Water retention management in the broader area of Ancient Olympia, Elia, Greece

Year of issue

2025

Summary

The project focuses on post-fire water retention management in the broader area of Ancient Olympia, Elia, Peloponnese, Greece. It involves afforestation of mountainous areas and the temporary installation of wooden structures using locally available timber to retain water, stabilize slopes, and reduce erosion. These natural measures aim primarily at flood control and risk mitigation, with secondary benefits for biodiversity conservation.

Recent scientific studies (2022–2025) have confirmed the effectiveness of these interventions. Field measurements showed that post-fire treatments in Olympia significantly improved soil infiltration capacity, up to 300% higher in deposition zones compared to eroded ones two years after implementation. Satellite-based erosion models (using Sentinel-2 and RUSLE) also indicated a sharp increase in soil erosion after wildfires, which was partly mitigated by restoration works that reduced erosion rates by approximately 18%. These findings demonstrate the long-term hydrological benefits of such nature-based solutions under Mediterranean conditions.

Key success factors remain the strong engagement of decision-makers, the willingness of local stakeholders, positive public perception, and the availability of expert knowledge and tools. The project is an example of adaptive, evidence-based post-fire watershed management in a culturally and environmentally sensitive region.

Photo Gallery

XII. Photos Gallery



Location

37.3835085, 21.378061

Project

NWRM

National ID

Greece_01

Sector

Forest

Installation Date

2007-2008

Implementation status

Completed

Contact

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Overview

Location of the project

The study area is located in Ancient Olympia, Elia, Peloponnese, Greece.

Country

Greece

NUTS2 Code

Δυτική Ελλάδα (Dytiki Ellada)

Sponge measures implemented in the case study

Maintenance of forest cover in headwater areas

Afforestation

Objectives

Flood control : Reduce flood risk via temporary timber barriers to slow runoff velocity

Soil retention & erosion control : Retain 7.5 mm fertile soil; 2,500 m^3 over 30 ha

Biodiversity conservation : Protect gene pool in riparian zones

Hydro-regulation : Reduce peak flows; sustain baseflows via afforestation

Project scale & duration : 49.5 ha affected; intervention executed Nov 2007–Feb 2008; lifespan 4–5 years

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Other	Institute of Mediterranean and Forest Ecosystems	Determination of design details of the measure	The Institute along with NAGREF are the scientific / technical responsible parties	Supporting
Regional / sub-national water authority	Hellenic Ministry of Culture and Sports . The main stakeholders involved for the study and the implementation of the restoration of the site were the	Monitoring	The Ministry is the beneficiary, responsible for initiating and monitoring the interventions procedures	Responsible
Other	Ephorate of Prehistoric and Classical Antiquities	Monitoring	The Ephorate is the regional cultural authority of the pilot area	Responsible
Other	Forest Products Technology of the National Agricultural Research Foundation (NAGREF)	Determination of design details of the measure	NAGREF along with the Institute of Mediterranean and Forest Ecosystems are the scientific / technical responsible parties	Supporting

Documents

cs-el-01-final_version.pdf (1.24 MB)

Site Information

Climate Zone

Warm temperate dry

Precipitation

863.05 mm

Temperature (°C)

16.70 °C

Runoff

675.00 mm

Elevation range

120

Vegetation class

The dominant vegetation type in the broader Olympia region is cultivated olive groves.

WFD Ecological status

Good

WFD Chemical status

Good

Water quality status

After wildfires the water quality was poor. As far as surface water is concerned, the wildfires have deteriorated the vegetation quality; thus the quality of water runoff was decreased.

Design and Implementation

Project scale

Meso

Project scale specifications

It is a medium scale project as it involves the 4 hills around the Ancient Olympia.
49.5 ha are the area affected by the fires and restored. In particular, Kronios Hill, International Olympic Academy – Zone A, International Olympic Academy – Zone B, Zouni Hill, Kolosaka Hill.
In these areas 80-100% of the vegetation has been burned.

Project area

49,5

Area subject to Land use change or Management/Practice change (ha)

49.50 ha

Principles

The specific principles that were followed in the design of this application include aesthetic benefit, functionality, integrative planning, impact on public perception & acceptability, etc.

Constraints

The factors that influence the selection and design of the measures is morphology, vegetation, climate and geology of the area. The morphology of the area (large slopes), increases surface runoff, leading to soil erosion and increased risk of landslides as well as increased flood events. To address this, the use of geotextile had to be implemented in most sloping and vulnerable positions. The vegetation (after the fires) has eliminated and a hydrophobic layer in the soil has been created by the combustion of organic matterwhich increases surface runoff and flood risk. The local climate, with an annual precipitation of over 1.000 mm and often intense events, also tends to increase the intensity of flood events.
The soils of the study area are also very loose and corrodible; thus vulnerable to the rainfall.
A high challenge for the temporary small structures is the hydraulic undercut.
Improving the condition of existing rainwater drainage system e.g. cleaning of the rainwater drainage system to avoid filling the road network with logging waste and increasing the flood risk.

Favourable preconditions

The necessary preconditions are the climate conditions and the soil properties and characteristics.

Financing

Total cost

2762500.00 €

Total cost information

In terms of breakdown, the cost for the log barriers is not assessed in the provided information.

Costs investment

2762500.00 €

Costs investment information

This amount includes the fixed capital cost, infrastructure, construction and landscape rehabilitation.

Costs capital

1262500.00 €

Costs capital information

The irrigation system for the four hills was 464.658 € plus VAT.

Costs land acquisition

1500000.00

Costs land acquisition unit

€ (total value)

Costs land acquisition information

The cost for land compensations was about 1.500.000 € due to the overpriced value of the properties around the archeological site.

Costs operation maintenance information

The operational cost for irrigation as well as for pruning and fertilizer application was not assessed.

Compensations

Yes

Compensations total

1500000.00 €

Compensations basis information

The financial compensations were for 5-6 beneficiaries-fields with a total area of 10 hectares each. The cost per hectare for this high value area was about 20,000-30,000 €; thus the total cost for land compensations was about 1,000,000 €.

Policy and Governance

Policy description

The specific interventions aim at tackling the environmental impacts of the significant wildfires of the study area in 2007. The principal aim of the works includes reduction of soil erosion and flood management. The interventions also include burned trees harvesting and restoration actions on the existing vegetation and on the tree crops.

Land ownership

Public land. Private-owned land were bought for this project.

Policy targets

Runoff control

Peak-flow reduction

Erosion Control

Improved Biodiversity

Target remarks

The primary targets when designing this application were soil erosion management, flood control and flood risk mitigation in the context of restoring the fire affected area.

Policy pressure

Directive	Relevant pressure
Floods Directive identified pressure	Other pressure contributing to flooding/flood risk
WFD identified pressure	Other hydromorphological alterations

Policy impact

Directive	Relevant impact
Floods Directive identified pressure	Other Environmental impacts
WFD identified pressure	Altered habitats due to hydrological changes

Requirement directive

Requirement directive	Specification
Floods Directive-mitigating Flood Risk	Flood risk management and flood impacts mitigation
WFD-mitigation of significant pressure	Mitigation of hydromorphological alterations e.g. soil erosion

Policy challenges requirements

Law 3199/2003 &Presidential Decree (P.D.) No. 51/2007 (protection of water resources)
Fire protection laws (Law 998/1979, P.D. 86/69, 2612/1998, 3013/2002, 3208/2003, 3511/2006 (protection of forest ecosystems, reorganization of fire department & upgrade of its mission). In terms of water policies these laws (esp. 3208/2003) are addressing the protection of the forest ecosystem including water resources.

Part of a wider plan

No

Public consultation

No

Has contractual arrangements

No

Impacts and Monitoring

Monitoring System

Monitoring requirements

A permanent automatic meteorological monitoring station is necessary to be installed, in order to predict of the progress of the wildfire risk in the area as well as to inform the public in real time for the plant development.

Maintenance

Maintenance requirements

Plants irrigation, clearing and pruning as well as bio-fertilizer application. The intensity and the frequency of the maintenance activities are related to the season the plant and the meteorological conditions in the specific area.

Impact Assessment Methodology

Performance impact assessment method

Unknown

Performance impact estimation information

Non applicable

Socio-economic Impacts

Direct benefits information

The direct benefits include the reduction of the flood risk, the mitigation of soil erosion, the improvement of the micro-environment as well as the aesthetic restoration of the affected area.

Ancillary benefits information

Ancillary benefits include the increase of infiltration / percolation and recharge of aquifers; this water can be used for different purposes (e.g agriculture) as well as for ecosystem services. Also the aesthetic improvement of the area has positive societal impacts

Biophysical impacts: Hydrology

Information on retained water

The volume of retained water was increased due to the temporary log structures as well as the improvement in the area vegitation after the afforestation

Information on increased water storage

The measures increased the retaining of water for longer period enabling the infiltration/percolation and recharge of aquifers.

Deposition zones (DZ)—areas adjacent to the timber structures—showed significantly higher unsaturated hydraulic conductivity (K) compared to erosion zones (EZ):
Wattles: DZ K was 159 % higher than EZ in 2022; 145 % higher in 2023. K increased over time: +29 % in DZ and +36 % in EZ from 2022 to 2023.
Log barriers: DZ K was 174 % higher than EZ in 2022; 243 % higher in 2023.
Log dams: DZ K was 240 % higher in 2022; 190 % higher in 2023. Both DZ and EZ saw increases in K from 2022 to 2023 (+42 % in DZ, +67 % in EZ).

Information on runoff reduction

The measures improved the runoff control as the velocity of water volume was reduced leading to decreasing the intensity and frequency of floods.

Information on peak flow reduction

The peak flow rate is reduced due to the obstacle of the timber structures. This measures reduces the velocity of water volume resulting in the decrease of floods intensity.

Information on increased groundwater level

These measures have an impact on the increase of the groundwater level due to the increased infiltration, percolation and recharge that is achieved through the slowing down of water velocity. Also vegetation succeeded in eliminating the hydrophobic layer that was created in the soil after the fires and enables the water absorption towards the aquifers.

Information on soil moisture

These measures have a direct impact on soil moisture as the temporary timber structures enable to retain water for a longer period and inhibit the volume of runoff. Additionally, the area afforestation succeeds in eliminating the hydrophobic layer that was created in the soil after the fires and thus increased soil storage capacity.

Information on increased soil storage capacity

The rating for hydro-seeding was 60% “excellent”.
The rating for the log erosion barriers was “excellent” or “good” in 70% of the measurements.

Biophysical impacts: Biodiversity

Improved biodiversity

Yes

Information on improved biodiversity

The wildfires had significant impact on the area biodiversity and the restoration measures included using species from the surrounding locations in order to restore the decreased biodiversity

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Not relevant for this application

Information on water quality overall

Not relevant for this application

Soil quality overall improvements

Positive impact-SQ improvement

Information on soil quality overall improvements

The measures have a direct impact on the overall soil quality as afforestation of the area succeeds in eliminating the hydrophobic layer that was created in the soil after the fires and thus increase soil storage capacity. The fires have created the porosity of the soil to decrease, thus the restoration has positive impact on the soil infiltration capacity. Also the soil is improved due to the increase of the moisture.

The total estimated soil material w/30 ha or retention of a total 7.5 mm of fertile soi, equivalent to approximately 2,500 m^3 over 30 ha.

Biophysical impacts: Others

Ecosystem impact climate regulation

No information available

Information on ecosystem impact climate regulation

The micro-climate and micro-environment was positively affected by the implemented measures; however the degree of impact was not assessed

Lessons Learned

Key lessons

The Ancient Olympia case study shows that nature-based solutions can be quickly and effectively deployed in post-fire contexts. Using locally available timber, erosion control structures were installed within months after the wildfire. These low-tech interventions helped reduce surface runoff, stabilize slopes, and retain fertile topsoil across severely burned areas.

Scientific monitoring confirmed the long-term hydrological benefits of the measures. Infiltration capacity was significantly higher—up to 300%—in areas where structures were installed, even two years after implementation. This demonstrates that well-designed post-fire interventions can lead to sustained improvements in soil-water dynamics under Mediterranean conditions.

The project's design combined temporary physical structures with long-term ecological goals. Once vegetation recovered, it was expected to take over erosion control functions, making the solution both cost-effective and resilient. Supporting natural regeneration was key to amplifying long-term impacts.

Social and institutional engagement played a crucial role in implementation. The support of local authorities, the willingness of stakeholders, and the availability of expert knowledge were all essential for the project's success.

However, the lack of long-term environmental monitoring limits a full evaluation of its broader impacts. While soil retention and infiltration improvements were documented, there is little information on water quality, biodiversity, or climate regulation outcomes. Ensuring continuity in monitoring would strengthen the case for replicating such measures elsewhere.

Barriers

Barrier type	Barrier role	Comments
Other	Main barrier	The main implementation barriers were physical constraints such as the high slopes.

Drivers

Driver type	Driver role	Comments
Other	Main driver	Morphology, vegetation, climate and geology of the area.

Success factors

Success factor type	Success factor role	Comments
Attitude of relevant stakeholders	Main factor	The active involvement of the two Institutes was of critical importance
Attitude of decision makers	Secondary factor	—
Existing staff and consultant knowledge	Secondary factor	The expertise and knowledge tools of the two Institutes was important

Transferability

This measure is highly transferable to other Mediterranean or fire-prone regions with steep terrain and erodible soils. It requires low-cost, locally sourced materials and can be rapidly implemented. However, careful attention must be paid to site-specific factors like slope stability, soil type, rainfall intensity, and post-fire vegetation dynamics to ensure long-term effectiveness and avoid unintended erosion downstream.

Sources

Sources

Post-fire water retention management : The case study of Ancient Olympia, Greece

Restoration of the archeological and the broader landscape of Olympia

Impact of Post-Fire Rehabilitation Treatments on Forest Soil Infiltration in Mediterranean Landscapes: A Two-Year Study

Ηλεία 2030: Ανασυγκρότηση με επίκεντρο την Αρχαία Ολυμπία