UNECE

Assessment of the water-food-energy-ecosystems nexus and benefits of transboundary cooperation in the Drina River Basin

UNITED NATIONS

NOTE

The designations employed and the presentation of the material do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The approach to geographical names is not uniform. English names have been used in some cases and local names in others. In the text, either the English name was used or the names used in the different riparian countries. In maps, local names have been used to the extent possible.

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

ECE/MP.WAT/ NONE/9

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

Assessment of the water-food-energy-ecosystems nexus and benefits of transboundary cooperation in the Drina River Basin

UNITED NATIONS

New York & Geneva, 2017

ACKNOWLEDGEMENTS

This nexus assessment and identification of benefits of transboundary cooperation could not have been prepared without the help and input of many individuals and organizations. The UNECE secretariat would like to thank the following persons who contributed to the process, including to the work at the meetings of the Task Force on the Water-Food-Energy-Ecosystems Nexus, the basin workshops and consultations, for their help in preparing the assessment. All those whom we have inadvertently forgotten, please accept our sincere apologies along with our thanks.

Kasim Agović
Anisa Avdaković
Miloš Banjac
Gorana Baševic
Milija Čabarkapa
Vladimir Denić
Milica Đorđević
Jovana Dragić
Nenad Đukić
Dragana Đukić
Pavle Đurašković
Ana Džačić
Danko Gavrilović
Milorad Gerginić
Hazima Hadžović
Vernes Hrnjičić
Kosta Ilić
Milan Ivanković
Petar Ivanković
Ljubiša Ivanović
Petar Ivanović
Dušan Jagličić
Olivera Janković
Igor Jevtić
Vukota Jojić
Branislava Jovičić
Mirjana Karahasanovic
Amer Kavazović
Milan Kikić
Branka Knežević
Mirjana Kovač
Nataša Kovačević
Salih Krnjić
Ljubiša Lalović
Mario Livaja
Slobodan Ljubojević
Anton Ljucovic
Jasminka Luković Jagličić
Milica Maraš
Nikola Maravić
Srđan Marjanović
Radisav Matić
Dušan Mijović
Predrag Milanović
Nataša Milić
Luka Mitrović
Dušan Nešković
Darko Novaković
Irvina Numić
Maja Pavićević
Aleksandar Popović
Milo Radović
Jovana Rašeta
Radosav Rašović
Nino Rimac
Ljiljana Simić
Mira Šorović
Dragana Stanković
Dragan Stanković
Đorđe Stefanović
Verica Stojanović
Danijela Stolica
Adnan Topalović
Biljana Trivanović
Velizar Vojinović
Vladimir Vukčević
Nikola Vukotić
Dušan Živković
Nikola Zlatanović

National focal points

Momčilo Blagojević (Montenegro), Boško Kenjić (Bosnia and Herzegovina), Dragana Milovanović (Serbia).

Local experts

Sabina Hadžiahmetović, Zdenka Ivanović, Dalila Jabučar, Miroslav Kukobat, Miodrag Milovanović, Jasmina Ramčić, Goran Sekulić, Dragan Terzić.
Samo Grošelj, Dejan Komatina, Ana Marinić, Mirza Sarač, Dragan Zeljko (secretariat of the International Sava River Basin Commission).

International experts

Authors:
Roberto Martin-Hurtado (synthesis); Lucia de Strasser, Youssef Almulla, Francesco Gardumi, Eunice Ramos, Caroline Sundin and Mark Howells (Royal Institute of Technology, KTH), Stephen Stec (Central European University), Tamara Avellán (United Nations University, Institute for Integrated Management of Material Fluxes and of Resources).

Other contributors:
Savannah Carr-Wilson, Salvatore D'Angelo, Dann Moreno, Reuben Sessa, Otto Simonett, Tamara Vantwout, Lara Vrtovec.

Editing and design

Design and graphics:
Nick Jackson, North Creative (original design).
Carolyne Daniel (layout and graphics), Matthias Beilstein (maps).

Photos:
The International Sava River Basin Commission.

UNECE

Water Convention secretariat:

Annukka Lipponen, overall process and content coordinator.
Francesca Bernardini, Chantal Demilecamps, Sonja Koeppel, Cammile Marcelo, Katri Veldre.

UNECE Environment Division and other divisions:

Tea Aulavuo, Marco Keiner, Sergiusz Ludwiczak, Branko Milicevic, Antoine Nunes, Gianluca Sambucini, Martin Smutny, Iulia Trombitcaia.

The assessment of the Drina River Basin was carried out with the support of the project "Greening economic development in Western Balkans through applying a nexus approach and identification of benefits of transboundary cooperation" funded by the Italian Ministry for the Environment, Land and Sea.

LIST OF COUNTRY CODES

AL	Albania
BA	Bosnia and Herzegovina
BG	Bulgaria
HR	Croatia
HU	Hungary
ME	Montenegro
MK	The former Yugoslav Republic of Macedonia
RO	Romania
RS	Serbia

ACRONYMS AND ABBREVIATIONS

CAP	Common Agricultural Policy
DRB	Drina River Basin
EIA	Environmental Impact Assessment
EPR	Environmental Performance Review
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FASR	Framework Agreement on the Sava River Basin
GDP	Gross Domestic Product
GEF	Global Environment Facility
HPP	Hydropower Plant
ICPDR	International Commission for the Protection of the Danube River
IPA	Pre-Accession Assistance
IPPC	Integrated Permitting and Pollution Control
ISRBC	International Sava River Basin Commission
IUCN	International Union for Conservation of Nature
IWG	Interministerial Working Group
IWRM	Integrated Water Resource Management
MoU	Memorandum of Understanding
NREAP	National Renewable Energy Action Plan
NSSD	National Strategy for Sustainable Development
OECD	Organisation for Economic Co-operation and Development
OSeMOSYS	Open Source energy MOdelling SYStem
PRTR	Protocol on Pollutant Release and Transfer Registers
RBM	River Basin Management
RCC	Regional Cooperation Council
REN21	Renewable Energy Policy Network for the 21st Century
RES	Renewable energy sources
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SEE	South-Eastern Europe
SEIS	Shared Environmental Information System
SEPA	Serbian Environmental Protection Agency
SWG	Regional Rural Development Standing Working Group
TPP	Thermal Power Plant
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WBIF	Western Balkans Investment Framework
WWF	World Wide Fund for Nature

UNITS OF MEASURE

CO_2	Carbon dioxide
GW	Gigawatt
GWh	Gigawatt-hour
h	Hour
km^2	Square kilometre
km	Kilometre
kW	Kilowatt
m^3	Cubic metre
Mt	Metric ton
MW	Megawatt
s	Second
TWh	Terawatt hours
°C	Degree Celsius

TABLE OF CONTENTS

FOREWORD

This participatory assessment of intersectoral links, trade-offs and benefits in managing the Drina River Basin proposes more sustainable and collaborative ways of development and stewardship of the basin's water, energy, land and environmental resources. To that end, various actions could be taken by the Governments of the riparian countries, but also by other organizations and actors. Such areas of possible action identified include modernizing and diversifying agriculture; combining the promotion of local, high-quality agricultural products with nature-related tourism and/or renewable energy production; and coordinating dam operation for energy security, trade and better flood management.

The findings from the Drina River Basin are illustrative of the value of an integrated approach to development: Achievement of the 2030 Agenda for Sustainable Development requires reconciling different interests. The interdependencies between the Sustainable Development Goals (SDGs) need to be taken into account when devising implementation policies and measures. While such an approach applies to all SDGs, in this publication the focus is on the interlinkages between the management of water (SDG 6), sustainable energy (SDG 7), land and environmental protection (SDG 15), and food security and sustainable agriculture (SDG 2).

UNECE provides the secretariat for several regional or global conventions and protocols, and has developed numerous standards and guidelines. These cover multiple areas, among them environment, spatial planning and energy, and form a box of tools to support countries in improving integrated planning and intersectoral coordination. The UNECE instruments also provide frameworks where policy and cooperation can be discussed and commitments followed up with a long-term perspective. The way in which the ECE Environment and Sustainable Energy Divisions have fostered dialogue on the Drina River Basin is an example of this approach. The Programme of Work under the Water Convention provides for undertaking such joint activities that promote practical implementation of the Water Convention's key principles – equitable and reasonable use of shared waters, reducing transboundary impacts and strengthening cooperation.

Greater cross-sectoral and cross-border cooperation is key for realizing potential benefits from the jointly identified actions. While awareness about opportunities is a start, political commitment and concrete response actions will be decisive for further progress.

O. Algayerova
Executive Secretary, UNECE

CHAPTER 1
Introduction

Coordination between the water, energy, food and environment sectors is fraught with difficulties at the national level, the complexity of which increases substantially in transboundary basins. The "nexus approach" to managing interlinked resources has emerged as a way to enhance water, energy and food security by increasing efficiency, reducing trade-offs, building synergies and improving governance, whilst also protecting ecosystems.

This summary report presents the results of a participatory nexus assessment in the Drina River Basin. Shared by Bosnia and Herzegovina, Montenegro, and Serbia, the Drina River Basin is a water-rich river basin characterized by untouched landscapes and high levels of biodiversity. The basin also has significant hydropower generation capacity as well as unexploited renewable energy potential, but any development of this potential, notably of hydropower, implies trade-offs. Water quality is impaired by wastewater discharges and solid waste, and agriculture is under pressure to modernize and increase in monetary value (with implications for water use). Rural development in general – which could eventually respond to some of the challenges – needs attending to. With the different resource use needs and interests to consider, the process brought together sector authorities and other key stakeholders from the riparian countries to identify the main intersectoral issues and their possible solutions.

The nexus assessment of the Drina River Basin aims to contribute to the implementation of the Sustainable Development Goals in Montenegro, Bosnia and Herzegovina, and Serbia. The 2030 Agenda includes a dedicated Sustainable Development Goal (SDG) on water and sanitation, and many water-related targets in other Goals. There are also Goals on food security and sustainable agriculture, access to energy, and protection and sustainable use of ecosystems. These Goals are closely interlinked. Achieving them will require coordination across sectors, coherent policies, and integrated planning. It is increasingly clear that authorities need to look beyond their sectoral mandates and work in better coordination across different sectors. Applying a nexus approach and assessing intersectoral effects allows for better informed decisions to be taken about the trade-offs necessitated when meeting different sectoral objectives.

The nexus assessment of the Drina River Basin has three specific objectives:

- to foster transboundary co-operation among the three Drina countries by identifying (i) intersectoral synergies that could be further explored and exploited, and (ii) policy measures and actions that could alleviate tensions or conflict related to the multiple uses of and needs for common resources;
- to assist the three countries in optimizing their use of the Drina River Basin's resources through increased efficiency and improved policy coherence and co-management; and
- to build capacity in the three countries to assess and address intersectoral impacts of resource use and management.

This nexus assessment of the Drina River Basin is part of series of participatory assessments carried out in transboundary basins under the Water Convention with a methodology specifically developed for assessing intersectoral links, trade-offs and benefits. The nexus assessments completed in the series include the Syr Darya Basin, the Alazani/Ganykh Basin, and the Sava basin.[1] The objectives in general terms derive from the Water Convention's Programme of Work[2], and the process was guided and overseen by the Task Force on the Water-Food-Energy-Ecosystems Nexus, established by the Meeting of the Parties to the Water Convention.

This assessment has built on the findings of the nexus assessment of the Sava Basin as the Drina is a sub-basin of the Sava, and therefore analyzes the key issues specific to the Drina Basin in more detail. The nexus assessment of the Sava River Basin[3] was carried out with the aim of supporting the implementation of the Framework Agreement on the Sava River Basin (FASRB), particularly with regard to the further integration of water policy with other sectoral policies, as well as advancing dialogue with key sectoral stakeholders, notably in the sectors of energy and agriculture. The assessments sought to generate salient information to support decision-making.

The methodology and the participatory process for carrying out this nexus assessment have been tailored to the Drina River basin. As an innovation, this assessment includes a scoping assessment of the benefits of cooperation in managing the water-food-energy-environment nexus. The assessment mobilized local expertise, including through two basin workshops (Podgorica, Montenegro, 21-22 April 2016; Serbia, Belgrade; 8-10 November 2016), to identify key linkages between energy, water, land and ecosystem resources, as well as potential solutions that could help ensure that the basin's resources are developed and managed sustainably. A third workshop was organized to discuss and validate the findings (Sarajevo, Bosnia and Herzegovina; 19-20 April 2017). The process was carried out with the support of the "Greening economic development in Western Balkans through applying a nexus approach and identification of benefits of transboundary cooperation" project, funded by the Ministry of Environment, Land and Sea of Italy. The flowchart (figure 1) provides an overview of the nexus assessment process. More details can be found in the full technical report.[4]

The primary target audience of the nexus assessment are officials from the ministries responsible for energy, agriculture and rural development, environment, water management and natural resources of Bosnia and Herzegovina, Montenegro, and Serbia. The assessment already contributed to the diagnostic informing preparation of the GEF's Strategic Action Programme in the Drina Basin. More broadly, the nexus assessment can be of interest to the private sector (particularly water and energy utilities), non-governmental organizations, research institutes and other stakeholders.

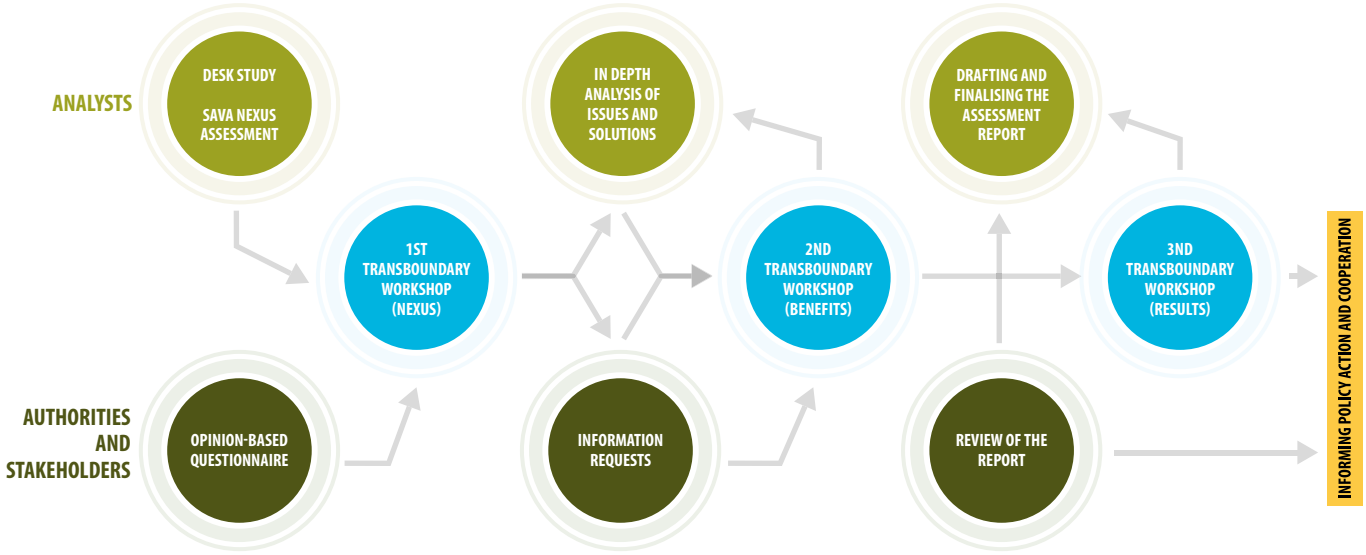
[1] The assessment methodology and the summary assessments of the first three basins can be found in UNECE, Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus (New York and Geneva, United Nations, 2015).

[2] UNECE, Report of the Meeting of the Parties [to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes] on its seventh session (Budapest, 17–19 November 2015), Addendum, Programme of Work for 2016–2018. ECE/MP.WAT/49/Add.1

[3] UNECE, Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus in the Sava River Basin (New York and Geneva, United Nations, 2017).

[4] Assessment of the Water-Food-Energy-Ecosystems Nexus and the benefits of transboundary cooperation in the Drina River Basin: The Technical Report (UNECE, 2017) is available from: http://www.unece.org/env/water/publications/pub.html

FIGURE 1
Nexus assessment process in the Drina River Basin



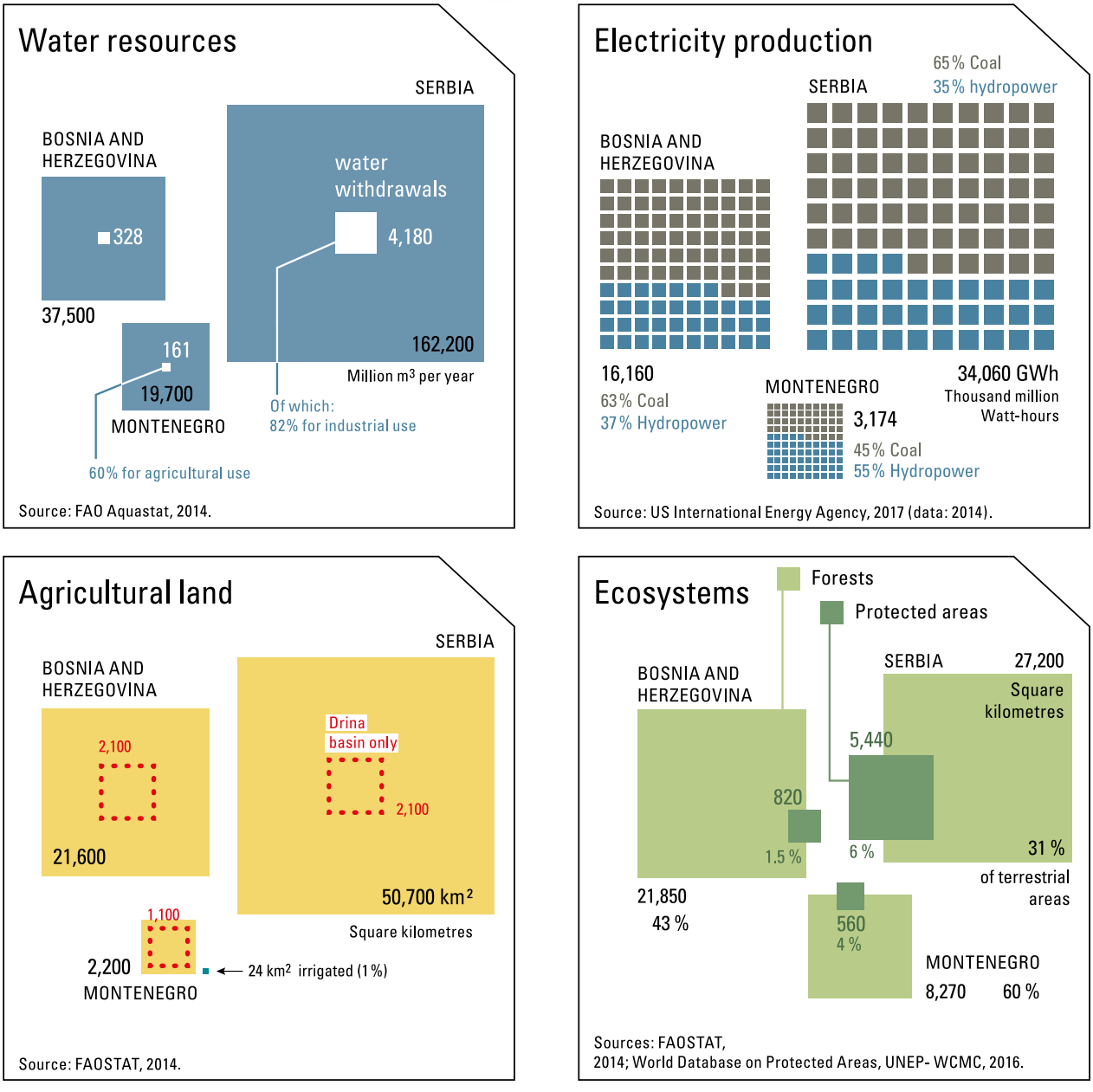
CHAPTER 2.
Natural resources of the Drina Basin

2.1 Location and extension

The Drina River Basin is located in the South-Eastern Europe (SEE). The Drina Basin extends from the central part of the Dinaric Mountains to the Pannonian plain. It is a sub-basin of the larger Sava River Basin, in turn part of the larger Danube River Basin. The Drina river originates at the border of Bosnia and Herzegovina and Montenegro where the Piva and Tara rivers converge, near the town of Šćepan Polje, flows northwards, and terminates at the confluence with the Sava river. The length of the Drina River is 346 km, of which 220 km define the border between Bosnia and Herzegovina and Serbia. The basins's surface area of 20,320 km^2 [5] is almost evenly distributed between three of the four riparian countries, covering the northern half of Montenegro (32% of the river basin), part of the east of Bosnia and Herzegovina (36% of the river basin), part of the west of Serbia (31% of the river basin) (Table 1) and a very small part of the North of Albania (less than 1% of the river basin). This study focuses on the first three riparian countries only.

The Drina River Basin is of high importance for the riparian countries in terms of water, energy and land resources as well as ecosystems, taking into account the resource bases of these countries at the national level (figure 2 provides a visual overview).

FIGURE 2
Key indicators describing the resources of the Drina countries



[5] International Sava River Basin Commission (ISRBC), Sava River Basin Analysis Report (Zagreb, ISRBC, 2009). Figure may vary between sources, e.g. In its Support to Water Resource Management in the Drina River Basin Inception Report of 2015, World Bank reports a total basin area of 19,680 km^2.

TABLE 1
Extent of the Drina Basin

	Bosnia and Herzegovina	Montenegro	Serbia
Country area in the basin (km^2)	7,260	6,184	5,969
Share of national territory in the Drina River Basin (%)	25	45	7.7
Share of Drina River Basin (%)	36	32	31

Source: Data extracted from FAO Aquamaps. Available from: http://www.fao.org/nr/water/aquamaps

2.2 Land resources

Forests and agricultural land prevail over other land types in the Drina Basin. Forests constitute the highest share of land use in the Bosnia and Herzegovinan and Montenegrin parts of the basin, while for Serbia the basin area is mostly agricultural land (Table 2).

TABLE 2
Summary of the land use in the Drina Basin in the three countries (%)

	Bosnia and Herzegovina	Montenegro	Serbia
Agricultural land	22.5	15	30
Forest	61	47	40
Other land uses[a]	16.5	38	30

Source: World Bank, Support to Water Resource Management in the Drina River Basin. Bosnia and Herzegovina, Montenegro and Serbia – IWRM Study and Plans – Background Papers (WORLD BANK, 2016)

[a] This includes human settlements

2.3 Water resources

The basin's surface and groundwater resources represent an important economic potential and have considerable environmental value. The Drina Basin drains a vast karst plateau that receives the highest rainfalls in Europe (around 3,000 mm) and produces the highest specific runoff in Europe (up to 50 l/s/km^2)[6]. Two thirds of the water of the Drina River is provided by the Lim, Piva and Tara rivers, which originate in Montenegro (Table 3). The Dinaric Karst Aquifer System is the main source of groundwater in the region[7] and within the Drina River Basin the main aquifers in the region are the Lim, Tara-massif and Macva – Semberija (Table 4). Groundwater makes up the main water supply to rural communities. The aquifers located near human settlements and agricultural areas face high risk of pollution – such as the Mačva district where nitrification, caused by an increased use of fertilizers, could seriously compromise the quality of groundwater for potable purposes[8]. During summer, some parts of the basin experience a lowering of the groundwater table due to the drawdown of hydropower reservoirs[9]. Some areas face severe water shortages in the dry seasons when the demand is high and supply is low. The basin is vulnerable to floods and droughts due to the high variability of river discharge rates.

[6] Global Environment Facility Special Climate Change Fund (GEF SCCF), Technical Assistance for the Preparation of the West Balkans Drina River Basin Management Project. Environmental and Social Management Framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en 2 UNECE, Report of the Meeting of the Parties [to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes] on its seventh session (Budapest, 17–19 November 2015), Addendum, Programme of Work for 2016–2018. ECE/MP.WAT/49/Add.1

[7] Transboundary Water Resource Management (TWRM) in Southeastern Europe. Available from: http://www.twrm-med.net/southeastern-europe/supported-processes-and-projects/dinaric-karst-aquifer

[8] World Bank, Support to Water Resource Management in the Drina River Basin. Serbia – IWRM Study and Plan – Background Paper (World Bank, 2016)

[9] GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en

TABLE 3
River network in the Drina River Basin[a]

River (tributary to)	River Basin area (km²)	River length (km)	Countries sharing the basin	Tributary order
Sava	97,713.2	944.7	SI, HR, BA, ME, RS	-
Drina	20,319.9	335.7	ME, BA, RS	-
Piva (Drina)	1,784.0	43.5	ME, BA	1st
Tara (Drina)	2,006.0	134.2	ME, BA	1st
Cehotina (Drina)	1,237.0	118.7	ME, BA	1st
Lim (Drina)	5,967.7	278.5	AL, ME, RS, BA	1st
Uvac (Lim)	1,596.3	117.7	RS, BA	2nd

Source: ISRBC, Sava River Basin Management Plan (Zagreb, ISRBC, 2014). Available from: http://www.savacommission.org/srbmp/en/draft.

[a] Values for the basin area and river length may differ according to different sources

TABLE 4
Transboundary aquifers in the Drina River Basin

Aquifer	Groundwater resources Mm³/year	Countries sharing the aquifer	Area (km²)	Water use
Lim	~ 35 (average 1980 – 2000)	Serbia	600 – 800	-60% domestic supply, 12% agriculture, 12% industry, 10% for energy and 6% for other uses
		Montenegro	n.a.	< 25% of the abstraction is for agriculture
Tara massif	4.47	Serbia	211	80% drinking water supply, 10% irrigation and remainder for other uses
		Bosnia and Herzegovina	> 100	Drinking water to close by villages (small amounts)
Macva - Semberija	n.a.	Serbia	967	50-75% drinking water, <25% irrigation, industry and livestock
		Bosnia and Herzegovina	250	Drinking water, irrigation, industry and livestock

Source: UNECE, Second Assessment of TransboundaryRrivers, Lakes and Groundwaters. (New York and Geneva, United Nations, 2011).

2.4 Energy resources

The Drina countries are rich in energy resources, not only in terms of hydropower potential but also because of non-hydro renewable potential and reserves of fossil resources. In Serbia, coal (mostly lignite) is produced in several mines and constitutes 85% of the country's overall primary energy reserves. The majority of the production is consumed for electric power production in thermal power plants. Production of coal in Bosnia and Herzegovina for 2009 was 11.5 million tons (5% brown coal, 49% lignite), and about 88% of the total coal production is used to fuel thermal power plants in the country.[10] Montenegro's geological reserves of oil and gas are estimated at a total of 2.587 million tons of oil equivalent and exploited in 676 million tons of oil equivalent[11], and the largest coal mine, Pljevlja, which produces annually about two million tons of dark lignite coal[12], is located in the Drina River Basin.

The potential and current exploitation of renewable energy sources (RES) is varied. Almost two thirds of RES potential in Serbia is biomass potential and almost one third is hydropotential.[13] Serbia exploits about 55% of its hydropotential while Montenegro exploits 17%. Montenegro also has important potential for wind (potential estimated to be 900 GWh/year but mostly outwith the Drina Basin) and for solar. Because of the potential for biomass, Montenegro's agriculture and forestry are estimated to have an overall energy production potential of about 400 GWh[14]. Bosnia and Herzegovina has extraordinarily favorable conditions for the use of biomass, thanks to the extensive forest cover and production of wood waste estimated at 1,785,000 m³/year, and poorly explored potential for geothermal resources.[15] Information about energy generation capacities in these riparian countries is given in section 4.3.

[10] Foreign Investment Program Agency, Bosnia and Herzegovina Energy Sector (Sarajevo, 2011). Available from: http://www.fipa.gov.ba/doc/brosure/Energy%20sector.pdf

[11] Ilija Vujosevic, 'A brief background note on the power sector reforms in Montenegro', background paper for the Fourth PRSP Forum for the Balkan countries (Athens, 2007). Available from: http://siteresources.worldbank.org/PGLP/Resources/ENERGYSECTOROFMONTENEGRO.pdf

[12] Pljevlja mine website (Rudnik uglja AD Pljevlja): http://www.rupv.me/

[13] Republic of Serbia, Ministry of Energy, Development and Environmental Protection, National Renewable Energy Action Plan of the Republic of Serbia (Belgrade, 2013).

[14] Igor Kovačević, Renewable Energy Sources in Montenegro, presentation at the 4th meeting of the Renewable Energy Task Force, Energy Community Secretariat (Vienna, 2010). Available from: https://www.energy-community.org/pls/portal/docs/794183.PDF

[15] Vlatko Doleček, Isak Karabegović, (2013). Renewable energy sources in Bosnia and Herzegovina: situation and perspective. Contemporary Materials (Renewable Energy Sources), vol. IV–2, pp. 152–163.

2.5 Ecosystems and biodiversity

The Drina Basin is considered one of the last 'untouched' river basins in Europe. It hosts a diversity of habitats, from mountains and glaciers, to canyons, forest, meadows, wetlands and underground rivers. Consequently, there is great biodiversity in the basin and a significant number of endemic species, as well as species that are threatened throughout the rest of Europe.[16] A wide altitude range in the basin contributes to a wide biodiversity and large variety of flora and fauna, with the fauna including fish, birds, amphibians, mammals and insects. The valleys of Piva and Tara as well as the Durmitor site record high numbers of species in the region.[17] The climate and environmental conditions of the Drina River Basin allow for a large number of mediterranean and sub-mediterranean species to grow despite the fact that large parts of the basin consists of the European-deciduous forest. Water quality is in general very good in the basin, resulting in abundant fish resources which include the endangered and regionally very important Danube Salmon. Yet, biodiversity is considered to be decreasing, although a paucity of precise data on flora and fauna populations in the Drina River Basin makes it difficult to quantify this phenomenon[18].

2.6 Climate change

There are no specific studies addressing the impact of climate change in the Drina Basin. Table 5 offers a summary of the projected impacts in the Drina countries.

TABLE 5
Climate change impacts projections in the Drina countries

Country	Temperature	Precipitation	Run-off and water levels
Bosnia and Herzegovina	Temperature is likely to increase within the range 0.7- 1.6°C, per 1°C of global increase. Summer period and inland areas will register the higher increases. In winter and spring temperatures could rise up to 2°C, while in autumn the rise could be between 2°C and 3 °C. Rise of the average maximal daily temperature more distinct than the minimal daily temperature.	Precipitation increase during winter (December to February), with rainfall expected to be heavier. Reduction of precipitation during summer. Effect more pronounced in June and August during the period 2031 to 2060, when rainfall could be halved. In this case, half of the country territory will be affected.	n.a.
Serbia	General projection indicates an increase of 0.04°C per year of the average yearly temperature, except for the south-eastern regions. Temperatures have been rising in the period 1951-2004. Future trends indicate, in the A1B scenario, a possible temperature rise between 0.8 and 1.1 °C for the 2001-2030 period. When taking the results from a more severe scenario (A2), the temperature increase could rise up to 3.8 °C between 2071 and 2100.	Observed rise of yearly precipitation in the 1950 – 2004 period, except for the south and south-eastern regions of the country. Increased number of days with intensive rainfall. Up to 2020 various climate models show a decrease of the average precipitation level on average by 15%, (16.9% in the vegetation period and 13.9% in the non-vegetation period). Up to 2020 various climate models show a decrease of the average precipitation level on average by 15%, (16.9% in the vegetation period and 13.9% in the non-vegetation period). Up to 2100, the estimated rainfall decrease is 25.1% (in vegetation period 13.4% and in non-vegetation 39.6%).	Results of the various climate models indicate that, in comparison to current average levels, water discharge is expected to decrease by 12.5% until 2020 (vegetation season -11.1%) and suffer a 19% reduction until 2100 (for the vegetation period 5.4% but 32% for the non-vegetation period). Average yearly figure for evapotranspiration until 2020 will decrease by 16.5%, and by 27.2% until 2100.
Montenegro	Increase in temperature trend registered from the second half of the 20th century in most parts of the country. A temperature increase of 2°C in winter; Temperature increase between 2-3°C in summer (with projected increase of 0.2°C per decade).	A precipitation reduction of 5–15%, especially in the warmer part of the year. Reduction of soil moisture of 15–25%.	Increase in water demand and water abstraction: National statistics record a significant increase in the water abstraction for water supply from 95 million m^3 in 2002, to 102 million m^3 in 2006.

Sources: ISRBC, Sava River Basin Management Plan. Background Paper No. 10 – Climate Change and RBM planning (Zagreb, ISRBC, 2013). Available from: http://www.savacommission.org/srbmp/en/draft; Andrej Ceglar and Jože Rakovec (2015). Climate Projections for the Sava River Basin. In: Radmila Milačič,. Scancar, Janez and Momir Paunović, eds. The Sava River. Handbook of Environmental Chemistry 31 (Berlin Heidelberg, Springer-Verlag, 2015), pp. 53 – 72; World Bank. Water & Climate Adaptation Plan for the Sava River Basin (Washington DC, World Bank, 2015).

[16] GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en

[17] World Bank, Support to water Resource Management in the Drina River Basin. Montenegro – IWRM Study and Plan – Background Paper (World Bank, 2016).

[18] World Bank, Support to water Resource Management in the Drina River Basin. Montenegro – IWRM Study and Plan – Background Paper (World Bank, 2016).

CHAPTER 3.
Governance context

3.1 Governance beyond the basin

Salient global standards and regional regimes. The Sustainable Development Goals, which were agreed upon by the international community in September 2015, are expected to have a major impact on the domestic policies of the Drina countries. An overview of the status of the Drina countries in relation to the ratification of selected international instruments and the adoption of frameworks is shown in Table 6.

TABLE 6
Ratification status with regard to some important conventions and protocols

Instrument	Bosnia and Herzegovina	Montenegro	Serbia
UNECE Water Convention	X	X	X
Protocol on Water and Health	X		X
Espoo Convention (EIA)	X	X	X
Espoo/SEA Protocol	X	X	X
Aarhus Convention/PRTR	X	X	X
Industrial Accidents Convention	X	X	X
UNFCCC	X	X	X
Paris Agreement (sig)	signed only	signed only	signed only

Source: United Nations Treaty Collection, CHAPTER XXVII : Environment.
Available from: https://treaties.un.org/Pages/ParticipationStatus.aspx?clang=_en

European Union context. The European Union (EU) has a major influence on developments in the Drina Basin, since all three countries have taken steps towards EU accession. As a consequence, the three countries have made commitments derived from the acquis communautaire (EU Law) that affect water, energy, ecosystem and food policies, These laws include the EU Water Framework Directive and its substance-specific (or "daughter") directives directives, various energy directives and strategies, the Common Agricultural Policy, the Rural Development Policy, and a number of environment directives such as the Birds and Habitats Directives. Because of the accession process, these commitments are part of the closure of particular chapters, and are subjected to progress monitoring, without specific sanctions other than delay in accession. The Drina countries typically have specific institutions dedicated to EU integration and may adopt specific national strategies for approximation or transposition. The EU integration process also includes possibilities for financing activities aimed at reaching cross-sectoral integration goals. One accession requirement that is particularly important to energy sector development in the western Balkans is the requirement to meet binding renewable energy targets by 2020 and to prepare and implement National Renewable Energy Action Plans.[19] Each country is undergoing gradual structural reform in the agricultural sector to prepare for EU membership. The approximation adoption of the water-related directives has advanced at different stages in the Drina countries.

International relations between the Drina Basin countries. There are no specific agreements among the three countries or between any two of them with direct relevance to the Drina River Basin per se. There are also very few direct bilateral agreements between any of the two countries. The countries report, however, that they plan to negotiate bilateral agreements on water management in the near future. There is an agreement on "Special Parallel Relations" between Serbia and Republika Srpska, an entity within Bosnia and Herzegovina. Under this agreement, four councils have been held, and it covers cooperation on, inter alia, energy, transport, tourism and environmental protection. The countries have many avenues and opportunities for collaboration through various regional groupings and mechanisms for cooperation on the technical level, such as the Regional Cooperation Council (RCC), the Central European Free Trade Agreement (CEFTA), the South East Europe Transport Observatory (SEETO) envisioning a Transport Community Treaty, and the South East Europe Investment Committee (SEEIC).

[19] REN21, UNECE Renewable Energy Status Report (Paris, REN21 Secretariat, 2015).

3.2 Governance at basin level

Governance water resources at basin level. There is no specific basin-level cooperation mechanism for the Drina River Basin. As a sub-basin of the Sava, the Drina benefits from a well-developed water governance mechanism at the level of the larger Sava River Basin. The Framework Agreement on the Sava River Basin (FASRB) provides the legal and institutional framework for cooperation, while the International Sava River Basin Commission (ISRBC) operates as the implementing body of the FASRB. Montenegro is not presently a party to the FASRB but has signed a Memorandum of Understanding on cooperation with ISRBC and in practice already cooperates on matters such as hydro-meteorological issues, flood management, and river basin management. Additionally, there are also robust water governance mechanisms in place at the regional level of the Danube River Basin, which affect its sub-basin the Sava and in turn the Sava's sub-basin Drina.

Cross-sectoral governance at Sava and Drina Basin level. While the ISCRB's mandate is limited with respect to energy and food related issues, two subsidiary bodies under the ISRBC (the permanent expert groups for River Basin Management and Flood Protection) have competencies related to the different sectors that either use water or affect the hydrology. The Strategy on Implementation of the Framework Agreement on the Sava River Basin[20] envisages further integration of water policies with other sector policies, and financial aspects of multi-level governance aimed at a nexus approach are routinely considered within the FASRB. Some additional regional coordination may take place in the form of transboundary Environmental Impact Assessment (EIA) or Strategic Environmental Assessment (SEA) that is conducted pursuant to the states' obligations under the Espoo Convention and/or SEA Protocol (and related obligations under legislation harmonizing the salient EU Directives), and which relate to nexus sectors such as water and energy.[21] While examples have been identified in the broader Sava Basin, no specific transboundary EIAs salient to the Drina Basin currently exist. A number of EIAs have been performed in connection with hydropower development in the Drina River Basin, although it is unclear the extent to which transboundary considerations were taken into account or transboundary participation took place. Some case studies have been collected by the South East Europe Sustainable Energy Policy Programme.[22]

Cooperation in the energy sector. Operation of hydropower facilities in the Drina River Basin was formerly coordinated during the years of the Socialist Federal Republic of Yugoslavia, but that cooperation has largely broken down. All three countries cooperate on energy matters through the Energy Community, whose purpose is to extend the European Union's single market in the area of energy to a broader European neighborhood, including the Western Balkans. In this context, the three Drina countries, along with Albania, Kosovo (UN administered territory under UN Security Council Resolution 1244), and the former Yugoslav Republic of Macedonia agreed in 2015 to take steps towards the establishment of a regional electricity market, and in 2016 they agreed upon a roadmap and a set of priority measures aimed at removing national obstacles to efficient regional capacity allocation.[23] Closer coordination of Drina countries in the energy sector will likely be driven by EU policies. The RCC supports the countries' commitment to the EEC through instruments such as the SEE 2020 Strategy, the Energy Strategy by 2020 and the Sustainable Energy Development Regional Initiative (SEDRI).

Cooperation in the agricultural sector. More than 20 years ago, the three countries were part of a single national market for agricultural products, and there is still substantial trade in agricultural products across the borders. The countries participate in the Regional Rural Development Standing Working Group (SWG), established in 2006. The SWG implements various projects including a European Commission project to foster both regional cooperation and a balanced territorial development of Western Balkan countries in the process towards EU integration[24]. While there is a long history of Farmer-Based Organizations in the three countries, there appear to be few examples where they work across boundaries to cooperate and lobby on priority issues.

Cooperation on the environment. Nature protection authorities in the three countries have a long history of cooperation, particularly with respect to migratory species. In 2011, IUCN conducted a feasibility study about the establishment of a transboundary protected area – the Tara-Drina – including several existing national parks in Serbia, to be joined with a proposed Drina "Biosphere Reserve" to be designated in Bosnia and Herzegovina. Another feasibility study was conducted by UNEP in 2010 for a transboundary mountain biosphere area between Montenegro and Albania in the Prokletije area, part of which would be in the high uplands of the Lim River, a tributary of the Drina. With respect to environmental regulation, the three countries have moved towards adoption of the EU environmental acquis.

[20] ISRBC, Strategy on Implementation of the Framework Agreement on the Sava River Basin (Zagreb, ISRBC, 2011).

[21] Lucia de Strasser, Annukka Lipponen, Mark Howells, Stephen Stec and Christian Bréthaut (2016). A Methodology to Assess the Water Energy Food Ecosystems Nexus in Transboundary River Basins. Water, 8(2), 59.

[22] WWF Adria and South East Europe Sustainable Energy Policy (SEE SEP), EIA/SEA of Hydropower Projects in South East Europe. Meeting the EU Standard. (2015). Available from: http://www.door.hr/wp-content/uploads/2016/06/hidro_v6_webr.pdf

[23] Energy Community, Creating a Regional electricity Market in the Western Balkans: From Paris to Rome.,(Vienna, Energy Community, September 2016). Available from: https://www.energy-community.org/documents/reports.html

[24] Further information is available from: www.seerural.org

3.3 Governance at national level

National governance context. The three countries tend to rank just above the middle of the 168 countries assessed in the global Corruption Perception Index. The OECD policy outlook of competitiveness in South East Europe includes an analysis of cross-cutting challenges to foster increasing competitiveness in the region.[25] While the outlook is regional in scope, the conclusions also have application to the DRB countries specifically. Many of the challenges directly relate to governance, including: (i) strategic approach to policymaking; (ii) limited capacities in and autonomy of public administration; (iii) co-ordination mechanisms generally lacking; and (iv) limited use of cross-policy stakeholder consultations.

Intersectoral coordination on the national level. The earlier experience with intersectoral coordination mechanisms in the three countries was in connection with specific project requirements. There has been a move towards more permanent mechanisms in recent years. The three countries have had substantial experience in intersectoral coordination in connection with the development of National Strategies for Sustainable Development (NSSD). Montenegro established a National Council for Sustainable Development, a multi-stakeholder body, in 2002 and in 2015, the country adopted a new NSSD to incorporate the 2030 Sustainable Development Agenda. Serbia has established an Inter-ministerial Working Group (IWG) with the task of monitoring the implementation of the SDGs and related targets, working on a revised National Strategy for Sustainable Development and the development of national targets. Montenegro has taken strides in planning and implementing a range of agri-environmental support measures designed to strengthen sustainable agriculture. Work across sectors is also undertaken in the area of climate change: Bosnia and Herzegovina have adopted a Climate Change Adaptation (CCA) strategy which is predicated on a coordination mechanism on an inter-entity level.

Governance issues in single sectors. The volatility of the configuration of ministries and their constant restructuring poses problem for effective governance. The application of the subsidiarity principle has accelerated the trend towards shifting responsibility for the financing of environmental and other infrastructure towards decentralised local government, particularly for wastewater collection and treatment infrastructure. Greater decentralisation has resulted in the fragmentation of efforts and insufficient capacity and resources at the local level. In some riparian countries, the lack of a regional level authority combined with a high degree of municipality autonomy has created a governance gap in environmental performance. Monitoring capacities vary widely throughout the basin. The countries have introduced Integrated Permitting and Pollution Control (IPPC) into their legislation to varying extents. While understaffing is still a problem, capacities of inspectorates have increased in recent years and national inspection authorities now play an important role both in terms of enforcement and for ensuring compliance with relevant regimes. According to the OECD Competitiveness Report, natural resources conservation practices in the three countries are not systematic. The countries have a relatively low proportion of land under protection.

Nexus-specific governance at national level. Table 7 gives a summary of the major institutional frameworks salient to nexus governance in the three countries, in the fields of water, energy, agriculture and environment[26]. Table 8 lists salient policy documents.

[25] OECD, Competitiveness in South East Europe: A Policy Outlook, Competitiveness and Private Sector Development (Paris, OECD Publishing, 2016).

[26] Further information is available in the technical report of the Drina nexus assessment.

TABLE 7
Overview of institutions relevant to managing the components of the nexus in the Drina River Basin[a]

Regional level	European Union			
Subregional level	Energy Community			
	Danube Commission			
	International Commission for the Protection of the Danube River			
Basin level	International Sava River Basin Commission (sub-basin)			
	BOSNIA AND HERZEGOVINA		**MONTENEGRO**	**SERBIA**
State Government	Ministry of Foreign Trade and Economic Relations Ministry of Communications and Transport		Ministry of Sustainable Development and Tourism Ministry of Agriculture and Rural Development Ministry of Economy Inspectorate	Ministry of Agriculture and Environmental Protection Ministry of Mining and Energy Ministry of Construction, Transport and Infrastructure Inspectorate
Entity level (Bosnia and Herzegovina only)	Federation of Bosnia and Herzegovina Ministry of Environment and Tourism; Ministry of Energy, Mining and Industry; Ministry of Agriculture, Water Management and Forestry; Ministry of Spatial Planning; Ministry of Transport and Communications Inspectorate	Republika Srpska Ministry of Trade and Tourism; Ministry of Industry, Energy and Mining; Ministry of Agriculture, Forestry and Water Management; Ministry of Spatial Planning, Civil Engineering and Ecology; Ministry of Transport and Communications Inspectorate		
Committees and agencies	State Electricity Regulatory Commission		Energy Regulatory Agency	Environmental Protection Agency (SEPA)
	Regulatory Commission for Energy in the Federation of Bosnia and Herzegovina Federal Hydrometeorological Institute Environmental Protection Fund, Federation of Bosnia and Herzegovina	Regulatory Commission for electricity of Republika Srpska Republic Hydrometeorological Institute of Republika Srpska Environmental Protection Fund of Republika Srpska	Environmental Protection Agency Water Directorate Institute for Hydro-meteorology and Seismology of Montenegro IHMS	Energy Agency Republic Hydrometeorological Service Institute for Nature Conservation
Regional level	Regional Water(shed) Agencies			Provincial government
	Federation of Bosnia and Herzegovina Sava River Watershed Agency situated in Sarajevo	Republika Srpska Public Utility "Vode Srpske" Regional office for DRB situated in Zvornik		Public Water Management Company "Srbijavode"
Energy producers	Elektroprivreda Bosne i Hercegovine	Elektroprivreda Republika Srpska	Elektroprivreda Crne Gore	Elektroprivreda Srbije
Local level	Canton relevant ministries and local government water supply and sewage enterprises	Local government water supply and sewage enterprises	Local government	Local government, water supply and sewage enterprises

[a] The table was developed in the present assessment using information from the literature review and inputs from governments and local experts. It should be noted that this represents the institutional setting in spring 2017, and changes have occurred since (notably, Serbia established the Ministry of Environmental Protection).

TABLE 8
Overview of policies relevant to managing the components of the nexus in the Drina River Basin

	BOSNIA AND HERZEGOVINA	MONTENEGRO	SERBIA
State Government	Adaptation Strategy to climate change and low-emission development (2014) National Renewable Energy Action Plan National Environmental Action Plan The Strategy and Action plan for the protection of biodiversity (2015-2020) Action Plan for Flood Control and River Management 2014-2017 Sustainable Forestry Management Strategy Strategic Plan for Harmonization of B&H Agriculture, Food and Rural Development (2008 -2011) Action Plan for implementation of the Strategic Plan for Harmonization of B&H Agriculture, Food and Rural Development (2008 -2011) Action Plan for Environmental Protection (2003	Water Management Strategy 2016-2035 (draft) Strategy for the development of agriculture and rural areas 2015-2020 Energy policy to 2030 Energy development strategy to 2030 Energy Efficiency Action Plan up to 2018 National Renewable Energy Action Plan Spatial Plan of Montenegro 2020 National strategy of sustainable development to 2030 National Strategy with Action Plan for transposition, implementation and enforcement of the EU acquis on Environment and Climate Change 2016-2020 National Strategy on Biodiversity (2016 – 2020) Tourism development strategy to 2020 National Climate Change Strategy 2030 Sustainable Forestry Management Strategy Water Management Strategy to 2013 (draft)	Water Management Strategy to 2034 Spatial Plan 2010-2020 Strategy of agriculture and rural development 2014-2024 Energy sector development strategy for the period by 2025 with projections by 2030 National Renewable Energy Action Plan National Energy Efficiency Action Plan National Strategy for Sustainable Use of Natural Resources and Goods National Environmental Approximation Strategy Action Plan for Adaptation to Climate Change and Vulnerability Assessment National Program of Environmental Protection (2010)

Entity level	Federation of Bosnia and Herzegovina Water Management Strategy 2012- 2020 Strategy of Agricultural Land Management (2011) Medium term development strategy of agricultural sector 2015-2019 Strategic plan and program for energy sector development (2008) Action Plan on Renewable Energy Sources Spatial Plan (2018- 2028) Environmental Protection Strategy (2008-2018) Federal Waste Management Plan (2012-2017) Tourism Development Strategy (2008-2018)	Republika Srpska Strategic plan for the development of agriculture and rural areas 2016-2020 Agricultural Development Strategy up to 2015 Action Plan for implementation of the Strategy Agriculture Development Energy strategy up to 2030 Action Plan on Renewable Energy Sources Spatial Plan up to 2015 Nature Protection Strategy Sectoral Strategy of Industrial Development (2009-2013) Integrated Water Management Strategy, 2014-2024 Tourism Development Strategy (2010-2020) Air Protection Strategy		
Regional level		National park Sutjeska Rulebook on internal order in National park (Official Gazette of RS No. 83/11)	Durmitor National Park Management Plan 2011-2015 Piva National Park Management Plan	Regional Spatial Plan for the Administrative Districts of Kolubara and Mačva Regional Spatial Plan for the Administrative Districts of Zlatibor and Moravica Special-purpose Spatial Plans for Tara National Park and Uvac Nature Reserve

CHAPTER 4.
Socioeconomic context

4.1 Population

The Drina River Basin hosts a population of 867,000 with higher population densities found along the Drina River and its main tributary rivers[27]. Around 60% of the basin population lives in rural areas, but the level of urbanization can vary significantly from one municipality to another[28]. There are 57 municipalities in the Drina River Basin, of which 30 are to be found in Bosnia and Herzegovina (12 in the Federation of Bosnia and Herzegovina and 18 in Republika Srpska), 13 in Serbia, and 14 in Montenegro. The highest population density is to be found in Teočak (Bosnia and Herzegovina) with 262 inhabitants/km^2, and the lowest in Plužine and Šavnik (Montenegro), which count fewer than four inhabitants/km^2 [29]. As with other rural areas in south east Europe, the Drina Basin is characterised by a contraction of population – for example, in the Montenegrin area of the basin, the census registered a decline of around 16,500 people between the years 2003 and 2011[30]. This is driven by a paucity of job opportunities (average unemployment is 34% in Montenegro and 46% in Serbia and Bosnia and Herzegovina [31,32]) and as the migrants are predominantly young people it also means that the average age of the remaining population is higher than it otherwise would be.[33]

TABLE 9
Population in the Drina River Basin

Country	Basin population	Country population (2015)[a]	Share of basin population	Share of country population
Bosnia and Herzegovina	429,581 (census 2013)[b]	3,810,420	50%	11%
Montenegro	150,000[c]	622,390	17%	24%
Serbia	286,986 (census 2011)[d]	7,098,250	33%	4%

Notes and sources:

[a] World Development Indicators. World Bank (2015).

[b] Of which: 58,120 in Federation of Bosnia and Herzegovina and 371,461 in Republika Srpska. Information from national experts, 2016.

[c] Estimate from World Bank, 2015 (as in note a), confirmed by national experts, 2016.

[d] Estimate based on boundaries of catchment from Water Directorate, using ArcMap software. Information from national experts, 2016.

4.2 Access to services

Energy services. Access to electricity is generally high, with 98.5% of household connection in the Serbian part, and between 95% and 99% in the Montenegrin part.[34] Affordability of energy can be an issue, with a share of 29%, 35%, and 49% "energy poor" households in Bosnia and Herzegovina, Montenegro and Serbia respectively.[35]

Water and sanitation services. Access to water supply is relatively high, whilst access to the sewage networks is more limited. Both vary from municipality to municipality reflecting the fact that some settlements are more difficult to connect as they are located in mountainous areas. Most large settlements are supplied by utility companies, which provide for water and sanitation services, while remote villages rely on their own water wells or boreholes. Most of the water supplied originates from mountain springs and is transported without the need for pumping stations, after simple disinfection with chlorination[36]. Water consumption is very high, mostly due to the poor state of the water supply network and illegal consumption, resulting in 40% to 81% of overall losses[37]. Groundwater is widely used; water from wells comes from the first (topmost) layers of groundwater, and it is generally chemically safe[38]. Currently, water use for irrigation is marginal, while all the riparian countries have plans to increase the irrigated land in order to improve economic performance of the agricultural sector and to adapt to the increasing frequency of droughts due to climate change[39].

[27] Note that numbers may be different by source. The World Bank estimates a total population of 970,000 (Source: World Bank, Support to water Resource Management in the Drina River Basin. Inception Report (World Bank, 2015)), whereas GEF-SCCF's estimate is 750,000 (GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en).28 United Nations Environment Programme, *The future of the Aral Sea lies in transboundary cooperation* (UNEP, 2014).

[28] Urban population exceedes rural population in Foča (62%), Pale (62%), Han Pijesak (53%) (Bosina and Herzegovina) and Uzice (77%) (Serbia), while it is very low in Andrijevica (18%) and Šavnik (19%) (Montenegro) (Source: World Bank, 2015, as in note 28). Andy Thorpe and Raymon van Anrooy, *Inland fisheries livelihoods in Central Asia, policy interventions and opportunities*, (Rome, FAO, 2009).

[29] World Bank, 2015, as in note 28.

[30] GEF SCCF, 2015, as in note 28.

[31] World Bank, Support to Water Resource Management in the Drina River Basin. Bosnia and Herzegovina – IWRM Study and Plan – Background Paper (World Bank, 2016)

[32] Note that numbers may differ by source. According to GEF-SCCF, average employment rates, calculated on the past 5 years, are: 46.35 % in the Federation of Bosnia and Herzegovina, 38.35% in Republika of Srpska, 22.98% in Serbia, 37.7% in Montenegro (Source: GEF SCCF, Technical Assistance for the Preparation of the West Balkans Drina River Basin Management Project. Environmental and Social Management Framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en)

[33] World Bank, Support to Water Resource Management in the Drina River Basin. Inception Report (World Bank, 2015)

[34] World Bank, Support to water Resource Management in the Drina River Basin. Inception Report (World Bank, 2015)..

[35] Energy poverty is defined as the share of households in a country that spend a significant portion of their budget (more than 10%) on energy. Data from 2012. Source: REN21, UNECE Renewable Energy Status Report (Paris, REN21 Secretariat, 2015)

Solid waste services. Waste produced in municipalities amounts to 90,000 tons/year in the Bosnian and Herzegovinan part of the basin, 35,000 tons/year in the Montenegrin part, and 60,000 tons/year in the Serbian part. None of this is treated[40]. Solid waste is often illegally disposed on the banks of the river and approximately 30% of this waste ends up in riverbeds[41].

4.3 Economic structure and trends

The Drina countries are transitional economies moving towards a market system. In Serbia and Montenegro market forces are already dominant in most areas of the economy – more than 85% of previously stated-owned companies (banking, energy and telecommunications) have been privatized in Montenegro since 1999. In Bosnia and Herzegovina only few market reforms have been implemented so far[42]. Foreign investments are important drivers for the economy of each of the three countries[43] and the economies of all three, both in terms of employment and contribution to GDP, are driven by services and industry. However, with the exception of a well-established wood processing industry[44], the Drina Basin does not host major industrial centres. The key economic activities in the basin are electricity production (mainly from hydropower), agriculture, and tourism[45].

TABLE 10
Economic structure of the Drina countries (2015)[46]

Country	Total GDP (million USD)	GDP per capita (current USD)	Agriculture (% of GDP)	Industry (% of GDP)	Services (% of GDP)	GDP growth (annual %)
Bosnia and Herzegovina	15,995.39	4,349.3	7.2	26.8	65.9	3.2
Montenegro	3,992.64	6,406.1	10	17.7	72.3	3.4
Serbia	36,513.03	5,235.1	9.3	30.2	60.5	0.7

Source: World Development Indicators. World Bank (2015).

Agriculture. Agriculture is the main employer in most of the basin's municipalities[47]. The Drina Basin is largerly characterised by low-value subsistence agriculture in plots tended at family level[48]. The main crops are cereals (wheat or maize), followed by fodder crops, and potatoes. Some signficant shares of permanent crops (such as vineyards, raspberry and plum) can be found in Serbia. There are some examples of holdings that specialize in vegetables and flowers (and which present the highest average economic value per farm[49]) as well as industrial crops and aromatic plants[50]. Most agricultural land in the basin consists of meadows and pastures, which in Montenegro account for 97% of the total agricultural land, due in part to the limited availability of good soil for farming but also to the abandonment or conversion of arable land because of demographic and econonomic trends[51]. National data presented in the technical report suggests that irrigation in the basin is likely to cover less than 2% of arable land, mostly used in orchards and for cereals. The basin is important for fish farming as well, with different species being bred in different stretches of the river and tributaries, by families or small companies[52] often not licensed[53].

[36] World Bank, 2015, as in note 34.

[37] Estimation made in the World Bank Diagnostic Study for Drina. World Bank, 2015, as in previous note.

[38] World Bank, Support to water Resource Management in the Drina River Basin. Inception Report (World Bank, 2015).

[39] World Bank, Support to water Resource Management in the Drina River Basin. Bosnia and Herzegovina, Montenegro and Serbia – IWRM Study and Plans – Background Papers (World Bank, 2016).

[40] ICPDR, The Drina River's floating problem. Available from: http://www.icpdr.org/main/publications/drina-rivers-floating-problem

[41] World Bank, 2015, as in note 34.

[42] Central Intellingence Agency, The World Factbook, 2016. Available from: https://www.cia.gov/library/publications/the-world-factbook/

[43] Central Intellingence Agency, 2016, as in previous note.

[44] GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en and World Bank, Support to water Resource Management in the Drina River Basin. Bosnia and Herzegovina, Montenegro and Serbia – IWRM Study and Plans – Background Papers (World Bank, 2016).

[45] Set of key economic activities confirmed by national experts, 2016.

[46] World Bank database – latest available data.

[47] Information from national experts, 2016.

[48] GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en

[49] Information from national experts, 2016.

[50] World Bank, Support to water Resource Management in the Drina River Basin. Montenegro —IWRM Study and Plan – Background Paper (World Bank, 2016).

[51] World Bank, 2016 (Montenegro), as in previous note.

[52] GEF SCCF, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (GEF SCCF, 2015). Available from: http://projects.worldbank.org/P145048?lang=en

[53] World Bank, Support to water Resource Management in the Drina River Basin. Bosnia and Herzegovina – IWRM Study and Plan – Background Paper (World Bank, 2016).

TABLE 11
Basin Land Cover[a]

Area (km^2)	Total agricultural land	Arable land	Pastures	Forests
Bosnia and Herzegovina (DRB)	2,121.71	105.13	432.06	4,285.10
Montenegro (DRB)	1,079.25	0.31	137.07	2,916.52
Serbia (DRB)	2,136.91[b]	157.53	135.18	2,447.15

Source: World Bank, Support to water Resource Management in the Drina River Basin. Bosnia and Herzegovina, Montenegro and Serbia – IWRM Study and Plans – Background Papers (World Bank, 2016)

[a] Data obtained using CORINE land use.

[b] No permanent crops included

Energy. The contribution of the basin's power plants to the total capacity installed in each country is approximately 15% for Bosnia and Herzegovina and for Serbia, and 65% for Montenegro. The Drina countries share an interest in the continuing development of hydropower -- by far the best established renewable source in the three countries. The Drina Basin is potentially central to this development, with eight hydropower plants (and many smaller ones) accounting for 1,772 MW of power installed, and an estimated 60% of capacity still unexploited[54]. Installed capacity in coal-fired power plants is 54 MW in Serbia, 225 MW in Montenegro and 325 MW in Bosnia and Herzegovina. Installed capacity in hydropower plants is 1,028 MW in Serbia (40% of Serbia's capacity), 360 MW in Montenegro (52% of Montenegro's capacity) and 333 MW in Bosnia and Herzegovina.

Industry. Wood processing is the most salient industry in the basin – for example, in Montenegro, about 90% of the country's wood industry is located in the Drina River Basin[55]. Mining and quarrying are also salient – Montenegro, Pljevlja and Berane have important coal and zinc mines, and in Bosnia and Herzegovina, Ugljevik hosts a coal mine, Zvornik a bauxite mine and Srebrenica a zinc mine. The potential for limestone production in the Montenegrin part of the basin remains unexploited.[56] Sand and gravel is extracted, often without the proper controls, on the banks of the river and its tributaries in the three countries,[57] creating problems in the lower Drina.[58] Little heavy industry remains in the basin.

Tourism. Tourism is an increasingly important economic sector in the Drina Basin. Tourism resources in the basin include a variety of environmental resources (landscapes and species such as brown bear, wolf, chamois, wild cat and otter) and cultural resources (ethnic villages, ancient sites and monuments) as well as opportunities to practice nature-based sports (rafting, hunting, fly-fishing, climbing). Several initiatives and projects are promoting eco-tourism development, such as the project "Drina-Tara" that focuses on the area comprising 14 municipalities at the border between Montenegro, Bosnia and Herzegovina and Serbia[59]. The potential for spa tourism is also being developed in several municipalities[60].

Trends in agricultural production. Investments in the agricultural sector are low and support for the sector often takes the form of income-support rather than support to improve market conditions, knowledge dissemination and integrated rural development[61]. The sector is slowly but increasingly oriented towards sustainable agriculture practices and higher value crops. In Montenegro, the main strategic orientation of the agricultural sector is explicitly to preserve nature, environment and biodiversity, and emphasis is given to high-quality, traditional products rather than on large productions[62]. In Serbia, "sustainable resources management and environment protection" is reported as one of five development goals. In Bosnia and Herzegovina, organic agricultural production and processing is fully established and there is an increasing interest in Mediterranean crops, such as olives[63]. Irrigation is likely to expand in the lower Drina – there are plans to do so in the area of Semberija (Republika Srpska) and high potential in the area of Macva (Serbia). Climate change will increase the need for irrigation.

Trends in energy production. Energy production is also expected to increase and energy security is a top priority in Montenegro and Republika Srpska. But while producing electricity for export to the EU is a common ambition of the Western Balkan countries, no new large hydropower plant is actually under construction in the Drina Basin. Despite the great potential to develop biomass resources and the introduction of incentives (such as feed-in tariffs in Serbia) biomass use remains mostly confined to wood consumption in households[64]. There are no significant plans for solar or wind energy in the basin area (despite legally binding commitments to achieve ambitious national targets for renewable energies), nor for new non-renewable power plants.[65] The Drina countries have also established a common energy efficiency target of 9% of final energy consumption in the period 2010-2018.

[54] World Bank, Support to water Resource Management in the Drina River Basin. Inception Report (World Bank, 2015)

[55] World Bank, Support to water Resource Management in the Drina River Basin. Montenegro – IWRM Study and Plan – Background Paper (World Bank, 2016)

[56] Information from the first participatory workshop, Podgorica, April 2016. Information on the workshop available from: http://www.unece.org/index.php?id=42800#/

[57] Information from national experts, 2016 and World Bank, Support to water Resource Management in the Drina River Basin. Bosnia and Herzegovina, Montenegro and Serbia – IWRM Study and Plans – Background Papers (World Bank, 2016)

[58] World Bank, Support to water Resource Management in the Drina River Basin. Serbia – IWRM Study and Plan – Background Paper (World Bank, 2016)

[59] Information from national experts, 2016.

[60] Information from national experts, 2017.

[61] FAO, Agricultural Policy and European Integration in Southeastern Europe. (Budapest 2014). Available from: http://www.fao.org/3/a-i4166e.pdf

[62] Ministry of Agriculture and Rural Development, Strategy for the development of agriculture and rural areas in Montenegro 2015-2020 (2015).

[63] FAO, Agricultural policy and European Integration in Southeastern Europe. (Budapest 2014).

[64] The UNDP/GEF-funded project Reducing Barriers to Accelerate the Development of Biomass Market in Serbia (2014-2018) aims at closing this gap between potential and investments.

[65] Information from the first participatory workshop, Podgorica, April 2016. Information on the workshop available from: http://www.unece.org/index.php?id=42800#/

CHAPTER 5.
Co-optimizing flow regulation

5.1 Key challenges

Cooperation in the operation of dams is limited. The Drina Basin's hydropower plants were originally designed and operated as a single system, when the countries were part of the former Socialist Federal Republic of Yugoslavia. The flow regime was controlled to minimise the impact of lower and higher flows, provide for flood protection and safeguard the maximum possible output from hydropower plants.[66] Currently, however, flow regulation is sub-optimal because hydropower plants operate on a single unit base.[67] This has increased the vulnerability of the power plants in the lower part of the basin to lower and higher flows. The uncoordinated operation of the dams with significant associated reservoir capacity may itself cause or aggravate high water levels, although the reservoir storage capacity on the Drina is relatively low from the point of view of flood response or containment, especially in periods of prolonged high precipitation.[68] Developments in the energy sector, notably liberalization, integration into the single European Union energy market, building new infrastructure, integration of non-hydro renewable energies, makes coordination on dam operations more urgent.

Hydropower development planning suffers from several shortcomings. The Drina countries want to develop the as yet unutilised hydropower potential in the Drina Basin. Ambitious plans have been put forward (as shown in figure 3) but are hampered by funding constraints and different interests in regional electricity trading. Low investment in renewable energies overall is affected by the state of development of the investment environment and related uncertainties, shortcomings in the governance including in the regulatory frameworks, complex procedures for issuing permits and limited institutional capacity. Hydropower development should be carefully planned, not least due to its potential negative effects on the basin's water resources and biodiversity, and with adequate consideration of, and consultation about, the related trade-offs. Hydropower development planning in the basin is not transparent and does not engage international cooperation. Many of the planned hydropower plants are located on river stretches of high conservation value that have not been fully utilised.

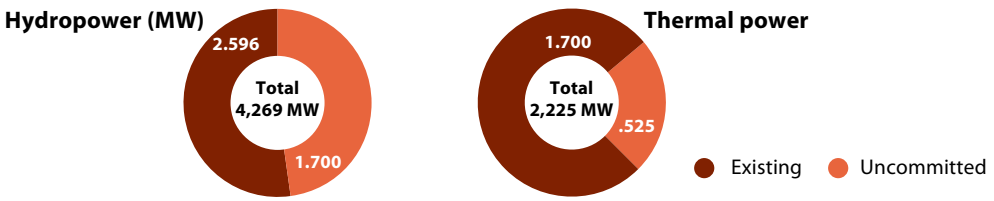
Environmental flow regulation is underdeveloped. The ecological characteristics of the basin have been altered by past hydropower development. At the same time, the very high sediment production in the basin has reduced the capacity of the reservoirs. Environmental flow regulations are only a means that could help to manage the inherent trade-offs, and the need to account for environmental considerations extends beyond this. Environmental flow regulations are currently at an early stage of review and implementation, and the methodologies applied vary between the countries. This is particularly relevant given the pressure to develop additional hydropower in the basin.

Institutional and policy short-comings are affecting opportunities in renewable energy sources and energy efficiency. The Drina countries' power systems are dependent on thermal and hydro generation (figure 4), which rely on water resources for operation. In the Drina countries there is potential for diversification in non-hydro renewable energy sources outwith the Drina and for increasing energy efficiency. Both will reduce pressure in the Drina's water resources. But the development of renewable energy sources is hampered by unrealistic planning processes while increases in energy efficiency are hindered by limited implementation of energy efficiency policy frameworks and the lack of a business-case for investment.

The basin population suffers energy poverty. Legislation in the Drina countries provides for discounted electricity prices for vulnerable customers, but some in the Drina Basin cannot afford to pay their electricity bills even at discounted prices. Failure to pay bills has resulted in utilities disconnecting customers. State support for introducing energy efficiency measures in households is scarce.

Responses to floods are inadequate. Floods have a high economic and human cost in the Drina countries – those of the May 2014 floods have been estimated at 15% of GDP for Bosnia and Herzegovina and about 4.7% of GDP for Serbia. The Drina Basin is characterized by the absence or poor maintenance of flood protection infrastructure, a paucity of early warning systems, and a limited degree of cooperation between the three countries (often restricted to emergencies) as well as among different agencies and users within each country. While all water users have prepared their own individual development plans, considerable effort is now needed to integrate these sectoral plans and address the trade-offs between different water uses. Efforts are being made to improve the situation, though, including at the level of the Sava River Basin, on flood forecasting and warning, as well as with flood risk management planning, with the support of the ISRBC (based on the Protocol on Flood Protection), and the Western Balkans Investment Framework (WBIF) programme.

FIGURE 3
PROSPECTIVE EXPANSION OF HYDRO AND THERMAL POWER CAPACITY IN THE DRINA RIVER BASIN

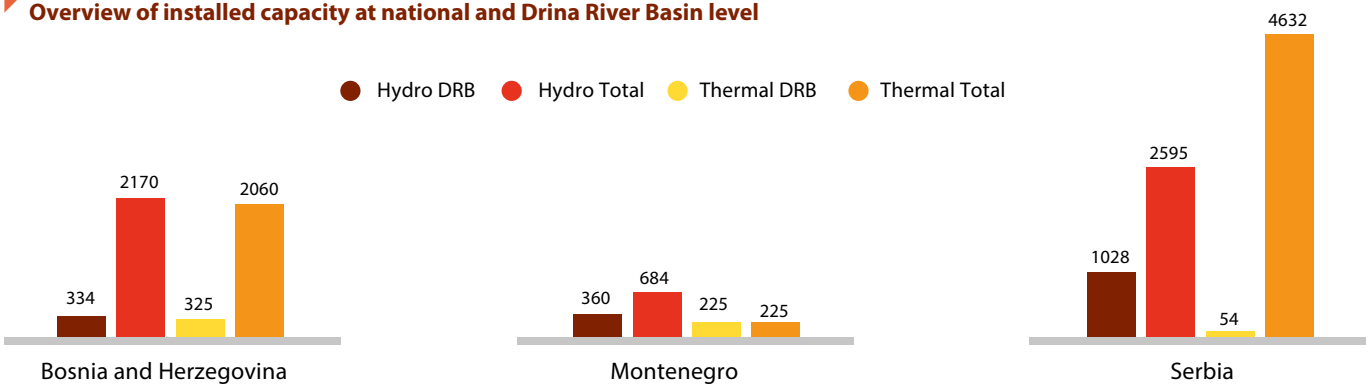


[66] Information provided at the participatory workshop in Belgrade, 8-10 November 2016. Information on the workshop available from: http://www.unece.org/info/media/news/environment/2016/study-finds-transboundary-cooperation-key-to-water-and-energy-security-in-the-drina-basin/doc.html

[67] GEF SFCC, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework (2015). Available from: http://projects.worldbank.org/P145048?lang=en

[68] World Bank, 2014. Drina Flood Protection Project. Project Information Document (PID) Appraisal Stage (Report no. PID 2584). Available from: http://documents.worldbank.org/curated/en/357511468035473553/pdf/PID-Appraisal-Print-P143844-02-12-2014-1392242559850.pdf

FIGURE 4
Overview of installed capacity at national and Drina River Basin level



5.2 Suggested solutions

Co-optimizing flow regulation requires a combination of solutions. This report suggests that the overall policy direction should prioritise (i) improving the cooperation in the operation of dams and hydropower plants for the benefit of the overall system of the three countries, (ii) exploring the opportunities generated by electricity trade between the Drina countries as a mechanism to enhance cooperation and as an enabler for the synchronised operation of hydropower plants (moving away from the single unit operation model) and (iii) encouraging the implementation of energy efficiency measures to reduce the electricity production requirement from hydro and thermal power. To move in that direction, this report suggests the following actions in the areas of institutions, information, policy instruments, infrastructure investments, and international co-operation.

Institutions

- Develop a formal agreement for the coordination of the operation of hydropower plants, and support this by setting up a contact group for discussing flow regulation issues among representatives of the three countries, with stakeholder involvement
- Take advantage of the ISRBC as a platform to discuss the basin level effects of planned energy sector developments, notably hydropower, as well as experience gained in electricity utilities in earlier cooperation
- Take advantage of the platform provided by the Energy Community to discuss implementation and financing of energy efficiency measures, as well as their impact

Information

- Improve the operation of hydro-meteorological monitoring and early warning systems, and develop forecasting models that consider climate, hydrology, energy, land use and environmental variables; Integrate the related efforts of different organizations (i.e ISRBC, World Bank, Energy Community Secretariat, Regional Environmental Center, ICPDR and others)
- Share information at the operational level between energy producers of the three Drina countries; and improve intersectoral communication (both at national and transboundary level) for hydropower plants' operation and development
- Update estimates of hydropower potential taking into account climate change impact and other environmental considerations; and revisit feasibility studies taking into account the current economic outlook
- Analyse and apply existing guidance for the sustainable development of hydropower plans and projects – such as that developed by the ICPDR, the World Commission on Dams, the International Hydropower Association, and the International Energy Agency

Instruments

- Harmonize legislation related to water resources' use for energy generation, the issuing of permits for hydropower projects and utilities, and environmental flows
- Carry out transboundary Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) of programmes and projects requiring infrastructure in the basin, including for energy projects

Infrastructure

- Revise or update feasibility plans of new power plants if projects are not implemented within 5 years
- Develop non-hydro renewable energy infrastructure to reduce dependence on coal and on water resources from the basin

International cooperation

- Revive regional electricity trade by removing national obstacles to efficient regional capacity allocation
- Accelerate the harmonization of legislative, regulatory and institutional frameworks, including as related to water resources management and water resources use for energy generation, in accordance with the EU requirements
- Develop an agreement on flow regulation between the riparian countries, taking into account aspects such as harmonization of approaches to environmental flow
- Improve cooperation in the operation of hydropower plants in event of floods and extreme weather events through better emergency preparedness and response planning, with attention to climate change scenarios
- Establish a unified and modern hydro-meteorological system

5.3 Implementation considerations: the operation of hydropower dams

One of the major challenges regarding co-optimising flow regulation is the (un)co-ordinated operation of hydropower dams. To analyse the potential impact of some of the solutions outlined in the previous section and, in particular, to quantify the implications of a more coordinated operation of the existing dams (listed in table 5.1), the nexus assessment of the Drina Basin involved the development of a multi-country electricity system model using the Open Source energy MOdelling SYStem (OSeMOSYS)[69]. The model represents the entire electricity system of each country, with a simplified hydrological representation in the model to specially focus on the cascade of hydropower plants along the Drina and its tributaries. The hydro power plants are constrained by historical capacity factors, the water balance along the river system and the seasonal availability of water. The technical details, assumptions, and uncertainties are described in the technical report.

TABLE 12
List of reservoirs and hydro power plants included in the analysis

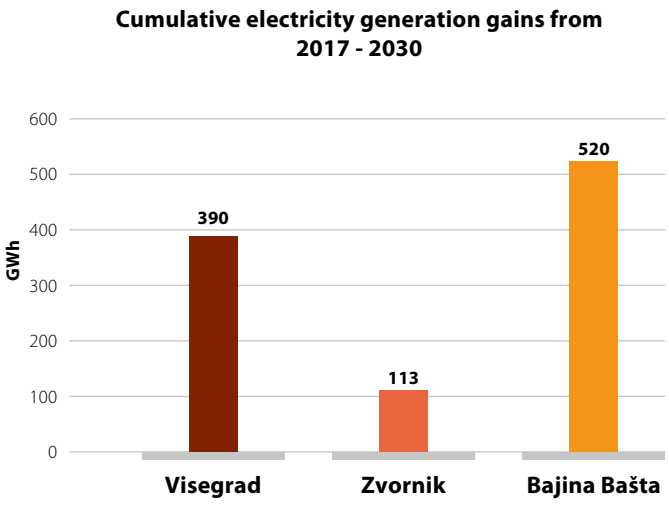
Name	River	Reservoir size (MCM)[a]	Installed Capacity (MW)	Country	Location on the Drina River
HPP, "Uvac "	Uvac	213	36	RS	Upper stream
HPP, "Kokin Brod"	Uvac	250	22	RS	Upper stream
HPP, "Bistrica"	Uvac	7.6	102	RS	Upper stream
HPP, "Potpec"	Lim	27.5	51	RS	Upper stream
HPP, "Piva"	Piva	880	360	ME	Upper stream
HPP "Visegrad"	Drina	161	315	BA	Lower stream
HPP, "Bajina Basta"	Drina	218	364	RS	Lower stream
HPP, "Zvornik"	Drina	89	96	RS	Lower stream

[a] Global Energy Observatory. Available from: http://globalenergyobservatory.org

The study analyses four alternative scenarios: (A) a base scenario reflecting the current situation of paucity of co-operation (each country operates their hydropower plants to maximise the benefits to the that country), (B) a co-operation scenario (the three countries operate their hydropower plants to maximise the benefits to the three countries as whole), (C) an increased electricity trade scenario that is based on Scenario B but additionally explores the impact of improving connections and trade between them and with neighbouring countries, and (D) an energy efficiency scenario that is based on Scenario B but additionally explores the impact of implementing energy efficency measures in the three countries.

In Scenario B, cooperation in dam operation allowing for timely water availability downstream leads to an increase in hydro generation that offsets some of the thermal production and thus causes a reduction in fuel imports. The results suggest that the cooperative operation of hydropower dams could deliver more than 600 GWh of electricity over the 2017-2030 period. The overall system savings[70] for the three countries amount to 136 million USD over the whole modelling period. Using 30%[71] of the available volume in all the reservoirs in the Drina Basin for flood control would increase the operation cost of the whole electricity system - including the three countries - by about 4%. The cumulative CO_2 emissions slightly decrease, in line with the increase in the hydro generation.

FIGURE 5
Benefits of moving from the base scenario to the co-operation for the hydro power plants downstream Piva (cumulative difference of GWh generated)



[69] M. Howells, H. Rogner, N. Strachan, C. Heaps, H. Huntington, S. Kypreos, A. Hughes, S. Silveira, J. DeCarolis, M. Bazillian and A. Roehrl (2011), OSeMOSYS: The Open Source Energy Modeling System, An introduction to its ethos, structure and development. Energy Policy, vol. 39, p. 5850–5870.

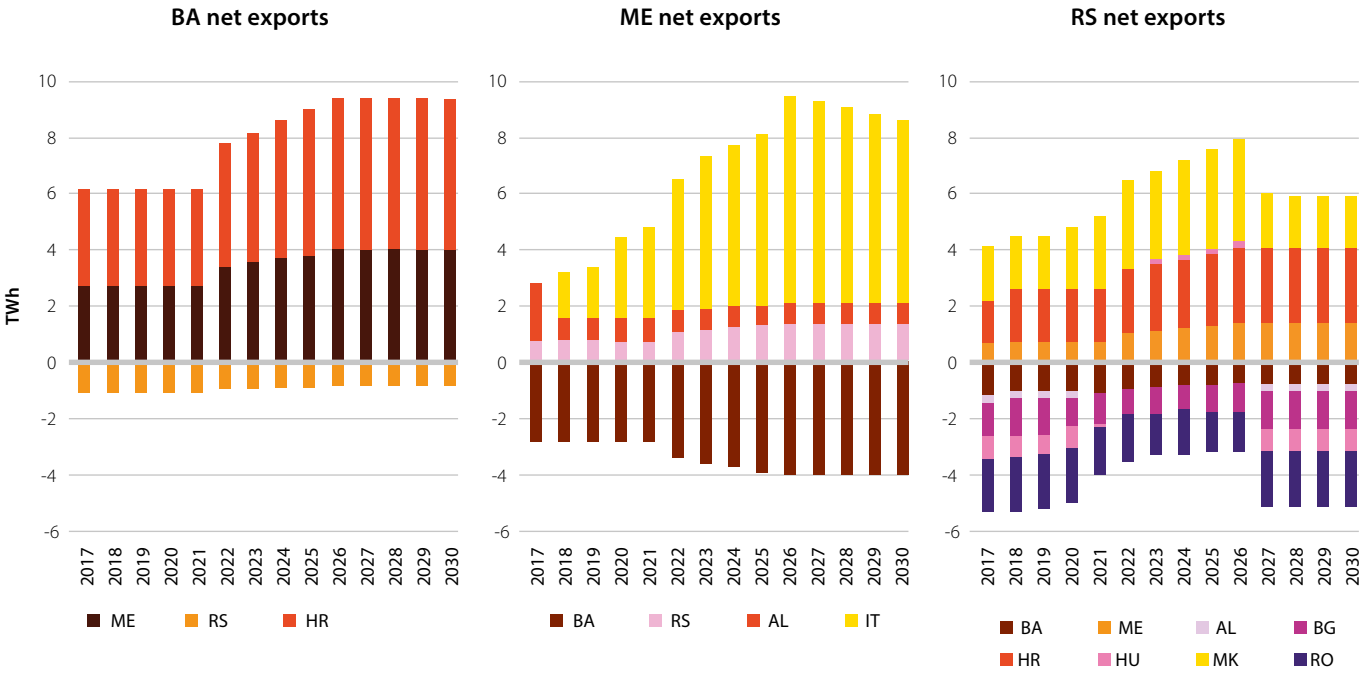
[70] The overall system savings (2010 – 2035) = System cost in the BASE scenario - System cost in the COP scenario.

[71] This assumption was considered as a result of a sensitivity analysis for different values between 10% and 40%.

In Scenario C, the three countries are allowed to trade up to 40% more than the historical maximum. Under this scenario Bosnia and Herzegovina continues to be mainly a net exporter of electricity to Montenegro and Croatia. In Serbia exports increase from 2021 onwards, but this growth is affected by the decommissioning of 'Kostolac' coal power plant in 2027 which will reduce the export level by roughly 4 TWh. Montenegro increases both electricity imports (to meet internal demand) and exports (to Italy), the extent of which is contingent on export prices and the evolution of the domestic energy generation mix. The contribution of non-hydro renewables to the increased trade opportunity will be marginal in all three countries, if their penetration is not assumed higher than the NREAP targets.

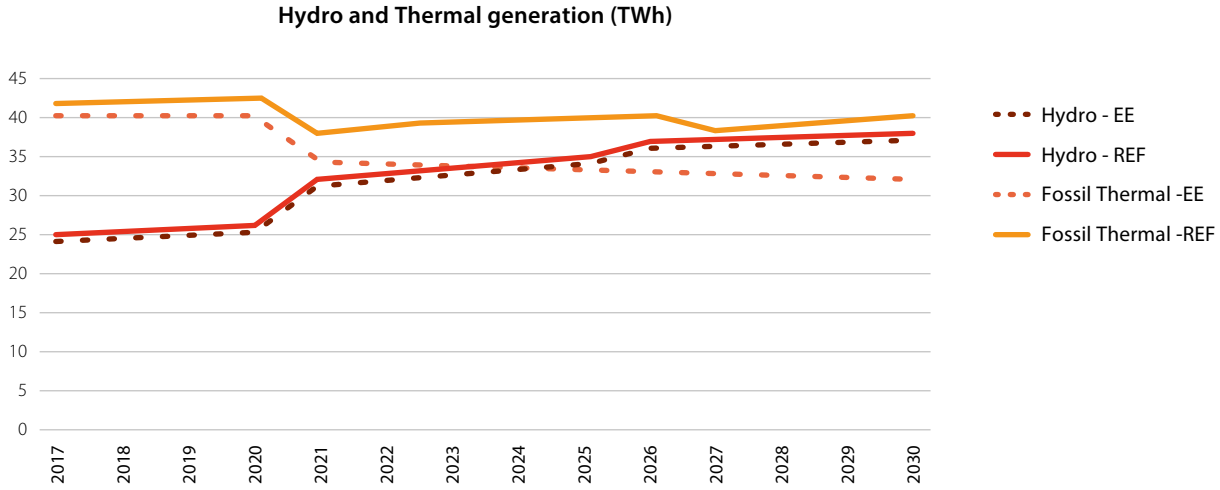
In Scenario D, achieving the energy effiency targets set in the national energy efficiency action plans of the three countries leads to a reduction in final demand that translates into a permanent reduction of thermal power generation and associated CO_2 emissions (which drop from 38 Mt in 2017 to about 28 Mt in 2030, or 21% of total CO_2 emissions across the three countries in 2015). Hydropower generation also experiences a reduction, but only temporary, as it picks up to reach maximum potential again by 2028.

FIGURE 6
Trade profile for the three Drina countries in under the cooperative extended trade scenario (Scenario C)



Country codes: AL – Albania, BA – Bosnia and Herzegovina, BG – Bulgaria, HR – Croatia, HU – Hungary, ME – Montenegro, MK – Macedonia, RO – Romania, RS – Serbia

FIGURE 7
Evolution of hydropower and thermal power generation for the Drina countries under Scenario B and Scenario D



Policy implications

Hydropower generation is one of the main economic activities in the Drina River Basin with a current installed capacity of over 1,700 MW, and it is characterized by an operational regime that is no longer coordinated to maximize output of the three countries. Cooperation to improve the operational regime would generate economic benefits in the form of increased power generation but also environmental and climate change mitigation benefits in the form of reduced greenhouse gas emissions. Coordinating efforts between the Drina Basin riparian countries towards a formal agreement on cooperation and data sharing in the operation of hydropower plants would support the realization of such economic and environmental benefits.

Further benefits could be achieved by optimizing the flow regime to also take into account flood containment needs and environmental flows. The dated hydropower potential estimates commonly do not take these considerations into account. Concretely, jointly developed standard procedures for energy investments and operations, and a harmonized environmental flow regulation could deliver increased water flows in the dry season. Increased water flows in the dry season would have positive effects on biodiversity, fisheries and agriculture.

This exploratory study of the benefits of cooperation can be further improved by integrating this long-term modelling tool with a hydrological modeling tool. Such integration would allow for better understanding of the operational dynamics of reservoirs during lower and higher flows and the resulting impact on electricity generation. Updating the modeling assumptions with consolidated site specific data would improve the accuracy and robustness of results.

New developments will change the picture in the Drina Basin, and to be most effective, the technical and policy actions should be coordinated among the riparian countries and supported with adequate information, comparing the national predictions about future water uses as well as the sectoral plans.

Potential gains from exports are uncertain because of the uncertainty related to the future development of electricity prices and other factors. All three countries face investment needs, and some of these expenditures could be avoided by encouraging energy efficiency improvement efforts as there is unused potential. More effective use of existing capacity in the sub-region will in any case be beneficial. Non-hydro renewables can provide sustainable solutions locally, especially in rural areas, and respond to the needs of developing agriculture and tourism (chapter 6), while also contributing to the current national commitments related to renewable energy and climate change mitigation. Financing challenges with renewable energy projects call for new financing models and partnerships that make use of synergies cooperating across sectors and borders.

CHAPTER 6.
Promoting rural development

6.1 Key challenges

In 2014 the Regional Rural Development Standing Working Group (SWG) identified three general, governance-related obstacles to rural development in the region: (i) the broad mass of rural people is ill-connected to development processes; (ii) policies and practices in rural development in the region are still relatively unformed; and (iii) both national and local government are involved in rural development but the roles of each are unclear, causing confusion for stakeholders. Specific challenges to the Drina Basin include:

Production, productivity, and competitiveness levels in the agricultural sector are low. Agricultural production in the basin is lower than its actual potential[72]. Large tracts of permanent grassland with potential for livestock rearing, fruit production and forestry remain fallow or abandoned[73]. Average yields have been increasing since 2005 but they are low compared with the EU[74]. Farms mostly produce low value crops, with basic technologies. Low productivity is related to several factors including sector organisaton (small size of farms, absence of farmer organisations) and the management of natural resources (low levels of irrigation, decreasing soil quality, and erosion of agricultural land[75]).

There is a paucity of employment opportunities in non-agricultural sectors. The main non-farming activities (wood production and sand and gravel extraction) do not offer significant opportunities to reverse the trend of depopulation and population ageing as younger people migrate to urban areas.

The potential for eco-tourism is not being exploited. While the basin's mostly untouched landscapes and wildlife offer significant opportunities for investing in eco-tourism and tourism related to outdoor sports, tourism in the Drina Basin remains underdeveloped [76].

The pace of reform of agricultural policies is slow. The three countries have made commitments derived from the acquis communitaire (EU law) which directly affects water, energy, environment and agricultural policies[77]. The process of alignment with the EU Common Agricultural Policy (CAP) creates opportunities to strengthen the role of the agricultural sector in the framework of a wider rural development strategy. Agricultural policies in south eastern Europe is generally not aligned with EU agricultural policy.[78] However, the Drina countries have made progress in the development of broad rural development strategies[79] (although with significant implementaton challenges[80]).

Levels of investment in maintaining and building infrastructure are low. This includes infrastructure for agricultural production (e.g. irrigation and drainage systems) but also basic infrastructures (e.g. roads, water supply network),[81] flood protection infrastructure, and wastewater treatment infrastructure.[82] Even when infrastructure is in place, it is often in a poor state of maintenance. This has a negative impact both on the competitiveness of local agri-food businesses[83] and on the management of natural resources in the basin.

[72] Information from the participatory workshop in Podgorica, 21-22 April 2016. Information available from: http://www.unece.org/index.php?id=42800#/

[73] FAO, Agricultural policy and European Integration in Southeastern Europe. (Budapest 2014). Available from: http://www.fao.org/3/a-i4166e.pdf

[74] FAO, 2014 as in the previous note.

[75] Information the participatory workshop in Belgrade, 8-10 November 2016.

[76] Information from national experts (Montenegro), 2016.

[77] UNECE, Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus. Chapter 6: Sava River Basin, (New York and Geneva, 2015). Available from: http://www.unece.org/index.php?id=41427

[78] FAO, 2014 as in note 73.

[79] The following can be mentioned as examples: Montenegro's Strategy for the development of agriculture and rural areas 2015-2020, and Serbia's Strategy of agriculture and rural development 2014-2024.

[80] Information from the participatory workshop in Belgrade, 8-10 November 2016. Information on the workshop available from: http://www.unece.org/info/media/news/environment/2016/study-finds-transboundary-cooperation-key-to-water-and-energy-security-in-the-drina-basin/doc.html

[81] FAO, 2014, as in note 73, and information from national experts, 2016.

[82] World Bank,Support to Water Resource Management in the Drina River Basin. Montenegro, Bosnia and Herzegovina, Serbia – IWRM Study and Plan – Background Papers (World Bank, 2016) Available from: http://www.wb-drinaproject.com/index.php/en/documents

[83] FAO, 2014 as in note 73.

6.2 Suggested solutions

Promoting rural development requires a combination of solutions. This report suggests that the overall policy direction could be promoting integrated rural development in the basin by exploiting the existing synergies between eco-tourism, sustainable agriculture, renewable energy production, at the advantage of local businesses and communities. To move in that direction, this report suggests the following actions in the areas of institutions, information, policy instruments, infrastructure investments, and international co-operation.

Institutions

- Ensure the participation of key stakeholders and the public in the development of salient plans, programs and policies.
- Strengthen associations and action groups to plan initiatives and mobilise resources including from regional development funds, e.g. Pre-Accession Assitance (IPA) funds.
- Develop capacities in the agricultural sector to (i) speed up the effective implementation of long term strategies on rural development, (ii) increase the ability of agricultural communities to access markets and financing, and to represent their interests in broader decision-making and policymaking processes, and (iii) adapt to climate change and manage natural resources sustainably.

Information

- Improve sectoral and intersectoral communication and information sharing across the basin (e.g. for dealing with sedimentation and protection of agricultural soil).
- Develop climate forecasting models, in particular seasonal forecasting to support farmers.
- Provide more opportunities for local communities to learn about nature-based tourism and how to exploit potential opportunities (e.g. rural enterpreneurship).

Instruments

- Develop practice in SEA or sustainability impact assessment in land use planning.
- Develop a mix of instruments to promote climate-smart and sustainable agriculture (modern technology including high-efficiency irrigation, agri-environmental measures, traditional agricultural products, organic agriculture) and sustainable forest management within an ecosystem approach.
- Provide incentives to increase horizontal and vertical integration of producers and processors.

Infrastructure

- Invest in flood control infrastructure, including through nature-based solutions.
- Invest in road infrastructure.
- Invest in waste and wastewater management infrastructure, including reconstruction of landfills.
- Develop tourism infrastructure, such as paths for tourists to reach important biodiversity areas, balancing supporting local communities and nature conservation.

International cooperation

- Accelerate the harmonization of laws among countries taking advantage of the process of EU accession.
- Develop bilateral and trilateral agreements for individual sectors, such as agriculture and tourism.
- Exchange experiences in rural development (such as modernisation of agriculture, transition towards higher-value crops, and nature-based tourism) taking advantage of existng fameworks (such as the South-Eastern Europe Standing Working Group on rural development).

6.3 Implementation considerations

Developing organic production. The potential to develop organic agriculture is high thanks to the preservation of traditional production methods, close proximity to EU markets, and the possibility of access to EU pre-accession funds. Aligning with EU organic certification standards would bypass the problem of a paucity of defined national standards. The expansion of organic agriculture would have positive effects on the basin's natural resources; there is genuine potential for this as traditional farming and pasture is largely in line with organic agriculture principles and the salient legal framework. The marketing of organic agriculture and products with a designated geographical origin can be mutually reinforcing with nature-based tourism. New technologies and practices should be introduced carefully. Capacities will need to be developed at all levels.

Using participatory research to advance adaptation and resilience. Innovative technologies can help farmers and other producers to overcome physical and environmental constraints, improve productivity and incomes, and help to adapt to changes. All actors in the food chain need to be fully involved and encourage innovation and experimentation. In order to ensure that adaptation processes are location- and context-specific, integrated and flexible, it is important (i) to undertake climate monitoring and context-specific vulnerability assessments, and (ii) to engage and work with stakeholders to develop institutional capacity and jointly identify, evaluate, and select available adaptation options and tools.

Reducing the share of unused land in the basin taking into account climate change and environmental value. The potential of natural grassland in the Drina Basin is insufficiently exploited. Low-intensity farming systems and semi-natural farmland could preserve the vital ecosystem services that unused land currently provides. Such High Value Nature farming is already widely practiced in the Drina countries, but challenges exist in terms of policy and regulation. Options include the cultivation of biofuel crops. Policymakers need to be made aware of the benefits and stakeholders involved in the decision-making process since the environmental impacts of expanding agricultural land can be controversial.

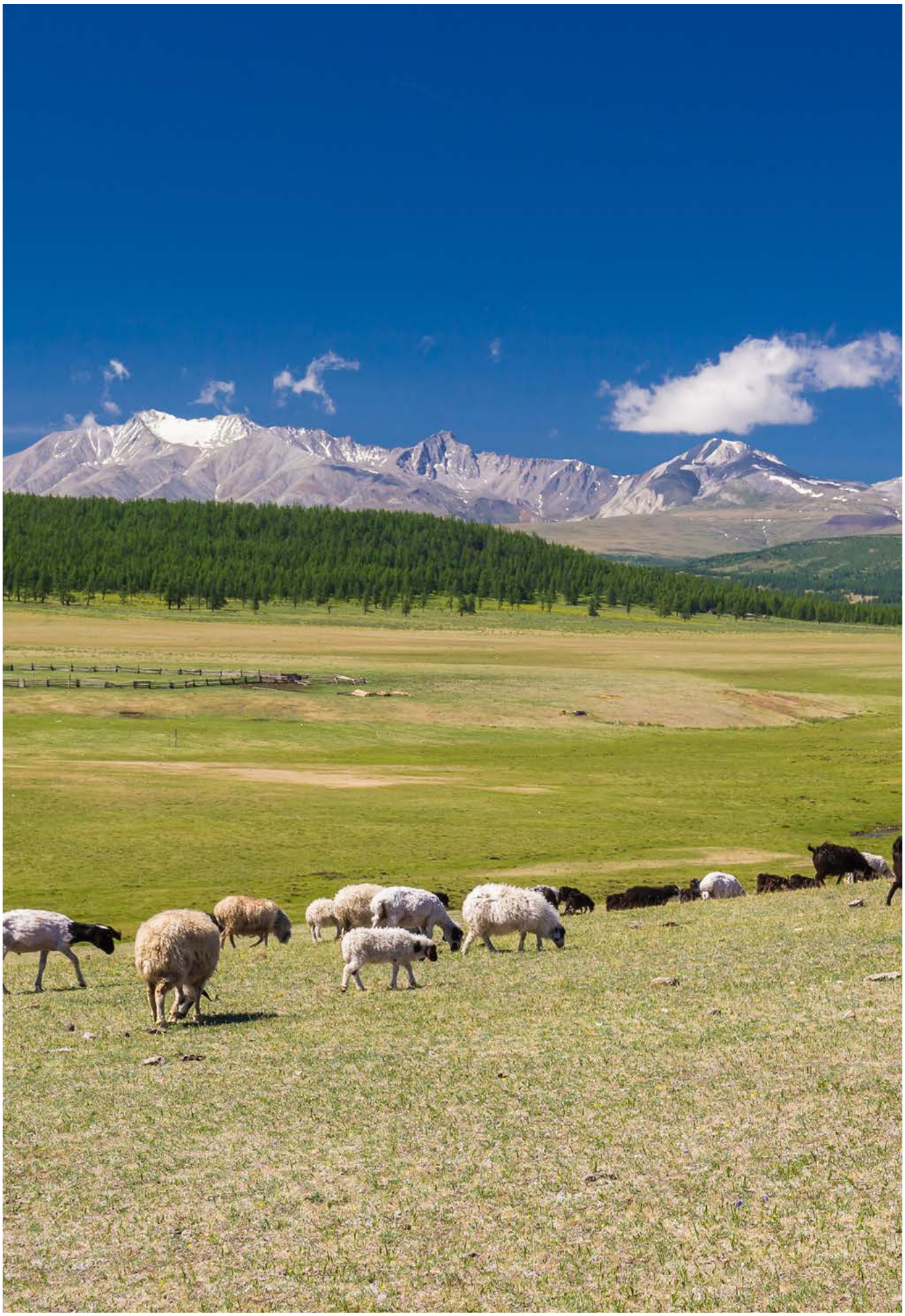
Expanding irrigation using modern technologies, including high-efficiency ones where appropriate, and water reuse. Crop production in the Drina countries is highly vulnerable to weather conditions and the situation is expected to worsen with climate change. To cope with this, irrigation is already expanding in the lower part of the basin. Existing infrastructure needs repair and renovation. The effect on water demand is yet to be examined. High-efficiency irrigation technologies and wastewater reuse are scarcely used in the region but could potentially help to control water demand and reduce the transboundary impacts of irrigation expansion. New projects could explore options for reducing the high cost of both introducing new technologies and maintaining the infrastructure, as well as developing farmers' capacities to operate them efficiently.

Promoting eco-tourism and other sustainable forms of tourism in the basin. There are opportunities to expand the services and value for tourism by further cooperating across the borders[84], including through common branding and marketing as well as the the development of multi-site packages to attract longer stays. Guidelines for the promotion of eco-tourism at the level of the Sava basin are available[85]. Eco-tourism in the Drina Basin can have positive linkages with the agricultural sector (agro-tourism, marketing of organic agriculture) and income generated can be used partly to invest in nature conservation. There is a need to educate local communities on how to preserve environmental quality and how to take advantage of business opportunities. Supportive infrastructure needs to be developed and the potential negative impacts on the fragile untouched landscapes of the Drina Basin carefully managed.

Developing Farmer Based Organizations. Farmers in the Drina Basin are smallholders that engage in traditional production and face many problems that require collective action. Agriculture cooperatives and associations could play key roles in procuring raw materials and equipment, marketing current products, identifying and exploiting new business opportunities (organic agriculture, agro-tourism), and lobbying. Farming cooperatives are not well developed in the Drina Basin and progress is likely to be slow. There is a need for active support for the development of formal and informal farmer-based organisations in small territorial units that can then link up at higher levels, including transboundary.

[84] GEF SFCC, Technical assistance for the preparation of the West Balkans Drina River Basin Management Project. Environmental and social management framework. (2015). Available from: http://projects.worldbank.org/P145048?lang=en

[85] ISRBC, Transboundary Ecotourism Guidelines for the Sava River Basin, (International Sava River Basin Commission, 2015). Available from: http://www.savacommission.org/publication



CHAPTER 7.
Protecting water quality and improving management of solid waste

7.1 Key challenges

Water quality is generally good but declining. Water quality of the Drina River Basin is generally good to excellent (in the upstream areas) with moderate water quality at particular areas of concern. The overall ecological status of the Drina River is between good to moderate. The chemical status is good, besides being moderate along the HPP Bajina Bašta Reservoir. The water quality is declining in the downstream parts of the river. The main identified pressures are organic and nutrient pollution along with hydro-morphological alterations which also affect the environmental status of the water bodies. Despite the indication of low values of heavy metals in the Drina River, increased values have recently been noted due to antimony mines and the exploration of, among other things, gravel and quartz sand.

Surface water quality monitoring is not regular and systematic and water quality data is not being shared enough. Methodologies and parameters for water quality monitoring are similar across the basin and are being adjusted to follow the requirements of the EU Water Framework Directive. Country officials and experts agree that further harmonization of monitoring methodologies, formats and indicators would be useful, and that data needs to be further shared. So far, limited data sharing has not been an impediment to cooperation. The most important information that is currently missing seems to be a coherent and transparent mapping of the sources of pollution, determination and quantification of the type of pollution, and its effect on water quality. Sharing of selected locations through the international river basin commissions at the main basins' level seems to be insufficient to understand the complexity of the impacts of pollution.

Groundwater quality is mostly unknown. Groundwater is the main source of drinking water in the basin, and it is highly vulnerable to surface-based pollution. Groundwater monitoring in Serbia is concentrated on the major alluvial aquifers, in Bosnia and Herzegovina does not take place, and its status is unknown in Montenegro.

Wastewater management is inadequate. Most municipalities do not have wastewater treatment plans and sewage is not separated from storm water which increases the risk of sewage overflow. Industrial wastewater is seldom treated before disposal and is discharged directly into the streams. It contains, among others things, oil, organic matter and metals.[86]

Solid waste management is also inadequate. The waste generated from municipalities (which includes a large organic fraction) and industries (which is hazardous) is often not separated. Existing municipal landfills are not sanitary and represent one of the main sources of pollution in the basin. Waste is often dumped illegally in locations close to the riverbanks. This affects water quality in the rivers and aquifers and also results in floating waste that affects hydropower production. Mining also causes contamination in the soil with the release of heavy metals which may lead to acidification and other environmental damage.

TABLE 13
Quality at two locations in Drina with regard to specific parameters[a]

	Bajina Bašta	Badovinci
Oxygen	Excellent	Excellent/good
pH & suspended solid	Excellent/weak	Excellent/good
Nitrate, nitrogen and orthophosphate	Good	Good
Phosphorus	Excellent/good	Excellent/good
Other ions (e.g. ammonium)	Excellent	Excellent
Manganese	Excellent/good	Moderate

[a] World Bank, Support to water Resource Management in the Drina River Basin. Serbia – IWRM Study and Plan – Background Paper (World Bank, 2016).

[86] UNECE, Environmental Performance Reviews – Serbia. Third Review. (New York and Geneva, 2015). Available from: http://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE_CEP_173.pdf

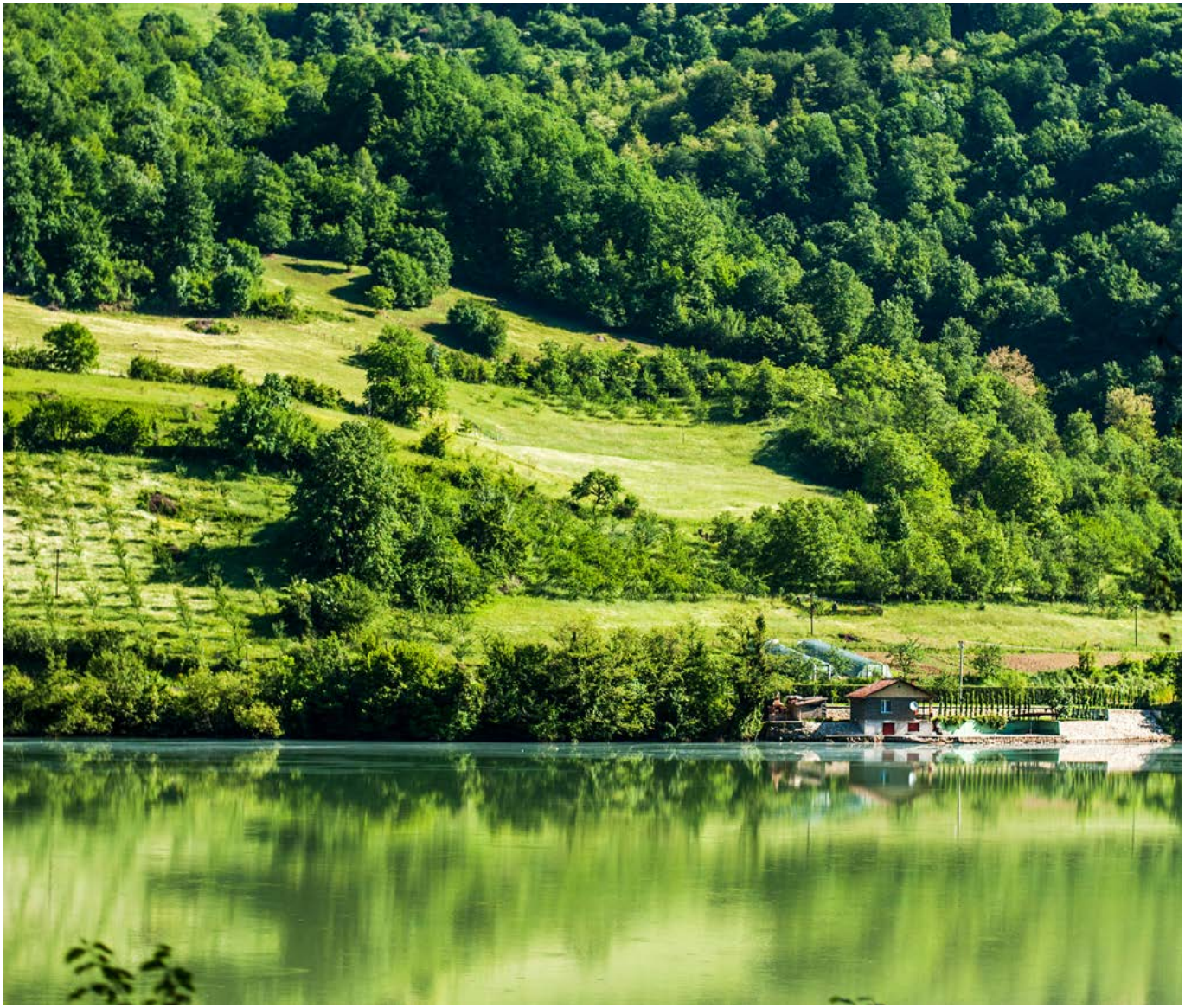
TABLE 14
Solid waste production and treatment[a]

Item	Bosnia and Herzegovina	Montenegro	Serbia	Total
Number of towns in the basin	10	7	8	25
Number of inhabitants	310,000	146,000	210,000	676,000
Produced waste (tonnes/year)	90,000	35,000	60,000	185,000
Treated waste (tonnes/year)	0	0	0	0
Released into the river (tonnes/year)	20,000	12,000	23,000	55,000

[a] ICPDR, 2008. Drina river's floating problem. Danube Watch I/2008, 25. Available from: http://www.icpdr.org/main/publications/danube-watch

7.2 Suggested solutions

Promoting rural development requires a combination of solutions. This report suggests that the overall policy direction could be as follows: Improve the monitoring of surface waters and groundwater quality by, for instance, inter-agency cooperation and improving coherence and coverage of data. Adopt and follow directives and sustainable practises in managing wastewater and solid waste, develop solid waste collection and disposal in sanitary landfills, extend wastewater collection and treatment as well as promote related transboundary cooperation. To move in that direction, this report suggests the following actions in the areas of institutions, information, policy instruments, infrastructure investments, and international co-operation.



Institutions

- Strengthen mechanisms for inter-agency cooperation including agencies responsible for water quality monitoring and departments responsible for each sector. Involve also municipalities and well as researchers and stakeholders in mechanisms for coordinating monitoring.
- Improve cooperation with issuing permits for the necessary infrastructure (wastewater treatment plants and landfills) and address the fragmentation of jurisdiction over water.

Information

- Improve data regarding water quality and the factors contributing to it, specifically the interaction between surface and groundwater.
- Ensure that quality of information is comparable across borders.
- Expand the current studies to cover a broader area, preferably one representative of the whole basin, in cooperation with authorities in all three countries.
- Map the sources of pollution, i.e. assess for different contaminants which of the identified hotspots are contributing, and quantify the impact on water quality.

Instruments

- Identify different remediation actions for already polluted areas and preventive actions to be taken in areas of possible future contaminations.
- Develop legislation approximating the EU Directive 1999/31/EC on waste for transformation into sanitary landfills and a plan for implementation.
- Establish a stronger liability regime related to wastewater and solid waste to apply 'polluter pays' principle, and develop plans for enforcement.
- Apply sustainable practices of agriculture and industry and mining in regards to technology and maintenance.
- Apply the EU waste hierarchy. Separate waste at source and ensure that waste reaches landfills or receives appropriate treatment.
- Engage stakeholders and run education campaigns to ensure community involvement in efforts to reduce waste and prevent pollution.
- Ban fertilizers and pesticides not approved by the EU.

Infrastructure

- Use and expand the current wastewater treatment plants for municipal and industrial use and ensure 100% coverage for the agglomerations above 2,000 inhabitants.
- Collect and separate municipal and industrial waste and ensure 100% coverage. Explore developing partnerships between municipalities and energy companies to reduce solid waste at source.
- Develop existing landfills and ensure they are sanitary.
- Ensure that existing or abandoned industries and mining sites are treated, that waste is collected and toxic material immobilized.

International cooperation

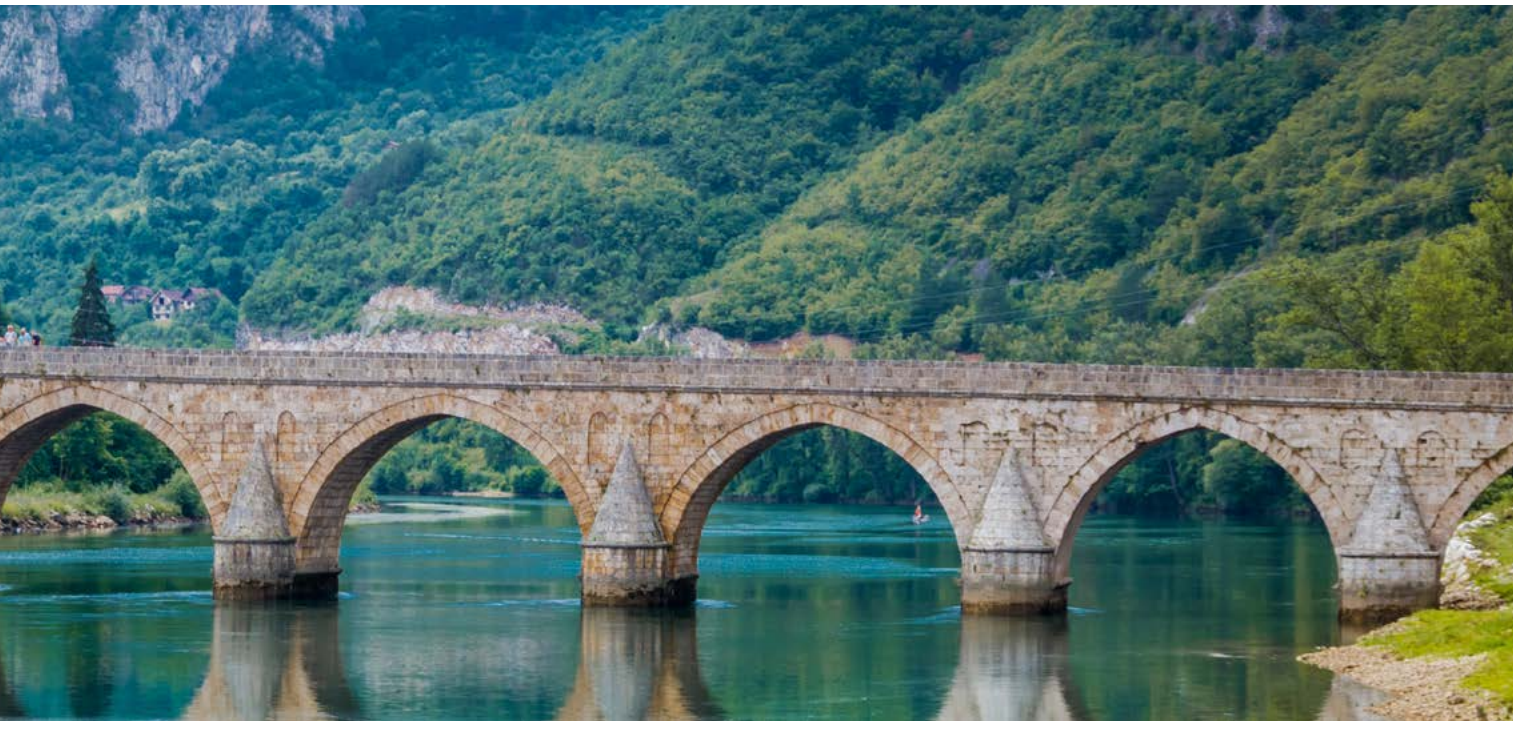
- Promote the harmonization of legislation to better integrate the work amongst all relevant sectors.
- Put transboundary cooperation on wastewater management and solid waste management as a high priority in transboundary cooperation among the three countries, ensuring commitment and involving the respective sectors and stakeholders.

7.3 Implementation considerations

Developing wastewater treatment and solid waste management infrastructure. Construction of the necessary infrastructure is impeded by financial constraints of municipalities, and as a result enforcement of, and compliance with, national laws are poor. There is a need to ensure that infrastructure facilities are part of sustainable management systems that are accepted by society as a whole and are economically feasible in the long-term (both in terms operational and maintenance costs). The design of systems should consider (i) separating industrial waste and wastewater from domestic waste, (ii) favoring decentralized systems that integrate into the city scape over centralized systems that display high energy consumption, (iii) using nature-based systems (such as constructed wetlands) that may also serve as a potential source of irrigation for agricultural activities, (iv) including adequate sludge management systems, and (v) separating sewage from storm water. It demonstrates the scale of the effort that in Bosnia and Herzegovina alone, 20 wastewater treatment plants are planned along the Drina River and its tributaries. Their combined capacity corresponds to 315,900 population equivalent, and the amount of investment is almost 100 million BAM (or some 51 million EUR).

Ensuring financial sustainability of solid waste management services. Implementing these necessary infrastructure projects requires significant amounts of investment and in particular from already strained city budgets. One option is to begin by identifying and implementing effective and relatively low-cost measures, such as those aimed at the remediation of smaller illegal dumpsites on riverbanks. Pricing for wastewater management services will have to increase, and subsidies could be reformed so that instead of awarding them to the utilities (resulting in lower prices for all households independently of their ability to pay) they are directed to those households that are unable to pay their bills. The price of waste collection needs to be set carefully – if it is too high, people may not use this service and continue with illegal dumps. Given that hydropower plants are spending part of their operational budget on cleaning reservoirs of solid waste, there may be an opportunity to develop partnerships between municipalities and energy companies to address the problem at source. Defining clear responsibilities through a liability regime that is actively and effectively enforced would encourage enterprises to work together in partnership to reduce the overall impact of waste by assigning the costs to appropriate actors.

Ensuring compliance with environmental legislation. The construction of industrial wastewater treatment plants is a legal obligation, and a requirement to operate licences, and has resulted in a noticeable increase in their numbers. Transposing the Directive 2008/98/EC on waste would mean adopting the waste management hierarchy.[87] Additional information regarding abandoned industrial sites is needed in order to determine what risk these sites pose to the environment. Capacities for inspection and enforcement need to be enhanced at all levels of government.



[87] The following waste hierarchy is laid down in Directive 2008/98/EC on waste as a priority order of what constitutes the best overall environmental option in waste prevention and management legislation and policy: (a) prevention; (b) preparing for re-use; (c) recycling; (d) other recovery, e.g. energy recovery; and (e) disposal. Source: Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

CHAPTER 8.

Broadening and developing the scope of cooperation

8.1 Key challenges

Existing regional arrangements are limited in geographical scope. There is no devoted organization with a specific focus on the Drina Basin per se, although there are a growing number of projects focused on the Drina Basin carried out by different institutions. The nearest basin-level organization is the International Sava River Basin Commission (ISRBC), which currently includes Serbia and Bosnia and Herzegovina as Parties. Montenegro has signed a memorandum of understanding (MoU) on cooperation with ISRBC and in practice already cooperates on matters such as hydro-meteorological issues, flood management, and river basin management. The ISRBC has a potentially important role to play in policy development and decision-making, and relevant international coordination related thereto. Equal status for Montenegro would be important to ensure a balanced geographical coverage of the entire Drina River Basin. Other regional arrangements with relevance to nexus such as the Energy Community do not make major distinctions at the level of river basins.

Existing basin-level arrangements are limited in subject matter. While there is no specific Drina Basin commission or other coordination mechanism, as a sub-basin of both the Sava and Danube, the institutional arrangements for these two larger basins are salient. The current view among the Sava countries is that sub-basin level processes should be taken up by ISRBC rather than by setting up a distinct structure for the Drina. While the mandate of the ISRBC is broad in comparison with other river basin commissions, the basin approach has in practice been to date limited to areas such as agriculture and energy – although some transboundary planning processes touch upon these sectors from the perspective of water management. ISRBC subsidiary bodies such as the RBM Expert Group, or multi-stakeholder platforms such as the Sava Water Council, are already at work on nexus-related issues but the full potential of the scope of the FASRB has not yet been realized.

Lack of internalization of nexus governance assessment under ownership of national authorities. To date the discussion, application and analyses of nexus assessments have been largely driven by international level processes, which are dependent for their success on high quality and robust information and analysis on a country-by-country level. As capacities and familiarity develop on the regional and country level, however, there should be a concerted effort to shift ownership and responsibility for nexus governance towards the countries, and other appropriate levels.

8.2 Suggested solutions

Broadening cooperation requires a combination of solutions. This report suggests that the overall policy direction could be: strengthen cooperation, building on existing intersectoral and multisectoral frameworks and supporting consultation and the participation of different interests and sectors in planning To the extent that it is possible, this cooperation could be framed within the ISRBC through options related to the subsidiary bodies. However, it is the responsibility of the Sava basin states (including Montenegro, which has signed an MoU) to determine the manner in which decisions taken under the ISRBC's auspices can feed into planning, policymaking and decision-making in other sectors. The three Drina countries could discuss Drina-related intersectoral (nexus) issues in a specific forum. While they might consider using existing platforms for international cooperation such as the ISRBC, the Energy Community and the Regional Rural Development Standing Working Group through their national focal points, a full, balanced and participatory forum for Drina nexus issues might require the establishment of a mechanism that takes into account different geographical scopes and sectoral ranges. Bilateral agreements and their focus on intersectoral issues should also be further developed.

Institutions

- Assess and examine institutions (public or private) salient to the implementation of nexus-related policies and identify the most appropriate institutions to develop comprehensive policy responses.
- Consider setting up a multi-stakeholder and multi-sectoral "Drina institutional platform" with a focus on identifying cross-sectoral impacts and sharing experiences with solutions.

Information

- Compile and maintain meta-information about the sources and quality of information salient to nexus assessments and analyses.
- Exchange information between countries to boost monitoring capacities – a major focus of resources in this area could be on developing broad, open, transparent and efficient platforms for reliable, high-quality data to serve as the foundation for high-quality decision-making.

Instruments

- Develop recommendations for increasing the integration of nexus-related factors in policy- and decision-making through specific instruments, including but not limited to SEA, EIA, integrated permitting, public participation requirements, and rules for intersectoral coordination and consultation.

Infrastructure

- Building upon the Sava Commission's prior experience with developing salient action plans and infrastructure and investment portfolios, develop a methodology for assessing and ranking specific infrastructure projects and investments in terms of nexus-related performance, and compile and maintain a portfolio of priority projects.

International cooperation

- Reach out through existing international (including bilateral) processes and partnerships to a wider community and develop recommendations on enhancing international coordination and cooperation through various mechanisms, including institutional linkages among international bodies, amendments to salient international agreements, and processes for harmonization of national approaches within the Drina Basin.

8.3 Implementation considerations

Creating a platform focused on intersectoral issues relating to the Drina Basin, with civil society and stakeholder engagement. Implementation of any such platform should take place in accordance with international standards of transparency, accountability and participation. There are economic costs and capacity constraints for implementing any given platform devoted to intersectoral issues or broadening participation in the existing ones. A potential obstacle is the motivation of sectoral bodies for participating in complex nexus-based discussions. A process is needed to develop a formal proposal for the platform, taking into account its limitations.

Carrying out public education campaigns aimed at priority issues. This is especially important in areas that are slated for growth, such as organic farming, tourism and hydropower. Shifts in growth of specific sectors and a greater understanding of multi-sectoral impacts give rise to new items for training and capacity building. The private sector as a driver of innovation also needs to be educated about interlinkages and nexus-type relationships. Youth education remains a key priority.

Conducting in-depth national level intersectoral (nexus) governance assessments under the ownership of national authorities. Because of limitations in availability of information and frequency of changes in law, policy and institutions, a detailed nexus governance assessment under the authority and ownership of national authorities in each country would be a valuable resource. Where responsibility over the governance assessment is dedicated to a particular agency or organization, there can be regular updates as well as greater involvement of local stakeholders. An accurate and detailed nexus assessment on the national level can be used for benchmarking and progress monitoring within a country. In the context of information exchange with the neighbouring countries in the Drina Basin, such up-to-date assessments can be valuable in many ways.

Developing practice in the application of complex assessment tools, including sustainability impact assessment, of plans, programs, policies, major actions and strategies. Seek to develop further practice in applying legal instruments and procedures for intersectoral consultation and ensuring that considerations in multiple sectors, beyond just environment (as in EIA/SEA), can be taken into account. Assessment also provides an opportunity to scope potential extreme scenarios, including preparedness and response planning. The application of such tools should also be linked with increasing resilience. A methodology that would satisfy the SEA Directive requirements as well as extend into other forms of assessment could be developed on a trial basis.

CHAPTER 9.
Benefits of Transboundary Basin Cooperation in the Drina

9.1 Past benefits of cooperation in the Drina Basin

Cooperation in the management of basin resources is not new in the Drina Basin. For most of the 20th century the three Drina countries (Bosnia and Herzegovina, Montenegro and Serbia) were part of a common country. The first ideas to harness hydropower in the Drina Basin predate the Second World War, and began to be implemented in the 1950s with the completion of HPP Zvornik. Water management plans taking into account the different aspects of water in the Drina (water use, water protection and flood mitigation) were developed in the early 1960s, in 1970 and in 1985. At the same time hydropower development continued in the basin. Within the framework of the Socialist Federal Republic of Yugoslavia (1945-1992) activities up until the 1970s were undertaken in a largely centralised manner, but since then there has been greater focus on the interests of the constituent republics. Some jointly developed projects were successful in coordinating the different interests of the constituent republics, but this was not always the case. The break-up of the former Yugoslavia aggravated the challenges of coordinating the interests of the now independent republics of Bosnia and Herzegovina, Montenegro and Serbia in managing the resources of the Drina basin.

One example of cooperation in the era after the dissolution of the Socialist Federal Republic of Yugoslavia is the agreement between Electric Power Industry of Montenegro (EPCG) and Electric Power Industry of Serbia (EPS) on the use and exchange of electricity from HPP Piva. Under the terms of this agreement, until March 2014, Montenegro was supplying Serbia with 1 MW of "peak electricity" and receiving in return 1.4 MW of "base electricity". The agreement was undoubtedly beneficial for both parties during the 23 years of its life.[88]

Over the last 15 years, cooperation within the framework of the International Sava River Basin Commission has also helped realize benefits for the Drina River Basin. Examples of that cooperation include information exchange systems (geographical and hydro-meteorological), modelling (hydrological and hydraulic), analyses (such as a Preliminiary Flood Risk Assessment), and planning efforts (such as the Sava River Basin Management Plan produced in 2014, and the Water and Climate Adaptation Plan for the Sava River produced in 2015). Those efforts have already delivered benefits for the Drina River Basin (mostly around reducing the human and economic impact of floods) and are expected to deliver more benefits in the future.

A perspective from Montenegro. Montenegro has benefited from past cooperation in the Drina in two ways: enhancing the generation of economic returns from water resources, and protecting environmental assets. The mobilisation of technical and financial resources across the former Socialist Federal Republic of Yugoslavia made possible the construction of the hydropower plant (HPP) Piva and the thermal power plant (TPP) Pljevlja. The conservation of pristine landscapes, including the Tara river canyon and the forests in the upper Drina basin, has continuously provided benefits in terms of scenic value, biodiversity conservation and fishing (both wild and farm-raised) and is considered to have high potential for tourism and recreation, which could provide significant sources of income for rural communities.

A perspective from Bosnia and Herzegovina. Within the framework of the Socialist Federal Republic of Yugoslavia, the main benefits of cooperation related to the development of a water master plan for the basin, infrastructure investments (construction of hydropower plants, flood protection works, and roads), environmental protection, and tourism development (linked to the designation of the natural parks of Sutjeska and Durmitor). Since 1990 some of those benefits have continued or increased – for example in the area of energy because of agreements with the electric power industries in Serbia and Republika Srpska and in the area of tourism because of the organisation of recreational activities in the Sutjeska and Durmitor national park. Additional areas of cooperation that have delivered benefits include agriculture, as well as infrastructure development in the border area of Bratunac/Ljubovija where both a bridge and a wastewater treatment plant are planned.

A perspective from Serbia. Within the framework of Socialist Federal Republic of Yugoslavia, joint and coordinated planning provided benefits of very high importance in the form of increased hydropower production, flood protection and growing economic activity, along with ecosystem conservation, and the development of tourism and agriculture. The straightforward trading of agricultural products generated highly important benefits in the form of food security and higher incomes, as well as additional benefits in the form of lower unemployment and reduced migration. More recently, cooperation in the management of protected areas has produced moderate benefits in terms of ecosystem conservation, tourism development, and the expansion of traditional agriculture. Another set of more recent benefits derives from the joint management of fish stocks, which has generated moderate benefits in terms of biodiversity conservation and some minor benefits in terms of the development of sport fishing.

[88] The contract was prematurely terminated on 19 March 2014 due to changes in the electricity market and the inability to reach an agreement over amending the coefficient of electricity exchange between the two companies. This information was obtained through direct consultation with EPS and EPCG

9.2 Identifying the potential benefits of future cooperation

Transboundary cooperation in the management of basin resources generates more benefits than generally thought. Following the UNECE typology of benefit (UNECE, 2015), they include economic, social, environmental, regional economic integration, and geopolitical (peace and security) benefits. There are two main sources of benefits: (i) the improved management of basin resources made possible by technical cooperation, and (ii) the enhanced trust between the riparian countries that the experiences of technical cooperation generates over time. At the same time these benefits can originate from the overall impact on economic activities. It is useful to focus on the '"outcome"' benefits generated by specific cooperation activities (such as the economic or health impact generated) rather than on '"intermediate"' or '"process"' benefits of cooperation (such as meetings organised or projects completed), both to avoid double counting, and to engage the attention of policymakers – who are much more concerned about development outcomes than the technical achievements in the process of cooperation. Table 15 reproduces the results of a rapid benefit identification exercise carried out during the first Drina nexus workshop.

TABLE 15
Rapid participatory identification of the benefits of cooperation in the Drina Basin

Economic benefits	Social and environmental benefits
• Increase in electricity production (e.g. by optimising water release regimes) • Increase in agricultural production (e.g. by improving irrigation systems through coordination and experience exchanged) • Reduced damage from floods (e.g. by better modelling of flood risks, developing protective infrastructure and cooperating in flow regulation) • Development of the tourism sector	• Reduced human costs of floods • Creation of jobs and reduced rural-urban migration (as a result of new economic opportunities) • Increased resilience of local communities to climate change • Protection of water quality and ecosystems (including through improved wastewater treatment and solid waste disposal)
Regional economic integration benefits	**Geo-political benefits**
• Increased transboundary cooperation in all areas by making the Drina a form of connection and not division • Strengthened process of accession to the EU and better use of EU funds • Increased energy trade and integration, and energy security • Increased number of people employed due to cross-border economic activity	• Increased trust between countries from working together in flood protection • Facilitated compliance with international obligations to the EU targets on renewables • Avoided conflicts and adoption of cheaper solutions, due to the development of connections between experts and the sharing of information

Source: First Drina Nexus workshop

This rapid benefit identification exercise is a useful first step in communicating to stakeholders the wide range of the benefits of transboundary water cooperation. It has limitations, however, related to the nature of the exercise. For example, it cannot capture the views of sectors that did not send representatives to the workshop, and some benefits may not be identified for lack of sufficient time during the workshop to carry out an exhaustive analysis of each issue. The rapid benefit identification exercise can be complemented by an expert analysis based on the materials produced by the thematic experts working on the nexus assessment. The following section presents such analysis.

Potential economic, social and environmental benefits of stronger cooperation

- **Benefits of cooperating to protect the quality of groundwater resources.** Measures to protect the quality of groundwater would provide a range of benefits, mostly in the form of avoided expenditures and preventing disease (health benefits). Over the long term, failure to protect the quality of groundwater would force water utilities to invest in more expensive water treatment. In order to avert disease, some households may decide to increase expenditures on alternative water sources, such as bottled water. Households not served by water utilities and those unable to pay for alternative sources of drinking water will suffer a negative impact on health.

- **Benefits of protecting the quality of surface waters.** Measures to protect the quality of surface water would generate a range of environmental benefits (in the form of improved habitat conditions in the Drina river and its tributaries), social benefits (enhanced recreational opportunities) and economic benefits (tourism development, fish-farming). Cooperation to improve solid waste management would generate additional economic benefits in the form of reduced expenses by HPP operators, since solid waste in the river interferes with their operations.

- **Benefits of cooperating to improve the operation of reservoirs[89].** An indicative quantification (developed in chapter 5) suggests that economic benefits could result from enhanced cooperation in flow regulation. This would allow for timely water availability and hence improve electricity generation in the hydropower plants downstream, without compromising generation upstream. Such benefits could be seen a) in term of increased hydropower generation that can reach about 3% annually[90] and b) in term of enhancing electricity trade in the regional market (between Drina countries and with other neighbouring countries). At the same time such cooperation would bring environmental benefits by reducing thermal generation and greenhouse gas emissions, in line with the Drina countries' Intended Nationally Determined Contributions. The timing of discharges from dams and use of the reservoir capacity could help achieve flood protection benefits, hence reducing potentially costly damages. The study suggests that some 30% of the capacity of the reservoirs could be set aside for mitigating floods at an estimated cost of 4% of total potential power generation.[91] In addition, jointly developed standard procedures for energy investments and operations and a common environmental flow regulation could deliver increased water flows in the dry season. This would have positive effects on biodiversity, fisheries and agriculture. The extent of these benefits will increase over time, as climate change is already reducing water flows in the dry season.

- **Benefits of cooperating to reduce water use.** Measures to reduce water consumption (which is high and almost twice that of Western Europe[92]) and reducing water network losses (which in some cases reach and exceed 60%[93]) would reduce the costs of sourcing water (energy), treating water (energy, chemicals) and distributing water (energy), and could alleviate dry season water shortages in some localities.

- **Benefits of cooperating to develop economic activities that are environmentally-friendly.** These economic activities would generate economic benefits (such as increased incomes), social benefits (such as a reduction in unemployment and migration), and environmental benefits (such as protection of water resources from agriculture pressures). Nature-based tourism can have a negative environmental impact, but also contribute to raising awareness about the need to protect habitats and landscapes.

- **Benefits of cooperating to protect biodiversity.** Measures to cooperate to protect the Drina's biodiversity would obviously generate environmental benefits (in the form of biodiversity conservation), but would also support the marketing of Drina products and services (such as tourism) and the generation of the associated economic and social benefits.

Regional economic integration benefits. The three Drina countries cooperate in many areas beyond the management of the Drina's resources. These include trade, investment, energy, and transport. The Drina countries usually cooperate in these areas through regional cooperation frameworks that include additional countries -- for example, they are working towards the establishment of a regional electricity market within the framework of the Western Balkans 6 Initiative. Trust built between the Drina countries in the process of technical cooperation around nexus issues could contribute to advancing negotiations in some of those other areas. At the very least, well-functioning technical cooperation on nexus issues would reduce the risk of negotiations in other areas becoming slowed down because of unresolved or unforeseen conflicts between the three countries in the management of the Drina's resources.

International relations, peace and security benefits. The three Drina countries share a common goal of closer relationships with and eventual integration into the European Union (EU). To this end, they have made a number of commitments and will need to meet a number of targets. Stronger cooperation on nexus areas should facilitate complying with those requirements, for example by sharing expertise and achieving cost savings in harmonizing regulations. It would also provide benefits in terms of meeting other international obligations -- such as those related to the Sustainable Development Goals (SDGs) or the climate change

[89] From a broad (whole-of-basin) perspective as opposed to a narrow (individual HPP operators) perspective.

[90] The quantification suggests that hydropower dams could deliver more than 600 GWh of electricity over the 2017-2030 period.

[91] More details about the quantification are given in Chapter 5 of the Technical Report.

[92] See Chapter 2.

[93] See Chapter 2.

agenda. Given that the three Drina countries share a tumultuous past that includes relatively recent armed conflict, the trust built and information shared through technical cooperation on nexus issues would also generate benefits by reducing the risk of conflict around the management of the Drina's resources.

Governance benefits. Governance improvements contribute to achieving economic, social and environmental benefits, but are often valuable in and of themselves. Given that the three Drina countries face similar governance (and specifically capacity) challenges, cooperation might increase the effectiveness and efficiency of efforts to deal with nexus-related issues.

Financial benefits. Technical cooperation in nexus areas has enabled the Drina countries to attract international funding. The geopolitical circumstances of the Drina basin, in particular the process of accession to the EU means that if the three Drina countries cooperate to develop and implement joint projects around nexus issues, there is an opportunity to continue and increase access to international funding.

TABLE 16
Rapid qualitative assessment of the benefits of cooperation in the identified key areas of action in the Drina basin

Key area	Main measures[a]	Rating of benefits
Benefits of co-optimising flow regulation	Improving cooperation in hydropower operation	**Very high importance.** Increased and more stable electric power output, the management of low and high flows in the basin (reduced impact of floods during high water periods, reduced impact of low flows on habitat preservation and tourism development) and economic growth.
	Developing a large hydropower plant	**Very high importance.** Increased hydropower output, adequate water management, economic growth, and the develoment of local communities, and to a lesser extent through the generation of new jobs.
	Increasing the share of renewables	**Moderate importance.** Biomass may generate moderate benefits and there is some potential for geothermal energy, but there is only small potential for solar, no potential for wind, and very small HPPs (below 2 MW) would generate more harm than good.
	Harmonisation and implementation of environmental flow regulations	**High importance.** Environmental flows need to be harmonised and the framework agreement on the Sava river could be used as an international legal framework to achieve it, while recognising existing concession agreements.
Benefits of actions to promote rural development	Promoting organic production in all Drina countries	**High importance.** The main benefit is the production of healthy food. Other perceived benefits are environmental protection and an improvement in living standards (and related reduction in depopulation).
	Expanding traditional biodiversity-friendly agriculture	**High importance.** The main benefit is the increase in agricultural production. Other perceived benefits include biodiversity conservation and environmental protection.
	Expanding irrigation	**High importance.** Higher incomes from increased agricultural production, diversification of agricultural products, reduced impact of natural disasters on agricultural production through improved drought resistance and – with improved related drainage – reduced impact from flooding, and a reduction in depopulation.
	Promoting eco-tourism, marketing of artisanal products, and aquaculture	**High importance.** Possibility of self-employment and additional income for the local population.
Benefits of actions to protect water quality	Investing in landfills and wastewater treatment plants	**Very high importance.** Positive impact on human health, biodiversity conservation and agriculture due to the improvement in water quality caused by a reduction in water pollution.
	Undertaking public education campaigns aimed at reducing illegal dumping and building the capacity of relevant agencies	**Very high importance.** Increasing the awareness of citizens as well as the knowledge of different agencies and stakeholders.
	Enforcing regulations	**Very high importance.** Biodiversity conservation benefits.
	Strengthening the financial position of water and wastewater utilities	**Very high importance.** Help to enhance water quality and deliver related benefits.

[a] It should be noted that the measures listed here represent a selection that reflects the interests of the experts and stakeholders that participated in the ranking exercise in the second Drina Nexus workshop and differ somewhat from the ensemble of the recommended measures. By way of example, the assessment does not recommend the development of a large hydropower plant as such but rather a basin-wide approach to sustainable development of any new hydropower plants that takes into account international best practice and guiding principles, and weighs the potential benefits from their development against the trade-offs, taking into account the different interests, including ecosystem protection.

9.3 Assessing the potential future benefits of cooperation in the Drina basin

The scoping phase of the Drina nexus assessment identified three broad areas for further analysis: co-optimising flow regulation, promoting rural development, and protecting water quality. These three themes are analysed in Chapters 5, 6 and 7 of this report. In addition, Chapter 8 discusses broadening and developing the scope of cooperation across the scope of the thematic chapters. To complement these analyses, during the second Drina Nexus workshop, experts from the three countries were asked to identify with participating stakeholders the benefits of progress in those three thematic areas, and to carry out a rapid qualitative assessment of these benefits.

9.4 Communicating the benefits of cooperation in the Drina basin

Communicating the benefits of cooperation in the management of basin resources is often forgotten. Technical experts (in water, energy, agriculture or the environment) are usually aware of the benefits of cooperation in their area of expertise. However, once some basin technical-level cooperation is in place, further developed, more extensive cooperation often requires the involvement of policymakers. Transboundary cooperation in the management of basin resources has costs as well as benefits. As transboundary basin cooperation processes develop and their costs more visible, policymakers become increasingly eager to ascertain why their countries should engage in greater cooperation.

The main target audience of efforts to communicate the benefits of greater cooperation in the Drina is national governments at the highest level (including the premier). But there are other stakeholder groups that need to receive (and provide) information about the benefits of basin cooperation. In the case of the Drina these include mayors, the local populations, high-level officials from competent ministries and other national experts, the ministry of finance, and project financiers.[94]

Communication efforts should focus on 'outcome benefits'. When asked to report on their achievements, national agencies and transboundary organizations, such as river basin organizations, (RBOs) have traditionally reported on 'activities' and 'outputs' of the process of transboundary cooperation. These often include the number of meetings that have been organized, the number of analyses that have been carried out, and the number of agreements signed. These activities and outputs may lead to improvements in the quality of information available to manage the transboundary basin and to the identification of actions that will help realize the potential benefits of transboundary cooperation. But policymakers generally require information only about 'outcomes' to support their decisions.

Communicating the benefits of transboundary basin cooperation in the Drina should go hand in hand with communicating other findings of the Drina Nexus Assessment. There are already a number of communication mechanisms used in the basin to promote cooperation, such as the Drina Day. But experts and ministerial representatives at the second Drina Nexus workshop pointed out that there are a number of additional opportunities, as yet unexploited. Examples include (i) providing information of the results of cooperation projects on national websites; (ii) organizing presentations and discussions as part of the planning processes of the Danube and Sava Commissions; (iii) lobbying at the ICPDR Inter-Ministerial Meeting, supported by a policy brief, (iv) informing the GEF-funded Strategic Action Programme, and (v) increased engagement on the part of the media.

There may be further opportunities to promote transboundary basin cooperation by communicating key messages in other regional cooperation forums, such as the RCC, as described in Chapter 3.

9.5 Maximising the generation of (net) benefits from cooperation around nexus issues

There is a risk that analysing each nexus solution independently will only encourage progress on a few issues. It is recommended that countries approach cooperation based on the aggregated benefits provided by a broad range of actions, from which each country and stakeholder might not benefit from every single issue but greater, overall gains might be reaped. This is likely to require a specific platform to discuss nexus issues on an ongoing basis, possibly building on existing institutional arrangements or in the short term by using opportunities provided by international projects of a multi-sectoral scope (see Chapter 8).

The Drina countries should consider carrying out additional and more detailed work on the benefits on cooperation in managing the basin's resources. This could include: (i) quantifying some of those benefitsand their associated costs), (ii) developing a beneficiary mapping exercise, and (iii) communicating the results of those efforts in a way that informs decision-making processes. While the primary target audience would be national governments at the highest level, a range of other stakeholders also needs to be targeted, using an expanded suite of communication mechanisms. Given the context of the Drina, where countries are negotiating and cooperating in many other policy areas (trade, investment, energy, transport, climate change) and on many other institutional platforms, it would be beneficial also to promote the potential benefits of nexus-based cooperation within ministries of finance and foreign affairs.

[94] These audiences were identified in a participatory exercise carried out during the first Drina Nexus workshop (April 2016). Documentation from the workshop is available from http://www.unece.org/index.php?id=42800#/.

CHAPTER 10.
Conclusions and Recommendations

10.1 The Drina nexus assessment

This report summarizes the results of a participatory nexus assessment in the Drina River Basin, shared by Montenegro, Serbia, and Bosnia and Herzegovina. This assessment builds on the results of a similar assessment at the level of the Sava River Basin (which includes the Drina River Basin) and mobilized local expertise, including through three basin workshops, to identify key linkages between energy, water, land and ecosystem resources, as well as related management challenges, followed by the identification of potential solutions to help ensure that the basin's resources are developed and managed sustainably. The process benefited from the convening authority of intergovernmental platforms, notably the Water Convention, the International Sava River Basin Commission (ISRBC) and the energy sector's regional cooperation frameworks.

Insights for moving towards sustainability: Balancing development with environmental and social considerations. The nexus approach strives to go a step further than traditional integrated resource management approaches, and can therefore facilitate addressing trade-offs in development whilst also identifying opportunities. Such insights can inform dialogue in and between the countries, and assist in the setting of related priorities. Coordination across sectors, coherent policies, and integrated planning are required both for transposing the EU instruments and delivering the related accession commitments as well as the global 2030 Agenda for sustainable development. The Sustainable Development Goals (SDGs) on water and sanitation, food security and sustainable agriculture, access to energy, climate action, and protection and sustainable use of ecosystems are all closely interlinked. It is clear that authorities need to look beyond their sectoral mandates and work in better coordination across different sectors.

The report shows that there are strong nexus linkages in the Drina River Basin (summarized in table 17). This nexus assessment has identified three key clusters of resource issues that have a major impact on the sustainable development of the basin: water flow regulation, rural development, and water quality and solid waste. Nexus linkages found in these three key clusters include: (i) the importance of the use of water resources to support hydropower and thermal power generation, (ii) the negative impact of hydropower dams on the river's ecosystems and on the river remaining clean and maintaining a high water quality, (iii) the impact of water flow regulation for hydropower generation on the availability of water for other current or potential uses, including irrigation, (iv) the potential use of hydropower reservoirs to contribute to the mitigation of the impact of floods on land-based assets, (v) the negative impact of pollution from land-based activities on water quality and water ecosystems, (vi) the central role of the environment and ecosystems in the development of the rural economy, through sustainable agriculture and eco-tourism. The distribution of economic activities with nexus effects and related potential is uneven across the entire basin, from upstream to downstream (figure 8).

The nexus assessment has identified a suite of options to address resource management issues in the Drina River Basin. These options include a mix of the "5is": institutions, information, instruments, infrastructure, and international cooperation solutions. Improvements in governance at many levels will be critical: improved coordination between sectors within each country, more formal cooperation arrangements between countries, broader engagement of stakeholders and greater focus on compliance. In parallel, technical solutions and, in particular, greater and better investments are also needed. Investing better entails among other aspects coordination, evaluation of alternatives taking into account different needs as well as consultation. Both governance and technical improvements have to be related to the process of accession to the EU, in which the three countries are currently engaged.

Cooperation in managing the basin resources has brought significant economic, social and environmental benefits in the past and will bring more in the future, although the decisions and actions taken will influence the extent of these benefits. There is still a lot of room for strengthening cooperation: developing inter-connectivity and electricity trade, and managing waste and wastewater treatment are only two examples of the many potential topics identified. Through increased trust, cooperation will also generate a range of additional benefits in terms of regional economic integration as well as peace and security.

TABLE 17
Nexus inter-linkages in the Drina Basin

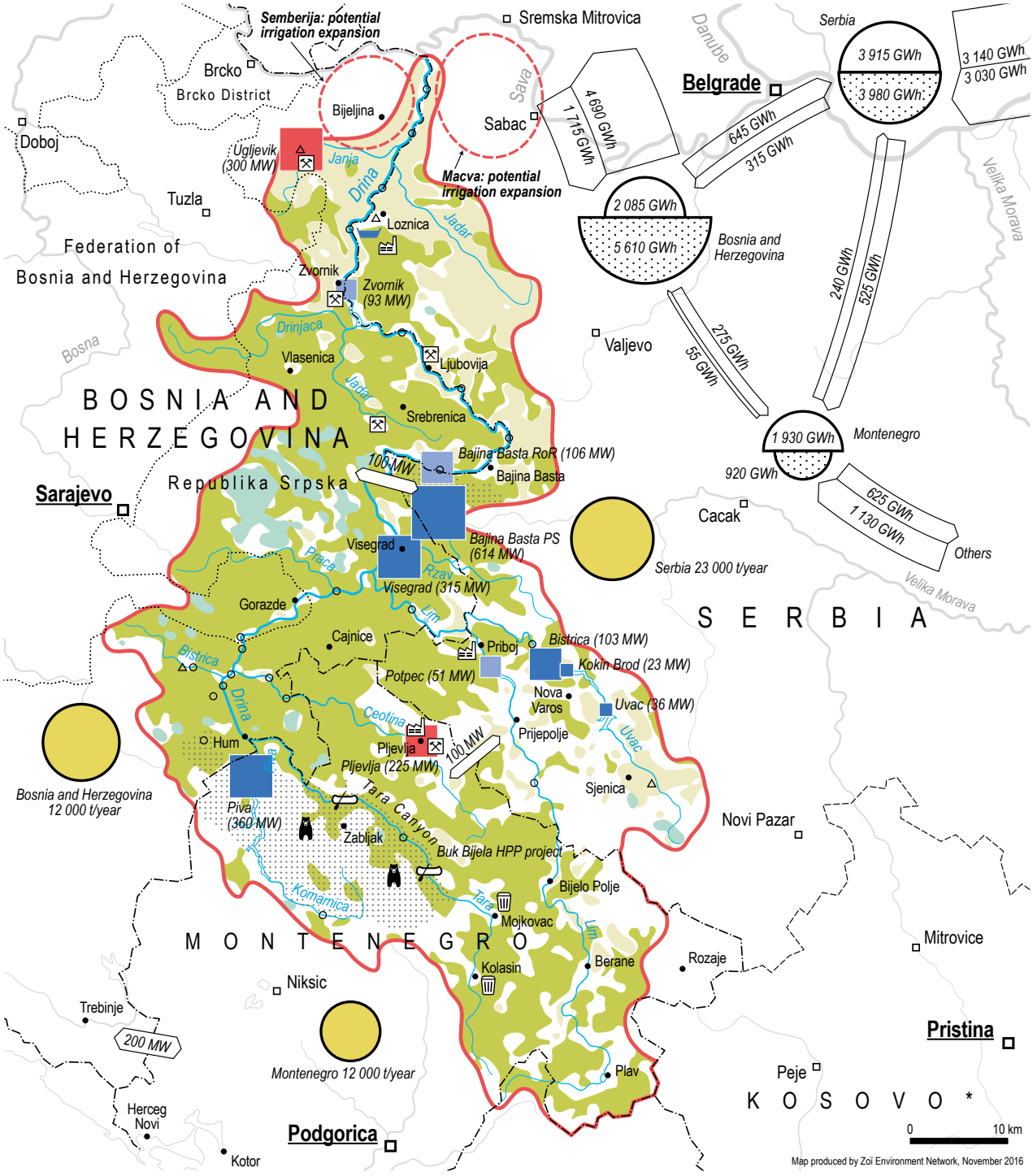
Sectors involved	Water	Energy	Food/Land	Ecosystems
Water		• Hydropower production from multipurpose reservoirs • Electricity production at risk during floods • Energy needs for water treatment (currently largely lacking)	• Agricultural water supply from multipurpose reservoirs • Settlements at risk of flooding	• Pollution from wastewater and solid waste (lack of appropriate disposal and treatment) • Flood control from multipurpose reservoirs • Hydromorphological alterations by water management infrastructure
Energy	• Altered river flow due to uncoordinated hydropower operations • Water needed for hydro- and thermal-power production • Pumped storage potential for integrating renewable energy in the grid		• Potential new land use for non-hydro renewable energy (solar and wind) • Potential for biofuels in the region	• Environmental flows compromised by lack of environmental regulation or enforcement in the energy sector • Ecosystems compromised by expansion of small hydropower (also in protected areas)
Food/Land	• Increase in water needs due to expansion of irrigated areas and increased frequency of droughts • Water and groundwater quality affected by agricultural discharges • Groundwater largely used for drinking, in some cases for irrigation	• Potential for installation of small scale renewable energy sources in the agricultural and eco-tourism sectors • Potential for biomass production associated with the wood industry		• Land/soil degradation and pollution from intensive agriculture • Alteration the hydro-morphology of the river caused by sand and gravel extraction • Pollution from tourism • Beneficial effects and synergies between eco-tourism, organic agricultural production, and high value natural farming
Ecosystems	• Clean water needed for biodiversity conservation • Key ecosystem services[a] for the water sector: provision of freshwater, wastewater treatment	• Key ecosystem services for the energy sector: carbon sequestration and storage (forests), provision of energy resources	• Key ecosystem services for the food/land use sectora: provisioning of raw materials and food, moderation of extreme events, erosion prevention and preservation of soil fertility, pollination, biological control	

[a] Classification of ecosystem services from The Economics of Ecosystems and Biodiversity(TEEB) website: http://www.teebweb.org/resources/ecosystem-services/

Source: First Drina Nexus workshop

FIGURE 8

Map of the Drina River Basin showing the main geographical features and illustrating the distribution of economic activities and pressures salient to the water-food-energy-ecosystems nexus : Electricity generation and trade, waste, tourism, agricultural land and planned expansion of irrigation.



Nexus Drina basin

Power plant facilities
- Thermal power plant (coal/oil/gas)
- Hydro power plant with reservoir
- Run-of-river hydro power plant
- Projected thermal power plant
- Projected hydro power plant

Untreated waste released annually in the basin 2008

Installed capacity (MW)
- > 500 MW
- 250 - 500 MW
- 100 - 250 MW
- 50 - 100 MW
- < 50 MW

Sites of touristic interest
- Water sports
- Biodiversity
- Spa

Water-endangering activities/deposition sites
- Industry / energy production
- Mining
- Municipal waste (Montenegro: only 65% coverage of sewage collection systems in urban areas)

Landcover
- Forest
- Agriculture
- Pastures

Electricity
- Electricity trade 2015 (GWh)
- Import
- Export
- Net transfer capacities (MW)

- Protected areas

Sources: World Bank, Support to Water Resources Management in the Drina River Basin, Final Inception Report, 2015; European Environment Agency, Corine Land Cover 2006 (2014); Pollution in the Drina River Basin, The Regional Environmental Center for Central and Eastern Europe (REC), 2011; United Nations Comtrade Database
* United Nations administered territory under Security Council Resolution 1244 (1999).

10.2 Conclusions

The Drina Basin today. The Drina River Basin's natural resources are of high importance for Montenegro, Serbia and Bosnia and Herzegovina, as well as for the region. Improved management of the basin's resources is critical for the socio-economic development of the Drina Basin's population. The Drina basin's resources are subject to various development plans and pressures while at the same time Drina countries have committed to improving the management of their natural resources.

The governance of the Drina Basin's resources. While there is no specific basin-level cooperation mechanism for the Drina River Basin, the basin benefits from well-developed water governance mechanisms at the level of the Sava and the Danube River Basins. The scale of planning and policy-making in energy and agriculture generally does not follow the river basin approach, and there is space for strengthening the mutual exchange of information about basin management and the economic sectors' plans. Cooperation experiences in other sectors and fora indicate there is a healthy and positive basis for stronger cooperation between the three countries at basin level. The sustainable management of the Drina Basin's resources will require stronger intersectoral coordination.

Co-optimizing flow regulation. Power generation is a key economic activity in the Drina Basin, and likely to remain strategic. The impact of power generation on river flow is at the heart of the nexus in the Drina Basin and water flow regulation for power generation in particular is sub-optimal. Water flow management has an impact on flood and drought risks. A modelling exercise carried out as part of this assessment to illustrate some trade-offs shows some striking results. They suggest that allowing for spare reservoir capacity as a means of flood protection would most likely not significantly harm overall electricity production. Furthermore, it can be concluded that basin level planning and coordination – as opposed to separately optimizing production for each power plant – can increase overall electricity production, underlining the potential value of transboundary cooperation.

Promoting rural development. Rural development in the basin is hampered by low agricultural productivity and a lack of infrastructure. The basin's resources offer unexploited potential to promote rural development.

Protecting water quality and improving management of solid waste. Water quality has been declining. The main pressures on water quality are largely unchecked.

Benefits of transboundary basin cooperation in the Drina Basin. Cooperation in the management of the basin's resources has already delivered significant benefits. Strengthening the current cooperation efforts and broadening cooperation around nexus issues would generate more and greater benefits, both from improvements in the management of the basin's resources and from the enhanced trust between the Drina countries, with a positive impact on economic and other activities.

10.3 Recommendations

Co-optimizing flow regulation. Strengthen and formalize the coordination between hydropower operators. Develop a basin-wide approach to the development of hydropower. Implement energy efficiency measures and assess the technical potential for wind, solar photovoltaic power and biomass. Strengthen cooperation on flood management beyond emergency response. Advance towards the development of a common environmental flows standard.

Promoting rural development. Establish Farmer Based Organizations to increase cooperation among farmers at local level. Promote integrated rural development in the basin by exploiting the existing synergies between eco-tourism, agriculture and renewable energy production. Support farmers to increase agricultural productivity and climate-resilience. Invest in infrastructure that supports sustainable rural development. Advance towards the establishment of transboundary protected areas, notably the Tara-Drina.

Protecting water quality and improving management of solid waste. Carry out an evaluation of potential financial solutions/ arrangements that could improve the capacity of utilities to resolve the infrastructural challenges of disposing and treating wastewater and for the communities to properly manage solid waste. Continue to improve regular systematic monitoring and analysis of water quality and quantity. Develop a common approach to effectively protect water quality.

Coordinate investments basin wide, across sectors. Making significant progress in the different clusters requires substantial investments in hydropower plants and other renewable energy generation facilities, energy efficiency, flood protection works, rural roads, tourism-supporting facilities, wastewater treatment plants, and solid waste disposal sites. Investments – beyond energy – require the further development of markets, transparency, predictability, accountability and adequate checks and balances in the regulatory system. The development of strategic investment coordination at the basin-level and an analysis of trade-offs, may help to both prioritise investments and attract funding. Various possible sources of funding should be explored (user charges, local taxes, national budgets, regional development and cross-border funds, EU funding, donor funding and climate funding).

Broadening and developing the scope of cooperation. Fully exploit existing platforms (such as the ISRBC, the Regional Rural Development Standing Working Group or the Energy Community) to extend the intersectoral dialogue, to share experiences and potentially agree on further action. Take full advantage of EU accession processes to increase cooperation and improve the management of the basin's resources. Explore the development of a platform focused on intersectoral issues in the Drina basin, with stakeholder involvement.

Promoting good intersectoral governance. At the national level, make further use of arrangements for intersectoral coordination, such as those for monitoring and reporting on progress towards the SDGs or on climate change. Integrate the nexus approach into strategic documents and local/regional development plans, taking into consideration that the incorporation of sustainable development policies, strategies and action plans can be a highly effective way of ensuring better coordination and more integrated decision-making. Develop the practice of applying tools such as EIA and SEA, particularly in a transboundary context, to assess the impact of proposed activities or policies on the environment, as well as to ensure proper public participation. Consider using national level assessments of intersectoral governance to ascertain further opportunities for improvement.

Benefits of transboundary water cooperation. Consider how to maximise the generation of (net) benefits from cooperation around nexus issues. Approach cooperation based on the aggregated benefits provided by a broad range of actions, where not all countries and stakeholders may benefit from every single issue but wider gains might be made. Carry out additional and detailed work on the benefits of cooperation in managing the basin's resources.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes
Environment Division
Economic Commission for Europe
Palais des Nations
1211 Geneva 10
Switzerland
E-mail: water.convention@unece.org
Website: www.unece.org/env/water

Assessment of the water-food-energy-ecosystems nexus and benefits of transboundary cooperation in the Drina River Basin

Coordination between the water, energy, food and environment sectors is fraught with difficulties at the national level and even more complex in transboundary basins. The "nexus approach" to managing interlinked resources has emerged as a way to enhance water, energy and food security by increasing efficiency, reducing trade-offs, building synergies and improving governance while protecting ecosystems.

This publication contains the main findings and recommendations of the nexus assessment and study of cooperation benefits in the Drina River Basin shared by Bosnia and Herzegovina, Montenegro and Serbia. The assessment was carried out from 2016 to 2017 as part of support to countries under the Water Convention.

The assessment aimed to foster transboundary cooperation by identifying intersectoral synergies and determining measures that could alleviate tensions related to the multiple needs of basin countries for common resources. The participatory assessment process sought to draw upon the experience and expertise of key actors in the Drina River Basin in order to strengthen the knowledge-base for decision-making. The process involved intersectoral workshops for the identification and review of the main issues and possible solutions, detailed by an analysis, and followed by consultations of the various sectoral authorities concerned.

The assessment identifies a broad range of actions that could help respond to the challenges of managing the interlinked water, food and land, energy resources and ecosystem services in the basin. The solutions identified involve different sectors and would bring multiple benefits. For example, for water flow regulation, coordinating the operation of the basin's existing dams would not only allow for better flood management, but would also improve national energy security, increase electricity export opportunities and reduce annual greenhouse gas emissions. In terms of rural development in the basin, there are various opportunities to improve the livelihoods of the population by combining the promotion of local, high-quality agricultural products with nature-related tourism and/or renewable energy production. As a further example, improving enforcement in the management of wastewater and solid waste is highlighted as key to achieving an improved environmental quality.

Intensifying cross-sectoral and cross-border cooperation for the improved management of the basin's resources could further amplify the benefits of these actions, supporting sustainable development and stimulating economic growth in the Drina River Basin.

Information Service
United Nations Economic Commission for Europe

Palais des Nations
CH - 1211 Geneva 10, Switzerland
Telephone: +41(0)22 917 44 44
E-mail: info.ece@unece.org
Website: http://www.unece.org