

## THE MONOGRAPH “GLACIAL LAKES OF ALBANIA”: A SCIENTIFIC, ENVIRONMENTAL, AND CULTURAL TESTAMENT FOR FUTURE GENERATIONS

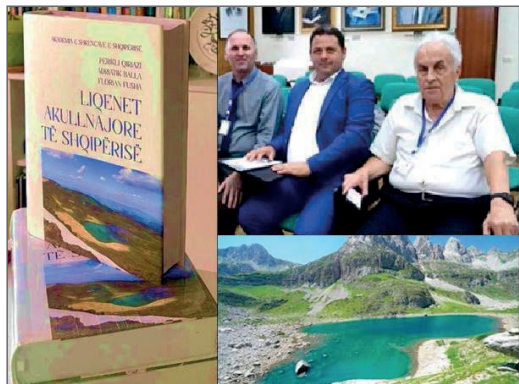
### Book Review Essay

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### BOOK REVIEW

“The Glacial Lakes of Albania” (“Liqenet akullnajore të Shqipërisë”) by Prof. Dr. Perikli QIRIAZI, Dr. Adriatik BALLA, and Dr. Florian FUSHA (2025), Tirana, published by the Academy of Sciences of Albania. 629 pages, 194 photos, 164 satellite images, 133 pictures, 19 tables, bibliography comprising 250 titles (in Albanian language, with an introduction in English). ISBN: 9789928809933.



#### 1 Introduction

Glacial lakes – geomorphological relics originating from the Late Pleistocene glaciation – constitute some of the most fragile, scientifically significant, and culturally meaningful elements of Albania’s high-mountain landscapes. Their formation is directly linked to the major climatic cooling events of the Quaternary period, particularly the Würm glaciation, during which cirques, trough valleys, and moraine systems accumulated and later became basins for present-day lakes once the glaciers melted. As the monograph emphasises, these lakes represent “geographic relic objects” embedded within the wider mosaic of Albania’s exceptional natural diversity, which scholars frequently describe as a “giant natural museum” and a natural laboratory for the study of landscape evolution.

Despite their scientific and cultural prominence, the study of Albanian glacial lakes has historically remained fragmented – sporadic descriptions, limited field measurements, and the absence

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of a unified methodological framework. Previous assessments were often secondary to broader geomorphological or physio-geographical surveys, leaving significant gaps in understanding their genesis, evolution, hydrological regimes, ecological dynamics, and conservation status. The monograph “*Glacial Lakes of Albania*” addresses precisely this gap, emerging as the first comprehensive, systematically structured, and research-integrated inventory of Albania’s glacial lake systems.

Produced under the scientific auspices of the Albanian Academy of Sciences, the work distinguishes itself through its encyclopaedic scope and methodological rigor. For the first time, nearly all of Albania’s more than 200 glacial lakes are identified, documented, and analysed in detail, including their spatial distribution, morphometry, hydrochemistry, level regimes, ecological characteristics, and evolutionary trajectories. The study also establishes a consolidated database and employs modern approaches to classification, grouping the lakes according to internationally recognised scientific criteria – such as cirque, moraine, and karst-glacial origins, permanence, seasonal variability, and geomorphological settings.

Beyond providing a scientific inventory, the monograph offers an interdisciplinary interpretative framework that integrates geomorphology, limnology, ecology, climatology, cultural geography, and environmental management. It highlights the lakes’ rich ecological, aesthetic, and inspirational values, which are deeply embedded in Albanian folklore, mythology, oral traditions, and artistic expressions. Their unique alpine ecosystems – shaped by snowmelt-fed hydrology, cold climates, and highly specific geological environments – host rare, relic, and endemic species, further underscoring their ecological and conservation importance.

Equally significant is the monograph’s contribution to environmental awareness and heritage protection. Many glacial lakes are currently endangered: some are shrinking, others have disappeared, and many face pollution, mismanagement, or the impacts of unregulated human activity. Nearly half of the lakes are considered at risk to varying degrees, a reality the authors underscore while making comparisons to best practices in countries with advanced strategies for the preservation and sustainable management of natural alpine heritage.

Thus, *Glacial Lakes of Albania* serves not only as an authoritative scientific reference, but also as an ethical and cultural appeal for the preservation of Albania’s alpine environments. Its extensive tables, maps, graphics, and field-based photographic documentation make the work accessible and valuable for researchers, policymakers, educators, environmental specialists, tourism operators, and the wider public. As the authors state, the monograph aims to encourage a deeper understanding of these “temples of nature” and to promote their protection, scientific study, didactic use, and inclusion in sustainable tourism development strategies.

By integrating modern theoretical concepts with comprehensive analyses of the lakes’ current status, the monograph brings Albanian geographical science closer to European standards in limnology and geomorphology. It stands as a foundational contribution to the study, conservation, and responsible management of one of the country’s most remarkable natural heritages.

## 2 Methodological Framework

One of the principal strengths of the monograph lies in its carefully articulated multidisciplinary methodological framework, which brings together a wide range of scientific fields to ensure both analytical depth and descriptive accuracy. The study integrates perspectives and approaches from:

- Physical geography and geomorphology, for understanding landform evolution, glacial modelling processes, and the spatial organisation of mountain landscapes.
- Limnology and hydrology, which provide insights into the physical, chemical, and hydrological characteristics of glacial lakes, including water balance, thermal regimes, and trophic status.

- Paleogeography and climate history, enabling reconstruction of past environmental conditions, Quaternary glaciations, and long-term climatic fluctuations that shaped the genesis and transformation of these lakes.
- Mountain ecology, focusing on high-altitude habitats, plant and animal communities, and the ecological services associated with alpine lake systems.
- Cultural geography and intangible heritage, illuminating the symbolic, mythological, and socio-cultural dimensions that glacial lakes hold within local traditions, collective memory, and community practices.

### *Empirical Foundation*

The empirical basis of the research is built on an extensive and rigorously collected dataset, relying on both modern scientific techniques and historical sources. The main components include:

- Comprehensive field observations, carried out over multiple seasons and across diverse alpine environments, allowing for direct assessment of geomorphological features, lake conditions, and environmental pressures.
- Morphometric measurements – including depth, area, volume, shoreline development, and spatial distribution – obtained through combined in-situ surveying and digital analysis.
- Physical and hydrological assessments of lake waters, covering parameters such as transparency, temperature layers, mineralization, and seasonal fluctuations.
- High-resolution satellite imagery and digital morphometric models, used to map lake basins, delineate catchments, track landscape changes, and evaluate long-term dynamics of glacial relief.
- A systematic review of historical documents, archival expeditions, and topographic maps, which situates present-day observations within a broader temporal framework and enables comparison with earlier geographic surveys and cartographic records.

### *Methodological Integration*

By interweaving these diverse methodological components, the authors achieve a research approach that is at once descriptively precise, analytically robust, and normatively oriented. Multidisciplinary integration allows the study to:

- Provide detailed empirical descriptions of each glacial lake and its geomorphological context.
- Generate analytical interpretations regarding lake evolution, environmental trajectories, and current ecological status.
- Formulate informed recommendations for policymaking, conservation planning, and sustainable management, grounded in scientific evidence and sensitive to both natural and cultural dimensions of the high-mountain landscape.

## **3 Organisation and Structure of the Monograph**

The monograph is organised according to a clearly articulated and logically progressive structure, guiding the reader from fundamental theoretical concepts to detailed empirical analyses and finally to applied recommendations of national relevance. This sequential design ensures both scientific rigor and practical usability. The principal components of the work are as follows:

1. A Conceptual Introduction to Glacial Lake Typology within the Broader Framework of Glacial Landforms. The opening chapter establishes the theoretical foundations necessary for under-

standing glacial lakes as geomorphological and limnological entities. It discusses their genetic types, formative processes, and distinguishing characteristics, situating them within the wider system of Quaternary glacial relief. This conceptual context prepares the reader for the methodological and analytical approaches developed in the subsequent chapters.

2. A Historiographic Survey of Foreign and Albanian Research on Alpine and Glacial Lakes. This section provides a comprehensive review of the scientific literature, tracing the evolution of glaciological and limnological studies in Albania. It highlights the contributions of international researchers – geographers, geologists, and explorers – alongside the growing body of Albanian scholarship. The historiographic overview identifies research trends, methodological advances, and persisting knowledge gaps that the present monograph seeks to address.
3. An Inventory and Systematic Classification of Glacial Lakes by Mountain Units. A core component of the monograph is the systematic inventorying of all recognised glacial lakes in Albania, arranged according to the major mountain massifs and regional groups – Lura, Korab, Jezerca, Biza, Valbona, Shebenik, and others. Each unit is analysed in terms of its morphological, geological, and climatic context, enabling the classification of lakes according to typology, genetic origin, and spatial distribution patterns.
4. Morphometric and Limnological Analyses for Each Lake Group. Detailed quantitative analyses are provided for each cluster of lakes, including measurements of surface area, depth, volume, catchment characteristics, hydrological behaviour, and other limnological parameters. These data offer insights into the physical structure, ecological functioning, and comparative morphology of the lakes across different mountain regions.
5. Assessment of Environmental Conditions, Human Impacts, and Climate-Related Changes. This section evaluates the current environmental status of glacial lake systems, examining both natural dynamic and anthropogenic pressures such as land use change, tourism activities, infrastructure development, and resource exploitation. Particular emphasis is placed on the impacts of contemporary climate change - alterations in snowpack, temperature trends, and hydrological regimes - which pose increasing risks to the stability and persistence of these high-mountain ecosystems.
6. Evaluation of Economic, Educational, and Ecotourism Potential. Recognising the multifaceted value of glacial lakes, the monograph explores their potential for sustainable economic development. This includes opportunities for ecotourism, agro-pastoral activities, scientific research, and environmental education. The assessment highlights ways in which glacial lake landscapes can support local economies while maintaining ecological integrity.
7. A Comprehensive National Catalogue: “The Glacial Lakes Cartothèque”. The work culminates with the creation of an extensive national cartographic and descriptive database – the *Glacial Lakes Cartothèque*. This catalogue compiles essential information for each lake, including geographical coordinates, morphometric parameters, environmental characteristics, and administrative classifications. It constitutes a permanent reference resource for researchers, governmental agencies, territorial planners, and environmental managers.

Overall, this structure renders the monograph simultaneously a scholarly work of significant scientific value and a practical reference tool for governmental institutions, protected-area administrations, development planners, and organizations engaged in environmental management and sustainable mountain tourism.

#### 4 Scientific Contributions and Innovations

The monograph offers a series of substantial and original contributions to the advancement of Albanian and broader Balkan geographical science, particularly within the fields of glaciology, limnology, and physical geography. Its interdisciplinary approach, combined with updated empirical data, positions the work as a reference point for future studies of mountain landscapes and glacial heritage in Albania.

##### *Updating and Advancing Scientific Knowledge*

One of the primary merits of the monograph is the comprehensive update of scientific information related to Albania's glacial lakes and their environmental context. The authors synthesise new field measurements, cartographic analyses, and interpretations grounded in contemporary geomorphological and limnological theory. The updated data includes:

- Genesis and evolutionary trajectories of glacial lakes, with detailed explanations of the geomorphological processes - erosional, depositional, and climatic - that shaped these water bodies from the Pleistocene to the present.
- A revised geographical distribution of Pleistocene glaciation, including clearer delineation of the spatial extent and altitudinal limits of former glaciers across mountain ranges in Albania.
- Enhanced morphometric and hydrological profiles of glacial lakes, such as measurements on size, depth, basin geometry, water balance, and seasonal fluctuations.
- A refined limnological typology, classifying lakes according to their physical, chemical, and hydrological characteristics across different alpine and subalpine regions.

A particularly important scientific finding is the determination of the altitudinal belt of Pleistocene glacial activity in Albania, identified at approximately 1300–2500 metres above sea level. This refined elevation range has significant implications for understanding past climatic conditions and necessitates the revision of national morphogenetic and geomorphological maps. It also contributes to broader regional debates on Mediterranean glaciation patterns and their variations in time and space.

##### *The "Atlas" Concept*

Among the innovative contributions of the monograph is the conceptualisation of an Atlas of Glacial Lakes of Albania. This is envisioned not merely as a cartographic product but as a comprehensive scientific and informational platform, integrating:

- detailed topographic and thematic maps,
- updated geospatial datasets,
- hydrological and ecological indicators,
- photographic and satellite imagery,
- and descriptive scientific documentation.

The authors emphasize the potential for this atlas to serve as the foundation for a future digital monitoring system, which could support:

- ongoing scientific research,
- environmental assessment and conservation planning,
- climate - related monitoring of alpine ecosystems,
- educational tools for schools, universities, and visitors,
- and the sustainable management of mountain tourism.

This initiative represents a forward-looking step toward building an integrated digital infrastructure for natural heritage in Albania.

*Integrating Mythology, Folklore, and Cultural Heritage*

For the first time in Albanian geographical literature, the monograph introduces an interdisciplinary narrative that places glacial lakes within the cultural and mythological imagination of the Albanian people. The authors explore how natural alpine landscapes have historically inspired traditional beliefs, symbolic stories, and ritual practices. They examine mythological figures and legendary beings associated with water and highland environments, including:

- Floçka – the “Bride of the Waters,” symbolising purity, mystery, and the life – giving essence of natural springs and lakes;
- Shtojzovallet – ethereal woodland and mountain entities deeply embedded in Albanian folklore;
- Zana – the mythic mountain nymph, representing beauty, protection, and the spiritual essence of the highlands;
- Vidasusi and other mythical guardians tied to the symbolic meaning of remote alpine waters.

By integrating these cultural elements, the authors enrich the strictly scientific narrative and illuminate the lakes as cultural – spiritual landscapes, not merely geomorphological features. This approach encourages readers and researchers to appreciate glacial lakes as spaces where nature, identity, history, and imagination intersect, thereby broadening the interpretative framework of Albanian physical geography.

## 5 Environmental and Economic Dimensions

*Environmental Challenges*

The monograph emphasizes that nearly half of Albania’s glacial lakes are currently experiencing varying levels of environmental degradation. This deterioration stems from multiple interacting pressures, the most significant of which include:

- Pollution associated with tourism and agricultural practices, such as waste accumulation, uncontrolled pasture use, and disturbances caused by unregulated visitor activity.
- Infrastructure development, particularly the construction of roads and trails, which alters natural drainage patterns, disrupts fragile alpine habitats, and accelerates erosion processes.
- Impacts of climate change, most notably the gradual drying or seasonal reduction of water levels in several lake basins, a process linked to reduced snowfall, earlier snowmelt, and rising temperatures in high-mountain environments.

These pressures collectively threaten the ecological integrity, limnological balance, and long-term stability of many glacial lake systems. In response, the authors advocate firm legal and institutional measures aimed at safeguarding these unique natural features. They propose that Albania should grant formal Natural Monument status to the most vulnerable and significant glacial lakes, thereby integrating them into national conservation frameworks and ensuring that they benefit from monitoring, restoration, and sustainable management programs.

*Economic and Developmental Potential*

Despite the environmental challenges, the monograph highlights the considerable economic, educational, and developmental opportunities that glacial lakes offer to Albania. These include:

- Sustainable mountain tourism, which can draw visitors interested in alpine landscapes, hiking, photography, and pristine natural settings.

- Environmental education, providing outdoor classrooms that introduce students, researchers, and visitors to glacial geomorphology, biodiversity, and climate-change processes.
- Ecotourism and regional development, through the creation of local employment, promotion of traditional agro-pastoral activities, and encouragement of community-based tourism models that preserve cultural heritage while protecting nature.

To illustrate this potential, the authors compare Albania's situation with well-established European experiences. In countries such as Italy, Switzerland, and Austria, glacial lakes have been successfully incorporated into national park systems, eco-tourism itineraries, and long-term environmental management strategies. These examples demonstrate that, with proper planning and protection, glacial landscapes can coexist with thriving local economies.

A particular reference is made to Gran Paradiso National Park in Italy, which is presented as an exemplary model of integrated conservation, scientific monitoring, and sustainable tourism. The park demonstrates how protected high-mountain lakes can serve simultaneously as natural heritage sites, research locations, and engines of regional growth.

Drawing from these successful models, the authors argue persuasively that Albania should adopt a similar integrated approach. They envision the country's glacial lakes as potential "open-air laboratories" that can support scientific studies in climatology, ecology, hydrology, and geomorphology, while also fostering responsible tourism and contributing to the livelihoods of mountain communities. Through such strategies, glacial lakes could become key components of Albania's broader sustainable development agenda.

## 6 Cultural and Symbolic Dimensions

Beyond its scientific analyses and policy-oriented conclusions, the monograph conveys a deeply resonant cultural message. The glacial lakes are not treated solely as physical formations shaped by ancient ice, but as multilayered cultural artifacts that embody Albania's natural and spiritual heritage. Within this interpretive framework, the lakes emerge as:

- "Frozen memories" of Albania's natural history, silent witnesses to geological epochs, climatic shifts, and the enduring dialogue between landscape and time. They preserve, in their depths and contours, the narrative of a land shaped by ice, water, and the resilience of mountain ecosystems.
- Spiritual and symbolic landmarks woven into folklore, where local traditions, legends, and mythological figures find a setting infused with mystery and reverence. For many communities, these lakes have long been perceived as sacred spaces - thresholds between the visible and invisible worlds, resonating with stories of nymphs, guardian spirits, and ancestral presence.
- Aesthetic and philosophical sources of inspiration within mountain culture, nurturing a contemplative relationship between humans and nature. Their reflective surfaces, seasonal transformations, and serene isolation have influenced artistic expression, ethical worldviews, and the profound respect that highland societies maintain for their surrounding environment.

The treatment of the Lura lakes, in particular, introduces a reflective and almost poetic dimension to the monograph. Here, the lakes are portrayed not merely as ecological entities but as places where ecological harmony, cultural memory, and human sensibility converge. Their beauty becomes a medium for introspection, inviting the reader to consider the delicate balance between preservation and change, and the shared responsibility to protect landscapes that hold both natural and symbolic significance.

## 7 Conclusion

*Glacial Lakes of Albania* stands as a landmark contribution to Albanian geographical scholarship – a work that bridges scientific rigor, cultural insight, and forward-looking environmental policy. The monograph does far more than document a remarkable natural phenomenon; it constructs a multidimensional narrative in which physical geography, ecological concerns, traditional knowledge, and national identity intersect.

In its essence, the volume operates simultaneously as:

- a comprehensive scientific synthesis, offering the most detailed limnological, geomorphological, and environmental analysis ever conducted on Albania’s glacial lakes,
- an environmental alarm, calling attention to the fragility of these high-mountain ecosystems in the face of climate change, irresponsible land use, and anthropogenic pressures,
- a cultural testament, highlighting the symbolism, myths, traditions, and historical experiences that have grown around these lakes and shaped local memory and identity,
- and a strategic guide for sustainable development, providing evidence-based recommendations for planning, conservation, tourism management, and long-term ecosystem monitoring in Albania’s alpine regions.

By documenting and interpreting one of the country’s most distinctive natural heritages, the authors reaffirm that geography is not merely the science of landforms. It is also a discipline of memory, preserving the stories and knowledge that landscapes carry; a discipline of identity, revealing how nature helps define communities; and a discipline of responsibility, reminding us that the future of these lakes hinges on the choices we make today.

Through its meticulous research and multidisciplinary perspective, the monograph elevates the standards of Albanian scientific inquiry. It provides future generations – scholars, policymakers, local communities, and nature enthusiasts – with both a literal and symbolic map: a map for understanding the origins and dynamics of glacial lakes, a map for appreciating their ecological and cultural significance, and above all, a map for preserving and safeguarding Albania’s alpine environment for decades to come.