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ADAPTATION TO CLIMATE CHANGE

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Participatory planning for climate resilience in Greece's agricultural heartland

Stakeholders at the Pinios River Basin uniting to develop a Climate Action Plan

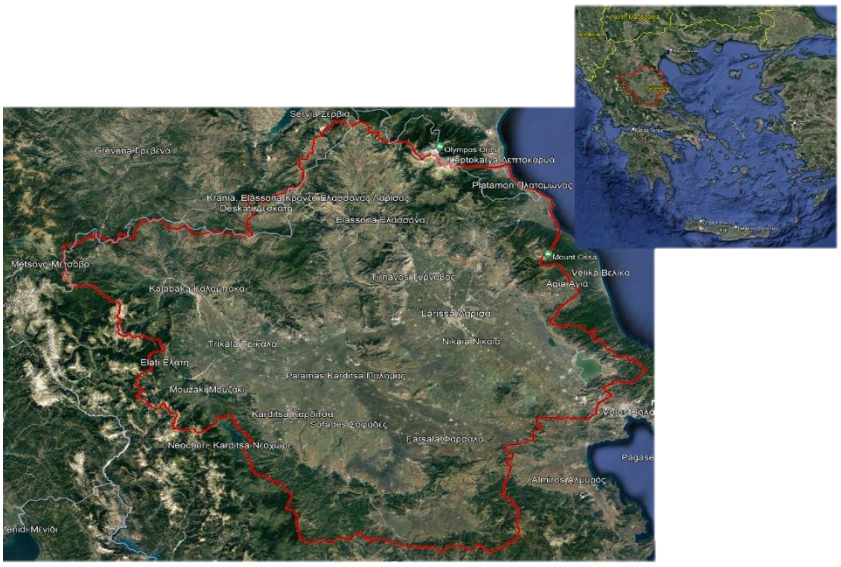
A three-year participatory process with local authorities and stakeholders in the Pinios River basin included climate-proofing recommendations across the Water-Energy-Food-Ecosystems Nexus sectors in the revised River Basin Management Plan.

Key Learnings

- **Extreme Weather Events as a Catalyst for Change**: Extreme weather events, such as floods and droughts, became a turning point, making previously resistant stakeholders call for climate support. When livelihoods are directly impacted, the urgency for adaptation becomes clear.
- **The Power of Science-Based Dialogues**: Participatory processes, clearly explaining climate models and future scenarios, bridge gaps between diverse stakeholders by shifting the focus from short-term compromises to long-term sustainability. European scientific institutions play a key role by providing trusted expertise and a neutral perspective, which can help break deadlocks and move discussions forward.
- **Strategic Timing for Policy Influence**: EU-funded projects should align with key policy windows, such as the revision of River Basin Management Plans or other regulatory updates, to maximise impact and ensure that scientific recommendations translate into concrete policy change.
- **A holistic Adaptation Approach enhances Climate Resilience**: Considering water, energy, food and ecosystems allows forward-thinking climate change adaptation, despite potentially conflicting interests.

About the region

The Pinios River Basin is one of the most productive agricultural areas of Greece, spanning 11,000 km^2, with rough topography. Approximately 550,000 inhabitants consume over 1,1 billion m^3 of water per annum, mainly groundwater resources to cover agricultural irrigation demands, covering 41% of the area. Overexploited groundwater resources and extreme weather conditions lead to highly vulnerable and unsustainable conditions.



Climate Hazards

Droughts, Water Scarcity, Extreme Heat,

Flooding

Sector

Agriculture, Water Management

Key system

Land use and Food systems,

Water Management

Climate Threats

In September 2023, Storm Daniel, followed by Storm Elias a few days later, brought extreme rain ranging between 150 and 1,100 mm (average 360 mm) in 5 days across the Pinios River basin. Usually, the mean precipitation is about 750 mm per year, meaning the heavy rains caused widespread destruction, 17 human fatalities and several billion euros in agricultural and urban infrastructure damages. The extreme weather event damaged more than 700 km^2, and about 180 km^2 remained flooded for over 12 months after the storm. In contrast, the basin had experienced consecutive droughts during the past five summers, leading to compacted soil in the basin and making the surface water reservoirs run completely dry.

Water scarcity is rising, challenging the sustainability of agricultural production that strongly relies on irrigation. In the Agia sub-basin, at the eastern edge of the Pinios River Basin, climate impacts are milder than in the basin's central areas. The 2025 irrigation period began with the central reservoir's water level already one meter below the critical threshold.

Figure 1: Following Storm Daniel, flooding in the area was so intense, that the revived Lake Karla in the Pinios river basin (drained in 1960 and partially restored in the early 2000s) expanded from an area of 37 km2 to about 180 km2 for more than 12 months. Image Credit: Alexandros Kandarakis / GWP-Med.

Climate Threats Spurring Collective Action

Competing agricultural and political interests, favouring the existing situation, have long hampered effective climate change adaptation strategies, addressing the emerging challenges and promoting sustainable agriculture. However, the series of extreme weather events coupled with declining water availability has made local communities realise the urgency of climate adaptation.

Stakeholders from the agricultural sector and the regional authorities now increasingly see the need for immediate concerted action to protect energy infrastructure, safeguard human lives, and ensure the region's long-term resilience and economic viability. This enabled raising awareness among stakeholders from the agricultural sector, regional and national authorities, as well as stakeholders from the water sector and research institutions of the basin's challenges within the frame of the Water-Energy-Food-Ecosystems Nexus. This is an integrated approach that recognises the dynamic interdependence of these four different sectors, aiming to manage and optimise their use sustainably and holistically.

Figure 2: The apple agricultural cooperative 'Kissavos' actively participated in the co-creation of measures for the Pinios river basin. Image Credit: Alexandros Kandarakis / GWP-Med.

A new Community of Practice Promoting Climate Adaptation

In response to climate change threatening the interaction between Water, Energy, Food and Ecosystems (WEFE-Nexus) and to break the deadlock hampering climate adaptation, the REXUS project team facilitated a three-year participatory process to develop a climate resilience plan. The Greek Soil and Water Resources Institute (SWRI) led the initiative to overcome fragmented governance structures that are aggravating the problem. Involving key stakeholders – such as local, regional, and national authorities, agricultural cooperatives, scientific institutions, and environmental NGOs – helped overcome this limitation. More than 50 practitioners formed a Community of Practice. The project team involved the stakeholders in three formal workshops, one-to-one interviews, detailed online surveys and focus group sessions that provided valuable feedback while maintaining active engagement. For the first time, various stakeholders came together to discuss shared challenges and develop a climate resilience plan, protecting the region's agricultural future, and resolving the barriers of different understandings and viewpoints.

> *"Throughout the whole participatory process, there were opposing views. However, we managed to set aside any differences and to propose measures that represented all stakeholders.",*
>
> *Participant*

The process received broad acceptance because it involved international scientific experts, ensuring credibility and political backing. Diverse local stakeholders, as well as politicians, considered the process and results mediated by the REXUS project to be valid because they involved international scientific experts who were considered impartial about local politics and long-standing views. Local stakeholders

saw political backing for the process from the outset, which had a reinforcing effect in encouraging local stakeholders to engage. The initiative created a strong platform for developing scientifically grounded and forward-thinking solutions by bringing together farmers, engineers, environmental advocates, and policymakers.

Science-based Participatory Planning

Stakeholder input fed a System Dynamics Model that maps key interactions and dynamics in the basin.

A suite of tools helped stakeholders to:

- **Assess the basin's status and projected future under climate change, using Climate Risk Assessments**, Land Use Suitability calculator, Agricultural Water Accounting & Footprint, and Carbon Footprint methodologies, combining adaptation and mitigation.
- **Develop strategies for overcoming institutional, governance and financing barriers,** including a framework for integrating Nature-based Solutions into adaptation planning and a Political Economy Analysis to understand and address coordination challenges.

By integrating stakeholder input into a scientifically informed process, these tools offered a clear perspective on current vulnerabilities, future risks, and alternative solutions, all within the Water-Energy-Food-Ecosystem Nexus framework.

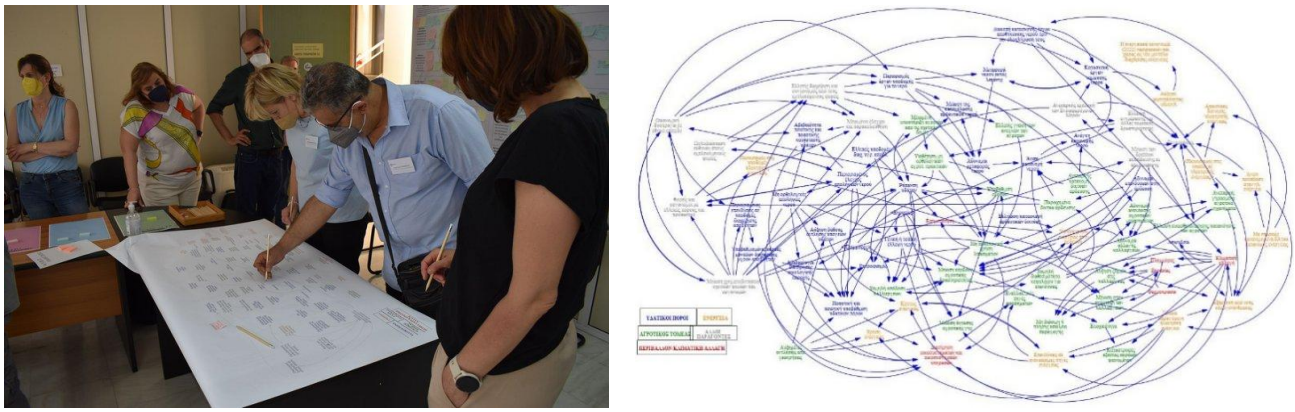


Figure 3: Stakeholders were asked to map the connections between different sectors, which were then represented into a Causal Loop Diagram, which helped stakeholders realise the complexity and trans-sectoral interdependencies of the WEFE NEXUS. This was a key step towards developing realistic and viable solutions that build resilience and sustainability. Image Credit: Alexandros Kandarakis / GWP-Med.

Strategic Communication Accelerating Change

Extensive media outreach was key in connecting the global climate agenda to local challenges, making the project directly relevant to affected communities. In-depth interviews with farmers, policymakers, and scientists provided a platform for their perspectives and concerns. Coverage on local and national television expanded public awareness, while agricultural media ensured farmers, among the most impacted, remained engaged. Through strategic communication efforts by the Global Water Partnership-Mediterranean, promoting action and facilitating dialogues, stakeholders saw the project as a policy discussion and a real opportunity for economic and environmental resilience in the face of climate change.

Participatory Vision and Recommendations

The process culminated in a participatory visioning exercise, where stakeholders identified and prioritised key measures for inclusion in the revised River Basin Management Plan. The recommendations were assessed for feasibility and cost-effectiveness to ensure practical implementation.

Figure 4: Stakeholders collaboratively elaborated a Strengths-Weaknesses-Opportunities-Threats (SWOT) Analysis for a series of environmental challenges and objectives for the Pinios River basin. Image Credit: Alexandros Kandarakis / GWP-Med.

"After many years, I realised that we have to respect the opinions of the other co-creators and of course, this is the direction we need to take from here, to co-decide which policies will help secure the reconstruction and resilience.",

Agronomist, former Director of the Land Reclamation Directorate of Larissa

Inclusion in the Revised River Basin Management Plan

The SWRI team facilitated the effort, and REXUS scientific partners analysed the impact of measures proposed initially by stakeholders. The stakeholders, including scientists, researchers, and local and regional authorities, selected and prioritised 20 out of 117 final measures, included in the revised River Basin Management Plan. This achievement marks a significant step toward climate-proofing the region's water, agriculture, and ecosystems through science-driven, stakeholder-led planning. The participants grouped the measures into four main categories: Eco-flood protection, Energy efficiency, Water resources management and optimisation, and Agroecological farming, which is a sustainable way of farming that works with nature.

"Promoting us to think and act before it is too late, created a win-win situation for everyone. If we don't have water, we have nothing. No agricultural production, no life, no nothing.",

Participating farmer

Summary

A three-year participatory process in the Pinios River Basin brought together authorities, farmers, scientists, and NGOs across the Water-Energy-Food-Ecosystems Nexus sectors to design a climate resilience strategy, tackling extreme flooding and water scarcity. The stakeholders used System Dynamics Modelling and Climate Risk Assessments to identify vulnerabilities and develop science-based adaptation measures. Through a structured visioning process, they prioritised 20 key interventions and successfully included them in the revised River Basin Management Plan for the Pinios River. This achievement demonstrates the power of collaboration in overcoming long-standing challenges and ensuring climate resilience for the region's water, agriculture, and ecosystems.

Further information

The work presented in this adaptation story is part of the REXUS H2020 project.

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- Video: https://youtu.be/0JDMxkdUrqU?si=dwuCeTCWjKEnoP-z

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