Il Regolamento sul ripristino della natura: recuperare la connettività fluviale per migliorare la qualità del territorio e adattarsi ai cambiamenti climatici

Torino, 22 novembre 2024

Sediment management in the Rhône-Mediterranean-Corsica river basin district

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Con il patrocino e la cooperazione di

Evento cofinanziato dall'Unione Europea tramite il programma LIFE

Sediment is vital for many species

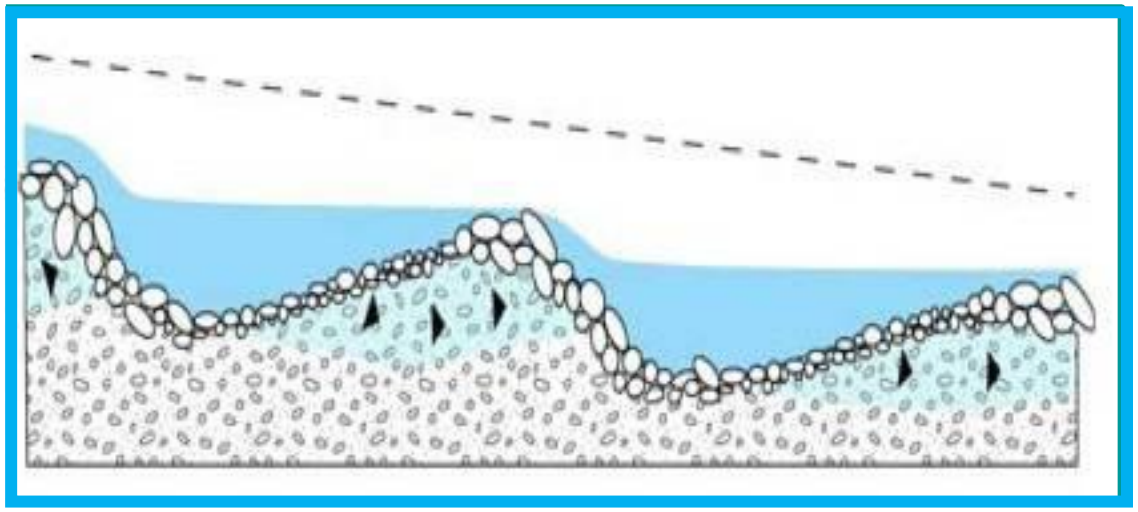
Out of the 80 species of fish present in France, **25 species use coarse sediment** for reproduction (Keith et Allardi, 2001)

(a) European bullhead

(b) Brown trout

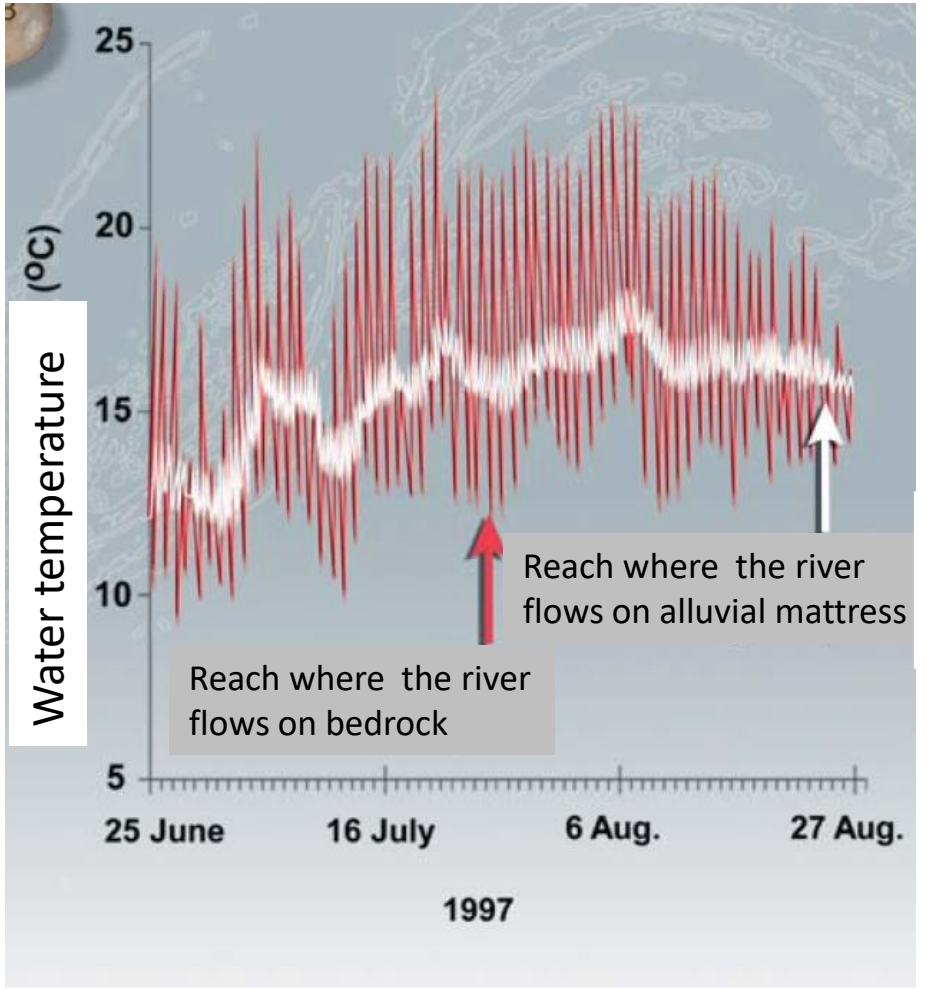
(c) Little ring plover (d) Pearl mussel (e) Ancylus fluviatilis (small gasteropod)

The key role of coarse sediment in the regulation of water temperature and water quality



In 2 different reaches of a same river: one reach has coarse sediment and a good range of aquatic habitat (pools, riffles) with subsurface flow while on the other reach there is only bedrock

=> Significant difference in the average daily water **T°C but even more on the daily amplitudes (4 times more!)**

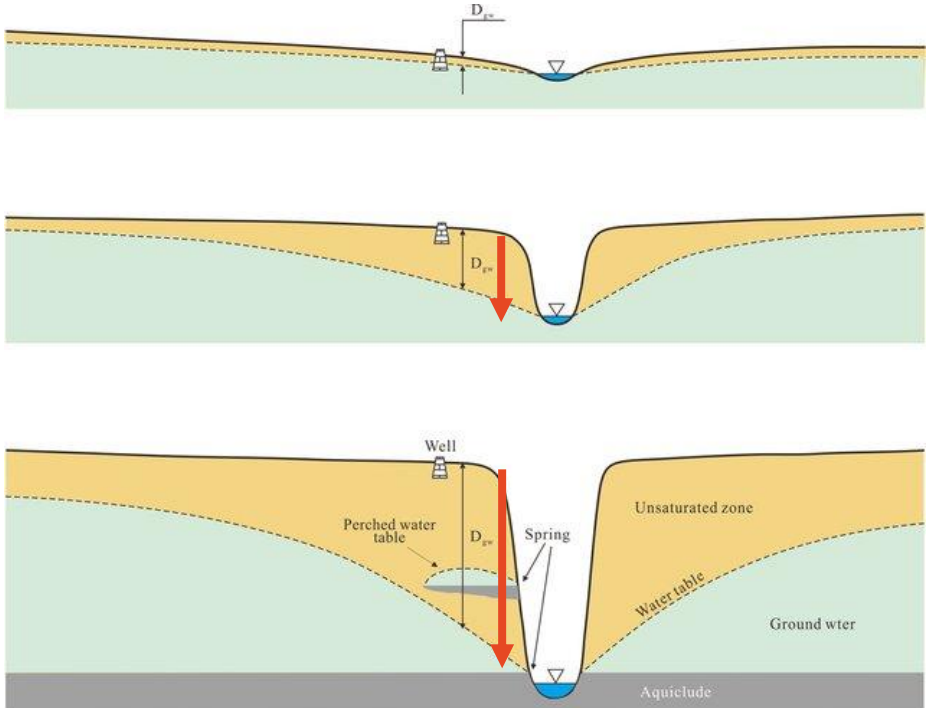


Burkholder 2007

Main alterations related to sediment

- Lack of coarse sediment due to **gravel mining** and **loss of sediment sources** (dams, river bank protections etc.) and incision aggravated by channelization

=> **Severe impacts** in terms of aquatic habitats, temperature self purification processes, groundwater levels



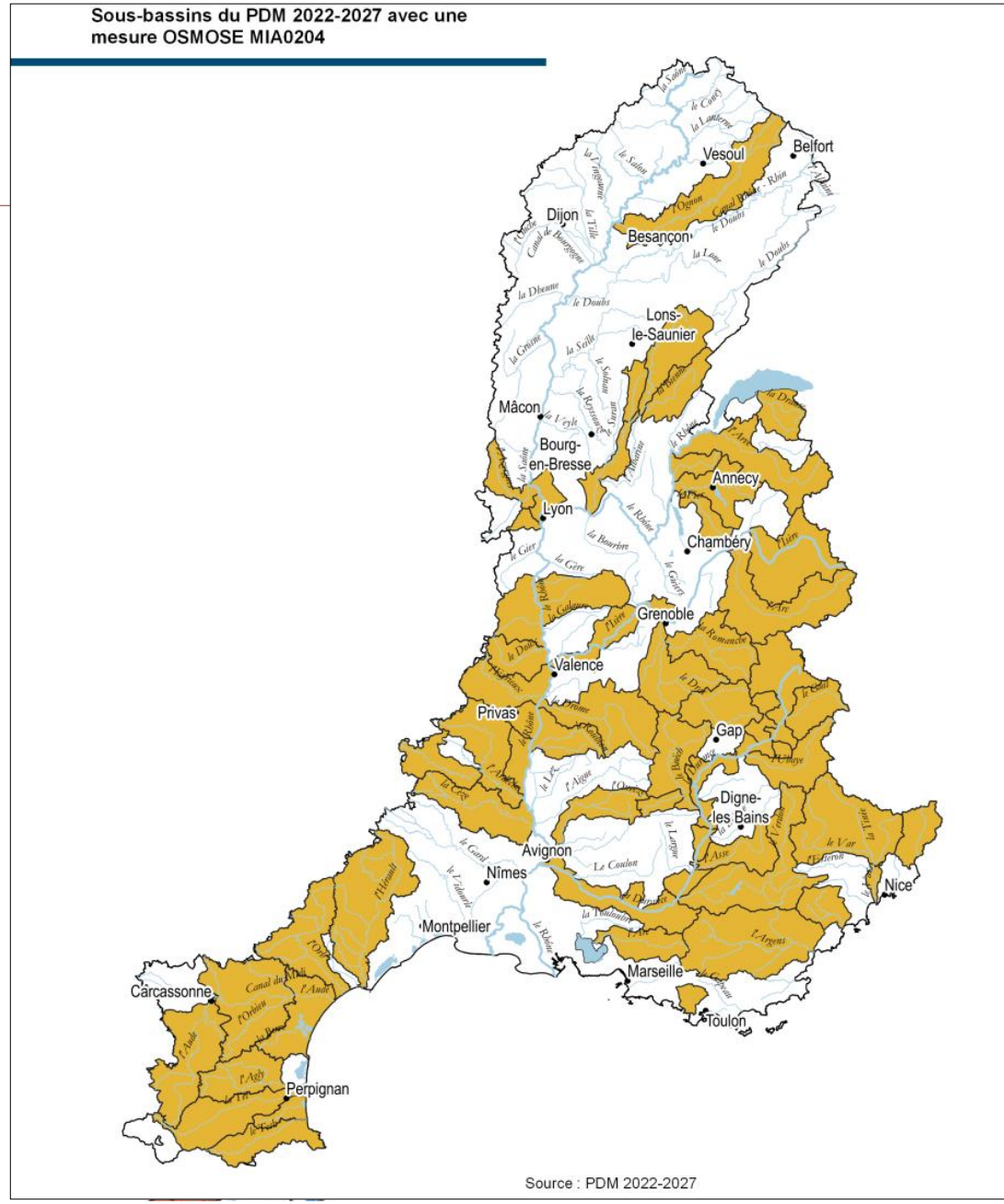
Impact of river incision on groundwater levels (Wei et al., 2022)

Scale of sediment related issues

On the Rhone and mediterranean catchment:

- **2/3rd of rivers have hydromorphological alterations**
- **About 45% among them have their biological and sediment transport continuity** disrupted by weirs or dams and **50% have an altered morphology** (channelization etc…)

The Rhone basin management plan asks for **sediment management plans** for catchments with significant alterations.
But **how to make a good sediment management plan** ?



Catchments identified with **issues linked to sediment** and measures in the program of measures

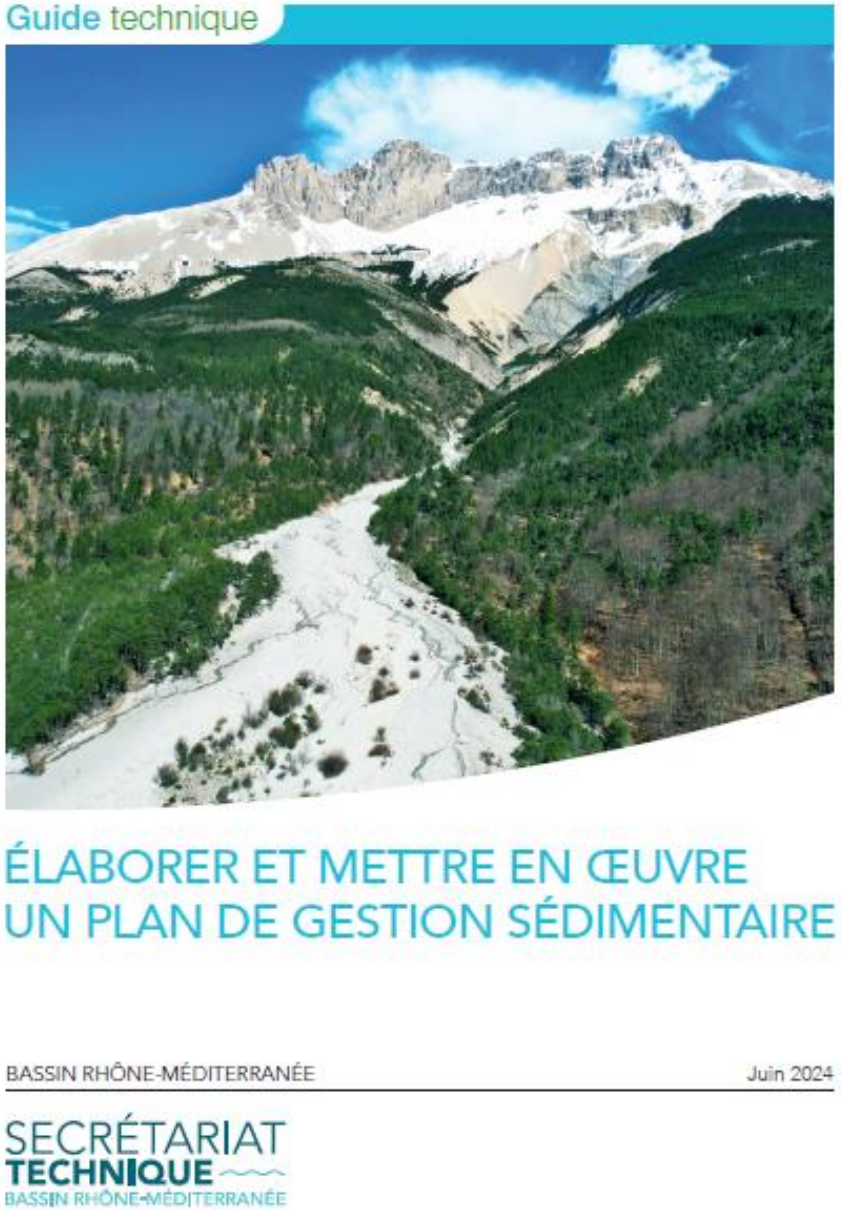
Scale of sediment related issues

A review carried out in 2021 identified one significant issue :

- in practice, sediment management plans often had vague objectives

- **their contribution to reaching Water Framefork Directive targets was often not clear or quantified**.

A **new technical guide** was published in 2024 to provide better guidance (Malavoi et al. 2024).



A new technical guide for sediment management

7 steps of a sediment management plan (SMP)

Preliminary step : assessment of spatial scale for diagnosis. First concertation with local stakeholders

- No issues related to sediment ?
- No need for measures related to sediment management ?
- No need for measures to preserve existing sediment dynamics ?

Exit of SMP process

1. Summary of the main issues, analysis of hydromorphology and ecology

concertation/validation

2. Spatial scale of SMP and objectives

concertation/validation

3. Elaboration of SMP : choice of actions, taking into account costs and constraints

concertation/validation

4. Final cost assessment of SMP

concertation/validation

5. Implementation of SMP

6. Monitoring

7. Assessment of SMP

concertation/validation

If not OK : go back to step 3 or 2 or update

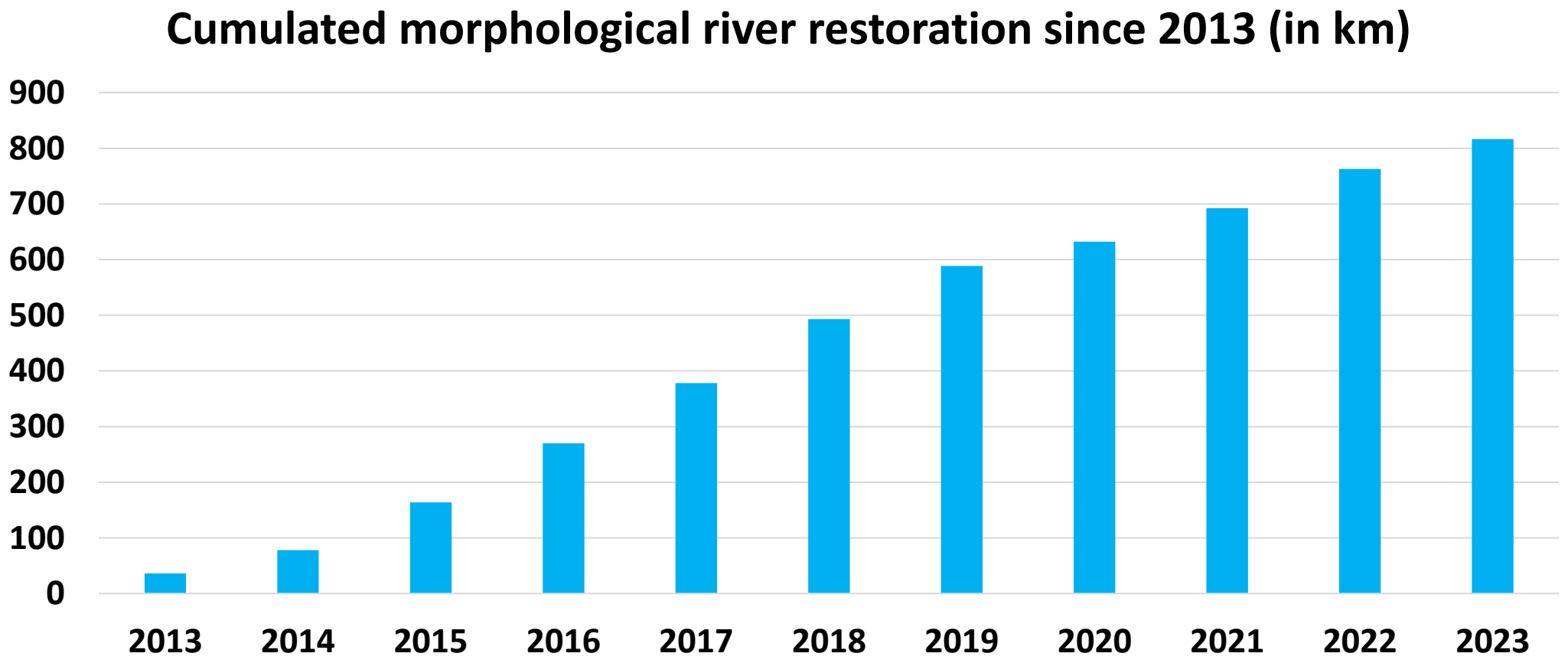
If OK : carry on implementation

Main types of restoration projects related to sediment in the Rhone basin

- **Dam/weir removal**, with clear targets and deadlines on identified structures (many examples, 30 to 50 cases / year)
- **Sediment replenishing** (from **lateral sources /** by taking sediment u/s of a dam or from another source and re-injecting it) (e.g. Drac, Rhone, Cheran, Guiers etc.)
- **Restoring the morphology of a degraded main channel** to a more natural state (e.g. Herbasse, Gier etc.)
- **Setting back flood defences** / reconnecting oxbows (e.g. Ain, Rhone, Saone etc.)
- Organise **flushing of dams** / **gate operations (e.g. Buech)**
- **Adding wood in the main channel** to slow down the flow, create side channels and generate aggradation (low tech process-based restoration) (e.g. Lierne, Veore, Clauge etc.)

Removal of Sapeon weir in Beaujolais (Syribt)

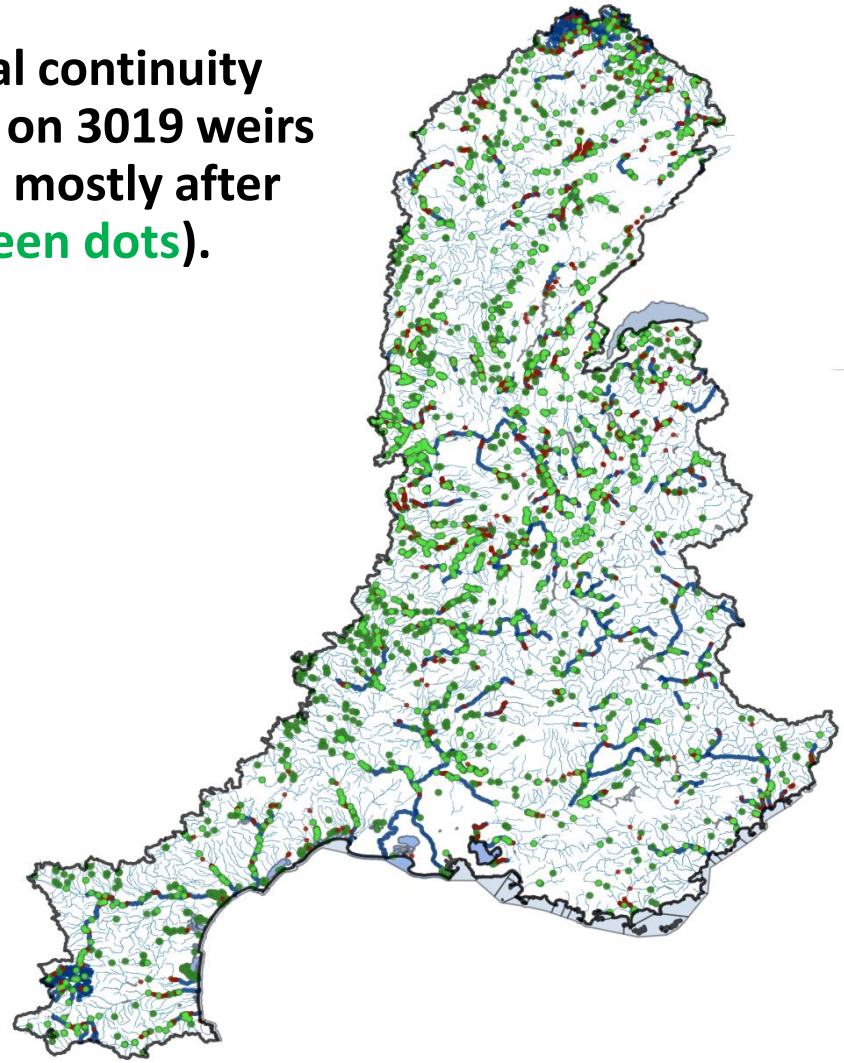
One of the top priorities on the Rhone-Mediterranean basin

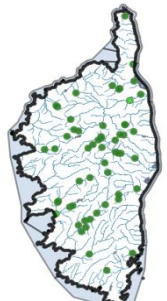


- On average between 50 and 120 km / year of morphological river restoration since 2013
- Around 400M€ to spend on restoring aquatic environments for a 6 years period

Key measures - restoring river connectivity

Ecological continuity restored on 3019 weirs or dams, mostly after 2010 (green dots).





- Barriers with continuity restored (demolished, removed, with fish pass etc.)
- Barriers with restoration financed by the agency
- Priority barriers
- Reaches in List 2
- Masses d'eau Rivières

Category	Number
Weirs/dam where ecological continuity has been restored	**3019**
Including those with work financed by the agency	***1339***
Number of dams removed	***About 800***
Weirs and dams defined as priority	1375
Including those already restored	*732*
Total number of weirs/dams on the river basins	**24704**

Rivers need space, not just from an ecological point of view

- Oct 2020 - Alex storm : up to 500mm of rainfall in less than 12h
- Massive sediment fluxes

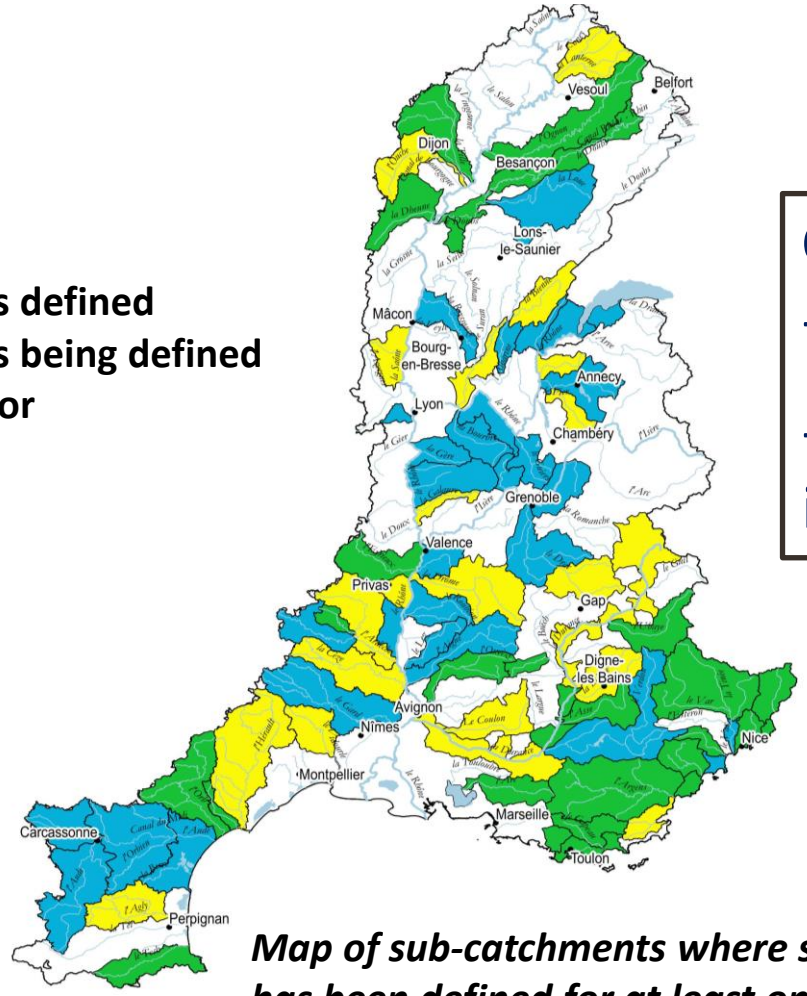
⇒ A fluvial transformation on more than 40km (Vésubie river)

⇒ A « making space for river » study was ongoing at the time of the storm…

Making space for rivers policy

- The river basin management plan requires to define and to take this space into account in urban planning
- It is an <u>essential tool</u> to tackle both flood risk and river restoration

Space for rivers defined
Space for rivers being defined
Erodible corridor



Map of sub-catchments where space for river has been defined for at least one river

Challenges:

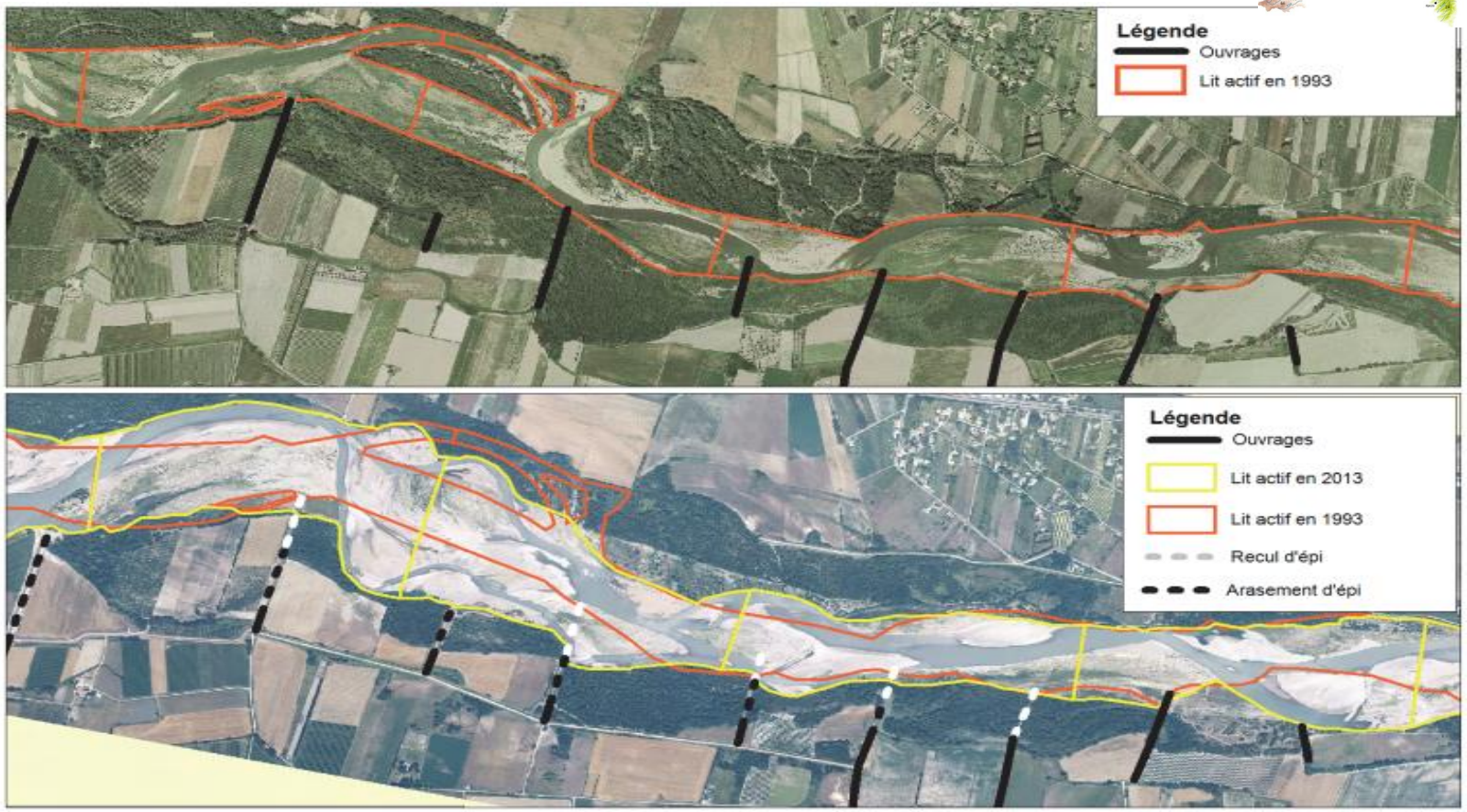
- implementation (land planning issues)

- requires significant concertation and stakeholders involvment

Making space for river policy

On the Durance river :

- **Following the 1994 flood event, embankments and groynes were set back from 100 m to 200 m**
- Between 1997 and 2013, increase of the active river bed of 40 % sur 4 km
- Around **10M€ avoided** by the restoration (reconstruction + maintenance cost) – **2M€ compared to 12M€**

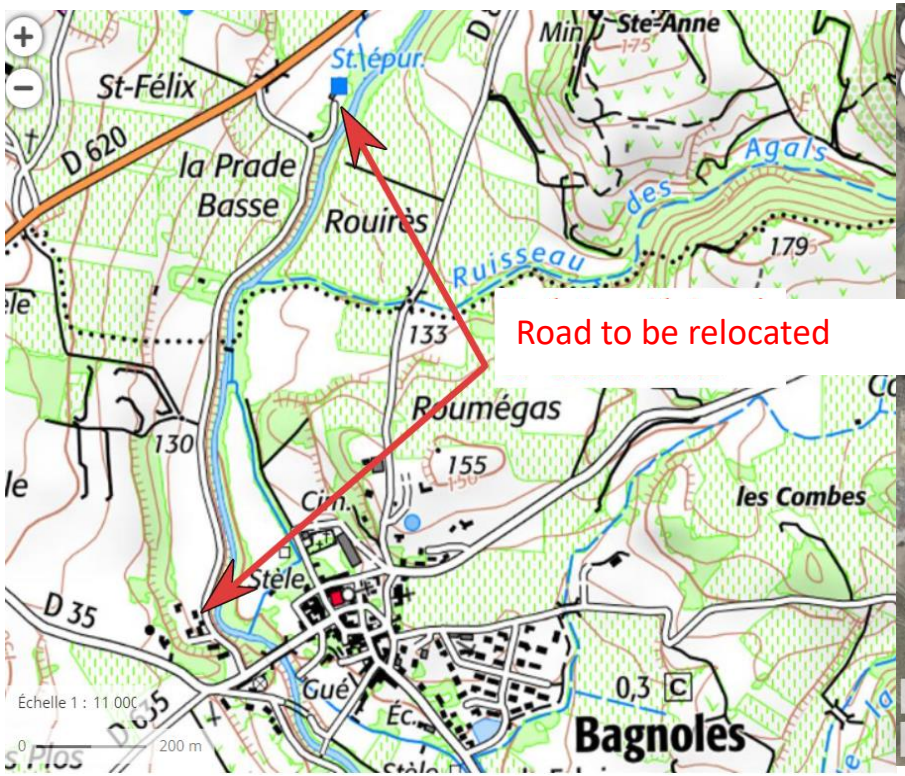


Aerial view of La Durance at la Roque d'Anthéron with active river bed in 1993 (in red) and in 2013 (in yellow) - SMAVD

Whenever it is possible, setback the infrastructures from the river

Example of the setting back of a road :

Following the **2017 flood event**, the local administration agreed **to set back a road on 900m along the Clamoux river**



The RD 97 road next to the Clamoux river : before work on the left and proposed new location for the road

Setback the infrastructures from the river

- In 2018 , land was bought so that the civil engineering works could be carried out for river restoration

The Clamoux river, along the RD 37 road before work. The river is constrained, it incised and bank protection is needed after each flood

Destruction of bank protections and walls (SMMAR)

The RD37 was then dismantled and a new road was built further away from the river.
=> **Make the area more resilient to flooding**

Removal of vegetation and first lateral erosions in spring 2022

Don’t wait for tragedy to take action

In 2018, 14 people died and 75 casualties due to heavy flooding in Aude catchment.

4 years later, **38 houses demolished** in Villegailhenc **to give more space to the river.**
This is much more than an ecological measure !

Key measures - Change the way dams are operated

On the Buech river, a braided river in the Southern Alp

Amplified d/s by Saint Sauveur dam, a discontinuity in sediment transport (EDF)

General context of decrease in sediment supply (reforestation, « natural » or implemented) and some degree of channelization (SMIGIBA)

Change the way dams are operated

Sediments were accumulating upstream of the dam, causing flood risk and depriving the downstream reach of sediment

⇒ ***43 500 m3 of gravel were taken from the u/s and injected d/s in 2016***

⇒ ***Dam gates are opened at lower flow rates to let more sediment through***

Reinjection of sediment downstream of the St sauveur dam

Opening of St Sauveur gates during a flood to let sediment pass (EDF)

Slow down the flow – remove concrete, bring back sediment and give more space

The Yzeron river in Oullins near Lyon

- One car park removed, one way removed from a dual carriageway to give space
- 3000 people protected against Q30, 85 M€ of damages saved over a 20 year period
- Greater amenity for local inhabitants

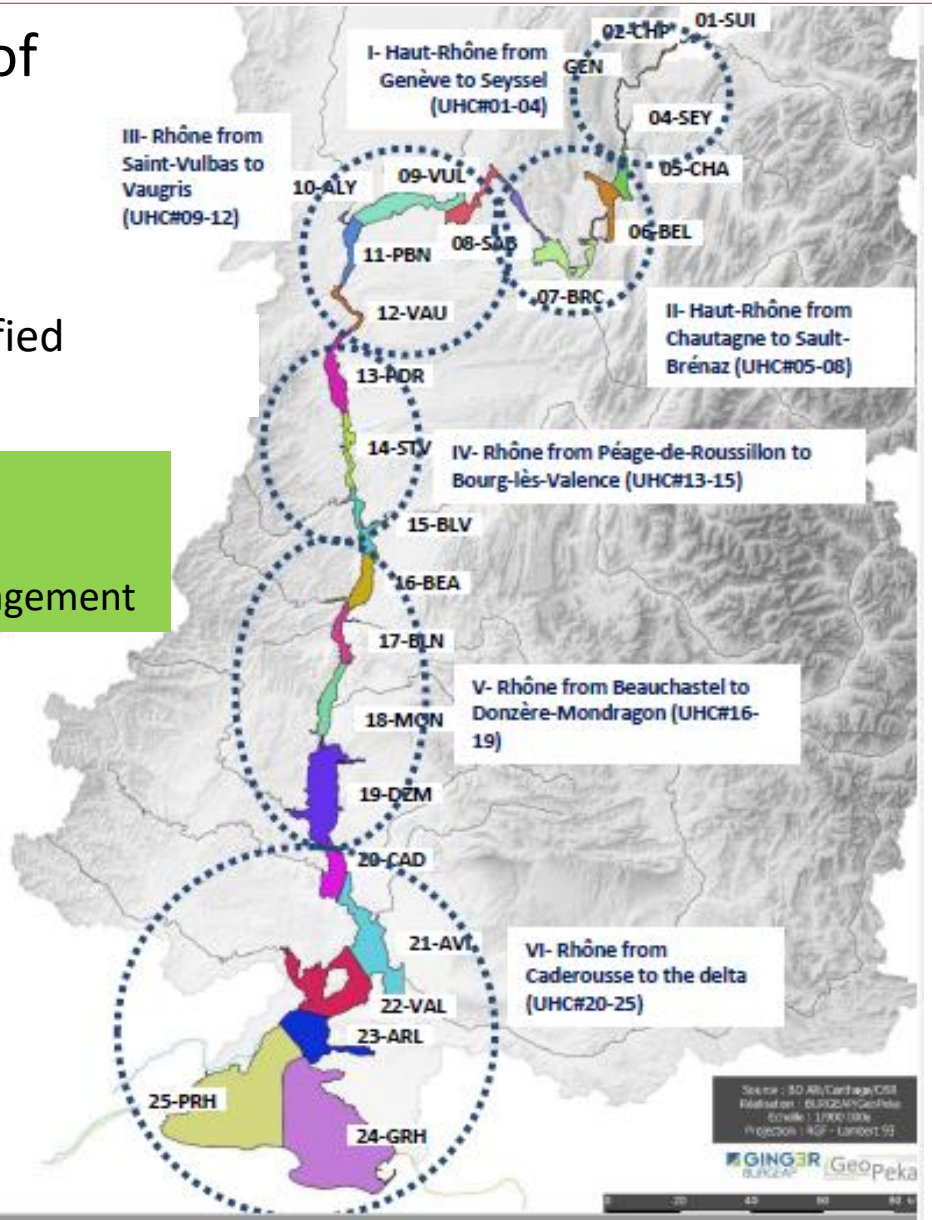
The Rhone strategic sediment management plan – results from a 4 year project

A detailed diagnosis on sediment at the scale of the Rhone river (550km) – (Ginger Burgeap)

- Main diagnosis and proposed orientations:
  - Hydromorphological trajectories identified
  - Bedload input, transport capacities and fluxes identified
  - **New management and restoration directions given**

Sectorization into homogeneous reaches:

- Series of run-off-river dams with diversion an bypassed reaches
- 25 coherent hydrographic units (UHC) + 6 major sectors for management



@Burgeap

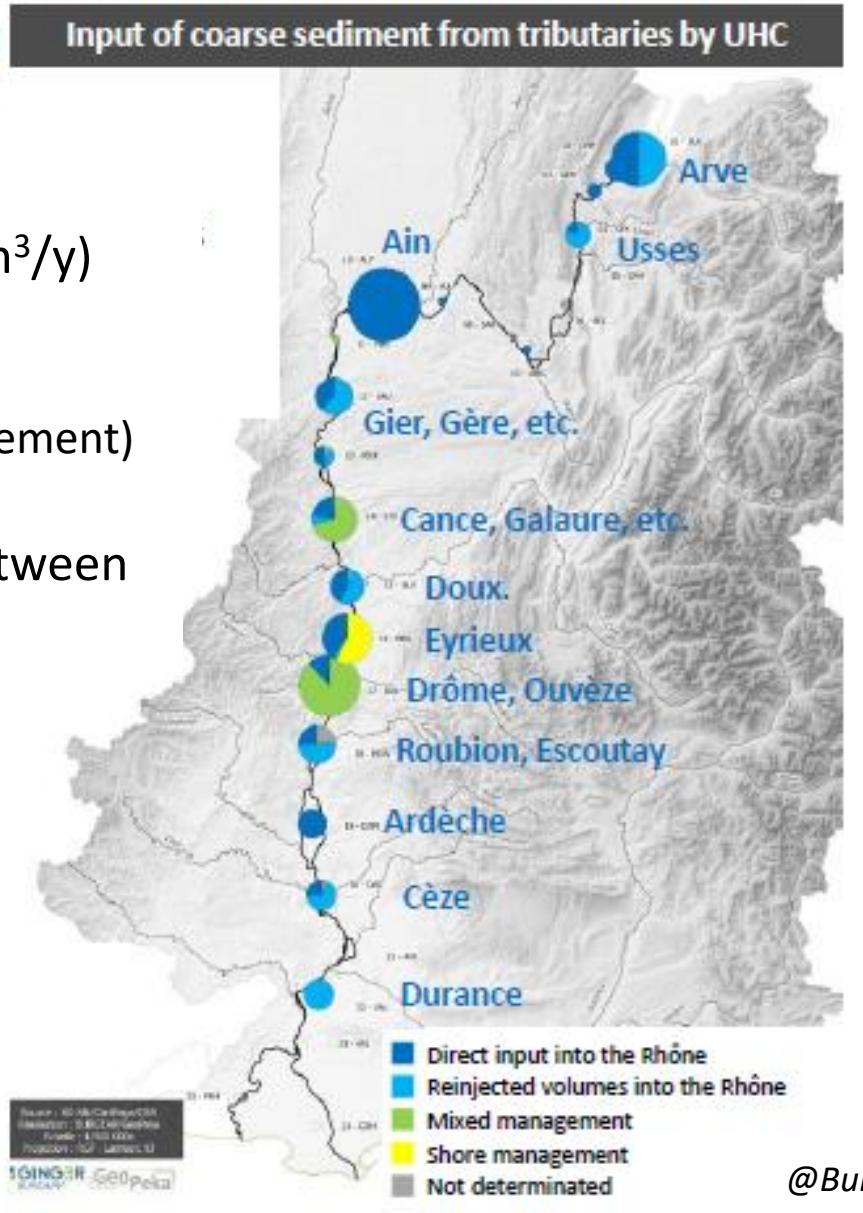
The Rhone strategic sediment management plan

What issues with coarse sediment ?

Average bedload input from tributaries (1995-2018)

- 36 tributaries over 241 with significant input (500 to 30 000 m^3/y)
- Total mean annual input : 151 000 m^3/y
  - 151 000 = 72 000 m^3/y (direct input) + 79 000 m^3/y (dredged)
  - 79 000 = 42 000 m3/y (reinjected) + 37 000 m^3/y (shore management)

=> In recent years, increasing reinjected volumes (400 000 m^3 between 2015 and 2019)



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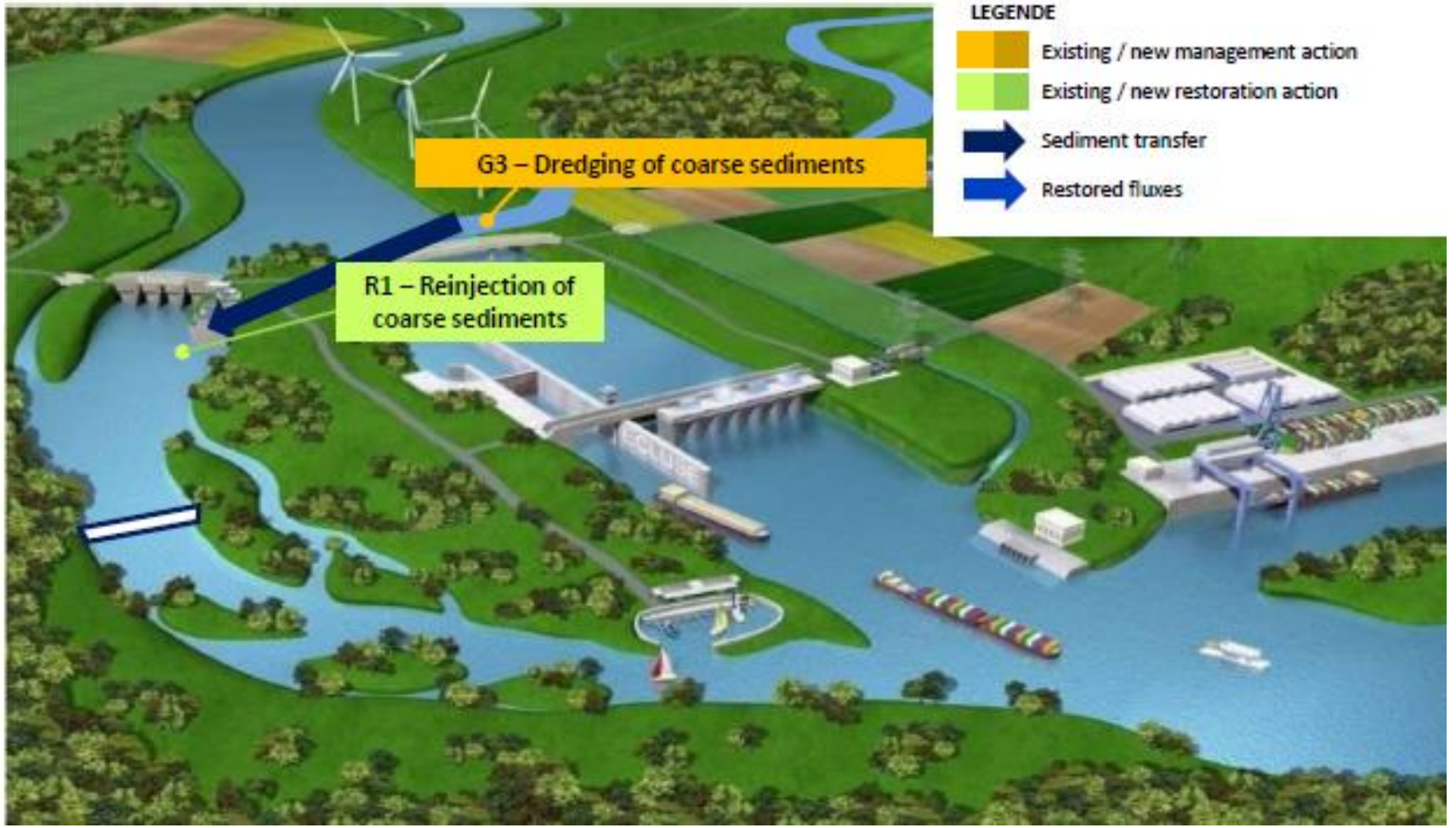
The Rhone strategic sediment management plan

Guidance : reinject dredged coarse sediment into bypassed channels to restore bedload continuity

- Possible synergies on :
  - Ecological reactivation of the by-passed Rhone
  - Financial savings



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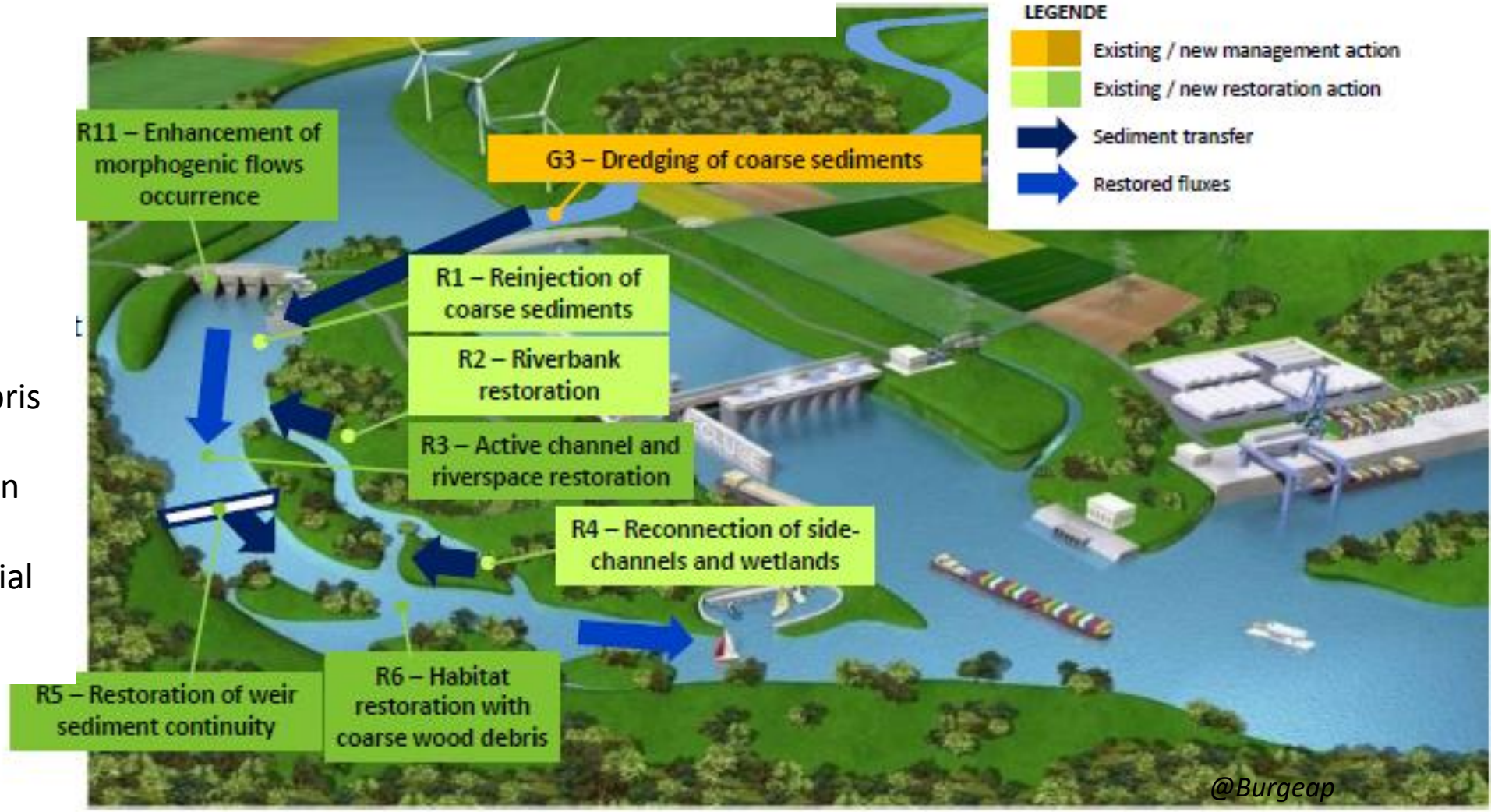
The Rhone strategic sediment management plan

- **Guidance : increase the ecological « value » and « lifespan » of coarse sediment**
  - Purpose : avoid reinjecting sediment into pipelike river

- River morphology has to be restored :
  - Active channel
  - Riverbank
  - Side channels
  - Riverscape
  - Weir continuity for sediment
  - Habitats with wood debris

- All this actions will slow down the sediment transit and enhance the diversity of fluvial forms



Example at Saulce

- Area : 30 ha
- Removal of 1,5km of longitudinal embankments + 1,7mm of groynes
- Restoration of oxbows : 1 500 m
- Sediment management :
  - Fine sediment injected in the Rhône : 25 000 à 40 000 m^3
  - Coarse sediment added in the Rhone : 15 000 à 35 000 m^3

News of the Rhonergia dam project on the Rhone

- CNR (Compagnie National du Rhone) wanted to build a 7m high dam on the Rhone, upstream of Lyon
- Cost of 330M€ - production of 140GWh/yr (annual electricity consumption of 60 000 people)
- Impacts :22km of ponding water, a 4km embankment to be built, significant dredging

The French State refused the project:

- Too costly, too much environmental damage
- Risk for the futur EPR nuclear plant

To conclude

- We need to **increase significantly** ecological river restoration and the implementation of nature-based solution projects to reach the WFD objectives.

$\Rightarrow$ Thousands kms of rivers have a degraded morphology, we're only restoring between 50 and 120km/year. **Sediment management has a key role to play.**

- Restoring river connectivities, giving more space to the rivers, restoring river morphology etc. are all even more essential to **adapt to climate change and bring resilience.**

- It can be difficult to undo what has been done (e.g. removing roads or houses). Stakeholders involvement, public participation and concertation are necessary. But today we have enough experience and knowledge to know what should be done and to deliver those projects.

Thank you for your attention