



## What are check dams made for? An historical perspective from the French experience

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The mitigation of torrent related hazards is an important issue in mountainous regions. Structural mitigation measures have been implemented on hill slopes and in streambeds for more than 150 years in all Europe. Check dams play a key role in these mitigation plans and can have highly variable functions (horizontal and vertical stabilization of streambeds, consolidation of hillslopes' toe, retention of sediments, modulations of high solid discharges, lowering of streambed slope, etc.). Thousands of structures had been built more than a century ago. Since their construction, land uses evolved, torrent control works, associated with reforestation, curtailed a part of the sediment production. According to field experience, defining the initial and current functions of some old structures can remain challenging in some cases.

To better understand for which purposes thousands of these structures were built during the 19th and 20th centuries, we analyzed old books to determine:

- what was the history of the comprehension of the processes involved in torrent related hazards? and;
- how the use of check dams evolved to take into account this improving comprehension?

*i.e. how the human actions on watercourses co-evolved with scientific knowledge from the early 19th centuries to nowadays?*

The presentation does not aim to determine who, the first, addressed any scientific question: equivalent history and scientific works took place in all regions of the world at different time and the French were not the first to build check dams and to undertake watershed scale mitigation plans. But the French example is interesting because the torrent control works were planned in mountainous regions at the country scale (the Alps, the Pyrenees and the Massif Central). Initial plans were to reforest mountains, relying on civil engineering works if needed. Their implementation, through the French Mountain Lands' reforestation and grass seeding laws of 1860 and 1864, proved to be difficult for technical and sociological reasons. The Mountain lands' conservation and restoration law of 1882 aimed to better fit local issues. The idea of the presentation is thus to highlight how evolved the historical comprehension of torrential hazards and of the usefulness of check dams in mitigation plans in a changing environment on the technical as well as on the sociological and regulatory points of view.

Pioneering scientific and technical works on torrential hydraulics and check dams will be presented. Describing the global context that leads to French laws of 1860, 1864 and 1882 will allow us to explain the extensive development of the works in more than a thousand of torrents and a hundred of big landslides. We then will discuss the evolution of technics during the beginning of the 20th century and the changes induced after WWII by the arrival of reinforced-concrete technics.

We will conclude the presentation with a synthesis table aiming to highlight the different functions of check dams based on a description of their situations in the watershed, compare to other structures' situations and on shape criteria. This historical perspective will hopefully help people to better understand for which purposes some structures have been built in the past centuries and what lessons can be learnt from this assessment.