

prespaNET

A NETWORK OF ENVIRONMENTAL NGOs FOR PRESPA



Prespa's Waters at a Crossroads: Our Water, Our Future

SOCIETY FOR
THE PROTECTION
OF PRESPA



MACEDONIAN
ECOLOGICAL
SOCIETY



PPNEA

PROTECTION AND PRESERVATION OF NATURAL ENVIRONMENT IN ALBANIA
- SINCE 1991 -

Why this review was needed

The Prespa Lakes basin - shared by Greece, Albania, and North Macedonia - is one of Europe's most valuable transboundary freshwater ecosystems. Its lakes and wetlands support rare biodiversity, agriculture, fisheries, tourism, and local communities. Because the lakes are shared by three countries, what happens in one part of the basin affects everyone.

Over decades, many scientific studies have examined Prespa's waters. Yet knowledge remained:

- scattered across countries and institutions
- uneven in quality and accessibility
- sometimes outdated
- and occasionally contradictory

Stakeholder dialogue on Prespa's waters is ongoing, but proposals are sometimes based on misconceptions. Without a shared evidence base, effective transboundary management is impossible.

Under **PrespaNet Project III**, a trilateral working group critically reviewed more than **120 scientific documents**, including state reports, NGO studies, academic publications, and monitoring data, focusing primarily on 21st century publications. The purpose was to understand the condition of our waters and what the future may bring.

The aim was not to undertake new research, but to answer three fundamental questions:

1. What do we know with reasonable certainty?
2. What remains uncertain?
3. What must be urgently investigated?



The core finding: a fragmented knowledge base

Although scientific work in Prespa is extensive, the review identified structural weaknesses:

- Most studies focus on one country only, despite the basin being shared
- Monitoring systems differ between countries, if they exist at all
- Data are often inaccessible or not publicly available
- There is a lack of multi-year modeling using modern hydrological simulations; many studies rely on outdated «steady-state» methods
- Ecological studies are rarely linked to hydrological data

In Albania and North Macedonia, systematic state monitoring is limited, while in Greece a structured monitoring system has operated only since 2012 under EU law.

The result is **an incomplete scientific picture** - a puzzle with missing pieces.

The Prespa Lakes and Rivers are not just beautiful landscapes. Together with underground waters they are:

-  Our drinking water source
-  The basis of our agriculture
-  A foundation for fisheries and tourism
-  A home for rare wildlife
-  Part of our identity and heritage



Water quantity

The Dramatic Decline of Great Prespa Lake

One of the clearest and most alarming findings concerns **water levels**.

Scientific records confirm that:

- Great Prespa Lake experienced a major decline during the late 20th century which continues at different rates until today
- Water levels remain low compared to historical conditions
- Lake volume has significantly decreased in recent decades

Why is this happening?

The dominant scientific interpretation is:

Reduced precipitation and climatic variability

Long-term reductions in rainfall and snowfall, particularly during wet seasons, are considered the main driver.

Irrigation abstractions

Water abstraction for agriculture contributes to the decline, but reliable quantification is lacking. Official abstraction figures may underestimate actual use.

What is **NOT** strongly supported?

- Increased losses due to tectonic activity
- The operation of the Koula sluice gate

These explanations lack convincing scientific evidence.

Why this matters locally:

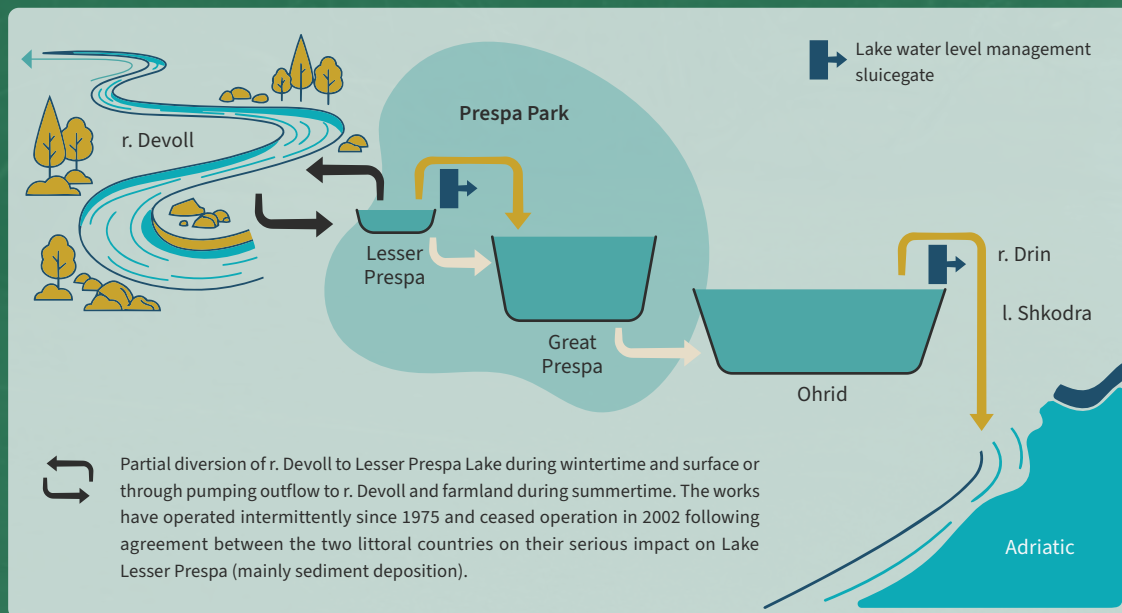
- Lower water levels affect fish spawning habitats
- Shorelines change and wet meadows shrink
- Availability of water for farming becomes less reliable
- Tourism is impacted



The “Unsolved Hydrological Puzzle”

Prespa is hydrologically complex:

- Water flows underground from Great Prespa to Lake Ohrid through karst formations. However, the exact quantities and seasonal variations remain poorly quantified.



Other uncertainties include:

- Limited high-altitude precipitation data.
- Weak knowledge of the other - except the Prespa-Ohrid - groundwater systems.
- Discrepancies between national water balance calculations.

Because the full water balance cannot yet be closed with confidence, stakeholders cannot fully agree on the relative weight of natural versus human causes for the water level drop.

The Power of Long-Term Data: Two Landmark Studies

I. The GFA Consulting (2005) Study (German Bank for Reconstruction supported)

Scope: 54-year hydrological simulation (1951–2004) of Lake’s system.

Innovation: First to merge trilateral data; used all available river data for calibration.

Main finding: Sensitivity analysis demonstrated high dependence of water level on lake inflows and less dependence on abstractions.

II. Van der Schriek & Giannakopoulos (2017)

Scope: Statistical analysis of the same 54-year period + regional climate drivers.

Innovation: Linked lake level behavior to the North Atlantic Oscillation (NAO).

Main finding:

- Annual lake volumetric change and thus water-level variability are strongly related to wet-season (October-April) precipitation
- regional climatic shifts play an important role on long-term level trends
- abstractions have contributed to the sustained post-1995 low levels.

The water quality & ecological status

Gradual Eutrophication and Ecosystem Stress

Review indicates a pattern of gradual nutrient enrichment and eutrophication of the Prespa Lakes.

Main source: Agricultural runoff (fertilizers and diffuse pollution).

Observed impacts:

- Seasonal oxygen depletion.
- Recurrent algal and cyanobacterial blooms.
- Changes in plankton communities.
- Signs of local ecological degradation

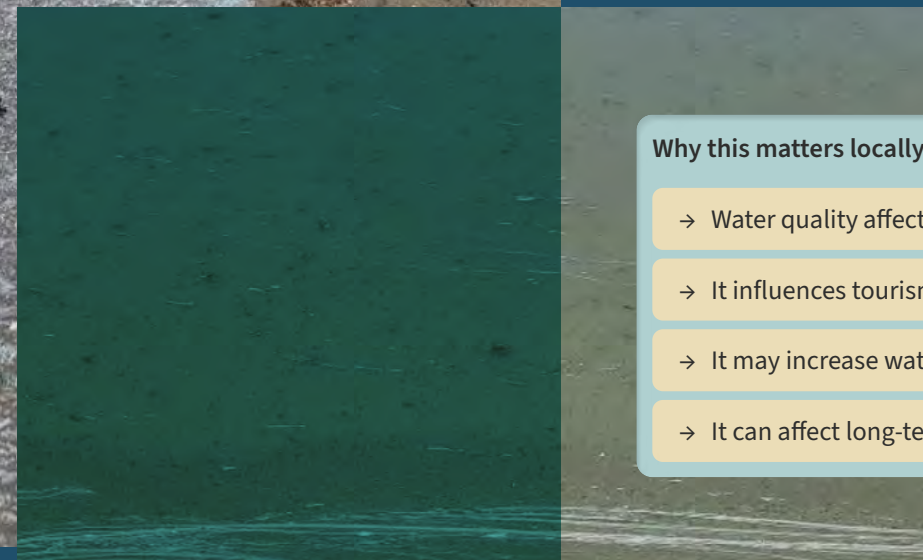
Heavy metals and most organic pollutants generally remain within regulatory limits, but their presence signals continuous input from agricultural and wastewater sources.



Critical gaps include:

- Limited monitoring of cyanotoxins and sediment contamination.
- Lack of data on modern pollutants (microplastics, new pesticides).
- Fragmented ecological assessments.
- Poor integration of biological and hydrological data.

Importantly, even if pollution sources remain stable, continued water level decline alone could worsen ecological conditions by concentrating nutrients and contaminants.



Why this matters locally:

- Water quality affects fish, birds, and overall biodiversity
- It influences tourism and public perception
- It may increase water treatment costs
- It can affect long-term soil and farming sustainability



Climate change as a threat multiplier

The Prespa basin lies within the Mediterranean region, one of Europe's climate change hotspots.

There is no full scientific consensus on the exact contribution of climate change to historical water-level decline, but climatic variability remains the dominant explanation.

Observed and projected trends include:

- Rising temperatures
- Reduced precipitation
- More frequent droughts
- Increased evapotranspiration
- Greater irrigation water demand

Climate change amplifies all existing pressures:

- It reduces water volumes and so increases concentration of pollutants
- It increases evapotranspiration and water demand for agriculture, while crops are stressed by increased seasonal temperatures too
- It threatens native biodiversity and ecosystem resilience

Therefore, **climate adaptation must be central to all future management and decision-making.**



Present and future challenges

The review reveals a transboundary aquatic system under significant and multifaceted pressure. It concludes that relevant challenges are deeply interconnected.

1. Data Fragmentation and Institutional isolation

- Monitoring is inconsistent across borders.
- Data sharing is limited.
- No central trilateral database exists.
- Research is often short-term and project-based.
- State institutions often operate in isolation

This situation, combined with the “unsolved hydrological puzzle”, makes it difficult to fully understand what is happening and to plan together

Without shared information, trust and cooperation become harder.

Without coordinated data, scientific consensus is weakened and policy becomes reactive.

2. The Governance Gap

The three countries operate under different:

- Legal frameworks,
- Institutional capacities,
- Monitoring obligations.

There is no robust permanent trilateral mechanism for:

- Joint water assessment,
- Coordinated planning,
- Evidence-based decision-making.

This governance gap allows misconceptions to influence public debate and policy and does not allow any significant progress in the management of waters that are a genuinely shared resource.

3. Emerging Threats

Poorly understood risks include:

- Microplastics and modern pesticides,
- Ecosystem resilience under repeated drought,
- Socio-economic pressures from reduced water availability for agriculture.

The basin remains vulnerable to threats that are not yet systematically monitored.



The path forward

Strategic Imperatives for Science and Management

The review calls for a **paradigm shift**.

Priority 1: Establish a Trilateral Monitoring & Data Framework

A harmonized system is urgently needed, including:

- Continuous hydrometeorological monitoring.
- High-altitude precipitation and snow measurements.
- Reliable irrigation abstraction quantification.
- Standardized water quality sampling.
- Monitoring of emerging contaminants.
- **A publicly accessible trilateral data platform** as the official reference for the basin

Transparency is foundational for trust.

Priority 2: Develop an Integrated Prespa–Ohrid Model

An integrated, long-term simulation model for water should:

- Combine surface water, groundwater, and water quality.
- Simulate climate and abstraction scenarios.
- Quantify drivers of lake decline.
- Test management interventions before applying them.
- Identify points where water level drops trigger irreversible ecological shifts

This tool would transform debate at both national and transboundary levels into evidence-based planning.

Priority 3: Foster Interdisciplinary and Targeted Research

Future research should be interdisciplinary linking hydrology with geology, ecology, agronomy, and socio-economics. It should address:

- Groundwater flux quantification.
- The Lesser Prespa–Koula isthmus hydraulic connection to Great Prespa.
- Nutrient and pollutant pathways, including microplastics and pesticides.
- Ecosystem resilience.
- Irrigation abstraction, agricultural water-use efficiency and socio-economic incentives for sustainable farming.

Science must be hypothesis-driven and management-oriented.

Priority 4: Strengthen Science–Policy–Practice Links

The “common interpretation” developed through this review should form the basis for developing a shared, evidence-based vision for the basin’s future. This involves translating complex scientific results into **actionable management plans**, such as:

- Trilateral drought contingency plans.
- Joint nutrient reduction programs.
- Sustainable agricultural strategies.
- Coordinated adaptation planning.

Climate-Resilient and Nature-Based Agriculture

Given Prespa’s agricultural economy:

→ Farming systems must become more climate-resilient

→ Diversification of crops and practices is needed

→ Water use must become more efficient

→ Fertilizer loss should be reduced

→ Nature-based solutions (reforestation, soil restoration, shade systems) should be promoted

→ Financial support for sustainable practices should be provided

The goal is not to reduce farming — but to make it more secure and sustainable.

Final Message: From the Scientific Challenge to the Governance Challenge – A call for Transboundary Cooperation

The scientific literature provides a solid but incomplete foundation that shows the direction of change and the severity of the threats.

The defining challenge is no longer purely scientific.

It is a challenge of:

→ Governance

→ Cooperation

→ Institutional capacity

→ Trust between countries

Prespa can either become a model of collaborative European water governance - or a case study of missed opportunity.

The future of the Prespa ecosystem and the communities that depend on it depends on whether Albania, Greece, and North Macedonia can move beyond fragmented national approaches and embrace a truly integrated, collaborative, and science-driven management of their shared waters and natural heritage.



A last note of caution is needed!



- Even if monitoring efforts were multiplied and coordinated across borders
- Even if all data were accessible and shared
- Even if research projects were carried out to answer all remaining scientific questions,

it would not be enough to make a substantial difference in what the future will bring to both people and nature in the Prespa basin. Science-based decisions must be taken, and interventions must be jointly planned and implemented. These decisions and plans necessarily need to be trilateral and not unilateral.

The three states must collaborate and act now!



This edition is based on the report:

«Collection and critical assessment of scientific literature on the status of Prespa waters – Synthesis of findings»

by Akis Zarkadoulas

Text drafting and editing:

Vivi Roumeliotou, Hara Vlachou, Giorgos Catsadorakis, Myrsini Malakou

Photographic material:

© SPP Archive | Christina Ninou (Cover photo)

© Achilleas Chiras (page 5)

© SPP Archive | L. Nikolaou (page 6)

© SPP Archive | Myrsini Malakou (pages 8-9)

© SPP Archive | Charis Nikolaou (pages 10-11)

© SPP Archive | Christina Ninou (pages 12-13)

© SPP Archive | Daphne Mantziou (page 14)

© Macedonian Ecological Society (pages 16-17)

© SPP Archive | Francisco Márquez / The Living Med (page 18)

Map source page 3: European Union, contains modified Copernicus Sentinel data 2026, processed with Copernicus Browser

The diagram on page 6 was designed by the graphic designer, based on a diagram by Dr. Giorgos Parisopoulos

Graphic design:

Productive Land – www.p-l.gr



PrespaNet Project III – Biodiversity Conservation in Transboundary Prespa (2024-2027), funded by the Prespa-Ohrid Nature Trust (PONT) and the Aage V. Jensen Charity Foundation and managed by EuroNatur



euRONATUR