Water resource management, wetland protection and biodiversity: the role of small dams in Europe

Scientists' opinion on Article 7 of the EU's “Nature restoration” draft to destroy river dams on 25,000 km of European rivers.

Dear Member of the European Parliament,

We were recently alerted to a bill called "*Restoring Nature*", Article 7 of which provides for the destruction of water reservoirs, described as "barriers" on 25,000 km of European rivers.

In the presentation of this article by the European Commission, it is stated that the scientific world is unanimous in considering the "*fragmentation*" of watercourses as one of the causes of biodiversity loss.

While the construction of large dams in France from the 19th century onwards has led to the documented disappearance of salmon, this is not the case for the small traditional dams of mills or ponds, **which today appear to be essential for the preservation of water and the maintenance of aquatic habitats suitable for life, particularly during dry seasons such as those we have been experiencing for the past few years.**

The case of France, which has destroyed several thousand of these small traditional reservoirs over the last 10 to 15 years, deserves to be known by MEPs. The French parliaments banned this practice when the "climate-resilience" law was passed one and a half years ago, **particularly because of the deadly droughts for fauna and flora that these destructions often cause during the summer seasons. These deletions have also had negative effects on the preservation of our water resources, both in the surface water tables (alluvial water tables) and in the deep water tables.**

1- A markedly seasonal climate: winter flooding, summer drought

After an increase at the end of the last century, rainfall in France has remained stable overall, although it has increased in the northern half. Heavy winter rainfall is followed by weaker summer rainfall, especially in the last 5 to 6 years. On the rivers, particularly at the head of the basin, the difference between the lowest daily flow (end of August) and the highest (mid-January) is often 1 to 20 or even 1 to 100. The high winter flows are sometimes followed by summer droughts when the water level has been lowered by the levelling of weirs. In this perspective, the presence of thousands of small reservoirs which had the function of storing large volumes of water in the rivers, but even more so in the alluvial water table, will be seriously lacking in a period of global warming.

It should be added that these small structures, by slowing down the speed of the water, played the role of flood attenuator but also favoured the winter recharging of the alluvial aquifers, which are known to give back some of their fresh water in the summer. It should be noted that

in low-lying regions with impermeable substrates, the only way of conserving water during the deficit period has always been the creation of small reservoirs, which has been attested to for more than 10 centuries, regardless of the location in Europe.

2- European rivers fragmented over millions of years by logjams and beaver dams

The course of the natural or "wild" rivers was formerly made up of more or less anastomosing channels delimiting between them numerous islets. In the rivers of the plains, the water level was close to the surface of the floodplain. The bed was cluttered with obstacles consisting of logjams caused by falling trees but also, notably, of innumerable **beaver dams, particularly at the head of the basin**.

The latter have been the subject of numerous scientific studies across the Atlantic and in Europe following their reintroduction (notably by the University of Exeter in England). They have positive to very positive effects on groundwater recharge, on the attenuation of flash floods, on water quality and also on aquatic biodiversity and associated ecosystems (insects, amphibians, mammals and birds). **In particular, during the dry seasons, they enable the conservation of large bodies of water in the rivers and in the surface water (alluvial water tables)**.

The fragmentation by small dams (we insist on the size of these obstacles), formerly of beavers, then of mills or ponds, is thus a constant in the history of the rivers of the northern hemisphere, largely beneficial to the aquatic environments, which respond to the marked seasonality of rainfall and flow.

3- The French case

The policy of ecological continuity of watercourses in France, which took the form of **campaigns to destroy these small old dams**, resulted in a significant drop in the water level upstream of the structures concerned. The effects of these works, combined with those of the over-dams carried out during flood periods due to the increase in erosive force, led to **a significant lowering of the water level and consequently of the level of the alluvial water table (by 1 to 2 m)**.

During the new drought in France in 2022, many press articles reported that rivers on which these old reservoirs had been destroyed were partially or even completely dry, leading to the disappearance of aquatic environments. Where they have been preserved, aquatic biodiversity has been able to find refuge on the water lines preserved by these reservoirs.

4- The key role of the water level on the stability over time of the water table, lateral continuity and longitudinal continuity

The role of alluvial water tables has always been essential in maintaining the flow of lowland rivers because, **in periods of drought,** they give back to the river and the underlying water table some of the fresh water stored during the autumn and winter rains. A drop in the water level in the river of 1 metre**, with a sediment porosity of 25%, will result in a loss of about 250,000 m^3 of water per km^2 of floodplain after a few years.**

There is some confusion in the assessment elements put forward by the European Commission to justify the destruction of these water reservoirs. Restoring longitudinal continuity by destroying them has the immediate effect of lowering the water level of the main river and gradually emptying the alluvial water table. This lowering of the water level and of the water table endangers **lateral continuity** through the gradual drying up of the hydraulic appendages (ditches, diversion bays) as well as the associated wetlands.

In addition, these destructions aggravate, or even provoke, situations of dryness during episodes of high rainfall deficits and very often call into question **the longitudinal continuity** of sections of rivers that had never before experienced such situations.

Every year in February, wetlands are celebrated throughout Europe. On this occasion, it is important to point out all actions that contribute to the lowering of the water table, which will have negative consequences for biodiversity as well as for water resources.

5- Water quality and reservoirs

French and international scientific studies unanimously highlight the denitrification process that occurs in slowed river water and in the alluvial water table thanks to riparian vegetation. In the latter case, any lowering of the water table has negative repercussions on the nitrate withdrawals provided by this vegetation.

The slowing down of the water flow in rivers due to the presence of small weirs plays a role in this respect, a process that is not possible with “free flowing rivers”.

Therefore, the destruction of small traditional reservoirs appears to be a degrading factor for water quality, while European rivers, despite the significant efforts made in recent years, are still largely polluted, particularly downstream of the basins.

This change is noticeable today due to global warming and changes in the water cycle to the detriment of surface runoff. Modelling of future climate change reinforces scientists' concern about this.

Conclusion

The European Water Framework Directive provides for both the preservation of water resources and the improvement of their quality. In this context, the preservation of the small water reservoirs that have been built for a long time in our basins appears to be essential, and their destruction will deprive us of the expected positive effects, as we are seeing in France.

The small dams of the past, thanks to the maintenance of a high water level, allowed the alluvial water table to ensure the minimum flows necessary for aquatic life in the dry season while preserving wetlands.

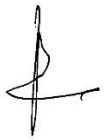
As regards migratory fish, in the absence of being able to destroy the more recent and larger dams that cut off access to their traditional spawning grounds, it is necessary to ensure that all dams that exceed the swimming and jumping capacities of these species are equipped with

adequate crossing devices, and before this, that the potential spawning grounds are sufficiently well identified.

Is it better for biodiversity to have dry rivers than rivers that allow flora and fauna to find temporary refuge in deeper areas? For optimal water management, **shouldn't everything be done to keep water in rivers and surface water tables rather than draining it quickly to the sea?**

We, hydrobiologists, limnologists, geomorphologists, geologists, must inform the MEPs that the policy of removing small hydraulic structures will **inevitably jeopardise** the preservation of our freshwater reserves, the safeguarding of wetlands and their associated biodiversity. We hope that they will follow the path set out by the French Parliaments, which have **rejected** this policy.

Pascal Bartout geographer - limnologist
Senior Lecturer - HDR in Geography
Director of the Geography Department
University of Orleans
Director of the journal *Dynamiques Environnementales*



Jean-Paul Bravard geographer - geomorphologist
Emeritus profesor at the University of Lyon
Honorary member of the « Institut Universitaire de France »

Laurent Touchart geographer - limnologist
University Professor of Geography

Christian Lévêque - hydrobiologist
Doctor of Science
Member of IRD (Research and Development Institute)
Author of Numerous Studies and Books on biodiversity

Pierre Potherat - geologist
Former Chief Engineer of the State Public Works Department, France
Author of *If Only Trout Could Speak* – Study on Effects of Small-Dam Destruction on Water Resources and Biodiversity

Notes:

M. Christian Lévêque is one of the most wellknown French hydrobiologist. He has published many important books and studies about rivers and biodiversity:
https://www.futura-sciences.com/planete/personnalites/developpement-durable-christian-leveque-802/publishing
https://www.researchgate.net/profile/Christian-Leveque-2

M. Jean-Paul Bravard (geographer, University of Lyon) is one of the leading specialists of geomorphology and sedimentation. See some of his publications and theses he supervised:
https://www.eyrolles.com/Accueil/Auteur/jean-paul-bravard-95343/
https://www.theses.fr/026750503

M. Laurent Touchart (geographer / limnologist, University of Orleans) is one of the leading French specialists of water environments, he published many studies and supervised numerous theses:
https://fr.wikipedia.org/wiki/Laurent_Touchart
https://www.theses.fr/035588748

M. Pascal Bartout (geographer / limnologist, University of Orleans) is one the leading French specialists of water environments, he published many studies and supervised numerous theses:
https://www.cairn.info/publications-de-Pascal-Bartout--100977.htm
https://www.theses.fr/113256949

M. Pierre Potherat (geologist) published the most complete work about the consequences of small milldams destructions on surface water and groundwater ("*If only trout could speak*" avril 2021 - 153 p.). His work has been "*peer reviewed*" by 3 french scientists including **M. Jacques Mudry** doctor in hydrogeology (University of Besançon):
https://www.eyrolles.com/Accueil/Auteur/jacques-mudry-51902/
https://www.theses.fr/033039488 /