Geophysical Research Abstracts
Vol. 21, EGU2019-2250, 2019
EGU General Assembly 2019

Open check dams: field inventory overview and feedback from the French experience

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Within a torrential watershed, several complementary facilities can protect people, housing, networks and facilities generally located on alluvial fans. Amongst them, open check dams have an effect on solid transport, i.e. boulders, gravel and wood, before it reaches elements-at-risk. They are generally associated with complementary components: deposit area for the dredged material, access path, and downstream scouring protection.
Almost 320 open check dams were inventoried in 2017. About one-quarter are located in French public forests and are managed by the department of Restoration of Mountainous Areas of the National Forestry Office (ONF-RTM). Although the three other quarters are managed by municipalities, the ONF-RTM officers were involved in the design of the majority of them.
In France, pioneer structures were implemented just after World War II. However, most of open check dams were built between 1980 and 2000. We aimed at understanding why their implementation has decreased in France since 2000? First hypothesis is that maintenance experience puts on light several problems such as downstream incision, excessive dredging costs, etc. Second hypothesis is that design is not so easy in practice. A field inventory and feedback was thus undertaken to cluster and formalize main problems. This contribution to EGU aims at presenting its method and main results.

The used methodology involved four main steps. (1) A bibliography analysis specified potential functions of open check dams, physical mechanisms involved and existing design processes. (2) A GIS general inventory of French open check dams sorted them according to their storage capacity but also achieved functions. (3) A more detailed inventory was implemented by field ONF-RTM officers for 'large' open check dams, i.e. with more than 1000 m3 retention capacity. They described design context, involved solid transport processes, elements-at-risk, structural components, history of maintenance interventions, and malfunctions. (4) In-depth feedbacks on a dozen of specific facilities involved a watershed analysis, description of local peculiarities, definition of structure objectives, and functional and structural analysis. It was performed by gathering several specialists on site.

As a result of step 3, no malfunctions were reported for 60 % of registered large open check dams. For the other 40%, main identified functional malfunctions were (i) deposit areas too frequently filled (46 %), (ii) lateral bypasses of the structure (27 %), (iii) structures located too upstream along the channel (21 %), and (ic) a lack of regular dredging. For step 4, a feedback methodology with standardized forms was developed and tested allowing clustering and disentangling several failure modes of open check dams. Thanks to this feedback, the global design process has been improved on three main points: (i) analysis for a minimum of three scenarios (frequent, project, danger), (ii) clarification of potential functions of open check dams, (iii) design of their opening sizes.

Finally, this feedback approach helps to exchange between specialists and field practitioners, to cluster information according to a similar knowledge, and to improve design and maintenance processes. As it is based on a formalized methodology and reporting tools, it can be easily implemented in other sites and countries.