>2</sup>, David Paulin<sup>1</sup>**

<sup>1</sup> Conservatoire botanique national alpin, Domaine de Charance, 05000 Gap, France.

<sup>2</sup> EDF R&D, Avenue des Renardières, 77250 Moret-Loing-et-Orvanne, France.

Correspondance : [s.huc@cbs-alpin.fr](mailto:s.huc@cbs-alpin.fr)