DRIN CORDA

Enabling
& Transboundary Cooperation
Integrated Water Resources Management
in the extended DRIN RIVER BASIN

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DRIN BASIN

TRANSBOUNDARY DIAGNOSTIC ANALYSIS

Summary

Basin Overview and transboundary problems

In the framework of:
Memorandum of Understanding for the Management of the Extended Transboundary Drin Basin

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ABBREVIATIONS

a.s.l.	above sea level
ALB	Albania
APSFR	areas of potential significant flood risk
AQC	analytical quality control
BOD	biological oxygen demand (five days)
BQE	biological quality elements
CCA	causal chain analysis
COD	chemical oxygen demand
DCG	Drin Core Group
EEA	European Environment Agency
EQS	environmental quality standards
EU	European Union
EWG	Expert Working Group
GDP	gross domestic product
GEF	Global Environment Fund
GIZ	Gesellschaft für Internationale Zusammenarbeit
GWP-Med	Global Water Partnership – Mediterranean
ha	hectares
HPP	hydropower plant
IUCN	International Union for Conservation of Nature
KOS	Kosovo
LME	large marine ecosystem
MNE	Montenegro
MoU	Memorandum of Understanding
MW	mega watts
N	Nitrogen
NAP	National Action Plan
NEAP	National Environmental Action Plans
NMK	North Macedonia
P	phosphorus
p.e.	population equivalent
PBT	persistent bioaccumulative toxic compounds
RBMP	River Basin Management Plan
SAP	Strategic Action Programme
SDGs	Sustainable Development Goals
TDA	Transboundary Diagnostic Analysis
TN (N')	total nitrogen
TP	total phosphorus
UNDP	United Nations Development Fund
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNWTO	United Nations World Tourism Organization
WISE	Water Information System for Europe

EXECUTIVE SUMMARY

Action at the Drin Basin level was uncoordinated until the development of the Shared Vision for the Sustainable Management of the Drin Basin and the signing of a related Memorandum of Understanding (Drin MoU – 25 November 2011, Tirana) by water and environment ministers and high-level officials of the Drin Riparians (Albania, Greece, Kosovo,[1] Montenegro and North Macedonia). The objective of the MoU is to deliver the agreed shared vision, to "promote joint action for the coordinated integrated management of the shared water resources in the Drin Basin, as a means to safeguard and restore to the extent possible the ecosystems and the services they provide, and to promote sustainable development across the Drin Basin".

Under the Drin CORDA (Drin Coordinated Action for the implementation of the Drin MoU) process, Global Water Partnership – Mediterranean (GWP-Med), the United Nations Economic Commission for Europe (UNECE), and the United Nations Development Programme (UNDP) initiated the Global Environment Facility (GEF) financed project "Enabling transboundary cooperation and integrated water resources management in the Extended Drin River Basin" (GEF Drin Project) to facilitate the implementation of the MoU. This has been undertaken through the GEF-inspired TDA/SAP process, which involves developing a Transboundary Diagnostic Analysis (TDA), which provides information on transboundary problems affecting the basin's water and environment, and a Strategic Action Programme (SAP), which presents the agreed strategy and actions to address the transboundary problems.

The main technical role of the TDA is to identify, quantify and set priorities for environmental problems that are transboundary in nature. Consequently, the TDA provides the factual basis for the formulation of an SAP. In the case of the Drin, further to the above, the TDA assists in enhancing the knowledge basis of the Riparians regarding the state of the natural and anthropogenic environment in the basin, developing the building blocks of a Drin Basin management plan in accordance with the European Union (EU) Water Framework Directive, should the Riparians decide to develop such a plan in the future.

The GEF Drin Project developed the TDA through wide stakeholder engagement. To analyse the system, the Source-to-Sea approach was adopted, to the extent allowed by the information available on transitional waters and the marine area.

The "Situation Analysis: Management of the Extended Drin Basin" (Drin Situation Analysis) served as a starting point for the Drin TDA. The TDA is the core document that synthesizes the findings of basin-wide thematic reports, undertaken at three levels: sub-basin; Drin Riparian within each sub-basin; and the Drin Basin:

1 This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

- Thematic Report on Socio-economics
- Thematic Report on Institutional and Legal Setting
- Thematic Report on Biodiversity and Ecosystems
- Thematic Report on the Hydrology and Hydrogeology
- Thematic Report on Pollution and Water Quality
- Thematic Report on the Nexus (water-food-energy-ecosystems).

The TDA focuses mainly on the issues that are affecting the basin at the transboundary level, with the information presented in the thematic reports providing additional details at the sub-basin level.

Based on the extensive assessment developed through the thematic reports and previous studies (including TDA/SAP activities undertaken through the GEF-supported projects on the Prespa and Skadar/Shkodër lakes), the following four key priority and crosscutting transboundary issues have been identified and confirmed by the Drin Core Group (DCG):[2]

- Deterioration of water quality, which affects – at different levels – all parts of the Drin Basin (surface water, groundwater and coastal water). Of particular concern is the presence of excess nutrients (from domestic wastewater and agriculture) pollution, leading to excess demand on the water's oxygen content (with consequences for ecologically important species), as well as industrial and municipal solid waste from mining and settlements.
- Natural and regulated variability of the hydrological regime as a result of climate variability, and, in some sub-basins, seasonal over-abstraction of water resources and hydropower generation, impacting the quantity of water available for the ecosystem and socio-economic development. Furthermore, it exacerbates naturally occurring extreme phenomena, such as floods and droughts. Agriculture is a key user of water for irrigation – under certain conditions, this may be affected by water shortages during the summer period from June to August.
- Biodiversity degradation. The importance of the biodiversity of the Drin Basin at the European level is significant, though it is under pressure due to multiple threats to the basin's ecosystems from pollution, changes in water quantity, alien species, loss of wetland, illegal activities and climate variability and change, among others.

2 The joint body established under the Drin Memorandum of Understanding (MoU) in November 2011, which is mandated to coordinate action for the implementation of the MoU.

Vipera ammodytes
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- Variability of the sediment transport regime, which is affected by natural events (for example, rainfall), climate variability and change (such as the increase of extreme weather, rainfall and drought) and anthropogenic impacts from gravel extraction, deforestation, poor land-use management and hydropower generation, among others. These changes are having impacts on both freshwater and coastal ecosystems.

Climate variability and change was also recognized as a significant factor that is likely to be influencing the four key transboundary problems impacting the Drin Basin's ecosystems and socio-economic status.

Through analysing the observations from the thematic reports, results from stakeholder meetings and the initial assessments made by the Drin Project, a causal chain analysis (CCA) was undertaken to identify the immediate, underlying and root causes of the transboundary problems.

The TDA and the CCA included therein provide the necessary information that enabled Drin Riparians to agree on the priority actions to be included in the SAP. The SAP will provide the framework for a new era under the Drin MoU, regarding the Riparian cooperation in managing the Drin Basin.

The TDA document and the associated thematic reports are 'living' documents that will be periodically revised and are intended to serve as a baseline against which future progress is measured.


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1. INTRODUCTION

The Transboundary Diagnostic Analysis (TDA) has been prepared through the Global Environment Facility (GEF)-supported project "Enabling transboundary cooperation and integrated water resources management in the extended Drin Basin" (GEF Drin Project). The project aims to support the Drin Riparians (Albania, Greece, Kosovo, Montenegro and North Macedonia) to enhance cooperative management of the shared water bodies within the Drin Basin using a wide range of means, including institutional capacity-building, testing novel basin management approaches, developing the means to enhance trust-building through information exchanges, etc. The core action of the project is to develop a TDA and a Strategic Action Programme (SAP). Problems in the natural and anthropogenic environment are assessed through the TDA, providing the factual basis for an agreed set of interventions included in the SAP to address the problems. The GEF approach of using a TDA and an SAP to deliver transformational change has been applied in over 35 international rivers, groundwaters, lakes and large marine ecosystems (LMEs).

To analyse the system, the Source-to-Sea approach[3] was used to the extent allowed by the information available on transitional waters and the marine area.

The boundaries of the Drin Basin area are defined considering the natural characteristics of the area and its local conditions, with the area comprising natural elements, including catchments, aquifers, transitional waters, coastal waters and the coastal zone.

The land boundary of the Drin Basin area was defined using the physical boundary of the Drin watershed. In the case of Montenegro, this boundary conforms to the administrative boundary of the river basin district, while for Albania, Kosovo and North Macedonia, the (watershed) boundary does not always conform to such districts' administrative boundaries.

Underlying aquifers extend beyond the watershed's boundaries and were therefore not included, as any measures later defined as part of the SAP would fall outside the sub-basins of each Drin Riparian.

The marine boundary and the coastal zone were estimated taking into consideration the primary influence of the surface-water flows on marine waters, as indicated by the levels of salinity, as a proxy measure of the main influences of land-based activities.

The Drin Riparians are either Member States of the European Union (EU) or in the process of seeking EU membership. A significant and relevant part of the

3 A Source-to-Sea approach consolidates analysis, planning, policymaking and decision-making across sectors and scales. It considers the entire social, ecological and economic system from the land area that is drained by a river system to the coastal area and even the open ocean it flows into (http://stapgef.org/sites/default/files/publications/S2SBrief.pdf). A source-to-sea system includes the land area that is drained by a river system or systems, its lakes and tributaries (the river basin), connected aquifers and downstream recipients, including deltas and estuaries, coastlines and nearshore waters, the adjoining sea and continental shelf, as well as the open ocean. Water, sediment, pollutants, biota, materials and ecosystem services key flows connect the subsystems in the source-to-sea continuum and their geographies.

EU acquis relates to the environment, especially water. Compliance with two water-related directives – the EU Water Framework Directive and Flood Risk Directive – requires a detailed analysis of river basins. The approach adopted by the GEF Drin Project has led to the development of detailed thematic reports that analyse a range of the basin's characteristics, addressing the needs of the TDA and assisting the Riparians in the implementation of the Water Framework Directive[4] and the Flood Risk Directive. The Drin TDA was developed in such a way to enable the Riparians to enhance environmental management.[5]

The Drin Project also builds on a significant history of collaborative action in the region through the development of specific TDA/SAP activities for key sub-basin lakes (Lake Prespa and Lake Skadar/Shkodër). While the Drin Project is assisting GEF-eligible Riparians, Greece, as a member of the EU, complies with the requirements of the Water Framework Directive and has previously participated in the Lake Prespa TDA/SAP, which is the only part of the Drin Basin involving Greece.

1.1 Drin Basin

The Drin Basin (Figure 1) sits in the south-east of the Balkan Peninsula with water bodies and watersheds spread across Albania, Greece, Kosovo, Montenegro and North Macedonia. It comprises the sub-basins of the Black Drin,[6] White Drin,[7] Drin and Buna/Bojana[8] rivers, of the Prespa, Ohrid and Skadar/Shkodër[9] lakes, the underlying aquifers, and the adjacent coastal and marine area.

Lake Prespa is the starting point of the water flow towards the Adriatic Sea, comprising two lakes (Micro and Macro Prespa) linked by a small channel, with regulated water flow, which traverses the alluvial isthmus that separates them. Micro Prespa is shared by Albania and Greece, while Macro Prespa is shared by Albania, Greece and North Macedonia.

Water also flows through underground karst cavities from Lake Prespa to Lake Ohrid. Shared by Albania and North Macedonia, Lake Ohrid is the largest lake in terms of water volume in South-East Europe. As the only surface outflow of Lake Ohrid, the Black Drin River flows north through North Macedonia. It forms the border with Albania for some kilometres, before entering the country between the cities of Debar and Peshkopi. The White Drin River rises in Kosovo and flows into Albania, where it meets the Black Drin River, near the city of Kukës, to form the Drin River.

Flowing westward through Albania, one branch of the Drin River joins the Buna/Bojana River approximately 1 km from where it flows from Lake Skadar/Shkodër near the city of Shkodra in Albania. Shared by Albania and Montenegro, Lake Skadar/Shkodër is the largest lake in terms of surface area in South-East Europe. The largest river flowing into the lake is the Morača River, which passes through Podgorica, the capital of Montenegro.

The Buna/Bojana River drains Lake Skadar/Shkodër and flows into the Adriatic Sea. Its lower part (23 km) forms part of the Albania–Montenegro border. The other branch of the Drin River, which is the older branch, discharges its limited flow directly into the Adriatic Sea, south of the city of Shkodra, near the city of Lezhë.

A number of aquifers exist, often with complex groundwater–surface water interaction and interdependency. There are five large reservoirs used for hydropower production and more than 110 irrigation reservoirs.

With its extensive water resources (the third greatest river discharge into the European Mediterranean, after the Po and Rhone rivers), this complex system provides a wealth of services to the Drin Riparians that share the basin: energy supply, recreation and tourism, fisheries, water supply for irrigation and domestic uses, sustenance of unique endemic biodiversity, and livelihoods. The basin is home to over 1.61 million people, living in over 1,450 settlements.

4 The thematic reports were prepared in a manner that enabled also the development of necessary elements to be used as building blocks for a river basin management plan (RBMP) at the Drin Basin level, should the Riparians decide to develop one (including an initial proposal for delineating water bodies in accordance with the Water Framework Directive, calculation of a water budget under different scenarios, analysis of pollution pressures, assessment of generated pollution loads, assessment of chemical pollution, identification of protected areas, analysis of the governance of water and environment in the basin and an initial assessment of the condition of and the pressures on biodiversity, among others).

5 The two (first ever) monitoring campaigns across the Drin Basin in 2016 and 2017 were implemented to fill in knowledge gaps. The monitoring network used was defined in cooperation with national institutions to: (i) cover the entire Drin Basin; and (ii) include routine sampling stations used by the Drin Riparians for their annual surface and underground water quality monitoring, as well as additional monitoring stations for which routine sampling is not performed. All information gathered or generated through the TDA development is stored in an online geographic database that enables institutions to use related information in their everyday conduct of business.

6 The river is called Drin i Zi in Albania and Crn Drim in North Macedonia.

7 The river is called Drini i Bardhë in Albania and Kosovo.

8 The river is called Buna in Albania and Bojana in Montenegro.

9 The lake is called Skadar in Montenegro and Shkodër in Albania.

Figure 1. Map of the Drin Basin

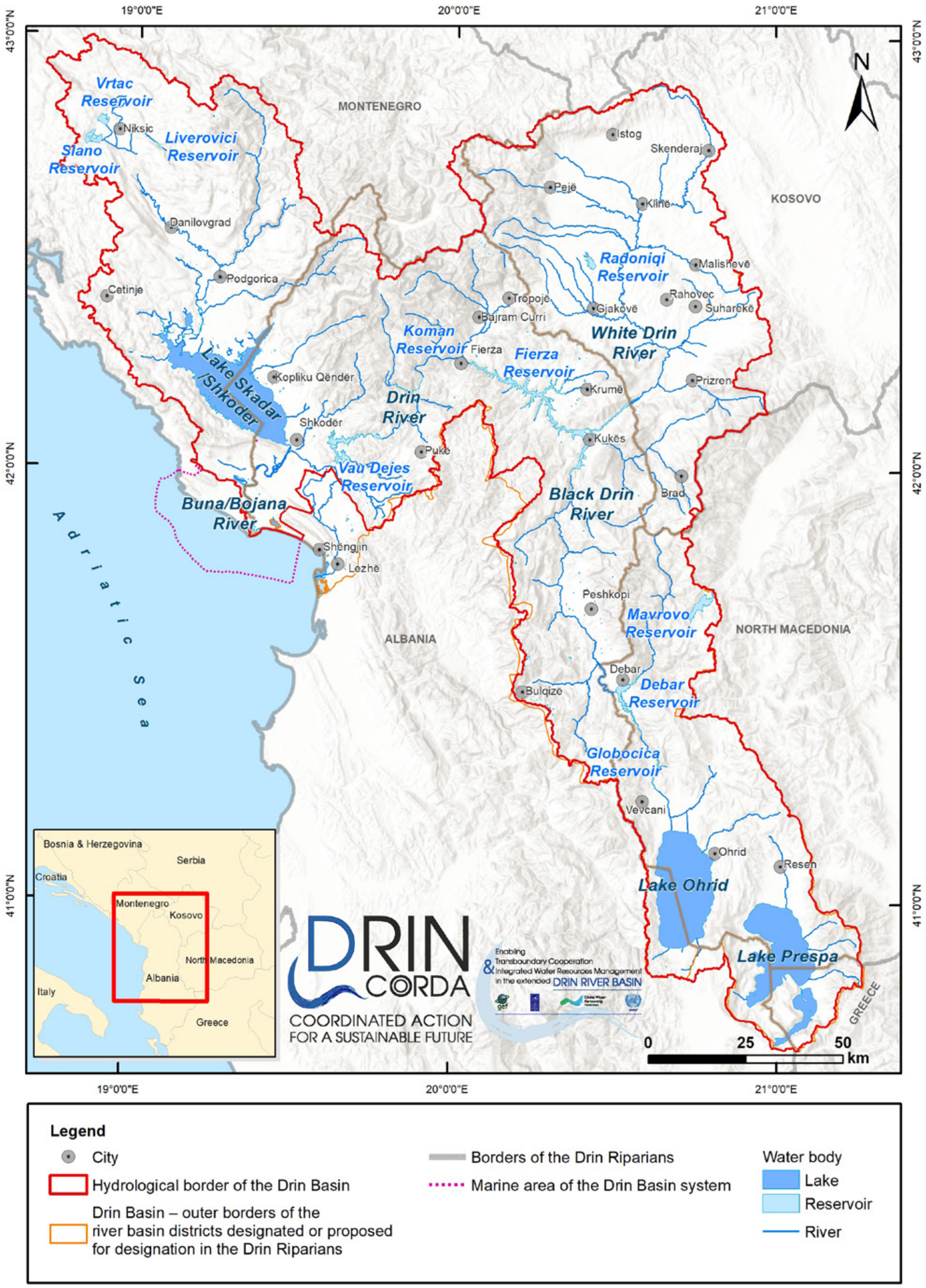
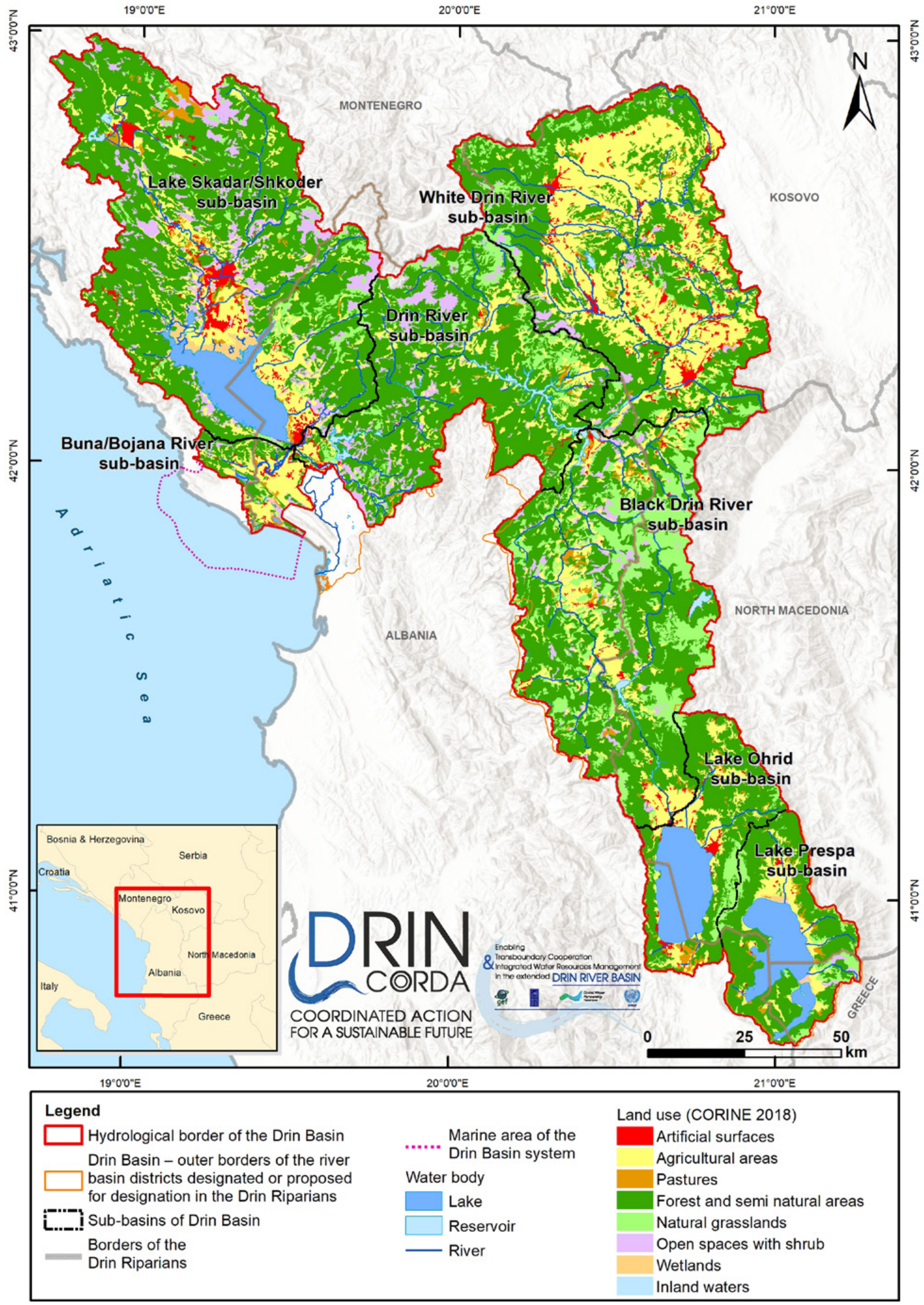


Figure 2. Land uses in the Drin Basin



1.2 Drin Coordinated Action

Action at the Drin Basin level was uncoordinated until the development of the Strategic Shared Vision for the sustainable development of the Drin Basin and the signing of a related MoU (25 November 2011, Tirana) by ministers and high-level representatives of the water and environment ministries of the Drin Riparians (Albania, Greece, Kosovo, North Macedonia and Montenegro). This was an outcome of the Drin Dialogue, coordinated by the Drin Riparians with the support of GWP-Med and the United Nations Economic Commission for Europe (UNECE).

The ultimate goal of the work in the Drin Basin is to reach a point in the future where the scale of management lifts from single water bodies to the basin's interconnected hydrological system, eventually leading from the sharing of waters among Riparians and conflicting uses, to the sharing of benefits among stakeholders.

A process referred to as the Drin Coordinated Action for the implementation of the Drin MoU (Drin CORDA) was established. Following the provisions of the Drin MoU an institutional structure was established, which includes:

- the Meeting of the Parties
- the Drin Core Group (DCG), comprising officially appointed representatives of the Drin Riparians' line ministries and mandated to coordinate actions for the implementation of the MoU
- four Expert Working Groups (EWGs) to assist the DCG in its work:
  - › Water Framework Directive Implementation EWG
  - › Monitoring and Information Exchange EWG
  - › Biodiversity and Ecosystems EWG
  - › Floods EWG.

The DCG Secretariat provides technical and administrative support to the DCG. By appointment of the Parties through the MoU, GWP-Med serves as the Secretariat.

1.3 GEF Drin Project

The aims, objectives and content of the GEF Drin Project are aligned with the Drin MoU.

The objective of the project is to "promote joint management of the shared water resources of the transboundary Drin Basin, including coordination mechanisms among the various sub-basin joint commissions and committees". Albania, Kosovo, Montenegro and North Macedonia are the project beneficiaries. Greece, as an EU Member State does not receive support from the GEF.

The GEF Drin Project has five components:

Component 1: Consolidating a common knowledge base

Component 2: Building the foundation for multi-riparian cooperation

Component 3: Institutional strengthening for integrated river basin management

Component 4: Demonstration of technologies and practices for IWRM and ecosystem management

Component 5: Stakeholder involvement, gender mainstreaming and communication strategies.

The project is implemented by UNDP and executed by GWP, through GWP-Med. UNECE is a partner to this process. The DCG acts as the project's Steering Committee.

1.4 Methodology for the development of the TDA

The Drin Project has followed the GEF TDA/SAP guidance.[10] The TDA builds upon (i) the formative work undertaken in 2014 by GWP-Med that led to the "Drin Situation Analysis" and (ii) six basin-wide thematic reports, which provide a detailed assessment and characterization of the Drin Basin:

- Thematic Report on Socio-economics
- Thematic Report on Institutional and Legal Setting
- Thematic Report on Biodiversity and Ecosystems
- Thematic Report on the Hydrology and Hydrogeology
- Thematic Report on Pollution and Water Quality
- Thematic Report on the Nexus.[11]

The thematic reports were developed with guidance from the GEF TDA/SAP as well as the EU Water Framework Directive. The thematic reports were elaborated at three levels:

- the sub-basin level i.e. Lake Prespa, Lake Ohrid, the Black Drin River, the White Drin River, the Drin River, Lake Skadar/Shkodër and the Buna/Bojana River
- the Riparian level within each sub-basin
- the overall Drin Basin level.

A summary of these thematic reports presented in the TDA focuses on the main transboundary problems with specific references to the details in the reports, particularly those regarding sub-basins and national specific issues. The thematic reports will also provide a substantive input to the development of Riparian river basin management plans (RBMPs) to meet the needs of the EU Water Framework Directive and the Flood Risk Directive, acting as a baseline for monitoring the future implementation of the SAP.

1.4.1 Stakeholder involvement in the development of the TDA

The GEF Drin Project has had significant stakeholder involvement in identifying priority transboundary problems and developing an agreed causal chain analysis (CCA) to understand the root, underlying and immediate causes of the problems. A summary of the processes that lead to the development of the Drin TDA is summarized in Table 1.

10 https://www.iwlearn.net/manuals/tda-sap-methodology.

11 The nexus report supplements information collected in the other thematic reports by assessing the linkages between water, food and energy security with the integrity of the ecosystem.

A total of fifteen national experts, four international experts, three companies and the Project Management Unit (PMU) worked to collect data and develop the TDA thematic reports and synthesis report.

Table 1. Stakeholder meetings towards the development of the Transboundary Diagnostic Analysis

Time	Location	Meeting	Topic
Project life	All Drin Riparians	DCG and EWG meetings/twice per year	The TDA table of contents was adopted. At each consecutive meeting, TDA development progress was discussed, specific thematic reports were presented to the DCG/EWG members, and the reports were reviewed/approved. The TDA was presented and approved.
Project life	All Drin Riparians	Individual meetings with representatives of the relevant Institutions: ministers, directors of departments, heads of agencies, etc.	Introduction of the project (the TDA was part of the introduction), investigation of opportunities for cooperation, presentation of developments, receiving of guidance on issues related to the development of the TDA ensuring compatibility with national priorities, especially the implementation of the EU Water Framework Directive.
Oct-Nov 2016	Six cities covering all Drin sub-basins	Focus Group meetings in Tirana, Shkodra, Pogradec, Ohrid, Podgorica and Pristina	Among others: identified the perceived key management issues and problems at the sub-basin and basin levels, as well as their causes and impacts from the stakeholders' perspective.
Mar 2017	Tirana	Meeting with riparian experts from all Drin Riparians	Coordination for the preparation of the thematic reports.
Nov 2017	Podgorica	Stakeholders conference	The stakeholders were presented with key findings from the process of developing the TDA thematic reports and provided input. Focus was placed on socio-economic, biodiversity and institutional and legal setting thematic reports, as well as on the main findings of the TDA and the causal chain analysis (CCA).
Nov 2018	Ohrid	Stakeholders conference	The stakeholders were presented with key findings from the process of developing the TDA and provided input. Focus was placed on the pollution and water quality, and hydrology and hydrogeology thematic reports, as well as the main findings of the TDA and the CCA.
Dec 2018	Athens	CCA-SAP workshop	Local and international experts participated in the preparation of the thematic reports reviewed the CCA analysis and prepared a first set of interventions to address the transboundary issues identified.
Jan 2020	Tirana	Stakeholders conference	The TDA was presented to the stakeholders.

A detailed stakeholder analysis was undertaken to understand: (i) the stakeholders' perception regarding the transboundary issues and problems; and (ii) the multilevel non-linear linkages among the groups of stakeholders that are by default engaged in the management of the Basin and that the project activities concern.

The stakeholder analysis and the six Sub-basin Focus Group meetings in Tirana, Shkodra, Pogradec, Ohrid, Podgorica and Pristina cited the following issues of transboundary importance:

- the unsustainable management of wastewater and solid waste
- industrial, mining and quarrying activities in the basin, which are linked to an increase in pollution loads, especially of toxic substances
- hydropower production and infrastructure, which reduce downstream water flows to less than the ecological minimum
- climate variability and change and related phenomena in the basin
- floods
- a lack of coordination between Riparians on how to manage hydropower infrastructure in order to regulate flows, which has reportedly intensified flooding problems in the past
- agrochemicals and excessive use of water in intensive agriculture
- preserving ecosystems and protecting biodiversity.

The stakeholder analysis and involvement has guided the final selection of developing CCA priority transboundary problems.

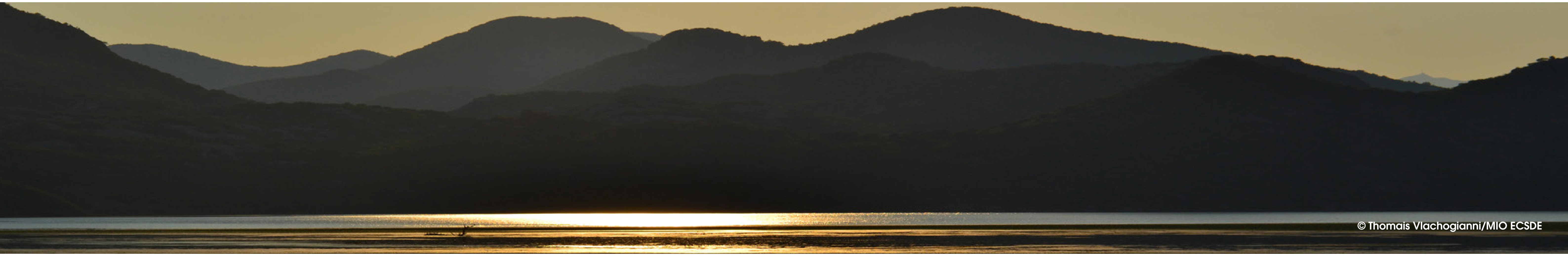
1.4.2 Situation analysis

A situation analysis, which was carried out by GWP-Med in 2014, has guided the development of the current GEF Drin Project, providing an important assessment of the basin. The TDA has also been guided by this situation analysis, which identifies the major issues and problems as relating to:

- water balance
- sediment balance
- water quality
- unsustainable forestry management and deforestation
- unsustainable fishing practices and the introduction of alien species
- urbanization and unsustainable tourism
- hunting
- sand and gravel extraction
- climate variability.

The situation analysis identified the key causes as:

- insufficient management of the sub-basins at the national level (including legal frameworks, institutional capacity, monitoring and research)
- insufficient management of the sub-basins at the transboundary level.



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2. BASELINE INFORMATION ON THE DRIN BASIN

2.1 Geographical scope

The total geographical area of the Drin Basin is 20,361 km². The basin is characterized mainly by mountainous relief, the highest peaks of which are the Dinaric Alps[12] at over 2,500 m above sea level, as well as flat land around the basin's coastal area in Albania. The Drin Basin comprises parts of five Riparians, with their respective share of the basin shown in Table 2.

Table 2. Main water bodies of the Drin Basin and their catchments

Sub-basin	Drin core sub-catchments[13]	Area (km²)	Area - cumulative (km²)	Shared by/areal extent of each Riparian (km²)				River length (km)	
				Albania	Greece	Kosovo	Montenegro	North Macedonia	
Lake Prespa	Micro Prespa	249.50		40.44	209.06				
	Macro Prespa	790.30		246.44	47.68			496.18	
	Golema River	178.40						178.40	22.60
	Brajčinska	77.80						77.80	16.20
	Kranska	30.00						30.00	11.40
	Agios Germanos	65.60			65.60				14.50
			1,391.60						
Lake Ohrid	Lake Ohrid	685.60		208.46				477.14	
	Cherava	71.00		71.00					10.10
	Koselska	190.40						190.40	21.20
	Sateska	453.70						453.70	23.00
			1,400.70						
Black Drin River	Black Drin 1	159.10						159.10	11.60
	Globočica reservoir	146.90						146.90	10.60
	Black Drin 2	124.80						124.80	8.70
	Spillje Reservoir/Lake Debar	189.70		34.00				155.70	20.60
	Radika	635.90				113.00		523.00	41.50
	Rosocka	101.60						101.60	9.20
	Tresonecka	97.20							12.00
	Black Drin 3	134.20		127.61				6.59	79.20
	Zalli i Bulqizes	455.60		455.60					17.50
	Black Drin 4	542.50		542.50					
	Seta r.	91.50		91.50					7.40
	Black Drin 5	83.20		83.20					
	Veleshnica	107.20		90.74		16.40			10.50
	Black Drin 6	62.40		24.97		35.68		1.74	
	Molla e Lures r.	149.50							21.50
	Bushtrice r.	176.90		6.74		170.16			12.50
	Black Drin 7	51.50				51.50			
	Black Drin 8	102.60				102.60			
			3,412.30						
White Drin River	White Drin	1,121.40				1,121.40			
	Istogut	448.60				448.60			20.00
	Kline	425.40				425.40			71.90
	Lumbardie e Pejës r.	487.50				487.50			37.50
	Mirusha	335.90				335.90			38.10
	Lumbardhie I Deqanit r.	253.90				253.90			46.90
	Ereniku	519.60				519.60			52.30
	Topliuhes	312.20							14.50
	Lumbardhiee Prizrenit	283.30		283.30					34.50
	Lumi i Thate	86.20		86.20					7.50
	Semetishta	110.10		110.10					
			4,384.10						
Drin River	Lake Fierza	988.50		988.50					
	Luma r.	557.50		557.50					19.80
	Kruma r.	51.10		51.10					7.40
	Vlahina r.	77.40		77.40					15.50
	Lake Komani	399.00		399.00					
	Valbona	661.20		661.20					46.50
	Curraj r.	154.20		154.20					7.20
	Shala	273.60		273.60					20.40
	Vau i Dejës reservoir	159.70		159.70					

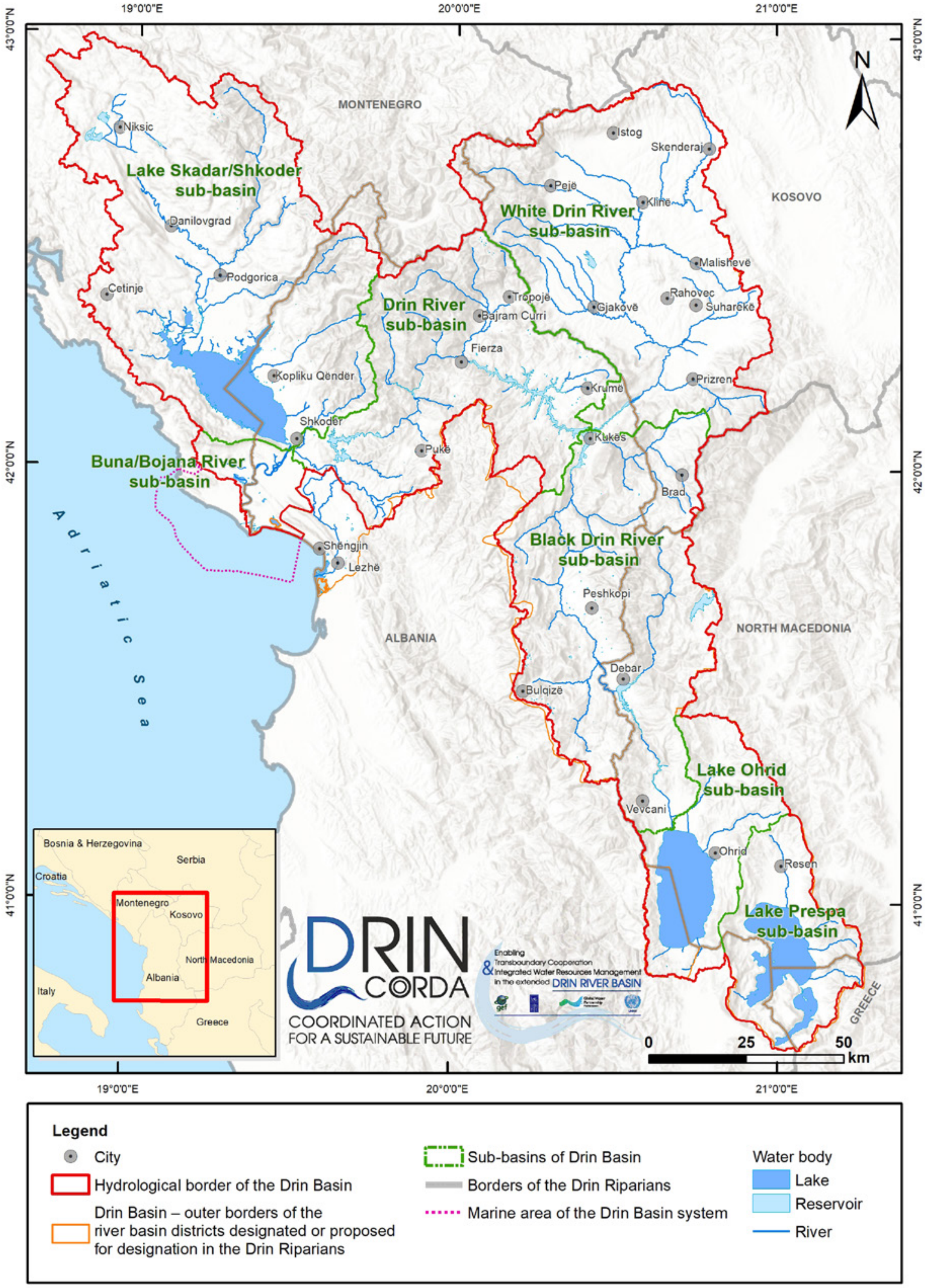
12 Prokletije/Bjeshkët e Nemuna Mountain.

13 The listed sub-catchments are identified as part of the work for the preliminary delineation of the surface-water bodies at the Drin Basin level, done to calculate the water balance in the Basin. The Drin Core sub-catchments are depicted in Figure 21 – Preliminary identification of surface-water bodies in the Drin Basin.

Sub-basin	Drin core sub-catchments[13]	Area (km²)	Area – cumulative (km²)	Shared by/areal extent of each Riparian (km²)				River length (km)	
				Albania	Greece	Kosovo	Montenegro	North Macedonia	
	Perroii Gomsiqes	146.70							19.60
	Drin 1	49.50							
	Gjadri r.	208.70		208.70					33.30
	Kiri	271.40							
	Drin 2	68.70					68.70		
			4,067.20						
Lake Skadar/ Shkodër	Morača	814.50					814.50		
	Mala Rijeka	142.70		80.87			61.79		18.50
	Zeta	1,655.90					1,655.90		50.90
	Cijevna	440.80					440.80		31.20
	Sitnica	252.10					252.10		11.40
	Lake Skadar/ Shkodër	2,036.50		1,692.17			344.33		
			5,342.50						
Buna/ Bojana River	Buna/Bojana	362.10	362.10						

2.2 Sub-basins in the Drin Basin – hydrology and interaction with marine waters

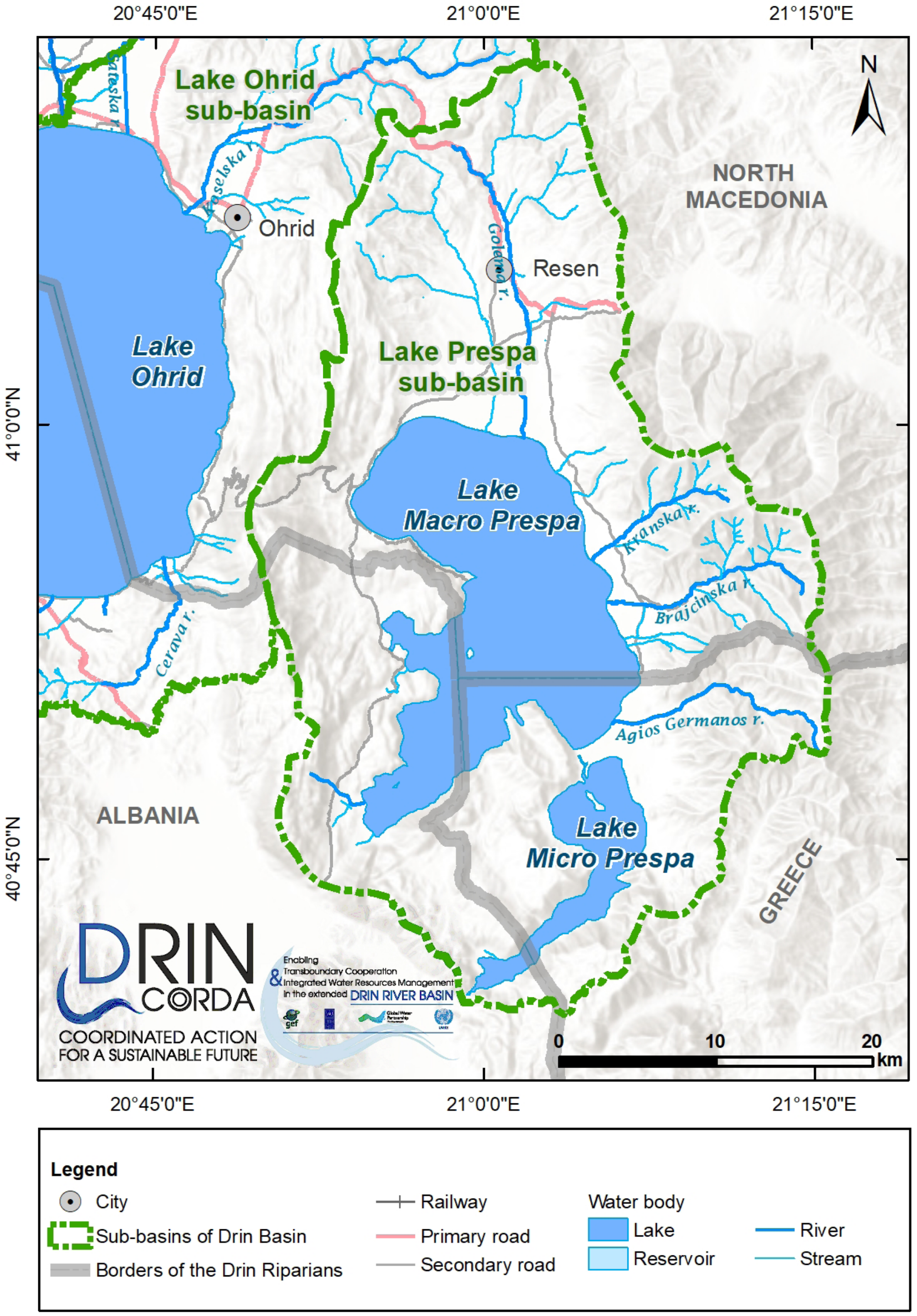
Figure 3. Sub-basins in the Drin Basin



The Drin Basin comprises the following interconnecting sub-basins with their main characteristics as summarized above in Table 2.

LAKE PRESPA

Figure 4. Map of the Lake Prespa sub-basin



In the Lake Prespa sub-basin there are two lakes – Micro Prespa and Macro Prespa – which are connected through an artificial canal. Lake Prespa is a tectonic lake with an average depth of 16–18 m and an average water residence time of 11–20 years (depending on the source of information). The karst geology of the area between the Prespa and Ohrid lakes makes it difficult to define the hydrogeological boundary, resulting in variations among studies of the Lake Prespa catchment's dimensions.

The total distribution of water inflows in the Macro Prespa Lake is estimated as follows: 56 percent from surface run-off, 35 percent from direct precipitation and 9 percent from Micro Prespa Lake. From 1976 to 2004, irrigation accounted for approximately 20 percent of the outflow, with 17 percent of total water losses for the same period comprising undefined outflows.

Water shortages in the watershed usually occur from May to September due to increased water demands and decreased precipitation, while at other times of the year there is no water deficit.

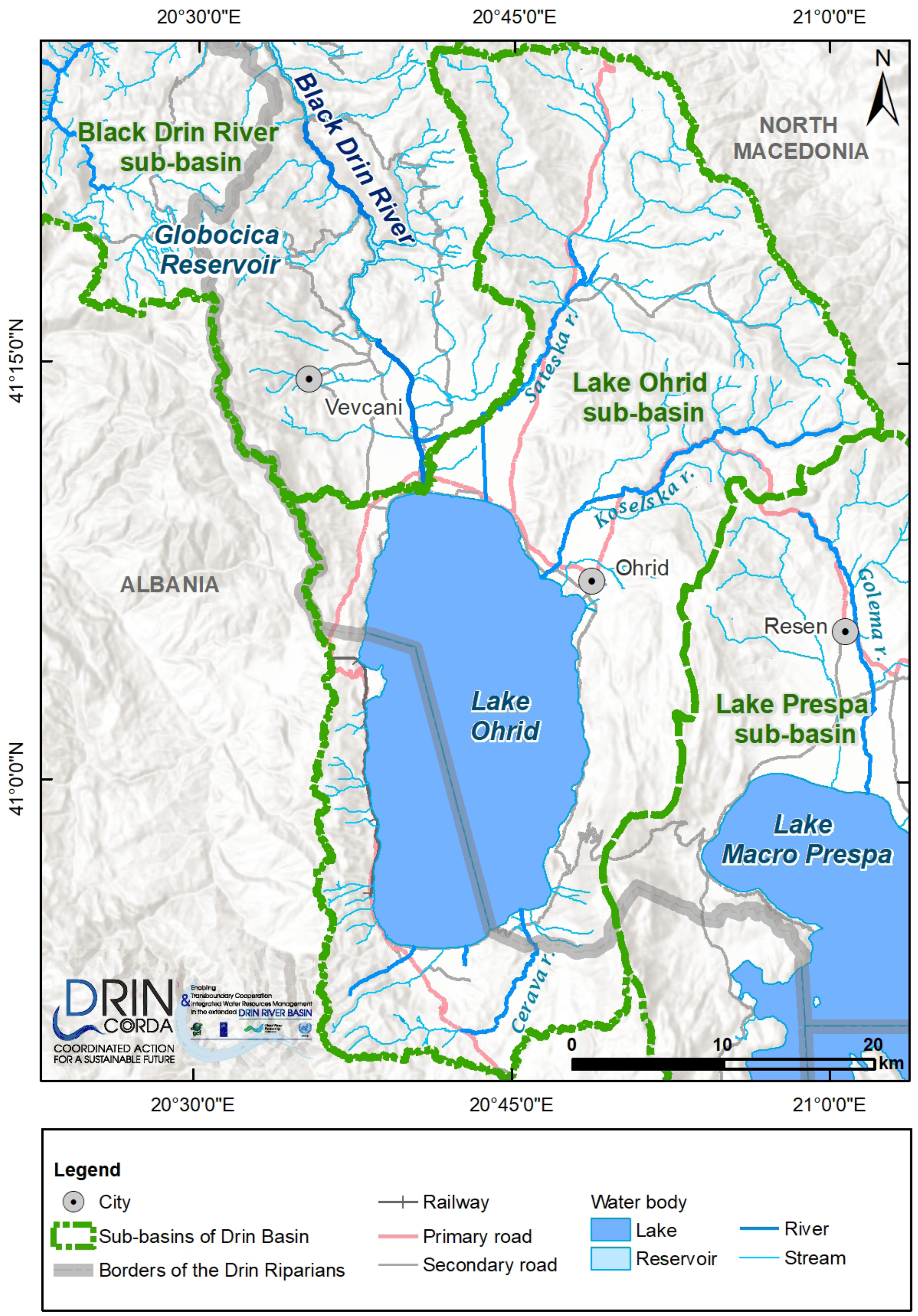
Under normal hydrological conditions, there are no surface outflows.

Water level oscillation causes the Macro Prespa surface area to vary from 259.4 to 280.0 km^2. The level of the water has fallen by more than 9 m in the last 60 years. The water level peaked during the 1963 flood at 853 m above sea level, falling in the years after, with the sharpest decline occurring between 1986 and 1991.

Even though the reasons for the decline in water level are not fully understood, they are believed to be predominantly related to natural variations in rainfall combined with human extraction and variations in the 'karstic outflow' regime.

LAKE OHRID

Figure 5. Map of the Lake Ohrid sub-basin



Note: The Lake Ohrid sub-basin is Ohridsko Ezero in North Macedonia and Liqeni i Ohrit in Albania.

Lake Ohrid is a tectonic lake with an average depth of 155 m and a maximum depth of 289 m. The average water residence time is 70–85 years.

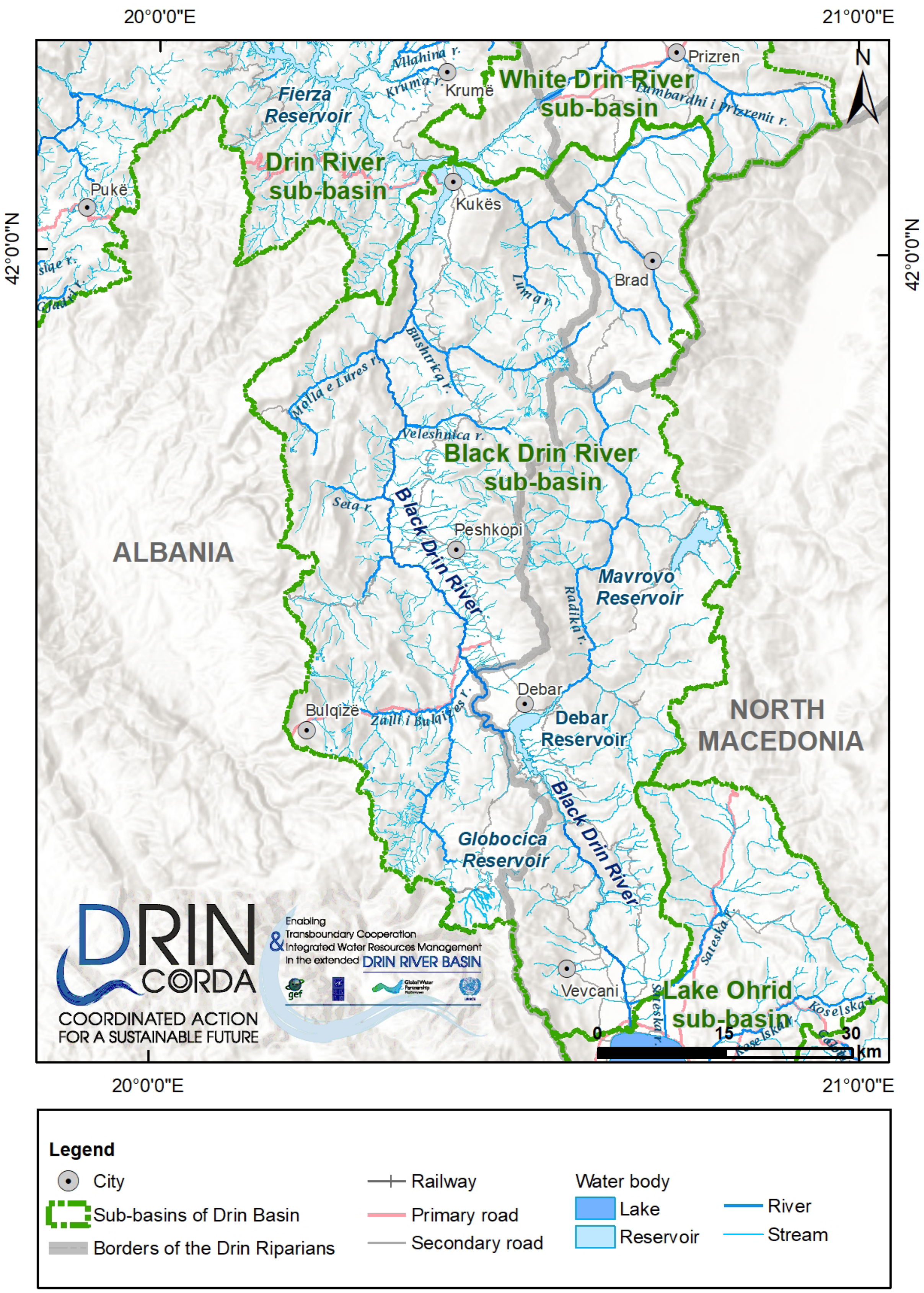
Lake Ohrid is hydrogeologically connected to Lake Prespa, which sits around 150 m higher than Lake Ohrid (depending on water level variations). The hydraulic connection between Lake Prespa and Lake Ohrid, through the karstic massif, makes Lake Prespa its most important source of water, contributing over 40 percent of its water. It only takes six hours for the water to travel through the karstic system from Zavir/Zaveri to Tushemisht, which means that any change in the quality of Lake Prespa's waters would also affect – almost immediately – Lake Ohrid.

The Sateska River in North Macedonia is the lake's main surface tributary. In 1962, the river was diverted from its natural confluence with the Black Drin River into Lake Ohrid. The diversion almost doubled the size of the lake watershed and greatly increased its siltation (the mean annual sediment yield is over 100,000 m^3). As a result, the pollution levels of the lake, especially with respect to phosphorus, have significantly increased. There is ongoing work to redivert the Sateska River to its natural riverbed.

About two thirds of Lake Ohrid's water outflows pass into the Black Drin River (the only outflow of Lake Ohrid), while the remaining third either evaporates or is consumed. Since 1962, the outflow to the Black Drin River has been controlled with a weir that regulates the lake's water level. This limits water level fluctuation to within the range of about 1 m.

BLACK DRIN RIVER

Figure 6. Map of the Black Drin River sub-basin

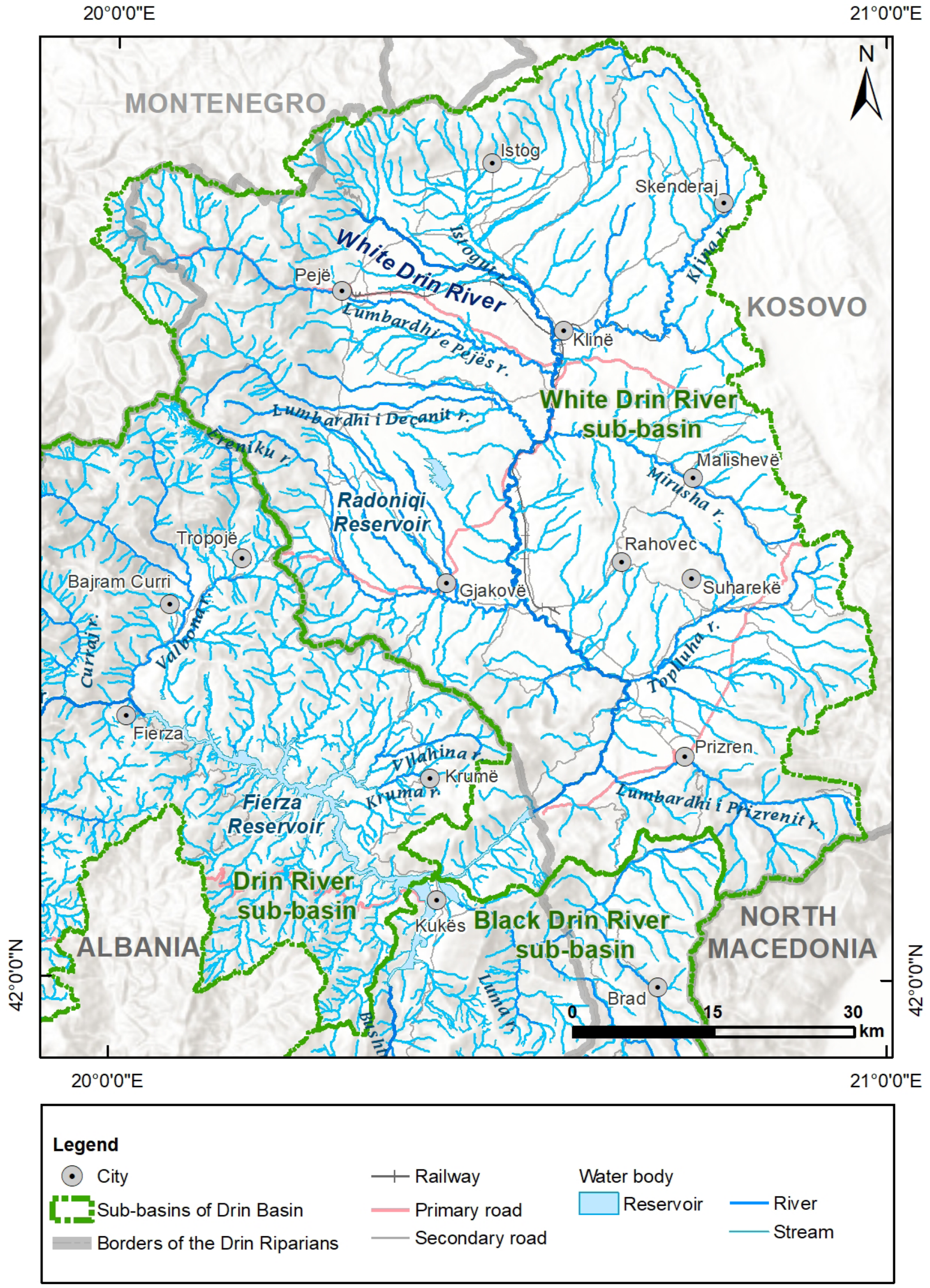


Apart from Lake Ohrid, the main tributary of the Black Drin River is the transboundary Radika River, which is shared by Kosovo and North Macedonia. The upper part of this river enters the artificial Mavrovo reservoir, which diverts its flow through a hydroelectric power plant into the Vardar River watershed (out of the Drin Basin), as an 'inter-basin transfer' of water. Due to this, the upper part of Radika River watershed is classified as an artificial and highly modified water body and is therefore not included in the hydrological and water balance analysis carried out for the needs of the present TDA.

There are two large dams constructed on the Black Drin River in North Macedonia: Globočica (92 m high) and Špilje (112 m high) close to the point before the river enters Albania. There are plans for the construction of two large-scale hydropower plants – Boskov Most and Lukovo Pole – and over 60 small plants in the Black Drin River watershed in North Macedonia.

WHITE DRIN RIVER

Figure 7. Map of the White Drin River sub-basin



Note: The White Drin River is Drini i Bardhë in Albania.

The White Drin River rises in Kosovo in the foothills of the large mountainous area north of the town of Peja. Its basin is the largest of the country's four sub-basins, and drains almost half of Kosovo. Only a small part of the sub-basin extends into Albania. The only existing dam in the White Drin River is in Radoniqi, which is 58 m high.

Altogether, the river discharge represents less than half of the inflow from natural springs and precipitation. Springs make up about 5 percent of the total inflow, but contribute around 9.5 percent to river discharge.

DRIN RIVER

After the floods of 1848–1858 and 1896, the Drin River[14] in Albania was split into two branches: one flowing via its original channel (old Drin) and a new one flowing towards the Buna/Bojana River, which it joins roughly 1.5 km from the outlet of Lake Skadar/Shkodër. At present, the 'old' Drin communicates with the Drin River through groundwater discharges in the Gjader fields and also the Gjader River itself.

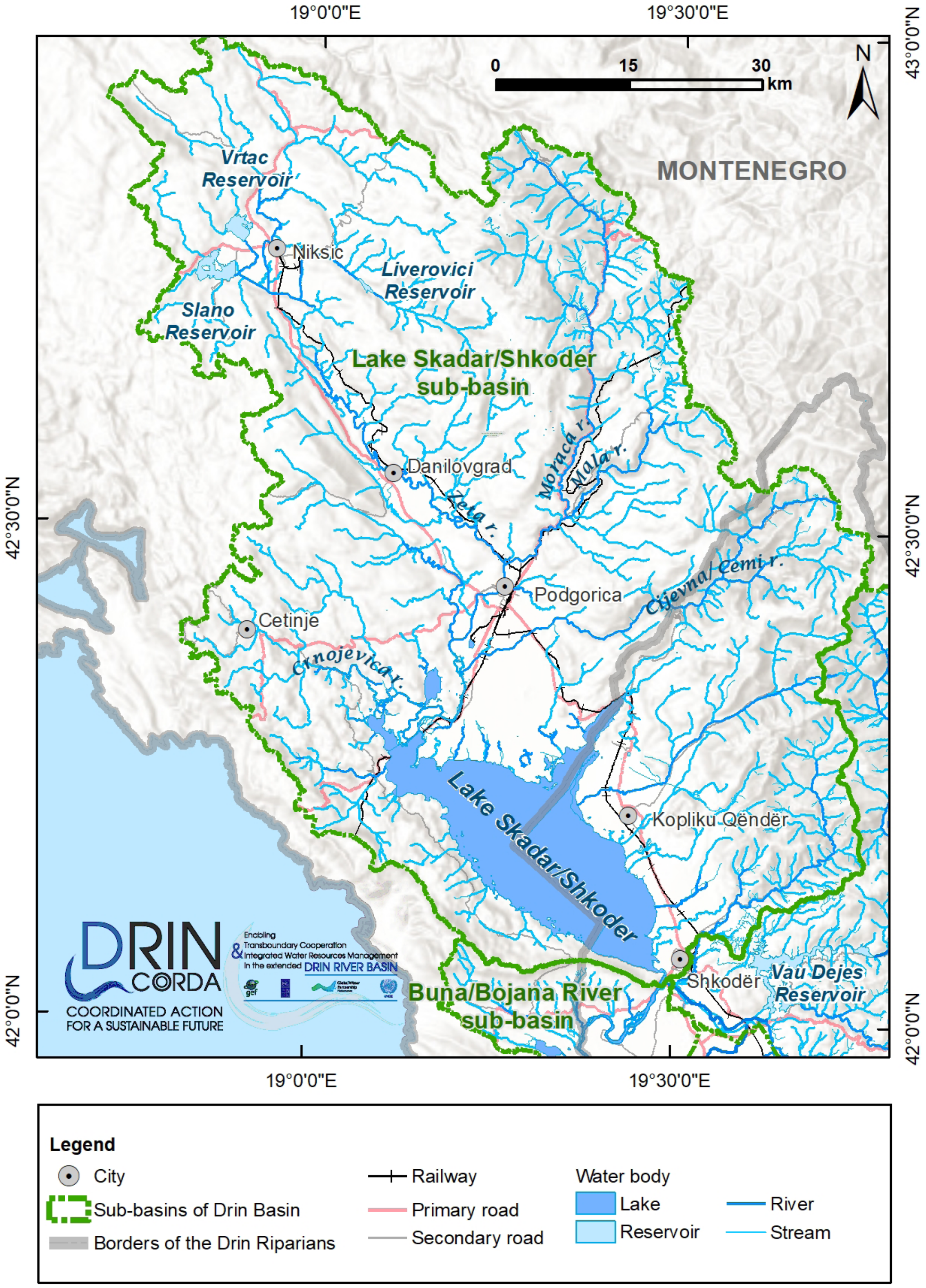
There are three major dams and associated reservoirs built on the Drin River. Of these, the Fierza reservoir has by far the largest storage. From October to March, the winter level is not exceeded, though during April, it increases to the maximum operating level. This provides maximum flood protection in winter when most floods occur, with the accumulated run-off from the last month of snow melt in spring maximizing available storage for summer. The total volume of all three reservoirs on the Drin River equals 3.76 x 10^9 m^3, which is greater than the average volume of Lake Skadar.

An analysis carried out for the needs of the TDA indicated that the operation of the dams in the Drin cascade is an important factor influencing the flow regime downstream of the Drin River and the Buna/Bojana River, and therefore influences the hydrological conditions in Lake Skadar/Shkodër. The functioning of the three dams alters the natural intra-annual flow distribution downstream of the dams, reducing some of the peak discharges during the wet season and increasing average discharges during the dry season. Because of the volume of its reservoir, the operation of the Fierza dam can – under specific conditions – affect the multiannual discharge distribution and eventual flooding events (see extreme observed values of the water level in Lake Skadar/Shkodër on page 37). Data from the Albanian Power Corporation (KESH) would allow more precise results and conclusions.

14 Drini i Bardhë (in Albania).

LAKE SKADAR/SHKODËR

Figure 8. Map of the Lake Skadar/Shkodër sub-basin



Note: Lake Skadar/Shkodër is Skadarsko jezero in Montenegro and Liqeni i Shkodrës in Albania.

Lake Skadar/Shkodër is a relatively shallow tectonic lake, which has a maximum depth of 9 m. The lake's water level varies widely, with extreme observed values recorded as 4.97 m and 10.31 m (2010 flood). Respective water volumes are 1.8 x 10^9 m^3 and 4.25 x 10^9 m^3. The lake's surface area at the mean water level of 6.52 m is 475 km^2.

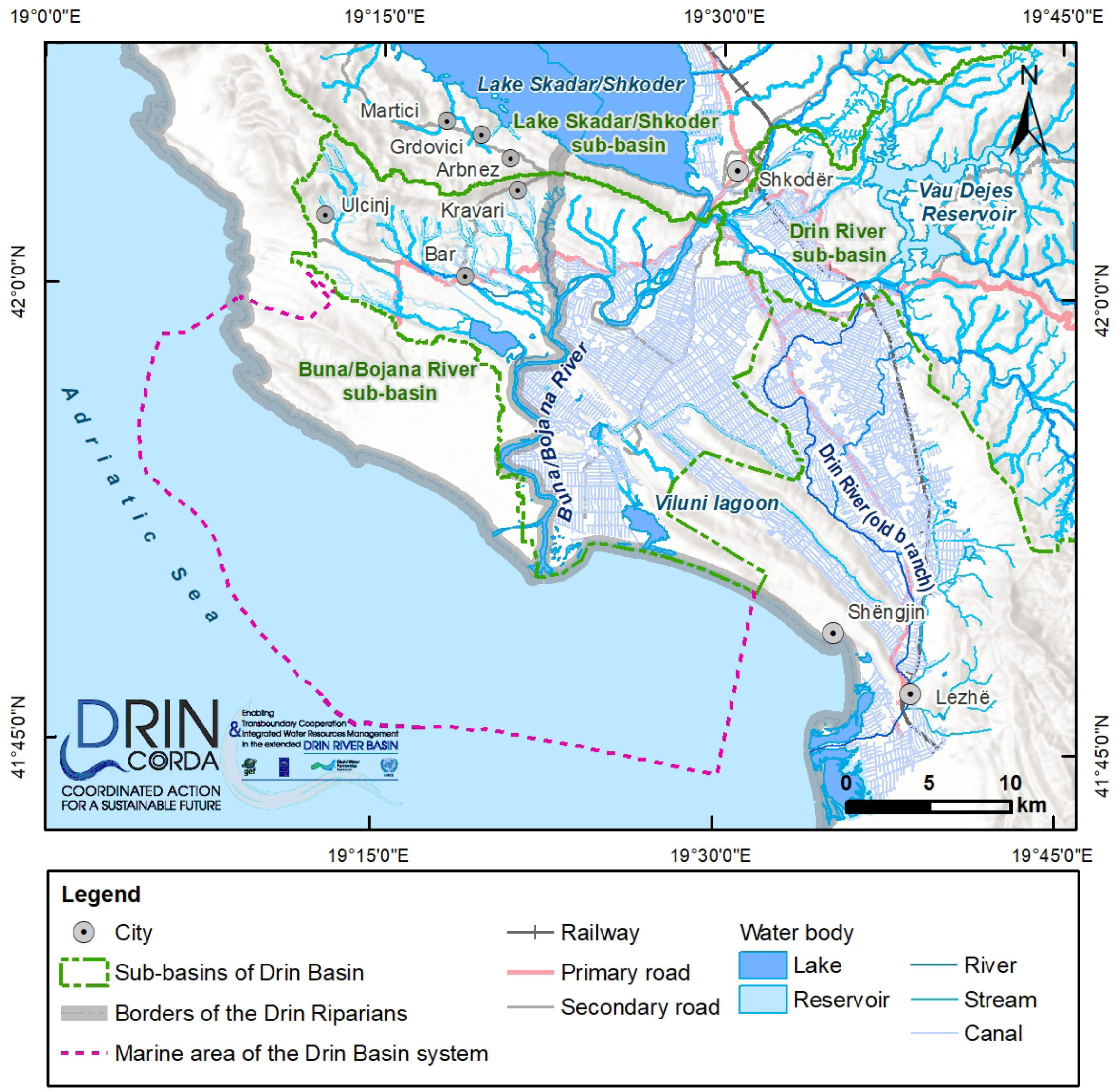
The main tributary of Lake Skadar/Shkodër is the Morača River, which drains about 32 percent of the territory of Montenegro and contributes around 60 percent of the lake's water. The lake also receives water from springs and groundwater bodies. The Syri i Sheganit[15] and Syri i Zi (in Albania) and Bolje sestre[16] and Karuč (in Montenegro) are the most important perennial springs in this region. They appear as small round lakes with a diameter of 15–20 m and have an estimated discharge of 0.15–10 m^3 s^{-1}. Several temporary springs also appear on the shore of the lake after intense rainfall or during the snow melt period.

15 The annual average discharge is 1,400 lt^{-1}. While discharge varies, the flow is equivalent to that of a river in winter.

16 The minimal capacity of the source (in September–October) is higher than 2 m^3/s, of which a maximum 1,200 l/s is used for the regional water supply of the Montenegrin coast.

BUNA/BOJANA RIVER

Figure 9. Map of the Buna/Bojana River sub-basin and adjacent marine area



The Buna/Bojana River – which is 44 km long with a depth that varies from 2 m to 4 m – is the only outflow from Lake Skadar/Shkodër. Discharges from Lake Skadar/Shkodër combine with flows from the Drin River about 1.5 km from the lake to produce a mean annual discharge of over 20 km^3 yr^{-1}.

Sometimes the outflow from the lake into the Buna/Bojana River is impeded due to an increase in the flow of the Drin River. This occurs mostly from December to February, but may also occur throughout the rest of the year, depending on the water released from the three hydropower dams upstream of the Drin River. The management of the dams depends on rainfall and electricity demand. The restriction to out-flowing water in the Buna/Bojana River significantly increases the lake's water level. With high Drin River water levels and low Buna/Bojana River water levels, Drin River water can enter the lake. The Drin River also deposits sediment, thereby further obstructing the flow in the Buna River and the outflow from the lake.

Land-use changes adjacent to the river channel have reduced the area of the floodplain, altering ecosystem structures and the hydrological functioning of the river. Before the intensive drainage and melioration of the area, almost 50 percent of the whole Buna/Bojana River and Delta region was regularly flooded.

COASTAL ZONE AND THE ADJACENT ADRIATIC SEA (AREA INFLUENCED BY THE DRIN FRESHWATER SYSTEM)

The Buna/Bojana Delta area comprises a recently developed small delta, several different lagoon complexes and freshwater lakes, as well as typical riverine and coastal landscapes. The growth of the delta by 1.0–1.5 km in the last 100 years is relatively slow compared with other Mediterranean deltas, such as the Rhone and Po (about 4 km in 100 years).

Lake Šaško and Viluni Lagoon are important wetlands in terms of biodiversity. Lake Šaško is situated within the Montenegrin part of the Buna/Bojana Basin (Ulcinj Field) and is fed by the Buna/Bojana River under favourable hydrological conditions. The lake is approximately 3 km long and 1.5 km wide. Viluni Lagoon, which is 3 km long and 0.9 km wide, lies in the Albanian part of the delta and is one of the most important lagoons in terms of biodiversity.

In the marine area, the predominant currents are northward during autumn and winter and reverse during summer. Four main external forces drive marine currents in the area: inflow of Ionian waters from the south; local winds; air–sea heat and water fluxes (collectively termed buoyancy forcing); and freshwater run-off from the Buna/Bojana River. Different factors dominate depending on the season. Freshwater river run-off and the influx of Ionian waters seem to be the main forcing factors for circulation in early spring.

Tides occur in this water system. As the bottom slope of the Buna/Bojana River is quite flat, tides can travel upstream of the river for several kilometres, with sea water potentially reach Reč or locations even further upstream. This phenomenon can be observed during dry periods, when the flow of fresh water is reduced. River fluxes influence a number of parameters, including sea surface salinity. Salinity levels are lowest between the Buna/Bojana River and the Ulcinj Salina wetland.

The coastal aquifers interact with the sea, including as submarine groundwater discharges, which contribute to the creation of brackish water habitats in the coastal zone. The submarine groundwater discharges to the Adriatic Sea in the Albanian portion of the study area are estimated to be 0.29 mm^2 yr^{-1}; no estimates exist for Montenegro.

3. PRIORITY TRANSBOUNDARY PROBLEMS

The TDA identified four key transboundary problems that affect the Drin Basin:

- deterioration of water quality
- natural and regulated variability of the hydrological regime
- biodiversity degradation
- variability of the sediment transport regime.

Climate variability and change has also been recognized as a significant regional (and global) problem that influences the four priority transboundary problems. Details of the potential impacts from climate change scenarios are outlined in the Thematic Reports on Biodiversity and Ecosystems, Hydrology and Hydrogeology, and Socio-economics and summarized in the following related sections of the TDA. In addressing the causes of the priority transboundary problems, climate change was recognized as a root cause of each problem, with the impacts of climate variability and change for each problem considered in the CCA.

These CCA present these problems following the approach outlined in the GEF guidance.

The following section presents a summary of the analysis of the four problems in a simple and common format:

- description of problem: presenting a short summary of the transboundary problem, reference to the relevant thematic reports, etc.
- CCA: presenting a summary of the goods and services at risk, ecosystem and socio-economic impacts, the relevant sectors involved and the immediate, underlying and root causes of the problem
- linkages with other transboundary problems
- significant knowledge gaps

3.1 Priority problem 1: deterioration of water quality

3.1.1 Description of the transboundary problem

The deterioration of water quality (in all or part of the following in the case of each of the Riparians: rivers, lakes, groundwaters and coastal and transitional waters) is a problem that affects all Riparians in the Drin Basin. All kind of diffuse (agriculture and agglomerations) and point sources of pollution (towns and villages, industrial activities, etc.) exist in the Drin Basin. Different sources and pollution pressures of varying intensity are found in different sub-basins.

All Riparians are either meeting the requirements of the EU Water Framework Directive (as in the case of Greece) or are in the process of meeting these requirements through the development of RBMPs that will address the issues resulting in the failure to reach good ecological status (or potential).

The analysis highlighted the following water quality issues that are of transboundary concern:

- Excess nutrients (nitrogen and phosphorus) are considered a problem across most of the Drin Basin. About 50 percent of the total nutrient load derives from agricultural diffuse sources, with 30 percent deriving from inadequate or insufficient wastewater treatment from domestic sources. Although nitrogen pollution is considered low compared with Europe, within the basin there is evidence of high levels in Lake Ohrid, the White Drin River, tributaries of Lake Skadar/Shkodër and especially the Morača River. Phosphorus (a significant part of which derives from wastewater effluents) was considered a major issue across the basin. Coastal waters are considered to be at risk from receiving excess nutrients.
- Excess biochemical oxygen demand (BOD) is an issue across the Drin Basin, particularly in the White Drin River and Lake Skadar/Shkodër sub-basins.
- Industrial, mining and solid waste sources are having detectable impacts in the form of chemical oxygen demand (COD), heavy metals (although there is a need to better understand anthropogenic and natural sources) and in some locations, priority substances. Heavy metals and priority substances are also an issue in groundwaters (for example, the White Drin River) and in sediments (for example, Lake Skadar/Shkodër).

3.1.2 Causal chain analysis for deterioration of water quality

Figure 10 indicates the main links between the causes of pollution for nutrients, BOD/COD and heavy metals/ priority substances in the Drin Basin. This is further elaborated in the summary presented in Table 3, which shows the main goods and services at risk, the main ecosystem and socio-economic impacts, sectors causing and impacted by the problem of pollution and the immediate, underlying and root causes of the deterioration of the water quality.

Figure 10. Causes and impacts of deterioration of water quality

ROOT CAUSES

- Pressure from increasing urban populations and intensification of agriculture
- Low level of financial resources for environmental protection
- Climate variability and change
- Increasing demand for food production
- Low political will

UNDERLYING CAUSES

- Insufficient/inadequate policies for agriculture
- Insufficient/inadequate policies for solid waste
- Insufficient monitoring
- Low level of enforcement
- Low capacity
- Low awareness of polluting activities

IMMEDIATE CAUSES

- Excess nutrients from diffuse sources
- Excess nutrients (and BOD) from wastewater
- Phosphates-containing detergents
- Inappropriate use of agrochemicals (herbicides, pesticides and fertilizers)
- Industrial wastewater discharges (priority substances and heavy metals)
- Heavy metals from mining activities
- Insufficient/inadequate wastewater treatment
- Inadequate management including collection/disposal of solid waste

IMPACTS

- Deterioration of biodiversity
- Drinking water quality
- Eutrophication
- Reduced food production
- Reduced amenity value

Table 3. Causal chain analysis for the deterioration of the water quality in the Drin Basin

Deterioration of water quality	
Goods and services at risk	• Drinking water supply • Ecological requirements/services • Tourism • Freshwater and marine fisheries • Agricultural/industrial water supply
Impacts (resulting from deterioration of water quality) on: ecosystems and socio-economics	• Deterioration of biodiversity • Drinking water quality • Eutrophication • Reduced food production (agriculture, fish) • Reduced amenity value
Sectors	• Agriculture • Urban › urban development › water supply › solid waste management • Industry (including solid waste management) • Mining
Immediate causes	• Excess nutrients from diffuse sources • Excess nutrients (and BOD) from wastewater • Phosphates-containing detergents • Inappropriate use of agrochemicals (herbicides, pesticides and fertilizers) • Industrial wastewater discharges (priority substances and heavy metals) • Heavy metals from mining activities • Insufficient/inadequate wastewater treatment • Inadequate management including collection/disposal of solid waste
Underlying causes	• Insufficient/inadequate policies for agriculture • Insufficient/inadequate policies for solid waste • Insufficient monitoring • Low level of enforcement • Low capacity • Low awareness of polluting activities
Root causes	• Pressure from increasing urban populations and intensification of agriculture • Low level of financial resources for environmental protection • Climate variability and change • Increasing demand for food production • Low political will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3.1.3 Linkages with other key transboundary problems

Water quality is impacted by the variability of the hydrological and sediment transport regime (for example, increased rainfall can cause additional surface erosion of soils and the release of pollutants), including from the impacts of climate variability and change, which affect the water quantity or concentration of dissolved oxygen in water. Pollution also has significant effects on the key problem of biodiversity degradation.

3.2 Priority problem 2: variability of the hydrological regime

3.2.1 Description of the transboundary problem

The TDA has identified several issues that either result in or are influenced by the variability of the hydrological regime as a key transboundary problem, including:

- Increasing frequency of droughts, as a result of climate variability/change or extreme weather events, can have an adverse effect during the summer period in agriculture and industry. Drought impacts can be worsened by additional impacts from hydromorphological modifications (as a result of hydropower dams and flood defences) that can, for example, reduce groundwater recharge.
- The variability of the hydrological regime is affected by the management of the dams to maximize energy production as well as the uncoordinated management of the cascade of dams between countries; this can further exacerbate extreme events (floods).
- Water level fluctuations in the Lake Prespa sub-basin are of concern regarding the ecosystems.
- Linkages between surface water and groundwater are significant, especially between the Prespa and Ohrid lakes via karst structures – the karstic connections within the basin need further investigation.
- The White Drin River and Drin River sub-basins are characterized as having relatively high water stress (consumption is more than 70 percent of the available water) during the summer months of dry years.
- Preliminary modelling indicated that the water resources in the main sub-basins and entire Drin Basin are adequate to cover the current water demands for anthropogenic purposes, though further modelling is required to improve understanding of the water demand under various development and climate change scenarios and to assess possible water stress.
- Mitigation measures are necessary to minimize water losses and apply water-saving measures (especially in agriculture).
- A lack of adequate hydrological monitoring and data management at the Riparian and regional levels prevent the Riparians from identifying and applying management solutions.

3.2.2 Causal chain analysis for the variability of the hydrological regime

Figure 11 presents the main links between the causes of the variability of the hydrological regime. This is further elaborated in the summary presented in Table 4, which shows the main goods and services at risk, the main ecosystem and socio-economic impacts, sectors causing and impacted by the problem and the immediate, underlying and root causes of the variability of the hydrological regime.

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Figure 11. Causes and impacts of the variability of the hydrological regime

ROOT CAUSES

- Climate variability and change
- Increasing water demand from increasing urban populations and intensification of agriculture
- Lack of financial resources
- Low political will

UNDERLYING CAUSES

- Lack of integration between sectors/ministries
- Lack of cooperation between hydropower plant operators
- Low enforcement of existing policies
- Low integration between Riparians on water management
- Low awareness/capacity
- Low application of climate change adaptation measures
- Lack of water protection measures
- Low/lack of emergency planning

IMMEDIATE CAUSES

- Exacerbation from extreme weather events (floods and droughts)
- Increased pressure on resources (water demand) locally or in sub-basins
- Hydromorphological alterations
- Hydropower plant operations of dams in the Drin River cascade (aiming to maximize energy production)

IMPACTS

- Economic loss (farming, fisheries, industry)
- Loss of food production
- Hydropower generation losses
- Flood damage (urban and rural)
- Fluctuations in lake water levels
- Wetland losses (and of services provided)
- Biodiversity loss/changes in geographic distribution of biological communities
- Increased erosion from deforested and agricultural land
- Increased sedimentation
- Coastal erosion
- Impacts on water quality

Table 4. Causal chain analysis for the variability of the hydrological regime

Natural and regulated variability of the hydrological regime	
Goods and services at risk	• Aquatic and land-based ecosystems and associated services • Groundwater recharge • Water supply (drinking, irrigation, industrial, hydropower) • Tourism • Freshwater fisheries • Marine fisheries
Impacts (resulting from variability of the hydrological regime) on: ecosystems and socio-economics	• Economic loss (farming, fisheries, industry) • Loss of food production • Hydropower generation losses • Flood damage (urban and rural) • Fluctuations in lake water levels • Wetlands losses (and of services provided) • Biodiversity loss/changes in geographic distribution of biological communities • Increased erosion from deforested and agricultural land • Increased sedimentation • Coastal erosion • Impacts on water quality
Sectors	• Agriculture • Industry/power • Urban planning • Tourism
Immediate causes	• Exacerbation from extreme weather events (floods and droughts) • Increased pressure on resources (water demand) locally or in sub-basins • Hydromorphological alterations • Hydropower plant operations of dams in the Drin River cascade (aiming to maximize energy production)
Underlying causes	• Lack of integration between sectors/ministries • Lack of cooperation between hydropower plant operators • Low enforcement of existing policies • Low integration between Riparians on water management • Low awareness/capacity • Low application of climate change adaptation measures • Lack of water protection measures • Low/lack of emergency planning
Root causes	• Climate variability and change • Increasing water demand from increasing urban populations and intensification of agriculture • Lack of financial resources • Low political will

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3.2.3 Linkages with other key transboundary problems

Variability of the hydrological regime is most closely aligned with climate variability and change, especially with the likely increase in extreme events, and also to socio-economic activity demand, such as for irrigation. While hydropower generation is a non-consumptive use of water, it influences water flows (leading to hydropeaking, among others) and sediment transport, which have consequential impacts on the state of ecosystems and the services they provide. The retaining dams for hydropower generation can also lead to sedimentation in the dams themselves, which in the absence of adequate maintenance will eventually lead to reduced generation capacity and changes in sediment transport. Changes in the hydrological regime can influence pollutant concentrations throughout the Drin Basin, particularly in karstic regions (for example, the Prespa and Ohrid lakes).

3.3 Priority problem 3: biodiversity degradation

3.3.1 Description of the transboundary problem

Biodiversity in the Drin Basin is of significant importance at the European level. The Thematic Report on Biodiversity and Ecosystems identified multiple threats to the ecosystems as well as issues that impede their sustainable management. These include:

- use of agrochemicals
- pollution, gravel activities, intensification of agriculture and urbanization leading to habitat degradation in rivers
- fluctuations of lake water levels impacting or resulting in the shifting of habitats in littoral zones
- hydromorphological alterations from flood and hydropower constructions resulting in lateral and longitudinal disruptions as well as the loss of wetlands
- deforestation and inappropriate use of and/or poorly managed forest resources
- inappropriate cultivation practices leading to destruction of soil structures or exposing soil to excessive erosion
- overfishing and inappropriate fishing practices
- illegal hunting
- invasive and alien species[17] putting pressure on local species
- a lack of recent information on fish stocks and other aquatic taxa
- unmapped or unidentified marine habitats.

3.3.2 Causal chain analysis for biodiversity degradation

Figure 12 indicates the main links between the causes of biodiversity degradation. This is further elaborated in the summary presented in Table 5, which shows the main goods and services at risk, the main ecosystem and socio-economic impacts, sectors causing and impacted by the problem and the immediate, underlying and root causes of biodiversity degradation.

17 Including 12 fish species in Lake Prespa, 7 fish species in Lake Ohrid, 13 fish species in Lake Skadar/Shkodër.

Figure 12. Causes and impacts of biodiversity degradation

ROOT CAUSES

- Pressure from increasing urban populations
- Intensification of agriculture
- Climate variability and change
- Low level of financial resources for environmental protection
- Low political will

UNDERLYING CAUSES

- Inadequate/insufficient policies and low enforcement of existing policies
- Lack of integrated water management/natural resources management (including wetlands and forestry)
- Insufficient technical capacity
- Insufficient coordination between ministries/sectors
- Low awareness

IMMEDIATE CAUSES

- Pollution (from basin activities involving agriculture, urban pollution, etc.)
- Gravel activities
- Insufficient water quantity and variability in water level/flow as a result of hydropower plants
- Hydromorphological alterations
- Deforestation/poorly managed forest resources
- Overfishing and inappropriate fishing practices
- Illegal hunting
- Invasive and alien species

IMPACTS

- Loss of fish and other aquatic species
- Loss of grasslands
- Soil fertility loss
- Increased erosion
- Sediment impacts on hydropower generation
- Loss of forests
- Loss of diversity and abundance (aquatic, land-based and birds)

Table 5. Causal chain analysis for biodiversity degradation

	Biodiversity degradation
Goods and services at risk	• Food from fishing and agriculture • Wild foods/herbs • Tourism (including hunting and fishing)
Impacts (resulting from biodiversity degradation) on: ecosystems and socio-economics	• Loss of fish and other aquatic species • Loss of grasslands • Soil fertility loss • Increased erosion • Sediment impacts on hydropower generation • Loss of forests • Loss of diversity and abundance (aquatic, land-based and birds)
Sectors	• Agriculture • Fisheries • Forestry • Tourism • Industry (power generation) • Cultural activities (hunting, wild foods, etc.)
Immediate causes	• Pollution (from basin activities involving agriculture, urban pollution, etc.) • Gravel activities • Insufficient water quantity and variability in water level/flow as a result of hydropower plants • Hydromorphological alterations • Deforestation/poorly managed forest resources • Overfishing and inappropriate fishing practices • Illegal hunting • Invasive and alien species
Underlying causes	• Inadequate/insufficient policies and low enforcement of existing policies • Lack of integrated water management/natural resources management (including wetlands and forestry) • Insufficient technical capacity • Insufficient coordination between ministries/sectors • Low awareness
Root causes	• Pressure from increasing urban populations • Intensification of agriculture • Climate variability and change • Low level of financial resources for environmental protection • Low political will

Podarcis tauricus
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3.3.3 Linkages with other key transboundary problems

Biodiversity is subject to impacts from the other three key transboundary problems and the crosscutting problem of climate variability and change.

3.4 Priority problem 4: variability of the sediment transport regime

3.4.1 Description of the transboundary problem

Sediment transport is affected by both natural events, climate variability and change (such as extreme weather events) and anthropogenic impacts (such as gravel extraction, deforestation, poor land use, dams and other hydromorphological alterations), resulting in sediment transport variability – both excess and reduced sediment transport – with consequential impacts on ecosystems and coastal environments. The Thematic Report on Hydrology and Hydrogeology identified the impacts and causes of excessive and insufficient sediment transport as:

- hydromorphological alterations
- reduced hydrostatic head for hydropower production due to the sedimentation in the dams
- decreased sediment loads and increased erosion from the operation of hydropower plants downstream of discharge locations
- Buna/Bojana River deposition and erosion
- coastal changes from changing sediment processes and interaction with the sea
- loss of habitats from changes of sediment deposition.

3.4.2 Causal chain analysis for the variability of sediment transport regime

Figure 13 indicates the main linkages between the causes and impacts of the variability of sediment transport. This is further elaborated in the summary presented in Table 6, which shows the main goods and services at risk, the main ecosystem and socio-economic impacts, sectors causing and impacted by the problem and the immediate, underlying and root causes of changes to sediment transport.

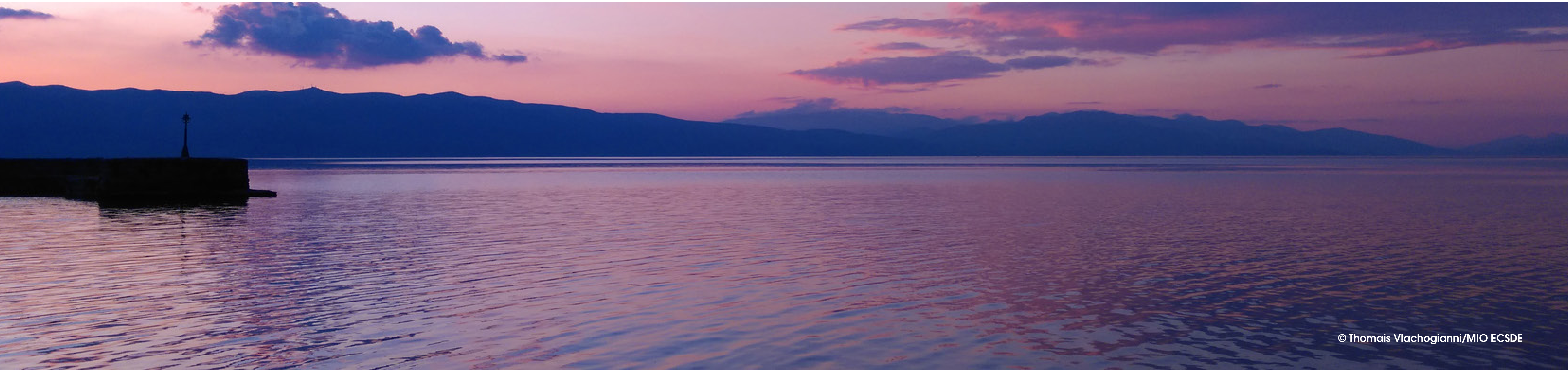

Figure 13. Causes and impacts of the variability of sediment transport regime

ROOT CAUSES

- Climate variability and change
- Low level of financial resources for environmental protection
- Low political will

UNDERLYING CAUSES

- Lack of enforcement
- Lack of capacity (identify and assess problems) and mitigation measures (nature-based solutions)
- Lack of monitoring
- Insufficient national and international coordination
- Lack of awareness

IMMEDIATE CAUSES

- Unsustainable agricultural practices
- Deforestation
- Extreme weather events (floods and droughts)
- Hydromorphological alterations
- Hydropower plant operations
- Gravel extraction

IMPACTS

- Hydropower plant operations
- Gravel extraction
- Changes in sedimentation in rivers and coasts
- Coastal erosion
- Tourism
- Fisheries (freshwater and coastal/marine)
- Biodiversity

Table 6. Causal chain analysis for the variability of sediment transport regime

Variability of sediment transport	
Goods and services at risk	• Hydropower plant generation • Flood protection • Navigation/tourism (Buna/Bojana River) • Tourism • Fisheries (freshwater and coastal/marine) • Biodiversity in lakes, rivers, coastal waters
Impacts (resulting from variability of the sediment transport regime) on: ecosystems and socio-economics	• Hydropower plant operations • Gravel extraction • Changes in sedimentation in rivers and coasts • Coastal erosion • Tourism • Fisheries (freshwater and coastal/marine) • Biodiversity
Sectors	• Forestry • Agriculture • Tourism • Industry (power production, gravel extraction)
Immediate causes	• Unsustainable agricultural practices • Deforestation • Extreme weather events (floods and droughts) • Hydromorphological alterations • Hydropower plant operations • Gravel extraction
Underlying causes	• Lack of enforcement • Lack of capacity (identify and assess problems) and mitigation measures (nature-based solutions) • Lack of monitoring • Insufficient national and international coordination • Lack of awareness
Root causes	• Climate variability and change • Low level of financial resources for environmental protection • Low political will

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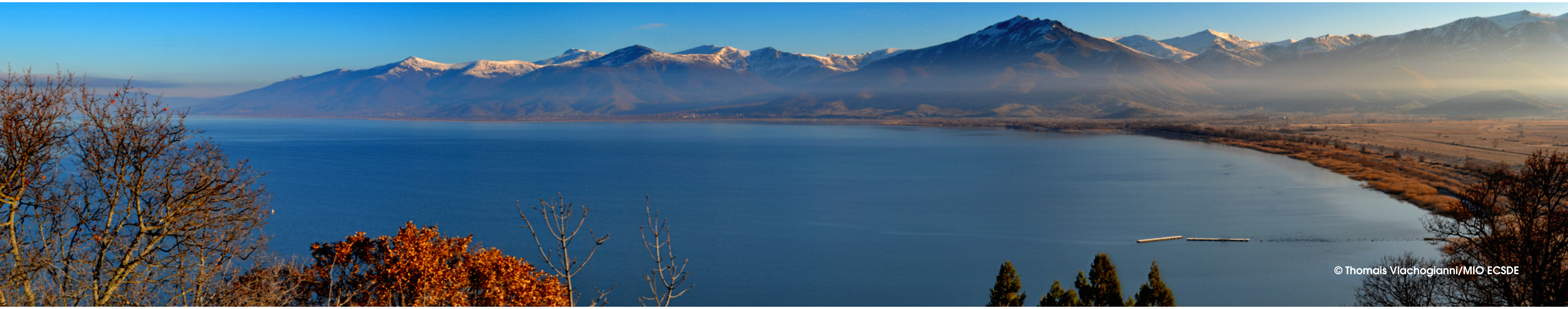
3.4.3 Linkages with other key transboundary problems

Changes in sediment transport are linked to the variability of the hydrological regime as well as climate variability and change. Changes in the water flow as a result of socio-economic activities (such as hydropower production) also impact this problem. Sediment transport variability has an effect on habitats and therefore ecosystems.

3.5 Overall recommendations to guide SAP development

The key issues raised in the thematic reports are summarized throughout the TDA and together with the CCA will guide the development of SAP actions. Furthermore, the CCA is supplemented by the results of an expert workshop (December 2018, Athens), which examined in more detail the specific problems, causes, impacts and potential actions to address the problems. The TDA identifies key/overall coordinated management actions that will assist in addressing groups of or all of the key issues, some of which include:

- improving intersectoral and regional coordination (including consideration to establishing a regional body/commission for the Drin Basin) for water and ecosystem management
- regional harmonization of approaches to water management, monitoring and data/information approaches, reporting, etc.
- regional policy strengthening, for example, on best available practices in agriculture or on the use of phosphates-containing detergents, through testing approaches in targeted pilot projects
- capacity development (technical, policy, enforcement, etc.)
- practical demonstrations to highlight common solutions to the transboundary problems that could be upscaled across the basin
- awareness-raising at all levels of society, from community to the Government
- procedural enhancements (for example, how hydropower plant cascades operate)
- infrastructure upgrades (wastewater treatment works, municipal solid waste, etc.) in accordance with EU Association Agreement commitments of the Riparians
- updating and implementing national action plans (NAPs) and/or strategies to reflect the ambition and objectives of the SAP at the Riparian/sub-basin level.




Orthetrum cancellatum
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