

Traditional stone drop structures for water conservation

Revival of a traditional flood control practice to deal with water shortages in small Greek islands.



Construction of a micro-dam with local stones, near Karavas village on the island of Kythira, Greece

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Completed micro-dams ready to receive water

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/// Context ///

Small-scale hydraulic structures were a traditional water management practice applied to the small islands of the Mediterranean since the Minoan era. For centuries, the local community of Kythira island has used various methods to collect water along the torrents of the island, to cope with water shortage during the dry season and to avoid seasonal flooding due to intense rainfalls. This led to the construction of small stone barriers across the stream to control water flow.

These micro-dams (or drops) reduce the slope of the steep streams and collect small amounts of water creating shallow ponds (locally called “Loutsēs”, in

Greek) with the purpose of irrigating adjacent crops and water livestock. Even today, the drop structures are constructed with local materials (stone), providing an easy and cost-effective solution for the local population’s water needs, and an effective tool against the severe flooding episodes faced by many Mediterranean islands in recent years, due to climate change. In addition, the promotion of this environmentally friendly millennia-old practice, apart from its enhanced cultural and aesthetic value, can also provide useful benefits in terms of biodiversity conservation, soil erosion mitigation and groundwater enrichment.

/// Solution for a Resilient Future ///

“Drops” are mild hydraulic structures used to control grade, water levels and flow and to reduce erosion, while achieving natural aesthetic adaptation and demonstrating environmental sensitivity.

In 2021 the Mediterranean Institute for Nature and Man (MedINA) in cooperation with the local community of Kythira started the reconstruction of several stone drop structures along the torrent stream of Patima in the northern part of the island. The main goals of the project were local irrigation and water filtration, biodiversity conservation, and cultural revival that can also act as a tourist attraction. Using the old local traditional technique, a network of 26 stone drops was constructed along 2.7 km of a riparian ecosystem. Using the stones of the area, as the basic construction material, those simple low-cost “micro-dams” have preserved the traditional character of the constructions and are fully in harmony

with the environment and the aesthetics of the area.

Drops do not require specialized hydraulic expertise and are created with natural materials from the stream itself. Large, wide stones are placed on top of each other, across the flow of the river and they function as small technical, hydraulic works that interrupt the continuity of water flow. They cause negligible hydro-morphological alteration. The water collected upstream of these constructions creates shallow ponds, small in quantity but very important for the following reasons:

- They provide essential anti-flood and anti-erosion protection, addressing an urgent need intensified by climate change, particularly in the Mediterranean islands. This simple design effectively slows down water flow, playing a crucial role in mitigating floods by retaining substantial water volumes.
- Drops enhance water infiltration and contribute to

aquifer enrichment. The concentrated rainwater in small pods significantly augments the volumes that are infiltrated into underground aquifers.

- The initiative encourages the re-utilization of abandoned crop plots along the stream, providing an ideal irrigation method during the frequent drought periods. The ponds created offer water access points for livestock, wild animals and birds, in addition to making water available for growing crops.
- These shallow pools serve as biodiversity hotspots, as they act as tiny wetlands in the dry, often semi-arid, island ecosystems, providing suitable habitats for various plants, insects and amphibians.



Small ponds (Loutsises) behind micro-dams on Kythira island
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- The stone drops become a tourist attraction, adding to the captivating environment of the small islands, contributing to the restoration of cultural heritage, benefiting local businesses and revitalizing sparsely-populated areas. A good proof is the recently mapped Patima trail which is already drawing nature enthusiasts and hikers.

A weakness of stone drops is that they are not solid enough to resist strong hydraulic loads in case of heavy flooding. Their stability may be compromised by potential erosion of the stream bed and the banks. They need more maintenance than reinforced-cement structures. They cannot avert the risk of intense flooding events. Lack of experienced workers can be a problem.



A small pond behind a micro-dam (detail)
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/// Always Moving Forward ///

The enhancement of drop structures can be taken to the next level through implementation of potential improvements. These encompass undertaking a comprehensive new study to enhance the structural integrity of drop structures, exploring innovative designs for increased robustness to withstand heavy water flow conditions. In parallel, establishing frequent visits by local users can act as continuous monitoring of the condition of each drop structure, especially in the aftermath of heavy rainfall events, will contribute to their timely maintenance, ensuring longevity and effectiveness. Moreover, a comprehensive understanding of the

environmental impact can be developed by implementing a systematic monitoring framework for ecological (presence of fauna and species), chemical (substances from anthropogenic activities) and hydrological (water quantities) state of the water concentrated in the ponds. It is also crucial to clarify the requirements and the contribution to water consumption of the local water users, such as farmers, to ensure that the drop structures capacity aligns with the specific needs of the local community. Finally, dissemination actions (publications, articles, educational programs, etc.) can spread the practice other places facing similar challenges.

Further information

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