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Non-conventional water sources on Greek islands

Integrating innovative solutions across multiple sectors to reduce water scarcity and increase climate resilience

The Aegean Islands in Greece are demonstrating methods to adapt to climate change through circular wastewater management of rainwater and flash-flood water sources.

Key Learnings

- **Traditional knowledge meets innovation:** The integration of Sifnos' traditional network of small stone barriers with modern conservation practices creates robust adaptation solutions that enhance ecosystem resilience, reduce flood risk, and support sustainable water management in dry environments.
- **Circular systems create multiple value streams:** The water reuse loops successfully combine wastewater treatment, energy generation, and agricultural production, creating regenerative business models that reduce the dependence on conventional water sources while supporting local economies.
- **Community acceptance through early engagement:** Despite initial reservations from local authorities and communities, continuous and reliable operation over multiple years at three testing sites (Lesvos, Mykonos, and Sifnos) has convinced stakeholders that these approaches are necessary pathways for addressing island water scarcity.

About the region

The North and South Aegean are two of the thirteen administrative regions of Greece, covering approximately 3,800 km² and 5,300 km², respectively. As of [2021](#), the North Aegean had a population of about 195,500, while the South Aegean counted more than 327,800 residents. Both regions are composed mainly of islands and are strongly shaped by tourism, which plays a major role in Greece's national economy. Agriculture and livestock farming also remain important pillars of their local economies. According to the EU's cohesion policy, the North and South Aegean regions are "transition regions", which means that the regions' Gross Domestic Product (GDP) per capita is between 75% and 100% of the EU average. These regions receive less funding than "less developed regions" (GDP below 75%) but more than "more developed regions" (GDP above 100%). Transition regions are a distinct category for receiving EU cohesion funds to help reduce disparities and support economic, social, and territorial development.

Climate Hazards

Droughts, Flooding, Water Scarcity

Sector

Agriculture, Biodiversity protection, Water Management,

Disaster Risk Reduction

Key system

Ecosystem and Nature Based Solutions,

Water Management, Land use and Food system



Climate Threats

Climate threats on the Aegean islands are intensifying. In the North Aegean, projections estimate that temperatures will rise by approximately 1.5 °C by 2050 and up to 3.5 °C by 2100, while average annual rainfall is expected to decrease from 510 mm to 451 mm. Drought periods are expected to double from 20 to 40 days, and flash floods already pose a growing risk. In the South Aegean, projections are even more severe: under the RCP8.5 high-emission scenario, dry periods could extend by up to 50 days, with temperatures increasing by 1 to 2 °C by 2050 and 3 to 4.5 °C by 2100. Rainfall is likely to decrease overall, but intense short downpours will become more frequent. Under the RCP4.5 stabilising scenario, precipitation may decline by 10–15% in the Dodecanese and 5–10% in the Cyclades, except in spring. In contrast, under RCP8.5, winter rainfall is expected to rise slightly over the next decade.

These shifts will reduce groundwater recharge, increase seawater intrusion into coastal aquifers, and threaten aquatic ecosystems and freshwater supply. Although current water management plans include water-saving measures, authorities must take further action. Over-pumping, salinisation, poor surface water management, pollution, and rising demand from tourism and agriculture already intensify water stress, making climate adaptation urgent.

Water management practices in the Aegean Islands

The Aegean's dispersed archipelago, low-yield aquifers, and seasonal tourism peaks make small-scale, site-specific water solutions more practical than large, centralised networks. Decentralised systems are already proving their cost, energy, and resilience advantages for islands that cannot depend on mainland pipelines. By localising supply, each island can adapt infrastructure to its actual needs, integrate renewable energy, reduce transmission losses, and expand capacity quickly during peak tourist seasons – all while lowering lifecycle costs and carbon emissions.

Lesvos Island – A sustainable system promoting wastewater valorisation through Nature-based Solutions

A circular system on the island of Lesvos treats domestic wastewater through anaerobic processes and Treatment Wetlands (Figure 1). The setup combines an Upflow Anaerobic Sludge Blanket reactor – operating without external heating – with a two-stage vertical subsurface flow treatment wetland and ultraviolet disinfection. This system enables the reuse of reclaimed water and the recycling of nutrients in it in a nearby agroforestry field, saving synthetic fertiliser and avoiding the use of other chemicals, such as pesticides.

Agroforestry combines trees and shrubs with crops, offering benefits that extend far beyond food production (Figure 2). It improves soil fertility, enhances water retention, and supports biodiversity. The long-term success of mixed-species cultivation in the field, along with educational activities such as open days, walking tours, and focus group sessions, has raised awareness among local farmers – many of whom have expressed interest in using the surplus reclaimed water for their own adjacent fields.



Figure 1: Small municipal Wastewater treatment plant upgraded with a newly created treatment wetland (top left corner). Image Credit: NTUA.



Figure 2: Agroforestry irrigated with the treated wastewater in Antissa, Lesvos. Image Credit: NTUA.

Sifnos Island – Reviving traditional practices for climate resilience and water retention

Reviving traditional water management techniques can strengthen modern climate resilience while avoiding large-scale and expensive civil works. A network of 120 dry-stone check dams built in 2025 across two seasonal streams (Figures 3 and 4) forms part of a broader Nature-based Solution for climate adaptation. These low-tech, decentralised structures slow down runoff during short but intense rain events, promoting groundwater recharge, reducing flood risk, and retaining sediment. Water sensors and a weather station monitor water-level fluctuations, helping to evaluate the effectiveness of the Nature-based Solution. Local engagement has been central throughout the process – from joint design and community participation in construction to educational activities and intergenerational knowledge exchange. This integrated approach enhances both ecological performance and social acceptance, offering a scalable, place-based model for sustainable water retention in arid island environments.



Figure 3: Visible construction of stone check-dams. Image Credit: MedINA.

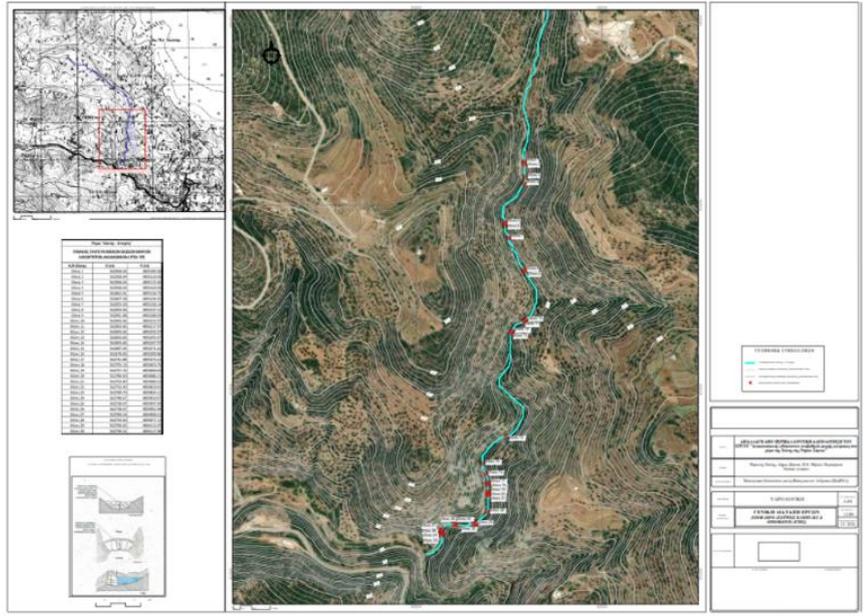


Figure 4: Location of the stone check-dams. Image Credit: MedINA.

Mykonos Island – Nature-based rainwater management systems for arid island areas

On Mykonos, two pioneering nature-based rainwater management systems help alleviate water shortages in an isolated and arid Mediterranean island. HYDROP (Figure 5) is a prototype rainwater harvesting system applied in a rural agricultural area with minimal landscape disturbance. Simplicity, flexibility, low-resource demand, and energy efficiency embody the circular economy approach. It features a shallow, subsurface collector and two flexible storage tanks. The water is used to cultivate oregano, a crop that tolerates drought. The system represents a successful application of Nature-based Solutions to address water scarcity in island regions.

HYDROP provides the annually required amount of high-quality water for oregano cultivation, demonstrating the technical feasibility and reliability of small-scale, decentralised rainwater harvesting for agricultural purposes. By combining rainwater use with the cultivation of drought-tolerant crops, the system reduces the dependence on freshwater sources while supporting the local economy through the production of value-added products.



Figure 5: HYDROP rainwater harvesting system – rainwater collector and oregano cultivation in Mykonos Island. Image Credit: Marine Conservation Greece.

The second system upgrades a residential rainwater collection network to maximise storage and reuse during the dry season (Figure 6). It integrates existing infrastructure, such as rainwater tanks and

groundwater reservoirs, with bioswales (shallow, vegetated channels that collect and filter stormwater runoff), slow sand filtration, and aquifer storage and recovery techniques. Originally developed under the [HYDROUSA](#) project, this initiative marks a milestone for the South Aegean Region: for the first time, a local resident has implemented decentralised solutions to increase water resilience through rainwater harvesting, artificial aquifer recharge, and irrigation reuse, moving beyond conventional top-down and publicly funded approaches such as dams, freshwater depleting boreholes, and energy-demanding desalination. It shows fellow island residents and farmers a replicable model, encouraging them to take actions for their water self-sufficiency and not only wait for utilities and authorities to provide solutions.



Figure 6: Residential Rainwater harvesting system – bioswale – aquifer recharge and lavender cultivation in Mykonos Island. Image Credit: MC Greece.

Despite initial reservations from the local community, authorities, and other stakeholders, due to a lack of prior experience with such technologies, six years of continuous and reliable operation have demonstrated clear benefits, both in terms of water volumes and in the quality of storage and recovery. Today, the stakeholders involved recognise it as a necessary pathway for addressing water scarcity in island clusters.

This Nature-based Solution water management system has demonstrated the technical feasibility and functionality of an integrated collection, storage, recharge, and recovery water system, enhancing resilience against droughts. The results confirm that the combination of nature-based processes (bioswale, aquifer recharge) and technical solutions (storage tanks, pumping systems, monitoring instruments) can significantly reduce dependence on conventional water sources and support sustainable, decentralised water management in dry Mediterranean regions.

“On our islands, water is life – and resilience is a duty for us decision-makers. By reviving traditional wisdom and pairing it with modern approaches and especially nature-based systems, scientists have proven that the Aegean can secure water, protect communities, and power local livelihoods even as droughts extend and extremes intensify. These solutions work because they are designed for our geography and governed with our people.”,

Ioannis Kalatzis, Director of the Development Planning Directorate for the Region of North Aegean

Conclusion

The [CARDIMED](#) project promotes holistic resource management by demonstrating the synergy between energy generation, waste recycling, and water reuse on Lesbos Island in the North Aegean Region. On Mykonos in the South Aegean Region, rainwater harvesting systems combined with filtration treatment help conserve freshwater for irrigation and recharge local aquifers. Meanwhile, on Sifnos, the revival of traditional stone check-dam network – a traditional network of small stone barriers – demonstrates how ancestral techniques can be integrated with modern conservation practices, thereby enhancing ecosystem resilience, reducing flood risk, and supporting sustainable water management in the Aegean’s arid island environments.

Summary

Non-conventional water sources across three Aegean islands demonstrate how decentralised Nature-based Solutions can effectively address water scarcity challenges in Mediterranean archipelagos. The multi-island approach successfully integrated circular economy principles with traditional water management wisdom, creating resilient systems that serve both environmental and economic needs. Examples on Lesbos, Mykonos, and Sifnos demonstrate practical, low-energy pathways that integrate circular water reuse, rainwater harvesting, and traditional water retention practices. Across the sites, a six-year operation validated technical reliability, community acceptance, and measurable benefits. Nutrient recycling and drought-proof irrigation have reduced the dependence on conventional sources. The results underscore a replicable model for dry island clusters: scalable, cost- and energy-efficient systems that integrate collection, treatment, storage, recharge, and reuse while supporting local economies and ecosystem resilience.

Further information

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