Traditional stone check dams in ephemeral stream in Paros Island

Year of issue

2026

Photo Gallery





Location

37.01639, 25.20278

Project

SpongeScapes

Sector

Hydromorphology

Installation Date

2022

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Overview

Location of the project

Paros island has a typical Mediterranean climate with high temperatures and limited rainfall during the dry months. As a result, Paros suffers from excessive droughts, which is amplified by tourism and the overuse of water resources.

Country

Greece

NUTS2 Code

Νότιο Αιγαίο (Notio Aigaio)

Sponge measures implemented in the case study

Peak flow control structures

Restoration of natural infiltration to groundwater

Check dams

Objectives

Increase water retention capacity (by constructing 34 small retention ponds).

Enhance groundwater recharge.

Improve biodiversity (support habitats for flora and fauna).

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
NGO	WWF Greece	Implementation	WWF Greece, in collaboration with local stakeholders, such as the Municipality of Paros and Paros Water Supply & Sewerage Company, coordinates the implementation and design of the traditional stone weirs. Their role includes project planning, stakeholder engagement, and monitoring the environmental and socio-economic outcomes of the intervention.	Responsible
—	Local stakeholders	—	Local stakeholders are particularly interested in the possibilities to mitigate droughts and prevent or reduce local flood risks, both in the rural and urbanized areas. Local stakeholders include provincial government, drinking water company (Paros), farmers, NGOs -Boulouki) and volunteers.	—
NGO	MedINA	—	Mediterranean Institute for Nature and Anthropos	—
Other	Archilochos Cultural Association	—	—	—

Authority type	Authority name	Authority role	Comments	Authority responsibility
Local water authority	Paros Water Supply and Sewerage Company	—	—	—

Site Information

Climate Zone

Warm temperate dry

Temperature (°C)

18.00 °C

Soil type

Regosols

Vegetation class

Mediterranean dryland grasses and hydrophytic plants around check dams (post-intervention)

Design and Implementation

Project scale

Meso

Project scale specifications

1.3 km of stream

Project area

The NWRM covers an area of approximately 5.9 km² (or 590 ha).

Project area specifications

The area of the river basin where the check dams were constructed. 34 stone check dams constructed along the riverbed

Size unit

m

Basis of design

The traditional stone weirs are designed to collect and retain small amounts of water and improve groundwater recharge during dry periods. The design aims to reduce water velocity and create small biodiversity hotspots. The weirs also contribute to flood mitigation by slowing down water flow.

Factor constraints

Limited rainfall and high evaporation in the region.
Potential constraints due to local topography and the riverbed’s natural flow.
Geology.
Accesibility.
Availability of stones.
Slope

Favourable preconditions

The Mediterranean climate and the calcareous soil of the region provide a natural environment conducive to water retention, making this an ideal area for implementing the stone weirs.
Low cost of the measure
Stones availability

Financing

Total cost information

The total investment costs include the construction of 34 check dams, ongoing monitoring, and coordination efforts between stakeholders. Specific figures for total costs are not mentioned beyond individual funding sources.

Costs investment information

The total investment for the project includes the construction of 34 stone weirs and other infrastructure, as well as contributions to monitoring and coordination efforts among stakeholders.

Costs capital information

The capital costs are primarily the costs related to the construction of the check dams, including the use of local stones and traditional building techniques.

Costs land acquisition information

The project does not mention any land acquisition costs because the project seems to utilise existing land under the jurisdiction of local stakeholders like the Municipality of Paros.

Costs operational information

The project is designed with low maintenance requirements, as it uses traditional stone structures that are sustainable and require minimal intervention.

Costs maintenance information

Maintenance costs would likely involve minor upkeep of the stone weirs to ensure continued water retention and vegetation support.

Costs disposal decommissioning information

The project does not specify any decommissioning costs since it is based on sustainable, low-maintenance infrastructure that is not intended for removal.

Administrative annual cost information

Administrative costs mainly related to coordination of monitoring activities and collaboration between local stakeholders

Compensations scheme information

No compensation scheme is mentioned for this project.

Policy and Governance

Policy description

The project addresses water scarcity in small Mediterranean islands by reviving traditional stone weirs to increase water retention and groundwater recharge, support local biodiversity, and mitigate flood risks.

Aiming at increasing the sponge functioning of the stream and enhancing its capacity to support biodiversity, WWF Greece together with Mediterranean Institute for Nature and Anthropos (MedINA), Paros Municipality, Paros Water Supply & Sewerage Company and Boulouki built 34 traditional dry-stone check dams along 1300 meters of the stream in June 2022.
These semi-permanent low-height structures, historically designed to collect small amounts of water for irrigation, also serve a dual purpose: by reducing flow velocity they allow more water to infiltrate into the soil, and by retaining water, they create shallow ponds that are biodiversity hotspots, critical for flora and fauna during dry periods.

Policy targets

Increase Water Storage

Groundwater Recharge

Improved Biodiversity

Target remarks

The primary targeted problem is water scarcity due to low rainfall, high evaporation, and increased water demand, particularly in islands with high tourism.

Policy pressure

Directive	Relevant pressure
WFD identified pressure	Water Scarcity

Pressure remarks

The project primarily addresses the pressure of water scarcity, which is exacerbated by climate change, urbanization, and tourism activities in the region.

Policy impact

Directive
WFD identified pressure

Impact remarks

The impact of the project is expected to include increased water availability, improved biodiversity, and enhanced ecosystem services in arid island systems.

Requirement directive

Requirement directive	Specification
Water Framework Directive (WFD) 2000/60/EC	—
Other EU	EU Strategy on Adaptation to Climate Change
Other EU	Water Resilience Strategy
Other EU	EU Biodiversity Strategy for 2030
—	The Greek National Adaptation Strategy
—	National Biodiversity Strategy- Greece

Requirement directive remarks

The project aligns with the EU Water Framework Directive (WFD), contributing to the sustainable management of water resources and the protection of aquatic ecosystems.

Policy challenges requirements

The project addresses the challenge of managing water resources in arid and semi-arid regions, with an emphasis on providing water for both human and ecological needs.

Part of a wider plan

Oui

Wider plan

Wider plan type	Wider plan focus	Name	Comments
Regional	Water	Mediterranean Islands Collective Action Plan	Water conservation, biodiversity, climate adaptation

Public consultation

Non

Has contractual arrangements

Non

Impacts and Monitoring

Monitoring System

Monitoring requirements

Biodiversity, surface water level, soil moisture

Monitoring parameters

While such check dams have been widely used for water management in the Mediterranean region for hundreds of years, our knowledge of their contribution to water availability (especially groundwater recharge) is limited. To support the case study, pre- and post- monitoring actions on biotic and abiotic factors are being conducted to monitor the impact of the dry-stone check dams on groundwater levels and biodiversity.

Biotic factors (biodiversity)
Abiotic factors (groundwater levels)-Pre and post monitoring of aquifer level by the project team.

Presence of formal monitoring system

Biodiversity: 4 stations with pitfall traps, 4/ Year; Surface water level and Soil moisture: 2 stations with sensor, continuously

Maintenance

Maintenance requirements

Low

Impact Assessment Methodology

Performance impact assessment method

In-Stream

Performance impact estimation information

The performance of the check dams was evaluated based on groundwater recharge, surface water retention, and biodiversity (flora and fauna surveys). Monitoring focused on measuring the extent of groundwater recovery, the formation and persistence of shallow ponds, and the development of vegetation.

Biophysical impact assessment method

Biotic Factors: Monitoring of flora and fauna, species diversity, and vegetation growth.

Abiotic Factors: Monitoring water retention, groundwater levels, and pond formation and persistence.

Data Collection: Pre and post-construction monitoring was carried out to determine the impact on local biodiversity and hydrological conditions.

Cost assessment method

Estimations were made based on the implementation costs of building the 34 check dams, ongoing monitoring expenses, and coordination between stakeholders. Costs are considered low due to the simple construction techniques.

Socio-economic Impacts

Benefits and co-benefits

Increase crop production: only small-scale local agriculture benefited
Amenity (number of visitor/year): increases stream amenity
Well-being: related to amenity
Tourism (number of people): ecotourism
Flood risk management: reduce flood risk
reduce downstream flooding (e.g., number of properties, number of people, both): reduce flood risk

Direct benefits

The direct benefits of this project include water retention, groundwater recharge, biodiversity improvement, and the creation of habitats for endangered species. Additionally, there is a benefit for human activities downstream, as the check dams also provide flood mitigation.

Ancillary benefits information

The ancillary benefits include the revival of traditional techniques, enhanced skills through training, and the creation of recreational opportunities related to the restored ecosystems. The project also contributes to increased resilience to droughts.

Negative / Other impacts

Access restrictions of some areas: some check dams are located in remote areas
Constrasting laws at different territorial level and need for policy changes: current policies allow high number of drillings and the removal of vegetation for flood management purposes, constrasting the benefits of the sponge measure

Biophysical impacts: Hydrology

Ecosystem water supply

The check dams help moderate water flow

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Lessons Learned

Key lessons

The application of this measure in Paros Island is a good example of a project where biodiversity is enhanced, the dissemination of the outcomes is at the local and national level, and where local authorities and communities have a good attitude and acceptance towards a project.

Barriers

Barrier type	Barrier role	Comments

Lacking financing sources	Main barrier	Initial financing challenges were overcome through partnership development and engagement with local and international stakeholders.
Limited staff and consultant knowledge	Main barrier	Initial lack of knowledge on monitoring
Other	Main barrier	Difficult accessibility in remote areas
Other	Main barrier	No data before the implementation
Expected maintenance needs	Main barrier	Difficulties with groundwater monitoring
Attitude of relevant stakeholders	Main barrier	Unsustainable agricultural practices by local farmers

Drivers

Driver type	Driver role	Comments
Other	Main driver	The project was initiated in response to the environmental challenges posed by climate change, particularly on small islands where water scarcity is becoming more acute due to low rainfall and high evaporation rates.
Other	Main driver	Strong expertise by locals and partners on traditional structures
Organisation committed to it	Main driver	Cooperation with partners and stakeholders (NGOs, municipal authorities, local community, volunteers)
Other	Main driver	No conflicts due to the public state of the land and social acceptance
Other	Main driver	Low-budget intervention and cost-effectiveness

Success factors

Success factor type	Success factor role	Comments

Attitude of relevant stakeholders	Main factor	Engaging local stakeholders from the start ensured community buy-in and effective implementation. The simplicity of the design also ensured low maintenance costs, making it a sustainable solution.
Other	Main factor	Appropriate check dam design and siting
Other	Main factor	Measured benefits (surface water, groundwater, biodiversity)

Cost effectiveness

The intervention is highly cost-effective due to the use of local materials (stones) and the low maintenance requirements of the check dams.

Flexibility / Adaptability

The project demonstrates flexibility in terms of scaling up the stone weir method, which can be adapted for use in other Mediterranean islands with similar conditions.

Transferability

The approach of using traditional stone weirs can be easily transferred to other Mediterranean islands facing similar water scarcity issues. Given that the technique relies on locally available materials and simple construction methods, it is adaptable to various regions with similar environmental challenges. The geological, topographical and hydrological characteristics must be suitable for this measure

Basin characteristics influence

The calcareous soil and Mediterranean climate of the basin (high evaporation rates, low rainfall) strongly influence the effectiveness of the check dams in promoting water retention and supporting local biodiversity.

Sources

Sources

Commentary: Dryland Watersched Restoration With Rock Detention Structures: A NBS to Mitigate Drought, Erosion, Flooding, and Atmospheric Carbon

Preliminary Assessment of Carbon and Nitrogen Sequestration Potential of Wildfire-Derived Sediments Stored by Erosion Control Structures in Forest Ecosystems, Southwest USA

Ecosystem Services of Riparian Restoration: A Review of Rock Detention Structures in the Madrean Archipelago Ecoregion

Quantifying geomorphic change at ephemeral stream restoration sites using a coupled- model approach.

Hydrologic Response of Streams Restored with Check Dams in the Chiricahua Mountains, Arizona, USA.

Hydrologic Response of Streams Restored with Check Dams in the Chiricahua Mountains, Arizona, USA. 2015

Model analysis of check dam impacts on long-term sediment and water budgets in Southeast Arizona, USA.

Natural infrastructure in dryland streams (NIDS) can establish regenerative wetland sinks that reverse desertification and strengthen climate resilience.