

Nexus Mapping Study in South East Europe

Background Study to support the Nexus Policy
Dialogue Process in the SEE2020 Region



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Disclaimer: This Draft Nexus Mapping Study is a contribution to the SEE2020 Strategy, facilitated by RCC. It provides input to the Nexus Theme of the UfM Water Agenda as well as to the GEF UNEP MAP MedProgramme (Child Project 2.2 on Nexus). The Study was prepared in the framework of the following projects: 1) "*Water-Food-Energy-Environment Nexus Policy Dialogue Process in South East Europe*" funded through the Advisory Assistance Programme of the German Environment Agency in cooperation with the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety; 2) GEF IW:LEARN Activity 2.3: *Supporting Regional Cooperation on Shared Water Resources through Dialogue*, and 3) "*Promoting the Sustainable Management of Natural Resources in Southeastern Europe, through the use of the Nexus approach*" funded by the Austrian Development Agency. The Study was drafted by "Fresh-thoughts Consulting GmbH" contracted by GWP-Med, with contributions by GWP-Med staff members. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of GWP-Med or the donor organisations.

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1. Executive Summary

The SEE2020 region includes six economies marked by relatively similar economic growth and land use, but with significant differences in energy, water and food production and consumption, as well as ecosystem preservation.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Size (km ²)	28,748	51,197	10,908	13,812	25,713	88,361
Population (million inhabitants)	3.0	3.5	1.8	0.6	2.0	7.05
Economic growth (NomGDP EUR/capita)	3537	4354	2852	6357	4813	4904
Water renewable resources (million m ³ /yr)	39,220	37,500	4,600	19,700	6,372	162,200
Water abstractions (million m ³ /yr)	15,100	329	245	161	1,123	4,150
Energy production (Mtoe/yr)	2.1	6.2	1.8	0.7	1.3	10.8
Energy imports (Mtoe/yr)	0.3	2	0.7	0.3	1.4	4.1
Energy efficiency (Mtoe/yr/capita)	1.32	5.84	4.78	3.8	3.48	6.27
Agricultural land (% of total)	28	35	47	38	49	57
Forest land (% of total)	60	55	48	40	38	38
Protected areas (% of total)	17.74	1.40	11.55	6.40	9.65	6.61

Table 1: Overview on key Nexus sectors in the SEE2020 economies¹.

The specific objectives of the Study are the following:

- Identification of interlinkages and potential benefits, trade-offs and conflicts among Nexus sectors (water, energy, food and ecosystems).
- Identification of the level of integration of management of natural resources related to Nexus (i.e. water, energy, food and ecosystems).
- Brief assessment of the level and status of cooperation for the management of transboundary basins in the SEE2020 region.

The study focuses on the SEE2020 Region, including Albania, Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia, Kosovo*, Montenegro and Serbia, within its wider geographic context. It is aimed as the conceptual and technical background to support and inform the Nexus Policy Dialogue process, ongoing since 2013 in SEE under the 'Petersberg Phase II / Athens Declaration Process' and Global Environment Facility's (GEF) programme "International Waters: Learning Exchange and Resources Network" (IW:LEARN) in cooperation with the Regional Cooperation Council (RCC).

1.1. Current Nexus management in the SEE2020 region

In the SEE2020 region, some existing **good practice examples** of the Nexus have been identified and include:

- The establishment of inter-ministerial coordination bodies
- The operation of multi-sectoral consultative bodies (e.g. rural development)
- The integration of water and biodiversity targets in agriculture/rural development plans
- The elaboration of Nexus conflict studies to identify areas of negotiation or synergies

However, many policy and management areas still show significant gaps and potential for improvements towards addressing the Nexus more effectively.

In general, the assessed SEE2020 economies have an established administrative system where several authorities share the competencies for each of the specific Nexus sectors, with one 'line' authority leading initiatives.

Specific coordination action on Nexus aspects has been in place for the set-up of some strategies and plans, such as the drafting of the Sava River Basin Management Plan or economies Councils for Rural Development and/or Climate Change. However, it is unclear how strong the integration of the different Nexus sectors has been and how much and in what ways it has focused on synergies beyond addressing negotiations/trade-offs. Policy development via regulation, strategies or plans is often characterised/hindered by:

- More, or less, formal cooperation which does, however, not necessarily translate into policy integration;
- Isolated efforts, lacking link with overall and/or higher level processes;
- Lack of common targets, including points of departure;
- Overlapping responsibilities, and competing objectives, among local and central governments.

The following overview can be provided on the administrative setup and coordination instruments for the Nexus in the SEE2020 region:

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Nexus coordination body	no	no	no	yes	no	no
Coordination between some Nexus sectors	no	yes	no	yes	yes	yes
Multi-sector Water Council	yes	no	yes	no	yes	yes

Consultative Council for Agriculture and Rural Development	no	no	no	no	yes	no
Climate change coordination body	yes	no	no	no	yes	no
Nexus coordination instruments	no	no	no	no	no	
One authority for several Nexus sectors	no	no	no	yes	no	yes
Recent new administrative structures	no	no	yes	no	yes	no
Recent new distribution of competences	no	no	yes	no	no	no

Table 2: Overview on the administrative setup and coordination instruments for the Nexus in the SEE2020 region.

Additionally, the capacities at management authorities are limited, in terms of human resources as well as regarding data and information. Similar is with policy makers, who often lack competencies on integrated approaches.

In order to avoid trade-offs and foster synergies between the different Nexus policies, regulation, strategies and plans should promote an early and wide integration of the aspects and concerns of the related Nexus sectors in own developments. This study, however, shows that the integration is still at a rather low level:

- Usually the related Nexus sectors are briefly, and partly, mentioned in documents, as topics relevant to the concerned sectors strategy.
- A majority of documents provide a wider reference to the concerns of the proper sector regarding others (e.g. an agricultural strategy referring to needs such as water supply or risks as water availability reduction due to climate change; an ecosystem strategy requesting other sectors to take action for reducing impacts).
- Only a few documents address the effects of the own strategy on other Sectors (e.g. an energy strategy referring to ecosystem deterioration; or a biodiversity document to land-use restrictions for agriculture) and identify and assess opportunities (for establishing joint objectives and targets) or alternatives to overcome trade-offs.

Recent policy developments in the Water and Food/Agriculture sectors show a higher integration of objectives and targets of the other sectors, than Energy or Ecosystems, being the latter focused on ways to minimize the negative impacts of economic development on biodiversity.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water integrates Energy	medium	low	high	high	high	medium
Water integrates Food/Agriculture	low	low	high	high	high	medium
Water integrates Ecosystems	medium	high	low	low	low	high
Energy integrates Water	low	no	low	low	medium	no
Energy integrates Food/Agriculture	low	no	no	medium	low	no
Energy integrates Ecosystems	no	no	low	low	no	medium

Food/Agriculture integrates Water	high	no	low	high	low	no
Food/Agriculture integrates Energy	no	no	high	no	no	no
Food/Agriculture integrates Ecosystems	high	no	no	high	no	no
Ecosystems integrates Water	low	no	low	low	low	no
Ecosystems integrates Energy	no	no	no	medium	low	no
Ecosystems integrates Food/Agriculture	low	no	no	medium	low	no

Table 3: Integration of Nexus aspects in recent regulation, strategies or plans for the Nexus in the SEE2020 region.

Explanation: “high” indicates identification of synergies, “medium” indicates identification and assessment of conflicts, risks and constraints; “low” indicates inclusion of concerns, needs or supply aspects; and “no” none of the previous (only textual mentioning). Note that a more detailed analysis can lead to a higher scoring.

Climate change resilience can be fostered by a varied set of measures addressing aspects like water scarcity, droughts or floods, temperature increase, heat waves, plagues and diseases, and ranging from efficiency increases to changes in production or management. Overall, climate change resilience has only partially been included in the sector-specific strategies/plans of the SEE2020 economies; and – with a few exceptions - the sectors do not seem ready to deal appropriately with climate change.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water	no	no	no	no	low	no
Energy	yes	yes	no	yes	low	yes
Food/Agriculture	yes	no	no	no	yes	no
Ecosystems	no	yes	no	yes	no	no

Table 4: Overview on the integration of climate resilience in recent regulation, strategies or plans in the SEE2020 region.

Explanation: “yes” indicates climate change being integrated; “high” indicates contributions to climate change resilience, “low” indicates recognition of climate change constraints; and “no” none of the previous (only textual mentioning). For some of the documents, a screening assessment whether the considerations are of ‘high’ or ‘low’ relevance has been carried out.

Furthermore, nature-based solutions and of resource efficiency initiatives (beyond either water or energy) though applied in the Economies of the SEE2020 region, are not Implemented under such branding and not with a coordinated approach. In addition, related references are very limited at Economy level regulation as well as in sectoral plans. However, even in the absence of these, authorities often embrace related concepts, particularly as their awareness on the benefits of such solutions develops.

1.2. Consequences of current policy and management

In the SEE2020 region, ten main Nexus conflicts/trade-offs have been identified for all sector relations; they apply to all economies though their presence is stronger or weaker in some of them:

1. water (over)allocation to the different uses, in particular during drought events
2. increasing flow regulation by hydropower for electricity generation
3. hydropower developments affect nature conservation areas
4. dam operations cause hydro-peaking and subsequent ecosystem deterioration
5. dam operations during floods cause downstream impacts
6. increasing use of energy in the food production (e.g. irrigation, fertilization, transport)
7. pollution of surface and groundwater by pesticides and nutrients, and their treatment (costs)
8. land-use intensification and disappearance of certain habitats/ecosystems
9. biofuel production as renewable energy source development, requiring water and land resources
10. unregulated cutting of fuelwood can contribute to deforestation and biodiversity loss.

These are represented in the following figure, connecting the different Nexus sectors which are involved.

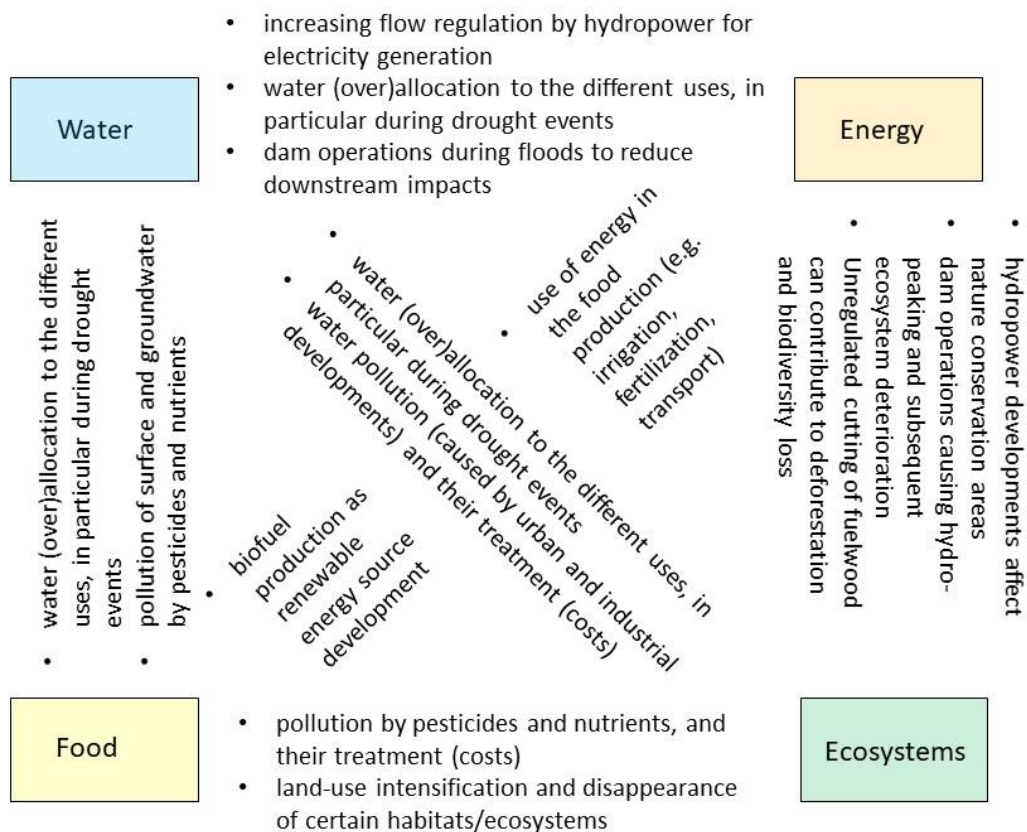


Figure 1: Ten main Nexus conflicts/trade-offs in the SEE2020 region, and the Nexus sectors involved.

Furthermore, the inadequate consideration of the Nexus in planning and management can lead to negative effects on people, economy and biodiversity. Such ‘insecurities’ have been detected for different areas and often affect the poorest or less powerful people or sectors.

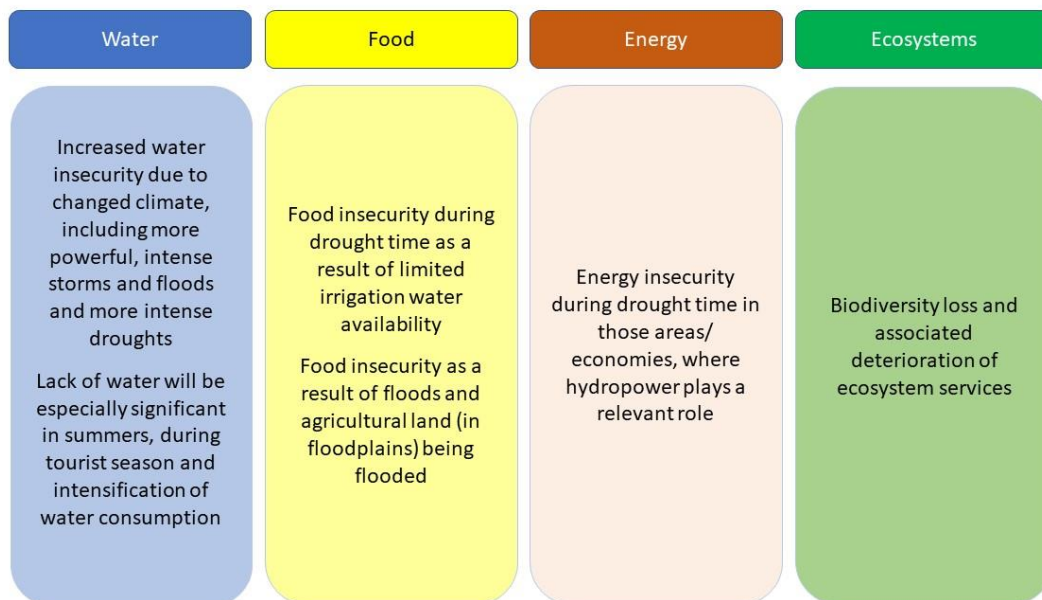


Figure 2: Nexus insecurities are negative effects of the relation between the different Nexus sectors.

1.3. Proposed strategy to improve Nexus management

Approaches to address the Nexus in an integrated way (e.g. administrative coordination, resource use efficiency, nature-based solutions and climate change resilience) are known and used in some cases in the SEE2020 region, but not systematically applied.

This study proposes implementing a more consistent Strategy to move from Nexus conflicts, trade-offs and insecurities towards shared benefits, by implementing a Nexus approach and actions.



Figure 3: Proposed strategy to turn Nexus conflicts, trade-offs and insecurities to Benefits, by implementing actions in the SEE2020 region in five prioritised pathways

The study envisaged that the following benefits can derive for the SEE2020 region from applying an integrated approach to the Nexus:

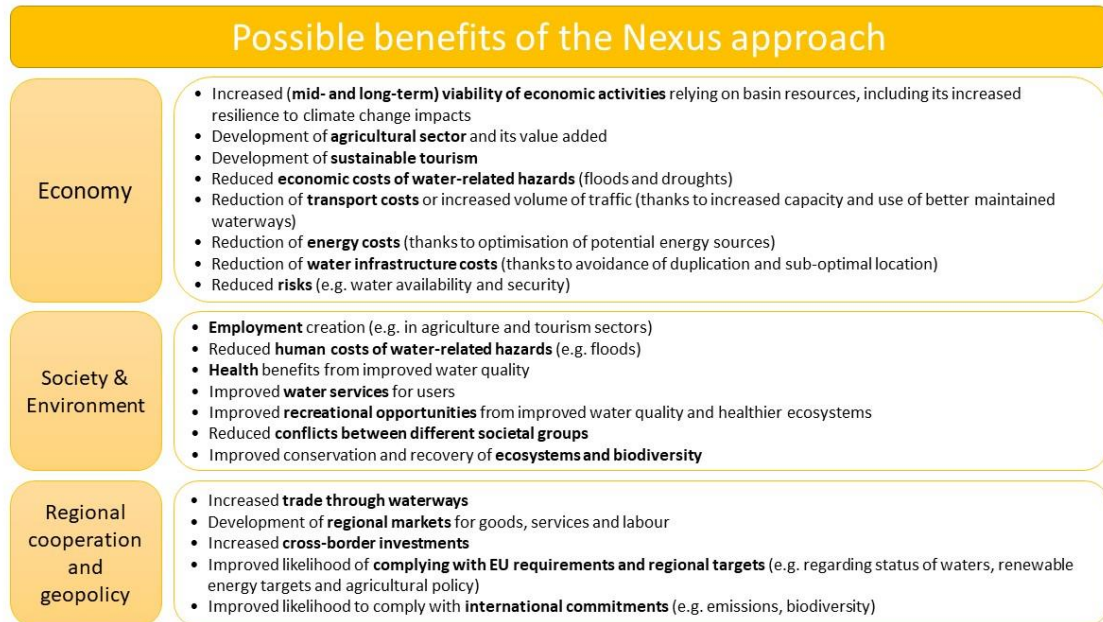


Figure 4: Possible benefits of the Nexus approach.

The study proposes to prioritise 5 major pathways with associated steps and actions. These pathways focus on:

- Implement pertinent recommendations from past studies and projects
- Optimise planning towards integration for benefits and resilience
- Develop and learn from pilots
- Prioritize (climate change) resilience
- Underpin decision-making (with better data)

The following specific steps and actions shall be taken by the concerned economies:

Pathways	Steps and actions
Implement pertinent past recommendations	<ul style="list-style-type: none"> - Implementation by concerned economies of actions adding value to on-going and emerging Nexus processes - Self-assessment of implementation and barriers - Regional identification/establishment of further funding sources for implementation - Regional exchange and monitoring on good practices and lessons learned during implementation
Optimise planning for benefits and resilience	<ul style="list-style-type: none"> - Foster early vertical and inter-sector cooperation within governmental authorities - Coordinate/integrate the different timeframes and geographic scales for planning in different sectors
Develop and learn from pilots	<ul style="list-style-type: none"> - Set up pilot experiences on the different actions in the economies - Draw lessons learned - Share and compare the experiences at regional level - Upscale implementation after learning - Document the process and experiences at regional level
Prioritize (climate change) resilience	<ul style="list-style-type: none"> - Develop planning based on resource availability and demand projections - Promote climate-resilient and no-regret measures (resource efficiency and nature-based solutions)
Underpin decision-making (with better data)	<ul style="list-style-type: none"> - Improve available monitoring, datasets, information - Promote procedures and platforms for accessibility and understanding

Table 5: Proposed steps and actions towards a Nexus Strategy/Roadmap in the SEE2020 Region

The study identifies additional support roles the Regional Dialogue can provide to the implementation of these pathways, focused on 4 key actions:

- Support policy-making as well as technical processes, by providing a forum for sharing information and debating priority issues
- Serve as a platform to assess how the economies perceive their position regards the implementation of past recommendations
- Support the development of pilot projects
- Promote good practice
- Identify or establish further funding sources for implementation

Possible support actions by the Regional Dialogue

- ➡ Serve as a **platform to assess** how the economies perceive their position regards the implementation of past recommendations
- ➡ Support the **development of pilot projects**, e.g.:
 - Stimulate and map interest to share and learn from pilot experiences across the region
 - Identify and collect pilot experiences already in place or planned in the economies
 - Agree on topics/issues and focus (technologies, governance) of major interest
- ➡ **Promote good practice**, e.g.:
 - Monitor good practice and lessons learned during implementation
 - Follow-up on lessons learned, and barriers identified
 - Share experiences and tools, e.g. for developing resource availability and demand projections under climate change
 - Exchange on climate resilience approaches to maximise benefits and avoid negative effects on the Nexus sectors, the wider economy or population
 - Support the integration of resource efficiency and nature-based solutions in planning and management of the different sectors
- ➡ Identify or establish further **funding sources** for implementation

Figure 5: Possible support actions by the Regional Dialogue

2. Introduction

This study consists of four main Chapters.

Chapter 1 presents an Executive Summary and chapter 2 the purpose of the study and the methodology which has been followed.

Chapter 3 is the core of the study. It provides the key elements of the SEE2020 regional Nexus assessment, including an assessment of key indicators for the economic development (chapter 3.1.1) and the four Nexus sectors: water, energy, food and ecosystems/biodiversity. Furthermore, it assesses the benefits, trade-offs and conflicts of the Nexus (chapter 3.2), the implementation of strategies for the integration of the Nexus approach in the economies (chapter 3.3) and the support provided by international initiatives (chapter 3.4).

Finally, the study develops conclusions and recommendations for further actions (chapter 4).

In addition, the report includes a number of Annexes. Annex 5.1 provides a summary on the main Nexus-related findings of the detailed assessment of each economy within the region.

2.1. Background

2.1.1. The SEE 2020 Strategy

The development of the regional growth strategy entitled “SEE 2020 – Jobs and Prosperity in European Perspective” was coordinated by the Regional Cooperation Council (RCC) Secretariat. Participating economies are these of Albania, Bosnia and Herzegovina, Croatia¹, The Former Yugoslav Republic of Macedonia, Kosovo*, Montenegro and Serbia. The Ministers in charge of the SEE 2020 economies endorsed the Strategy in Sarajevo in November 2013, entrusting the RCC with a role of coordinating and monitoring its implementation.

The SEE 2020 comprises of 5 main growth pillars as well as a number of policy dimensions under each pillar. Environment is one of the four Dimensions of the Sustainable Growth Pillar of the SEE 2020 Strategy. The Dimension “Environment” is being coordinated the Regional Environmental Center for Central and Eastern Europe (REC), Global Water Partnership – Mediterranean (GWP-Med) and the Regional Rural Development Standing Working Group (SWG RRD). GWP-Med is responsible for the coordination of activities

¹ The Strategy was developed before Croatia’s accession to the EU on 1 July 2013, therefore in the SEE 2020 Strategy (i.e. the document itself) Croatia is also listed as beneficiary.

related to the Nexus approach, water resources management, and transboundary water resources management. The SEE2020 economies participate in the coordination of the implementation of Dimension “Environment” through the Regional Working Group on Environment (RWG Env) which operates under the auspices of the RCC.

Advancing the Nexus approach in SEE is one of the key strategic actions of the Dimension Environment of the SEE 2020 Strategy that includes two related objectives:

a) “to identify steps and measures necessary for advancing the Water, Energy and Food nexus approach at Economy and trans-boundary levels and investigate opportunities of launching a political process under the RCC for the enhancement of cooperation in the SEE in the field of TWM”;

b) “to develop and put in place measures necessary for commencement of the Regional Integral Water Management Framework Agreement (RIWFA) implementation”.

under the auspices of the RCC.

2.1.2. The Regional Nexus Policy Dialogue in SEE

The Regional Nexus Policy Dialogue in SEE is a key instrument used to enable the achievement of the following main objectives:

- Support the discussion for the preparation of a regional Water, Energy, Food and Ecosystems/Environment Nexus Strategy/Roadmap under the SEE2020 Strategy, describing steps and actions for the introduction of Nexus approach considerations in the basin/aquifer management frameworks at Economy and transboundary levels as means towards sustainable management of water, land, energy and environment.
- Facilitate of the discussions among the SEE2020 economies for the possibility of a Regional Integral Water Management Framework Agreement (RIWMFA) comprising among others of regional means and tools to assist in addressing challenges related to transboundary water resources management (TWRM).
- Foster cross-fertilisation of institutions and practitioners at regional and economies’ levels.

The Regional Nexus Policy Dialogue in SEE builds upon the outcomes of the International Roundtable on Water and Energy Nexus in Transboundary Basins in Southeastern Europe, 6-8 November 2013 in Sarajevo, and the Regional Roundtable on “Water, Food, Energy and

Environment Nexus in Southeastern Europe”, 9-10 December 2014 in Zagreb, which aimed to catalyze action for concrete implementation of the Nexus approach in the SEE.

2.1.3. Activities designed as part of the Regional Nexus Policy Dialogue in SEE

A set of activities has been developed as part of a Regional Dialogue to serve the key strategic action of the SEE2020 Strategy for Advancing the Nexus approach in SEE. Activities include:

- Three Regional Roundtables and three back-to-back Nexus Groups Meetings i.e. Meetings of Nexus Ministries representatives. The first Regional Roundtable and the first Meeting of Nexus Ministries representatives were held on 20-22 June 2017 in Belgrade.
- The Regional Nexus Mapping Study to provide the conceptual and technical background to support and inform the Nexus Policy Dialogue process. The draft Study was prepared in July 2018 and will be finalized in October 2018 incorporating input from the representatives of the Economies and the participants of the September Roundtable.
- Nexus Assessment in one SEE2020 economy. The selection of the economy is on-going.
- Nexus Assessments in two transboundary river basins in SEE, namely Drin River Basin (shared by Albania, Montenegro, Kosovo* and The Former Yugoslav Republic of Macedonia) and Drina River Basin (shared by Bosnia and Herzegovina, Montenegro and Serbia).

The Regional Dialogue is financially supported by the following:

1. *Advisory Assistance Programme of the German Environment Agency in cooperation with the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety through the “Water-Food-Energy-Environment Nexus Policy Dialogue Process in South East Europe” Project (SEE NPDP)*

The project aims to enhance integrated management of natural resources and transboundary cooperation towards sustainable development in the SEE2020 region, fostering the introduction of the Water, Energy, Food and Ecosystems Nexus approach and catalysing action for its adoption and implementation at the Economy and transboundary basin levels.

2. *Global Environment Facility (GEF) through its programme “International Waters: Learning Exchange and Resources Network (IW:LEARN)”, Activity 2.3: Supporting Regional Cooperation on Shared Water Resources through Dialogue*

It features a set of International Roundtables and Capacity Building activities in the South East Europe area introducing elements that came out as priorities under the IW:LEARN such as the Water -Energy-Food-Ecosystem Nexus. The activity envisages to result in strengthened capacities for transboundary cooperation on shared water systems in the region, as well as improved regional cooperation on key shared issues, such as sustainable hydropower.

3. *Austrian Development Agency (ADA) through the project “Promoting the Sustainable Management of Natural Resources in Southeastern Europe, through the use of the Nexus approach” (NEXUS Project)*

The Project is implemented by GWP-Med in cooperation with the United Nations Economic Commission for Europe (UNECE).

It aims to introduce the Nexus approach to the ministries responsible for and the stakeholders related to the nexus sectors, facilitate action for its adoption and identify those interventions that will enable water, energy and food security on the ground without jeopardising the well-being of the ecosystems, at regional, transboundary and economies levels.

The Regional Dialogue is operating in synergy with the ‘*Petersberg Phase II / Athens Declaration Process*’, the GEF through its IW:LEARN programme and the UNECE Water Convention.

2.1.4. The ‘Petersberg Phase II / Athens Declaration Process’

The ‘Petersberg Process’ was initiated in 1998 and its on-going Phase II aims to provide support for translating into action the current developments and opportunities for future cooperation on transboundary river, lake and groundwater management in South East Europe. It is supported by the German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the World Bank.

The ‘Athens Declaration’ Process concerning Shared Water, Shared Future and Shared Knowledge was launched in 2003 at the Vouliagmeni International Conference (as part of the activities of the Greek Presidency of the European Union) with the primary aim to assist development of Integrated Water Resources Management Plans and related actions in SEE; it is jointly supported by the Hellenic Ministry of Foreign Affairs and the World Bank.

Since 2005, the ‘Petersberg Phase II Process’ works in synergy with the ‘Athens Declaration Process’ under the joint Petersberg Phase II / Athens Declaration Process (Process) to facilitate the enhancement of cooperation in transboundary basins in the SEE region.

The Petersberg Phase II / Athens Declaration Process for the enhancement of transboundary water resources management in SEE has been supporting since 2005 the building of capacity on Integrated Water Resources Management (IWRM), and the development of management plans for shared water bodies.

The Process is also strategically linked to the Global Environment Facility International Waters: Learning Exchange and Resources Network (IWLEARN) on capacity building and sharing of experiences.

GWP-Med provides administrative support and is the technical facilitator of related activities under the Process.

2.1.5. The GEF through its IW:LEARN programme

The GEF supported IW:LEARN programme (2005 -) represents a cooperative effort of the UN Development Programme (UNDP) and UN Environment Programme (UNEP), with the involvement of all GEF Agencies.

The IW:LEARN activities in Southeastern Europe aim to demonstrate innovative and feasible approaches to transboundary water resources management, by deepening multi-stakeholder dialogue and experience-sharing.

Activities since 2005

Since 2005 a variety of activities including regional roundtables, multi-stakeholders dialogues, targeted capacity building workshops and study visits, preparation of assessments, surveys and policy documents (on issues such as shared lakes basin management; multipurpose water management; shared groundwater management; climate change; stakeholders involvement; water-energy nexus etc.), have been implemented aiming at enhancing cooperation among SEE Economies and stakeholders for the management of transboundary water resources. More than 150 stakeholder organizations, governments and other entities have been engaged in these activities.

Overall, the Process has been catalytic in facilitating coordination among key international and Economy level players in the areas of focus and has attracted the interest of beneficiary Economies and donors.

2.1.6. UNECE Water Convention

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was adopted in Helsinki in 1992 and entered into

force in 1996. Almost all Economies sharing transboundary waters in the region of the United Nations Economic Commission for Europe (UNECE) are Parties to the Convention.

The Water Convention strengthens transboundary water cooperation and measures for the ecologically-sound management and protection of transboundary surface waters and groundwaters. The Convention fosters the implementation of integrated water resources management, in particular the basin approach. The Convention's implementation contributes to the achievement of the Sustainable Development Goals and other international commitments on water, environment and sustainable development.

The Water Convention requires Parties to prevent, control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management. Parties bordering the same transboundary waters have to cooperate by entering into specific agreements and establishing joint bodies. As a framework agreement, the Convention does not replace bilateral and multilateral agreements for specific basins or aquifers; instead, it fosters their establishment and implementation, as well as further development. In 2003, the Water Convention was amended to allow accession by Economies outside the UNECE region. The amendment entered into force on 6 February 2013, turning the Water Convention into a global legal framework for transboundary water cooperation. As of 1st March 2016, Economies outside the ECE region can accede to the Convention.

2.2. Purpose of the study – Context

This Nexus Mapping Study is prepared in the framework of the following projects:

- “Water-Food-Energy-Environment Nexus Policy Dialogue Process in South East Europe” funded through the Advisory Assistance Programme of the German Environment Agency in cooperation with the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety;
- GEF IW:LEARN Activity 2.3: Supporting Regional Cooperation on Shared Water Resources through Dialogue; and
- “Promoting the Sustainable Management of Natural Resources in South-eastern Europe, through the use of the Nexus approach” funded by the Austrian Development Agency.

This Study will be used as the conceptual and technical background to support and inform the activities of the three Projects above as well as the Nexus Policy Dialogue process, having the following objectives:

- Supporting the discussion for the preparation of a regional water, food, energy, environment Nexus Strategy/Roadmap under the SEE2020, describing steps and

actions for the introduction of Nexus approach considerations in the basin/aquifer management frameworks at Economy and transboundary levels as means towards sustainable management of water, land, energy and environment.

- Facilitation of the discussions among the SEE2020 economies for the possibility of a Regional Integral Water Management Framework Agreement (RIWMFA) comprising among others of regional means and tools to assist in addressing challenges related to transboundary water resources management (TWRM).
- Fostering cross-fertilisation of institutions and practitioners at regional and Economy levels.

The specific objectives of the Study are the following:

- Identification of the level of integration of management of natural resources related to Nexus (i.e. water, energy, food and ecosystems).
- Identification of interlinkages and potential benefits, trade-offs and conflicts among Nexus sectors (water, energy, food and ecosystems).
- Brief assessment of the level and status of cooperation for the management of transboundary basins in the SEE2020 region.

The study focuses on the SEE2020 Region, including Albania, Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia, Kosovo*, Montenegro and Serbia, within the wider geographic context.



Figures 6 and 7: Geographic area addressed in the Study².

2.3. Methodology for the development of the study

The work is divided in four main tasks, which have been developed in a sequenced way, overlapping in time, between August 2017 and September 2018. They are indicated in the following schema:

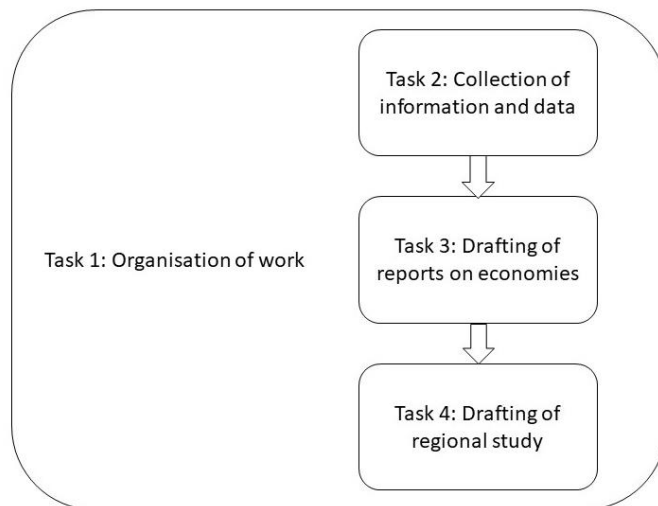


Figure 8: Schema of work developed for the study.

Based on the objectives established, expectations were drawn for data and information gathering, which was carried out both at the regional level and at the level of the economies. The main sources of information are listed in Annex 5.2, distinguishing between literature including regional reviews and project outputs (Annex 5.2.3), Information Sources at the regional and economy level (Annex 5.2.4); and 20 Interviews carried out (Annex 5.2.5).

Data and information were brought together to reflect the situation in each of the economies³ (reflected in Chapter 5.1) and synthesized to the regional level (Chapter 3) with the following selection criteria:

- **Availability and representativeness:** the regional synthesis reflects the situation across the region. Ideally, data should be available for all concerned economies and ideas or reflections be representative.
- **Relevance:** data or examples are relevant for the economies and the region.
- **Prevalence:** issues are relevant to the most economies or shared among neighbouring economies.
- **Novelty:** new approaches, regulation, institutions, etc. are presented, in particular if they are not yet known across the region.
- **Inspiration and replicability:** Examples and data can be used by other institutions in the region to adapt working solutions to their environment.
- **Failure and lessons learned:** Failure - recognised as a usual result of tests and changes- is presented in a positive way. Lessons learned – and in particular failures – can help other institutions to save time and effort by exploring different pathways.

Finally, conclusions were drawn for informing the second Regional Nexus Roundtable in SEE.

3. Regional-SEE2020 Nexus Mapping

This chapter provides an overview as well as a regional aggregation and synthesis of the main findings from the data gathering and assessment of information sources.

3.1. Key data and trends

The accessibility and reliability of information on the different Nexus aspects is a bottleneck for assessments and action. Regarding data availability, general information (e.g. water demand, size of protected areas, overall electricity production, overall GHG emissions) could be easily found either online or at the competent authorities; however, access was difficult for detailed information such as e.g. water consumption by sector, water availability and consumption per month. In addition, the regional integration of data and accessing procedures are in process of improvement, such as shown e.g. by the information compiled on hydrometeorological and hydrological monitoring stations in the Drin basin⁴; incomplete data series and non-operational monitoring stations prove to be additional constraints.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water	0	0	0	0	0	0
Energy	+	0	0	-	0	+
Food, agriculture & land	+	0	0	0	0	0
Ecosystems and biodiversity	+	0	0	0	0	0
Economic development	+	+	0	-	0	+
Grey and Green Infrastructure	0	+	0	0	0	0
Climate change	+	+	0	0	0	+

Table 6: Data accessibility in the SEE2020 region.

Explanation: “+” – Easy; “0” – limited; “-” – difficult/not accessible. Source: Judgment by the experts involved in the study

Regarding data reliability, the available datasets are considered as reliable. However, certain differences/inconsistencies have been detected, which could be caused by using different methodologies or inappropriate time-series.

3.1.1. Economy

The overall economic development of the SEE2020 region shows a steady increase since 2003 in terms of nominal GDP and nominal GDP/inhabitant, with a certain stagnation between 2008 and 2012; upwards trends are more marked for Montenegro than for the other economies. In comparison the GDP per capita of the economies is at around 60-70%

below the EU-28 average. The forecast⁵ existing until 2022 reflects in general similar growth trends as in the past few years.

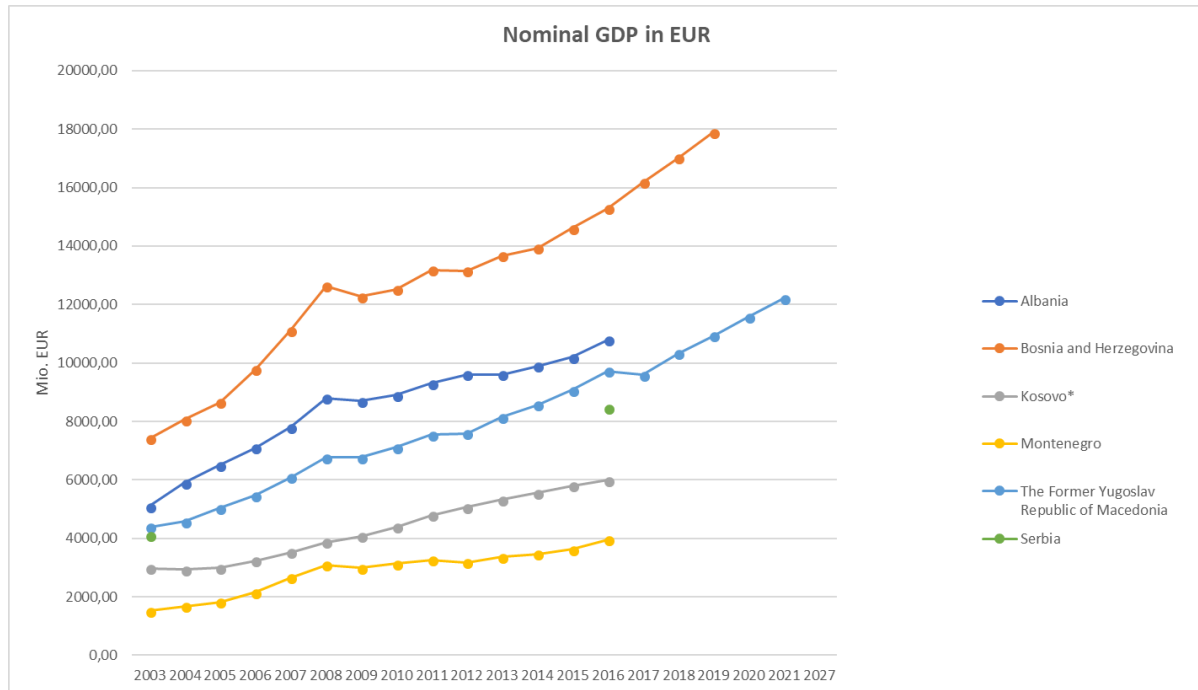


Figure 9: Nominal GDP per inhabitant/yr⁶.

In terms of the main economic sectors, the primary sector is still very relevant in Albania and Kosovo*, whilst of decreasing relevance in terms of economic weight and employment. In The Former Yugoslav Republic of Macedonia and likely also in other economies, agriculture has always served as a shock absorber for the socio-economic and structural changes in industry and other sectors of the economy⁷. The secondary sector is slightly increasing in Albania and Bosnia and Herzegovina, whilst it does not show upwards or downwards trends in the other economies. The tertiary sector is stable in all economies except Albania where it is declining.

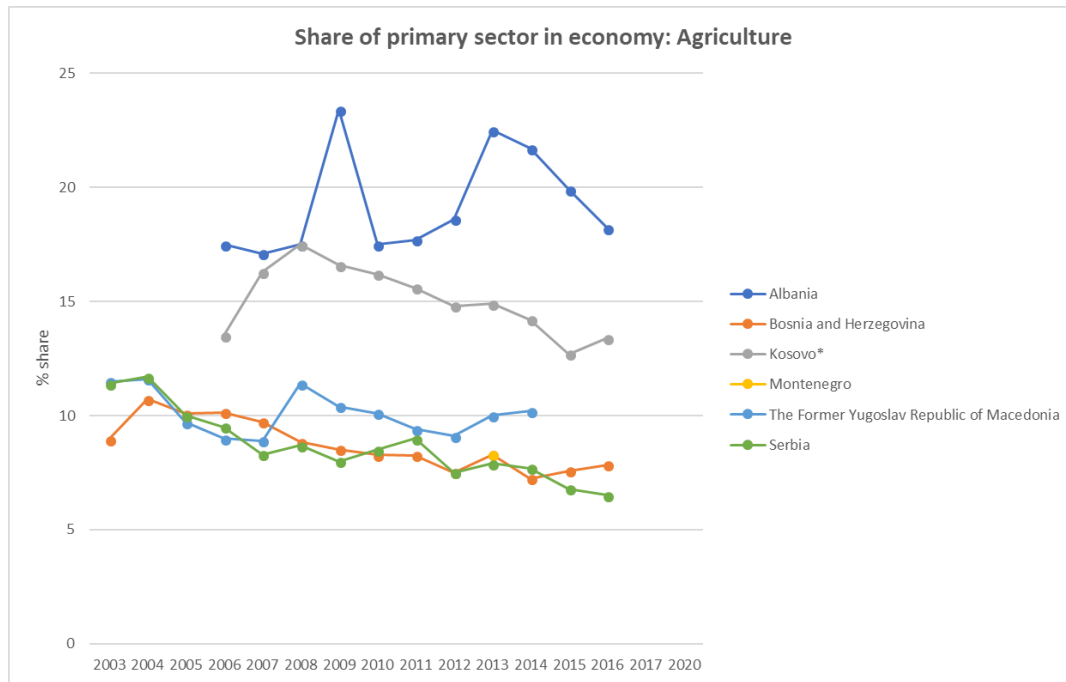


Figure 10: Share of primary sector in economy: Agriculture.⁸

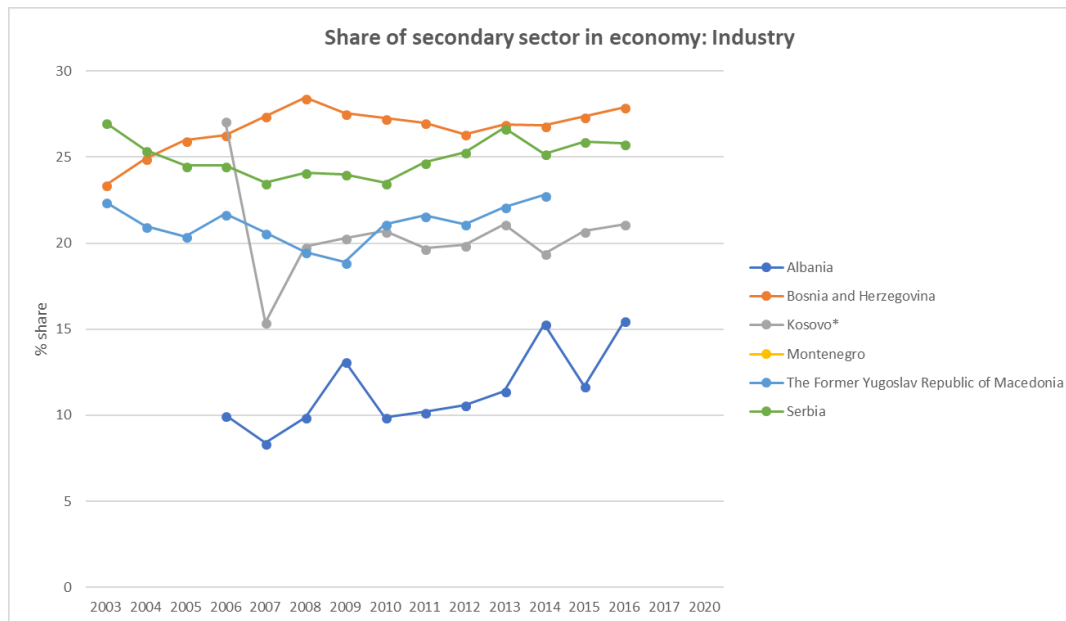


Figure 11: Share of secondary sector in economy: Industry.⁹



Figure 12: Share of tertiary sector in economy: Services¹⁰.

The employment rate in the SEE2020 economies is slowly increasing, with Serbia, Montenegro and The Former Yugoslav Republic of Macedonia having higher rates than the other economies.

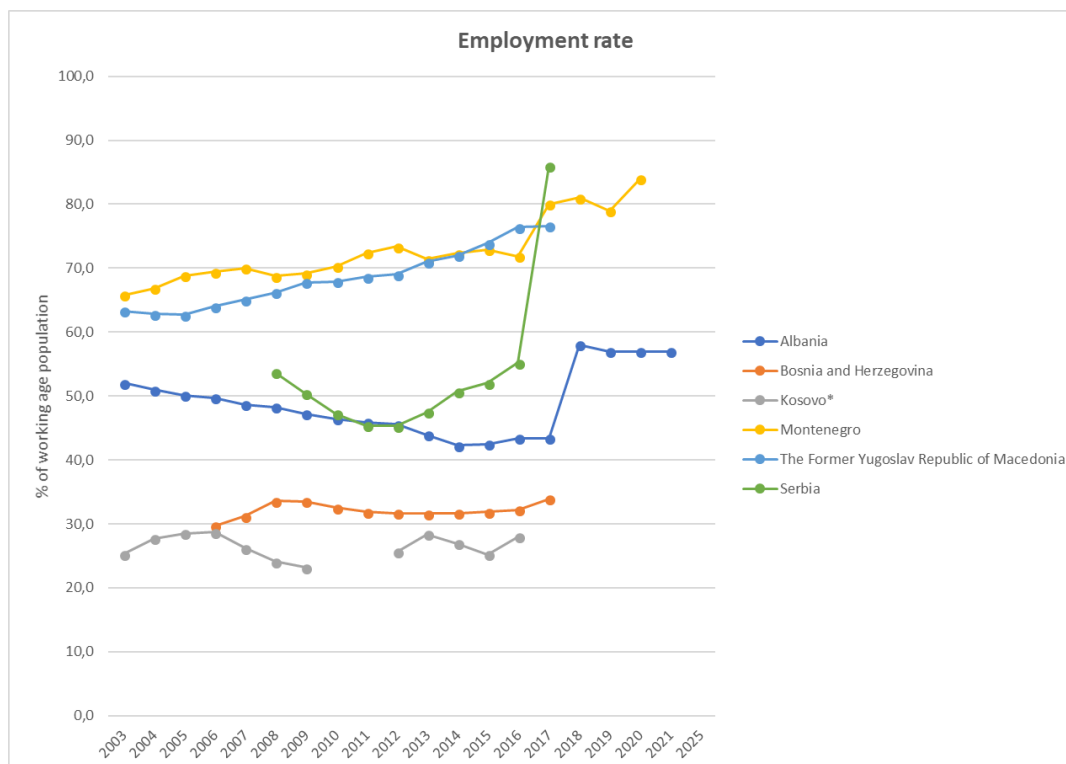


Figure 13: Employment rate in the SEE2020 economies¹¹.

The Gini index represents the (in)equality of wealth distribution, and all economies except Montenegro show slight improvements over the past years.

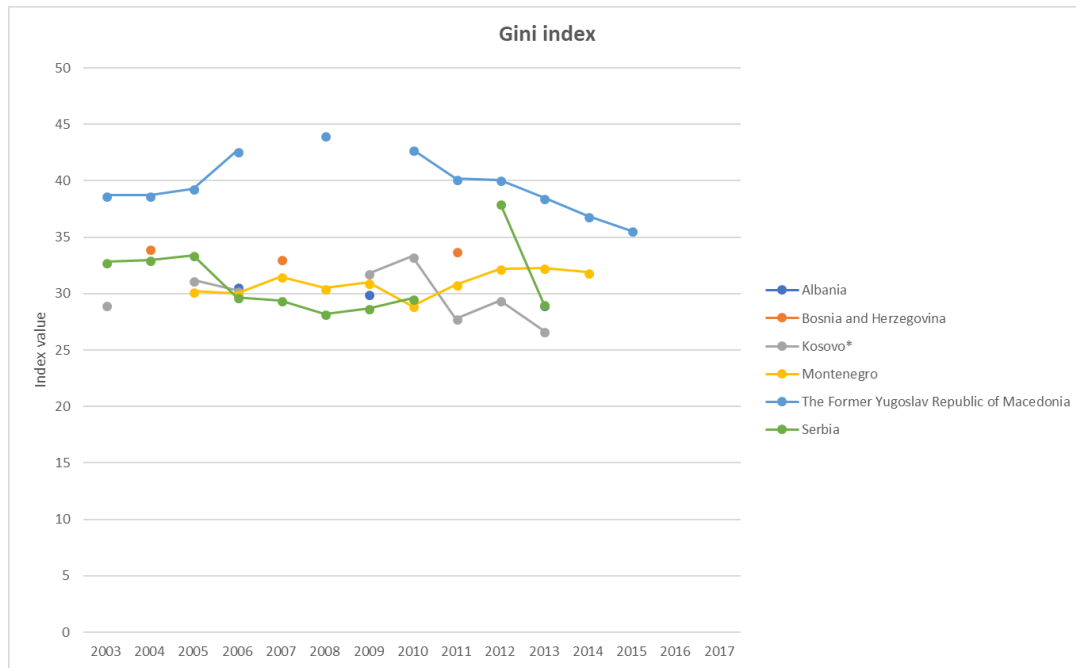


Figure 14: Gini Index¹².

In terms of the regional interaction, one fourth of the imports and one third of the exports are taking place with the other economies of the SEE2020 region; however, there is a marked decline in the past years.

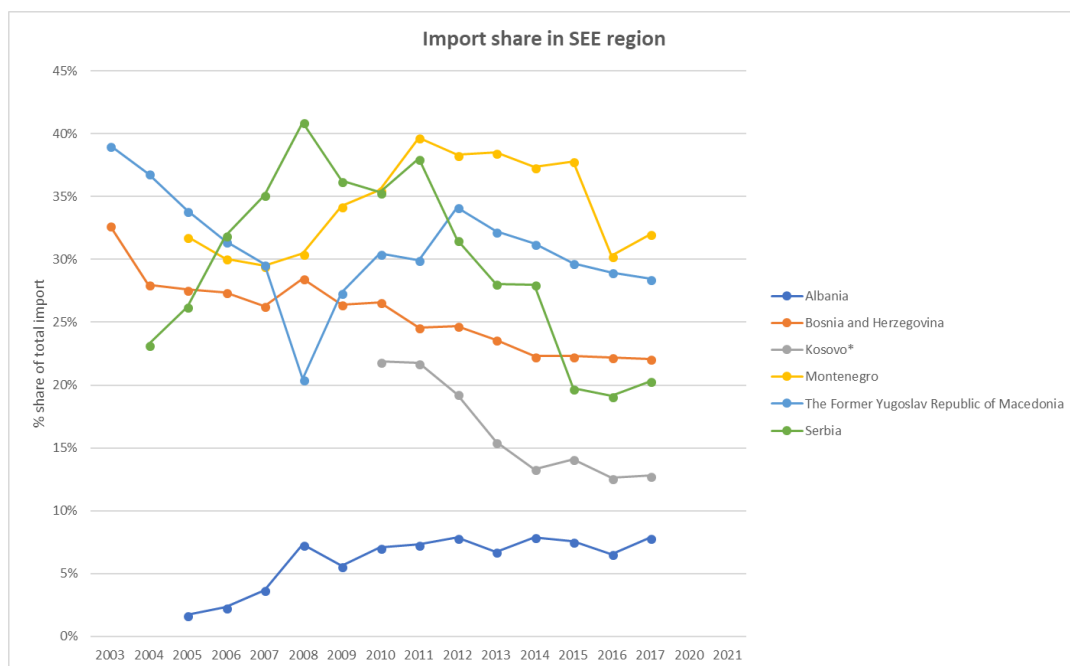


Figure 15: Import share SEE region¹³.

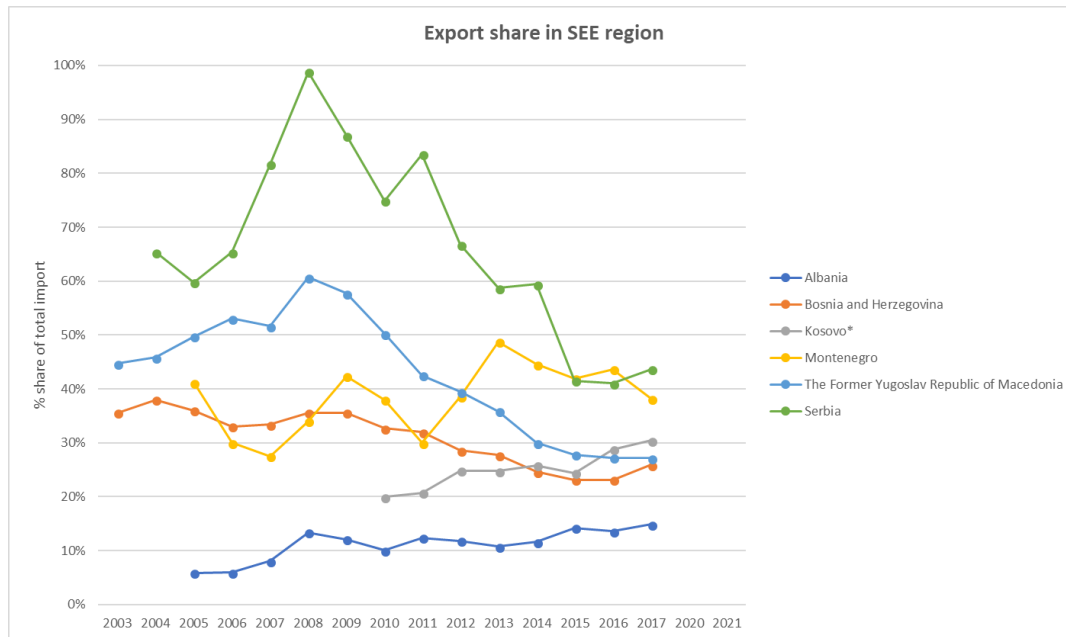


Figure 16: Export share in SEE region¹⁴.

3.1.2. Water

Water is connecting the different economies in the SEE2020 region, as all river basins and many of the aquifers are shared (see also chapter 3.4.1). Water plays a major role for the energy sector (hydropower, cooling water), and the agricultural sector (in particular for The Former Yugoslav Republic of Macedonia).

The water availability per economy varies significantly in the region, with Serbia, accounting for the flows in the Danube, having highest availability and The Former Yugoslav Republic of Macedonia the lowest. The Former Yugoslav Republic of Macedonia has furthermore faced a reduction of the annual values of the average discharges in the past years.

Climate change affects water availability¹⁵; it is expected to result in the following:

- The whole region is under the significant increase of temperature, with most pronounced signal over Montenegro and Bosnia and Herzegovina, and less over The Former Yugoslav Republic of Macedonia; there will be an increase of temperature over the whole territory with observed temperature increase of 1.2°C in the near future and destined to warm further by 1.7 – 4.0°C by the end of the century;
- Precipitation changes are not yet significant in general; noticeable change in annual accumulated precipitation starts from the mid-century period, with gradient change that shows increase in the northern parts of the region (north Serbia) and intensifying decrease towards the south, including coastal areas, particularly affecting Albania;
- Annual precipitation distribution is subject to change, which is evident from severe drying of the summer season (June-July-August), more pronounced towards the south of the region and in coastal areas;

- Winter season will receive more extreme precipitation, as well as more of total accumulated precipitation, over the regions with temperate continental climate, and alarming loss of snow pack is expected;
- Heat waves and droughts are expected to increase in frequency and duration.

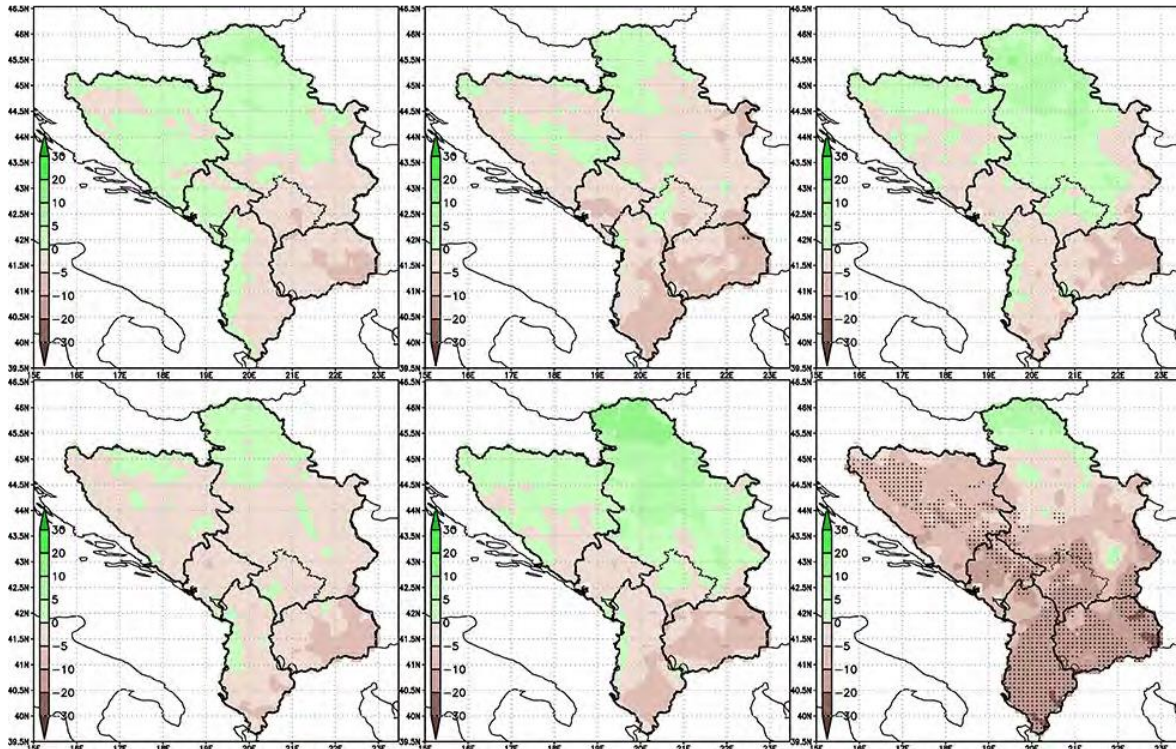


Figure 17: Annual accumulation precipitation change (%) for the near future 2016-2035 (left column), mid-century 2046-2065 (middle column) and end of the century 2081-2100 (right column) periods ¹⁶

Past or forecasted data on water abstraction, use and consumption are rather scarce in the SEE2020 region (e.g. consumption per sector, availability and consumption per month). The water demand of the economies is very different, and does not reflect clear regional trends, apart from the increase of water demand and consumption in The Former Yugoslav Republic of Macedonia, and the projected significant increase of water demand in Albania.

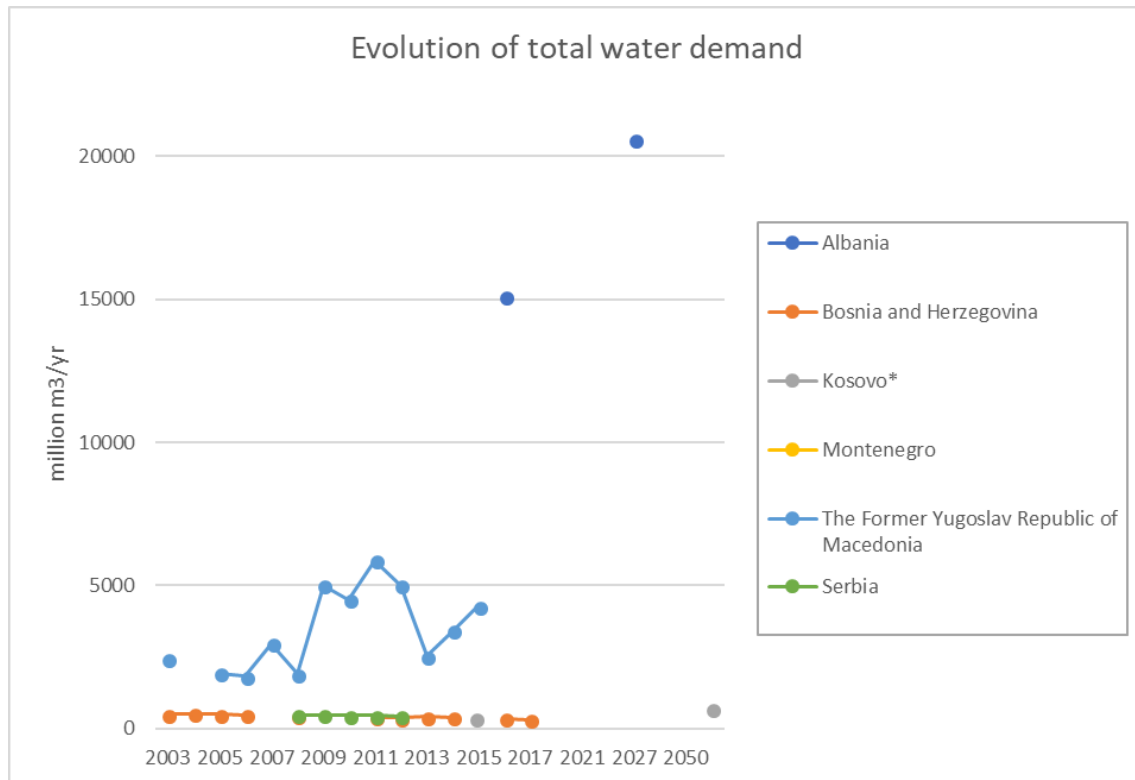


Figure 18: Evolution of total water demand¹⁷.

The water exploitation index¹⁸ (WEI) reflects the pressure of abstraction on water, with values above 20 % indicating water scarcity, whereas values higher than 40% indicate severe water scarcity. According to the Economy level data, Albania shows 'scarce' conditions, which will likely evolve towards the 'severely scarce' category along the coming years. The Former Yugoslav Republic of Macedonia is close to a 'scarce' situation; whilst no such overall scarcity has been yet identified for the other economies.

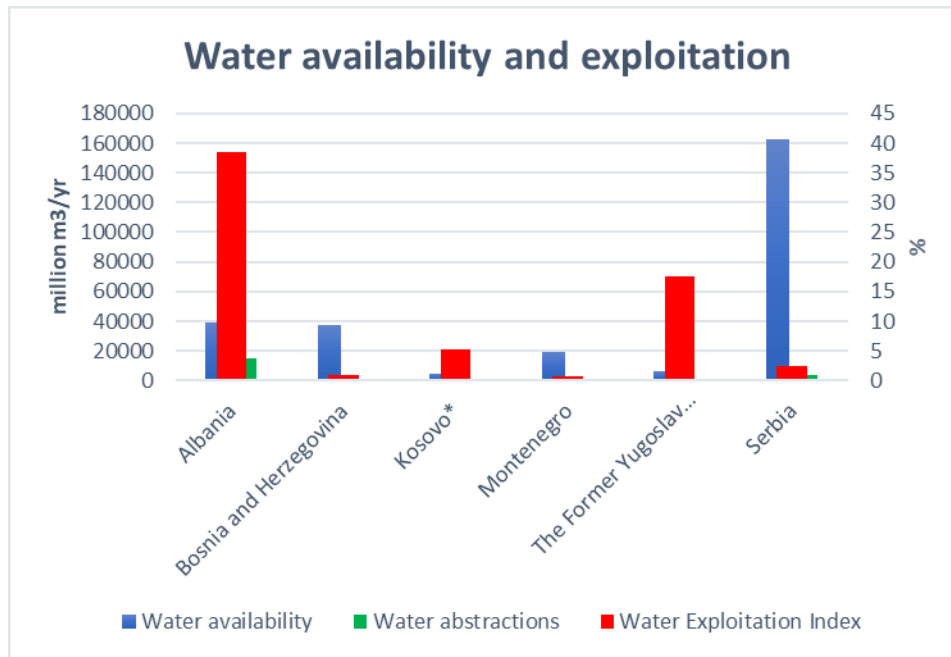


Figure 19: Water availability and abstraction (in million m³/yr) and Water Exploitation Index (in %), latest year available¹⁹.

Albania, The Former Yugoslav Republic of Macedonia and less so Kosovo* and the coastal area of Montenegro and Bosnia and Herzegovina also face pressure from water consumption, as shown by the river basin related Water Exploitation Index +.

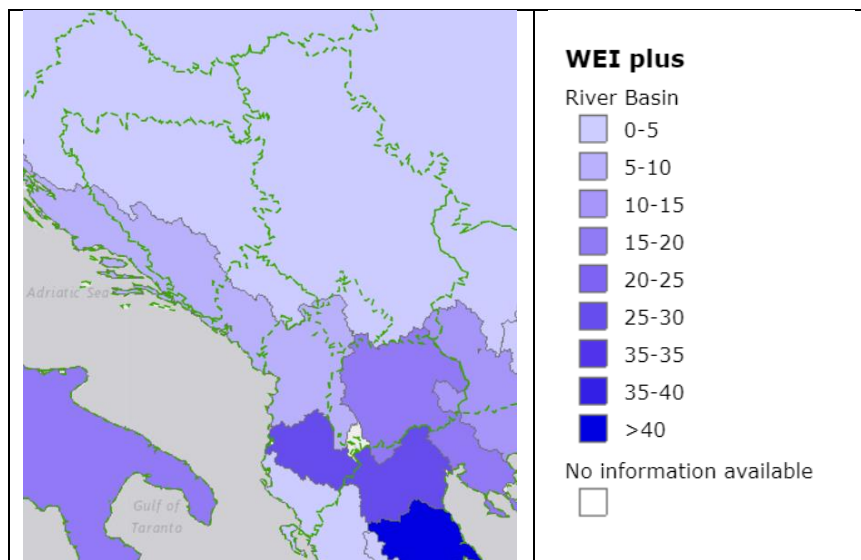
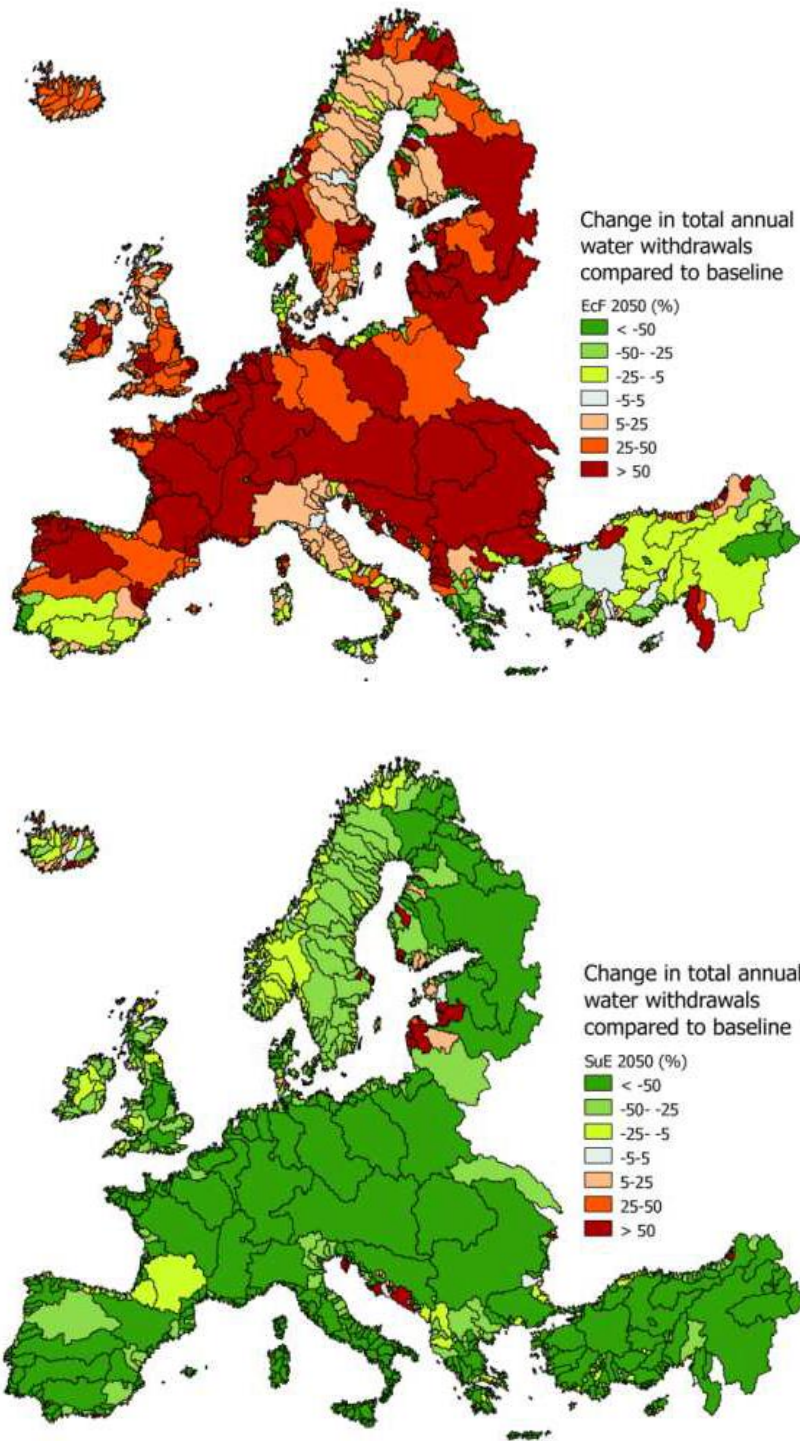


Figure 20: WEI + (January 2012)²⁰.

Irrigation is an important water consumer in Albania (2006: 39.69%) and The Former Yugoslav Republic of Macedonia (2007: 12.62%) and has only a minor role in Serbia (2007: 3.29%, 2009: 1.94%). No data are available for the other economies.

Except for Albania, strategies and plans do not reveal future projections on water abstractions or consumption in the economies. Scientific research provides a range for the evolution of future water abstraction trends.



Figures 21 and 22: Change in total water withdrawals compared to the base year. (top) Economy First scenario and (bottom) Sustainability Eventually scenario in 2050²¹.

Freshwater quality varies significantly across the region, which holds both pristine mountain streams as well as rivers polluted by industrial and urban wastewater, waste dumping (e.g. in Albania) as well as agricultural run-off. Concentrations of key pollutants, such as organic pollution (measured in terms of BOD, biological oxygen demand) and

ammonium, remained largely steady in the period 2000-2005. The extent of sewerage systems is low. Wastewater treatment is poor or non-existent in many urban and industrial areas²², with Albania presenting relatively better services in this field.

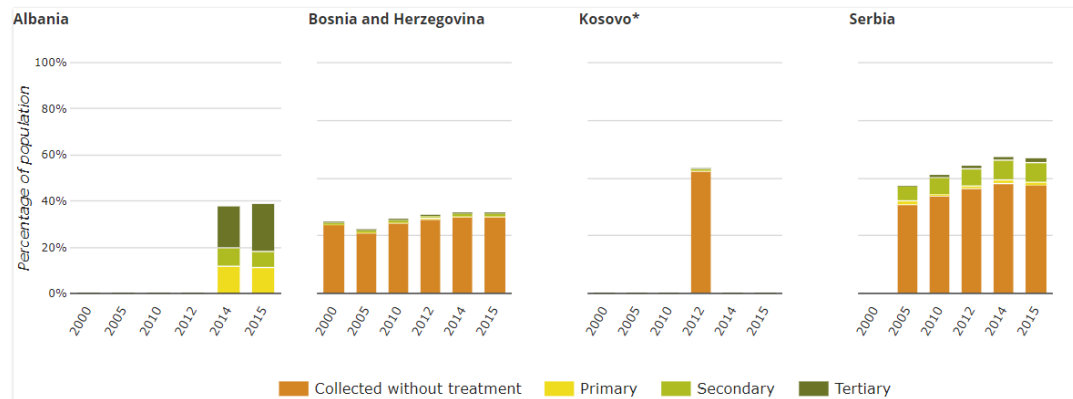


Figure 23: Changes in urban waste water treatment in the Western Balkans²³.

In general, drinking water and sanitation are safely managed for a large proportion of the population, ranging in 2015 from 91% (Albania, Serbia) to 98% (Bosnia and Herzegovina, Montenegro) regarding drinking water and from 91% (The Former Yugoslav Republic of Macedonia) to 98% (Albania) regarding sanitation²⁴, and reflecting in general static figures. However rural access 'on premises' to drinking water has significantly increased for the rural population in Albania, The Former Yugoslav Republic of Macedonia and Serbia since 2000²⁵. The 10.41% of the population of Kosovo* does not have access to drinking water services. For Bosnia and Herzegovina, concern is expressed due to the quality of potable water from the water supply system deteriorating steadily, the existing infrastructure being in poor condition, and water resources being increasingly polluted²⁶. Only a low proportion of the household's income is spent on drinking water, sanitation and hygiene (Montenegro: 2-5%; Albania: 2-3%; Serbia: 1-2%), which can thus be considered affordable, even if in Albania and Serbia low-income households pay a slightly higher proportion than high-income ones²⁷. The Former Yugoslav Republic of Macedonia – followed by Bosnia and Herzegovina and Serbia – are the economies with the largest inequalities when comparing access to safe sanitation²⁸. Within the SEE2020 region, Albania is the economy with the lowest (<80%) access ratio to drinking water services 'when needed', reflecting constraints in access²⁹.

Water losses appear rather high (e.g. 50% in Bosnia and Herzegovina³⁰) for urban water supply; no figures have been found for the use efficiency in irrigation areas.

The Sava River recently experienced one of its most severe floods³¹, and flash floods have also been faced in other parts of the region e.g. in The Former Yugoslav Republic of Macedonia (2004). In Serbia, apart from hindering the operation of thermal power plants³², flood events between April and May 2014 compromised coal supply because of the damage

caused to several open-pit mines. Significant increases are expected for flood risks for the second half of this century, which will likely affect land-use, energy production and safety.

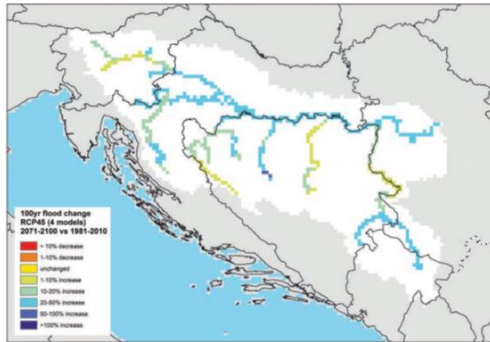


Figure 24: Projected changes in extreme flooding (HQ100)³³.

In the Sava river basin, climate change projects an overall increase in the flood peaks with 13% for the 2011-2040 period and a 23% increase for the 2071-2100 period. Floods might impact hydropower dams and downstream thermal stations³⁴.

3.1.3. Energy

The SEE2020 region produced in 2015 overall 22.9 Mtoe of energy, and imported an additional 8.8 Mtoe, thus consuming overall 31.7 Mtoe of energy. The main producer in the region is Serbia, whilst The Former Yugoslav Republic of Macedonia has the highest and Albania the lowest import share³⁵; all economies are net energy importers. Regarding future projections, from 2020, Montenegro, due to the expansion of hydropower and to the lowest demand in the region, will start exporting electricity to neighboring Economies as a result of the decrease in exports from Bosnia and Herzegovina. On the other hand, Serbia's net imports will start increasing from 2020 to meet the economy's high electricity demand, indicating that its own installed capacity is no longer sufficient to secure electricity supply³⁶.

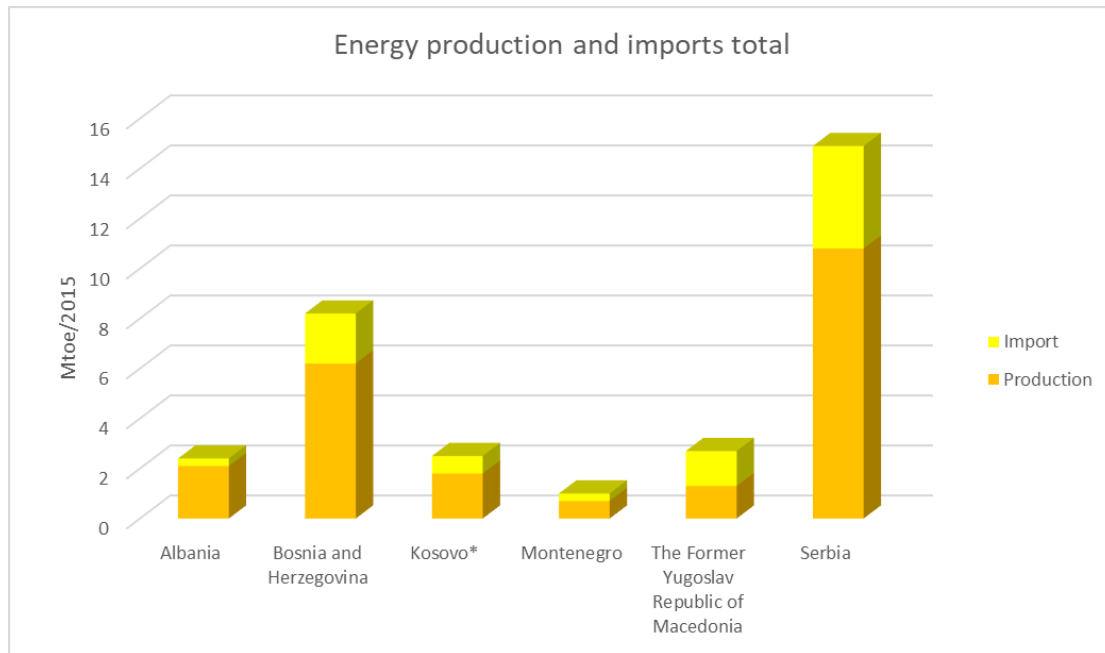


Figure 25: Energy production and imports of the SEE2020 economies in 2015³⁷.

Hydropower is one of the main sources to produce electricity in the region, with Albania highly dependent on it, whilst it plays a lesser role in the other economies. The production reflects the dependency on rainfalls and runoff, thus is interannually variable.

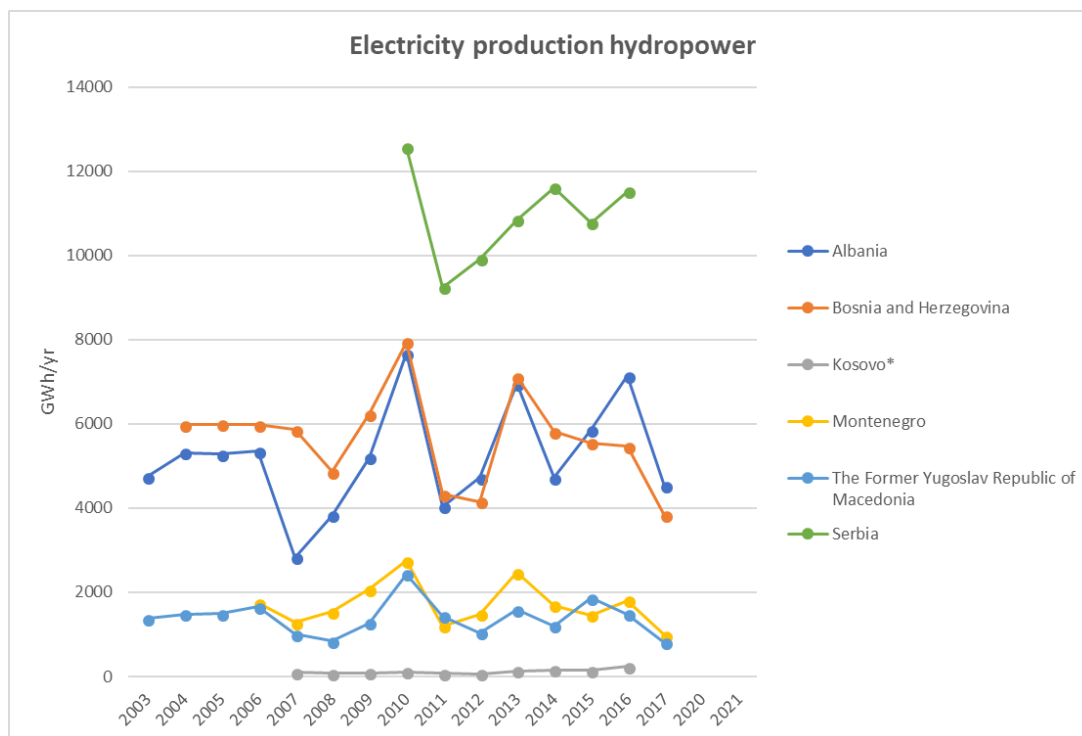


Figure 26: Electricity production by hydropower (GWh/yr)³⁸.

All economies aim to further develop hydropower generation as a source of renewable and clean energy generation. However, with a few exceptions the strategies or plans in place do

not provide information about the expected future quantitative growth, nor integrate the related concerns about the environmental impacts of hydropower on water bodies, ecosystems and biodiversity. According to a recent study³⁹, hydropower development in the Balkans, accounting for a) existing hydropower facilities (ca. 1,000), b) those in construction (ca. 180), or c) those planned (ca. 2,800) would face up to 49 freshwater fish species with either the threat of extinction or loss of between 50 and 100% of their Balkan distribution. Of these, eleven endemic species are threatened with extinction, seven will become critically endangered, and the number of endangered species will double to twenty-four. For 68 of 69 endemic species, habitat losses are estimated between 30% and 100%, resulting in increased levels of endangerment for essentially the entire endemic fauna. The main hotspots of biodiversity and threat from hydropower are:

- Neretva basin in Bosnia and Herzegovina and Croatia with fourteen listed species;
- Morača/Skadar system in Montenegro and Albania with eleven listed species; and
- Tara/upper Drina system in Montenegro and Bosnia and Herzegovina with nearly 200 kilometres of free-flowing riverine habitat.

The following figure provides a tentative overview on existing and planned hydropower plants.

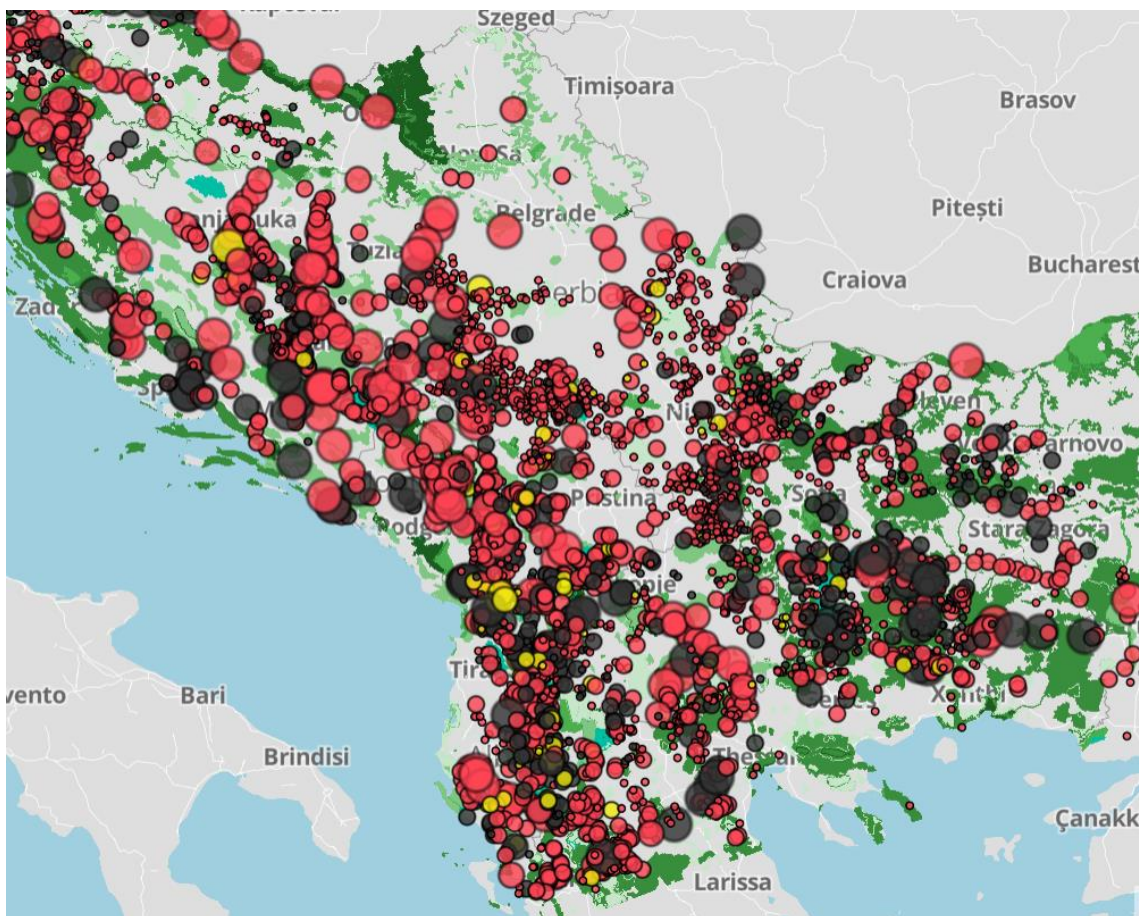


Figure 27: Planned hydropower developments in SEE.

In black existing plants, in yellow plants in progress, and in red plants in planning stage⁴⁰.

In the past years, the speed of construction of new hydropower plants is increasing, and the hotspots of construction are Albania, Serbia, The Former Yugoslav Republic of Macedonia and Bosnia and Herzegovina; 91% of those under construction are projects with a planned installed capacity below 10 megawatts (MW) for which no Environmental Impact Assessment (EIA) is required².

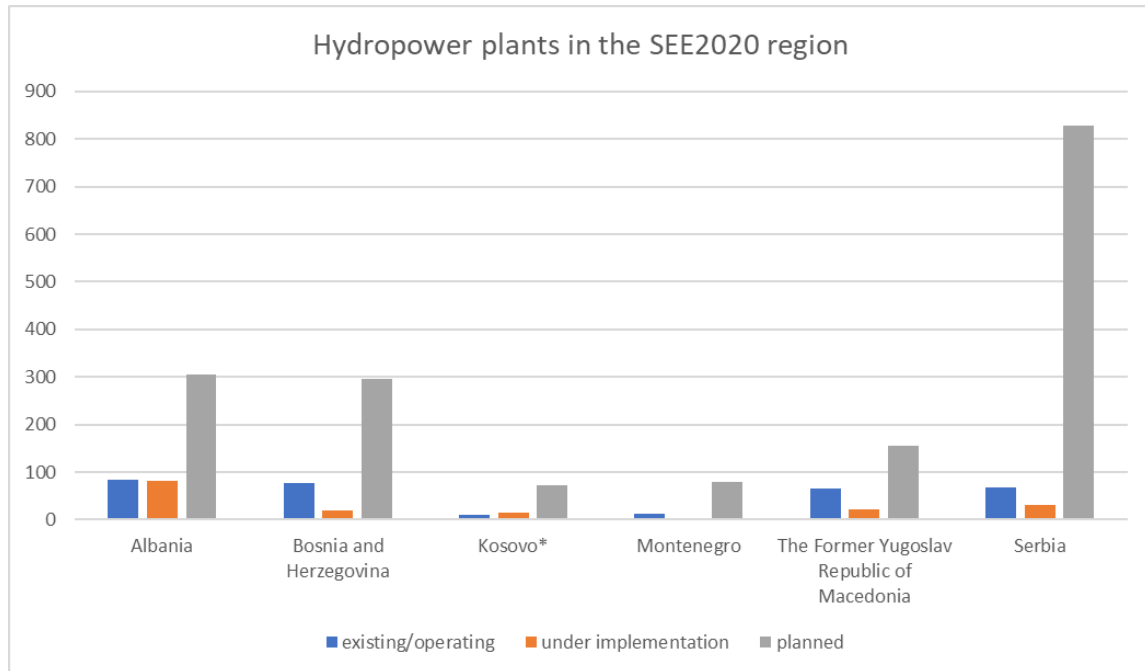
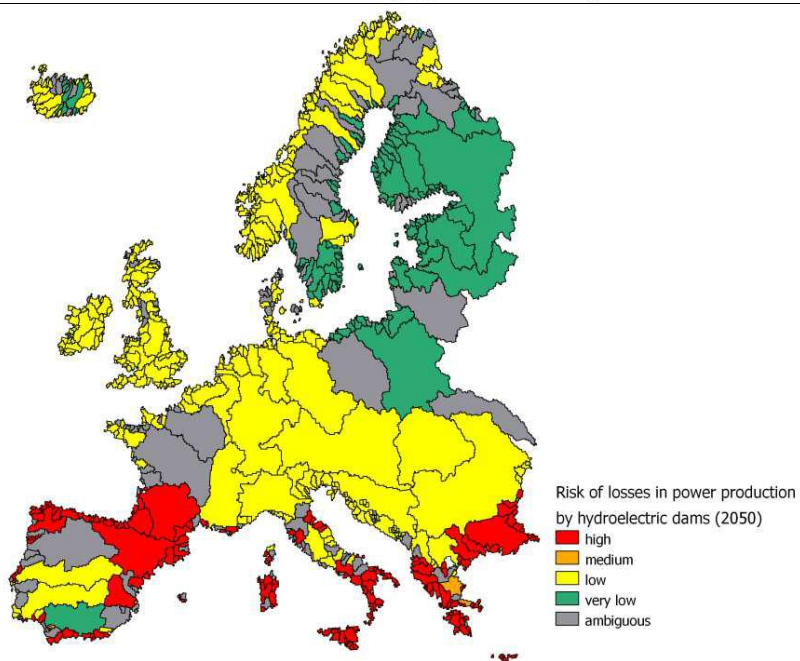
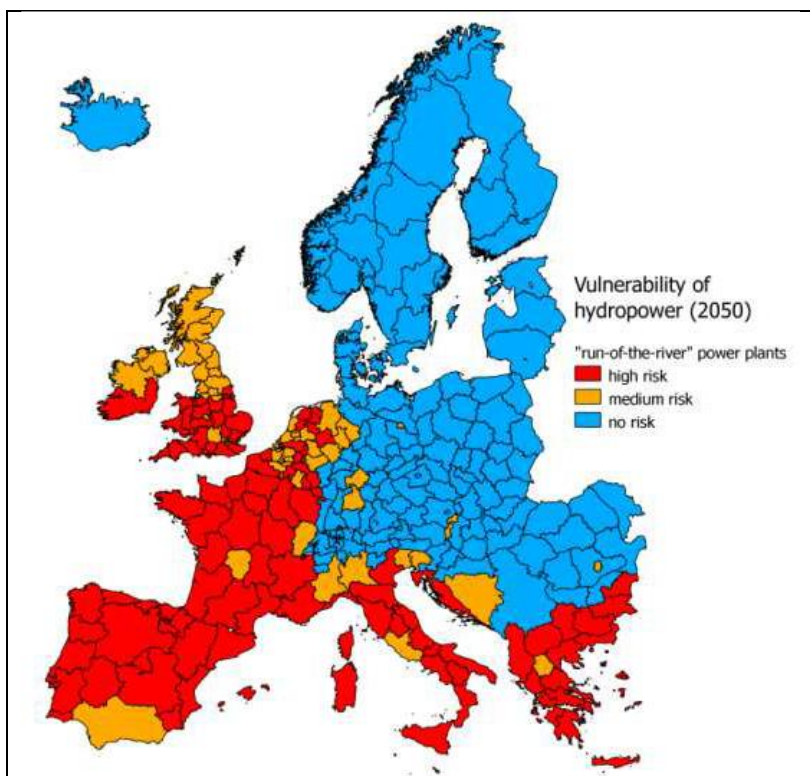


Figure 28: Hydropower plants in the SEE2020 region⁴¹.

Regarding future projections, it also relevant that power production in the SEE2020 region will be affected by climate change, with relatively higher impacts on hydropower in Albania and The Former Yugoslav Republic of Macedonia, and significant effects on thermal power production. Energy balance will be affected by decreased river discharge and increased summer energy consumption⁴².

² 2017 data from

<https://balkanrivers.net/sites/default/files/Hydropower%20development%20in%20the%20Balkans%202017.pdf>.



Figures 29 and 30: Vulnerability of hydropower production, in (top) run-of-the river power plant, and (bottom) reservoir stations in 2050⁴³.

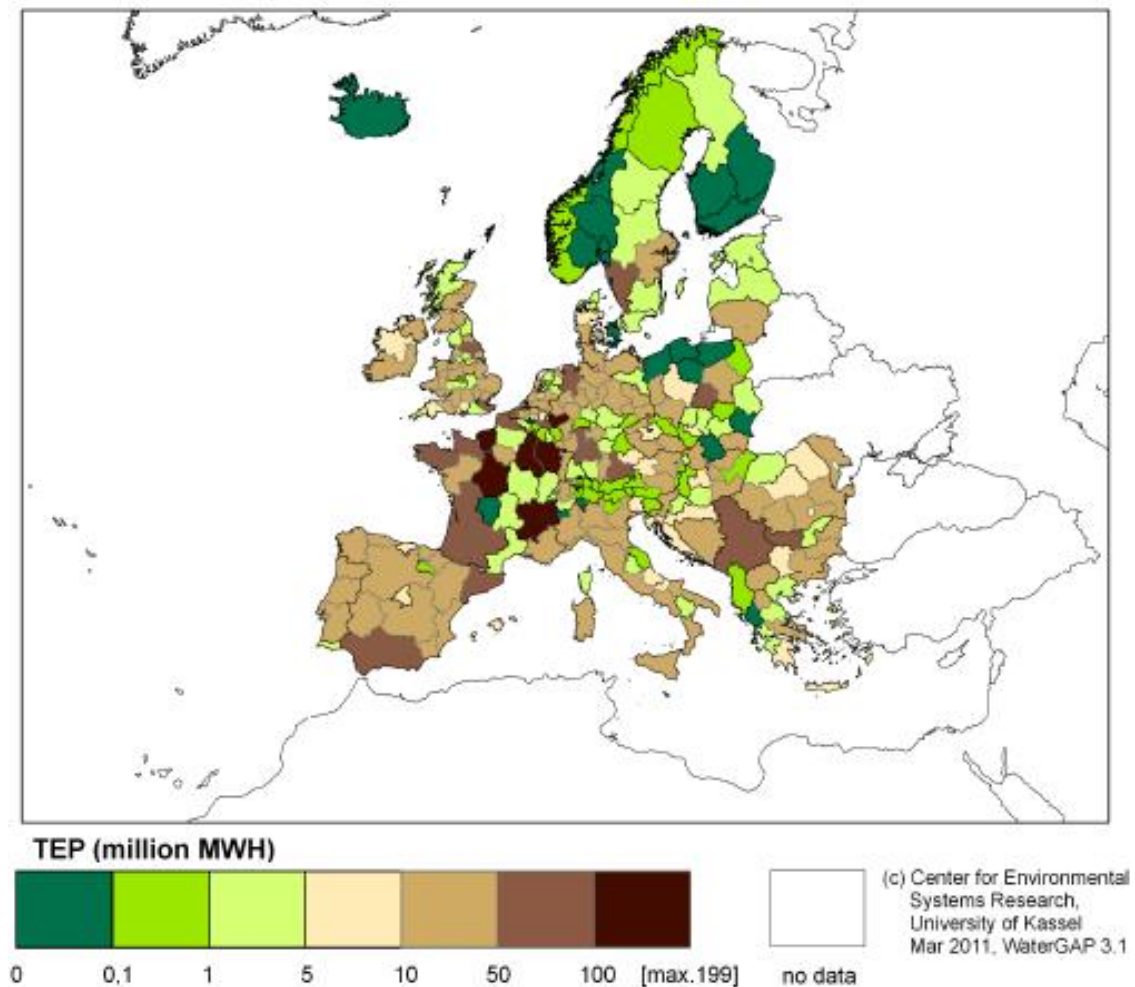


Figure 31: Potential thermal electricity production (TEP) affected by severe drought in Economy First Scenario for the 2050s⁴⁴.

Residential buildings are the largest single consumer of energy in the Western Balkans. Energy is used mainly for heating, though use of electricity for air conditioning and appliances is growing. Thus, household energy consumption will play an important role in shaping environmental impacts, in particular those arising from energy production. In Albania, The Former Yugoslav Republic of Macedonia and other parts of the region, many households use inefficient electric heaters. Fuel wood and coal is also widely used for heating in some of the economies (e.g. Albania, The Former Yugoslav Republic of Macedonia), usually by poorer households in both urban and rural areas: these fuels contribute to both indoor and local air pollution. Unregulated cutting of fuelwood can contribute to deforestation and biodiversity loss⁴⁵.

Bosnia and Herzegovina, Kosovo* and Serbia show the lowest energy efficiency ratio within the SEE2020 region, whilst Albania has the lowest energy consumption per capita and economic growth, even bearing in mind the losses in the energy transmission which are about 35-45%. Neighbouring Economies consume even larger energy amounts per capita but show higher efficiency per economic growth than Albania. All SEE2020 economies have

improved their energy efficiency since 2011, in comparison with economic growth, with The Former Yugoslav Republic of Macedonia showing the most significant and steady decline.

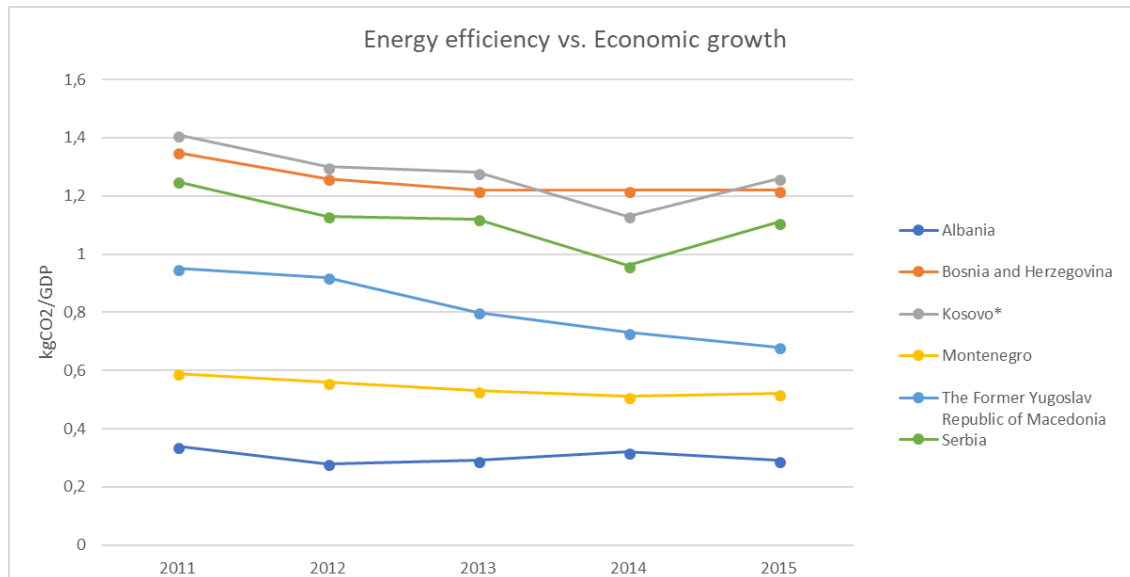


Figure 32: Evolution of energy efficiency compared to economic growth in the SEE2020 economies⁴⁶.

The trend in energy consumption per capita is less clear. Whilst all economies have increased the efficiency/capita between 2011 and 2015, The Former Yugoslav Republic of Macedonia is the only one which presents a clear and significant trend.

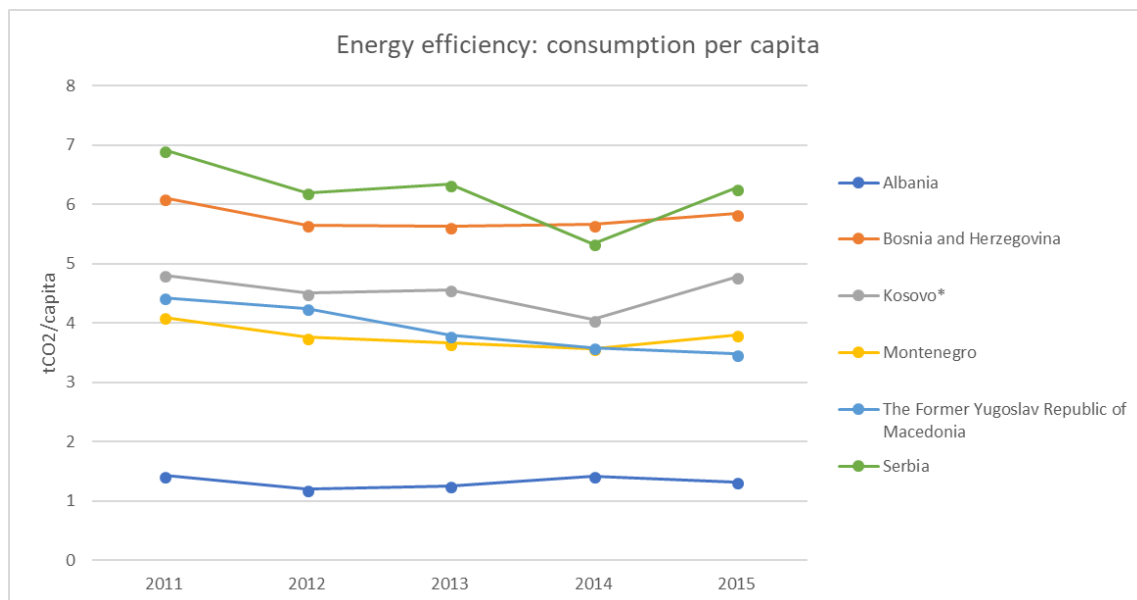


Figure 33: Energy efficiency in the SEE2020 region: energy consumption per capita (tCO₂)⁴⁷.

3.1.4. Agriculture and food

The landscape in the Western Balkans is very diverse and includes mountains, major river valleys and wetlands, large farming areas, Mediterranean coastal zones and urban and

industrial areas. The SEE2020 region is predominantly characterised by forestry and agricultural landscapes, which usually cover 90% of the territory. In some economies, forest areas are more relevant (Albania, Bosnia and Herzegovina, Kosovo*, Montenegro) and in others agricultural are more prominent (Serbia, The Former Yugoslav Republic of Macedonia).

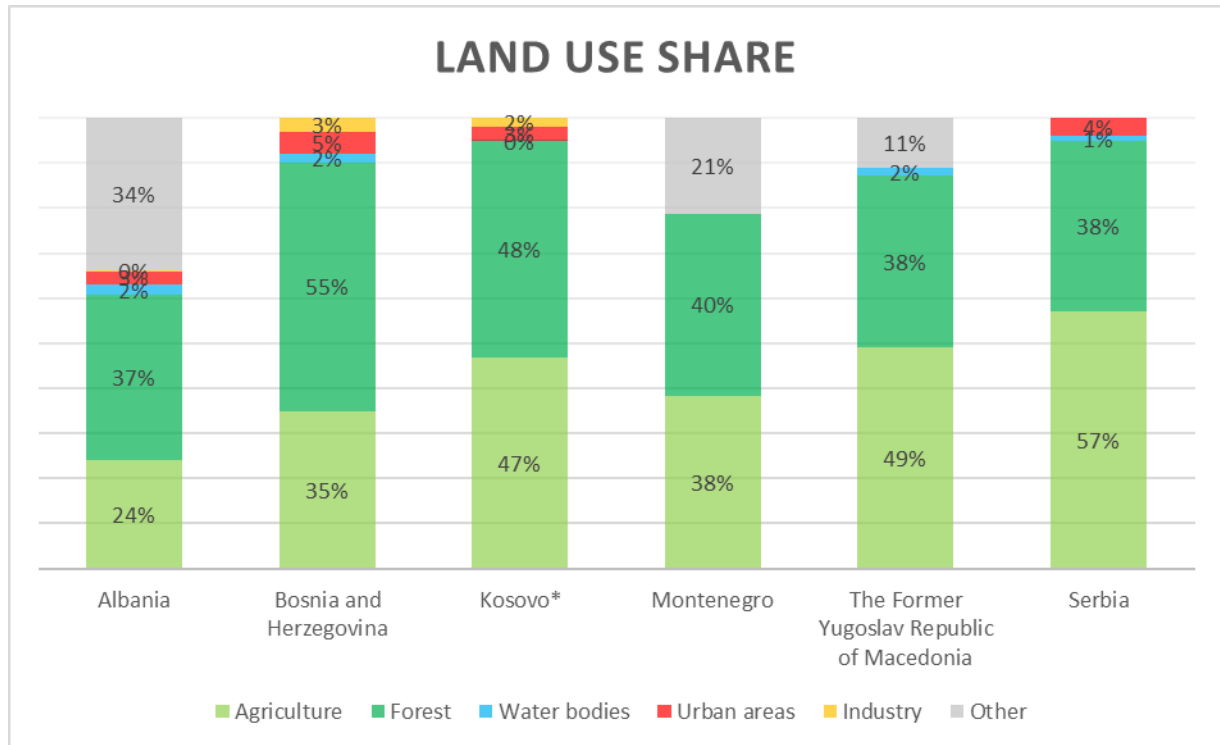


Figure 34: Land use share of the SEE2020 economies⁴⁸.

In recent years, key trends include a decline in farmland and growing sprawl in both urban and coastal areas. In several Economies, including The Former Yugoslav Republic of Macedonia, Montenegro and Serbia, mining remains a major economic and landscape-forming activity. Studies of future land use in the Western Balkans are not available⁴⁹.

Irrigation areas are a fundamental component in the SEE2020 economies' agriculture. Whilst Albania has the least modernized irrigation systems across the Mediterranean (90% surface and 10% sprinkler irrigation) with a low energy consumption associated, the rest of the economies show higher values (Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia and Serbia: 37% sprinkler and 62% drip irrigation). Agricultural intensification via the extension of irrigation systems could lead to significantly increased water demands from 414 as baseline up to 1,885 million m³/yr (multiplication by 4.5) and to a duplication of energy demand and associated CO₂ emissions from 25,802 (baseline) to 41,031 tCO₂e in the 'fully pressurized' scenario⁵⁰.

It should be noted that in some areas (i.e. Drin in The Former Yugoslav Republic of Macedonia), irrigation practice struggles with poor technical conditions, poor or even no

maintenance, not fully constructed, insufficient and poor hydromechanical equipment, large number of water users, small size of the plots, bad financial situation of the Water Management Organisations, low Law enforcement, huge water losses, poor services, low revenue collection rates, decreasing demand from farmers, low institutional capacity of WMOs, bad overall management in water sector etc⁵¹.

Agriculture can also be affected – positively and negatively - by the climate change-induced intrusion of sub-tropical climate further to the north, leaving coastal and southern areas very hot and dry during the summer season which is expected to have prolonged duration from near future to the end of the century⁵².

Agricultural run-off is a problem in many parts of the Western Balkans. Agriculture is the largest contributor of nitrogen pollution to groundwater and many surface water bodies, as nitrogen fertilisers and manure are used on arable crops to increase yields and productivity. In the 1990s, conflict and economic crisis reduced the pollution from agriculture, but fertiliser use has increased in recent years. Since 2000, water pollution levels have been largely steady. Forward-looking indicators of water pollution have not been identified for the region⁵³. Organic farming is of low relevance within the SEE2020 economies, with 14,358 ha in Serbia and 3,245 ha in The Former Yugoslav Republic of Macedonia⁵⁴.

In the Western Balkans, traditional patterns continue to influence household food choices — for example, strong ties to rural areas and family farms. Food expenditure represents a high proportion of total household expenditure in Kosovo*⁵⁵. New consumption patterns, facilitated by new supermarkets and processed food products, are spreading quickly and are expected to raise environmental impacts related to food. Albania, Bosnia and Herzegovina, Montenegro and The Former Yugoslav Republic of Macedonia are net importer of agricultural and food products⁵⁶. The future of food consumption patterns in the region and any related environmental and health problems will be tied to a series of drivers. One will be the evolution of cultural patterns, such as preferences for locally grown food and traditional products. Markets and business, including decisions by large retailers and advertising by food companies, will be another important force. Government policies and individual actions and can also play a key role. No trend analysis of the links between food consumption patterns and the environment is possible, due to data gaps⁵⁷.

FAO⁵⁸ estimates the number of 'severely food insecure people' for the 3-year-period 2014-2016 at 300,000 in Albania, 100,000 in Bosnia and Herzegovina and Serbia, and less than 100,000 in Montenegro. Data for The Former Yugoslav Republic of Macedonia are not reported and not available for Kosovo*. On the other extreme, obesity is increasing, with now covering between 4.6% (Bosnia and Herzegovina) and 8% (Serbia) of children and adolescents⁵⁹.

3.1.5. Ecosystems and biodiversity

The SEE2020 region hosts important ecosystems and biodiversity, including important freshwater ecosystems such as lakes, (free-flowing) rivers and aquifer-systems like the Dinaric Karst.

The Western Balkans hold a wealth of animal and plant diversity, including many endemic species and habitats. This biodiversity has faced a series of threats, including a sprawl of built-up areas in urban and coastal zones, mining activities and unregulated hunting and timber cutting. At the same time, governments in the region have taken a series of steps to protect species and habitats. In particular they have increased the share of their territory designated as protected. Predictive or forecasting indicators for ecosystems and biodiversity in the region are not available⁶⁰, thus no projections can be provided for the future evolution of biodiversity.

Overall, 500 protected areas have been identified in the SEE2020 region in 2018, with an important variety between Serbia (332 protected areas) and Montenegro (9). Albania (17.74% in 2018) is the economy with the largest share of protected areas, followed by The Former Yugoslav Republic of Macedonia (9.65%), Serbia, (6.61%), Montenegro (6.4%), and Bosnia and Herzegovina (1.4%)⁶¹. Albania has experienced a significant increase of its protected areas between 2003 and 2013.

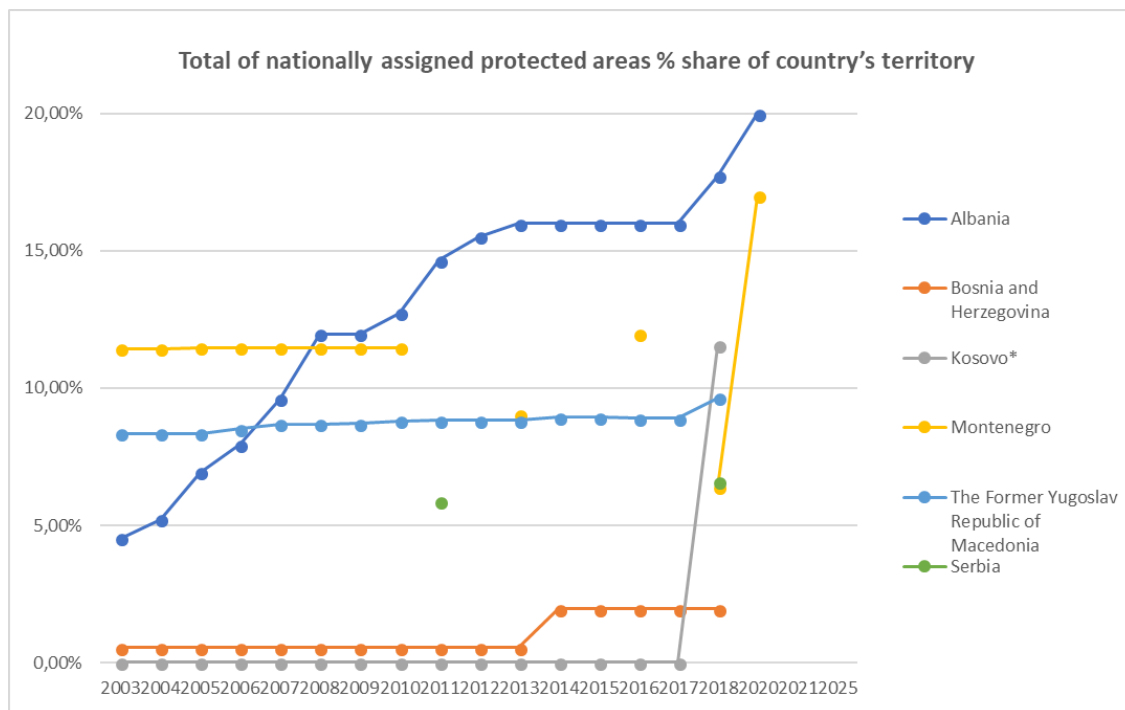


Figure 35: Protected areas as a share of the territory⁶².

The Former Yugoslav Republic of Macedonia reports on small hydropower plants and water storage in river beds, as well as land abandonment being the most important causes of biodiversity decline.

3.2. Benefits, trade-offs and conflicts among Nexus sectors

The Nexus in the SEE region is strongly influenced by a number of drivers, which are only partially dependent on decisions taken by the SEE economies, and which provide to the Nexus a dynamic context. The main relevant drivers⁶³ are:

- **Climate change.** The main impacts of climate change are increased frequency and intensity of summer droughts and heat waves, leading to more frequent wildfires, an increased intensity of extreme weather events such as storms and floods, as well as higher average temperatures resulting in changes in flora and fauna.
- **Societal and economic transformation.** During the last decades, the SEE economies have undergone a rapid economic development and transformation. The former socialist governance and centrally planned economic system have been replaced by democracy and market economy. This has triggered sometimes unbalanced, but generally rapid economic development, leading to higher income of the population and an increased level of investment in private businesses, private housing as well as in public infrastructure, with public institutions still in the process of adapting to regulation and governance.
- **Increasing energy and food demand,** both for domestic consumption and export. The energy demand is particularly high for renewable energy, such as electricity from hydropower and wood for heating, and emerging for solar and wind power.
- **EU Integration.** SEE economies are involved in the process of EU integration, with the goal of eventually becoming member states of the EU. This process is driving the legal and institutional development and provides significant funding for capacity building and increasingly for investments into infrastructure. The EU integration is also leading to an intensification of agriculture as preparation for joining the CAP, which is not necessarily in line with the EU strategy for a low-carbon economy⁶⁴, within the 2030 climate and energy policy framework⁶⁵.

3.2.1. Benefits

The following benefits⁶⁶ can derive for the SEE2020 region from applying an integrated approach to the Nexus:

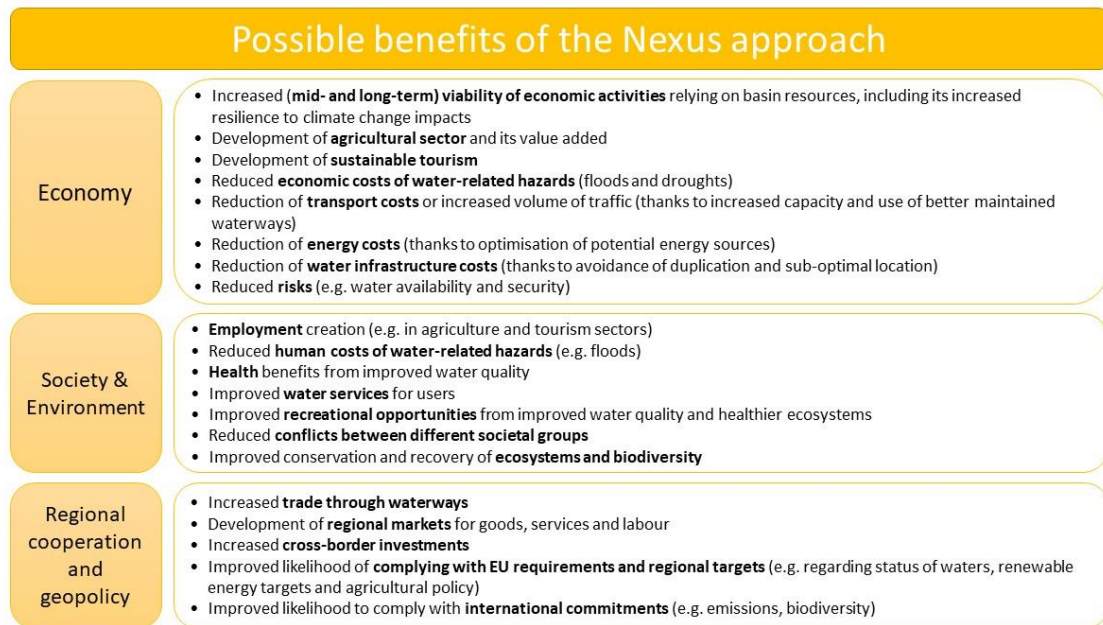


Figure 36: Possible benefits of the Nexus approach.

Economic benefits:

- Increased (mid- and long-term) viability of economic activities relying on basin resources, including its increased resilience to climate change impacts. If climate change and competing sector's interests/objectives and regulation are taken into consideration in planning and management, the economic activities – e.g. hydropower, irrigation, recreation – will reduce their needs to continuously adapt, and thereby fulfil the set targets, and avoid additional investment costs whilst operating, or even operational closures (e.g. during drought or flood events);
- Development of agricultural sector and its value added, e.g. fostering adequate integrated rural development, and avoiding competition on natural resources;
- Development of sustainable tourism, based on an integrated approach of economic development, whilst preserving/recovering biodiversity, landscapes and water quality;
- Reduced economic costs of water-related hazards (floods and droughts), in agriculture, energy production or other economic sectors;
- Reduction of transport costs or increased volume of traffic (thanks to increased capacity and use of better maintained waterways);
- Reduction of energy costs (thanks to optimisation of potential energy sources);
- Reduction of water infrastructure costs (thanks to avoidance of duplication and sub-optimal location);
- Reduced risks (e.g. water availability and security) for all economic sectors, including failure or reduction of operations.

Social and environmental benefits:

- Employment creation (e.g. in agriculture and tourism sectors);
- Reduced human costs of water-related hazards (e.g. floods), due to proper prevention, protection, preparedness and recovery measures;
- Health benefits from improved water quality;
- Improved water services for users, such as water supply, treatment, sewage, wastewater treatment;
- Improved recreational opportunities from improved water quality and healthier ecosystems;
- Reduced conflicts between different societal groups, e.g. on resource allocation;
- Improved conservation and recovery of ecosystems and biodiversity.

Regional cooperation and geopolitical benefits

- Increased trade through waterways;
- Development of regional markets for goods, services and labour;
- Increased cross-border investments, as to a better and more integrated assessment of investment opportunities and a reduction of related risks;
- Improved likelihood of complying with EU requirements and regional targets (e.g. regarding status of waters, renewable energy targets and agricultural policy);
- Improved likelihood to comply with international commitments (e.g. emissions, biodiversity).

3.2.2. Trade-offs and conflicts

The following main conflicts and trade-offs in the SEE2020 region have been identified between the different Nexus Water-Energy-Food-Ecosystems sectors:

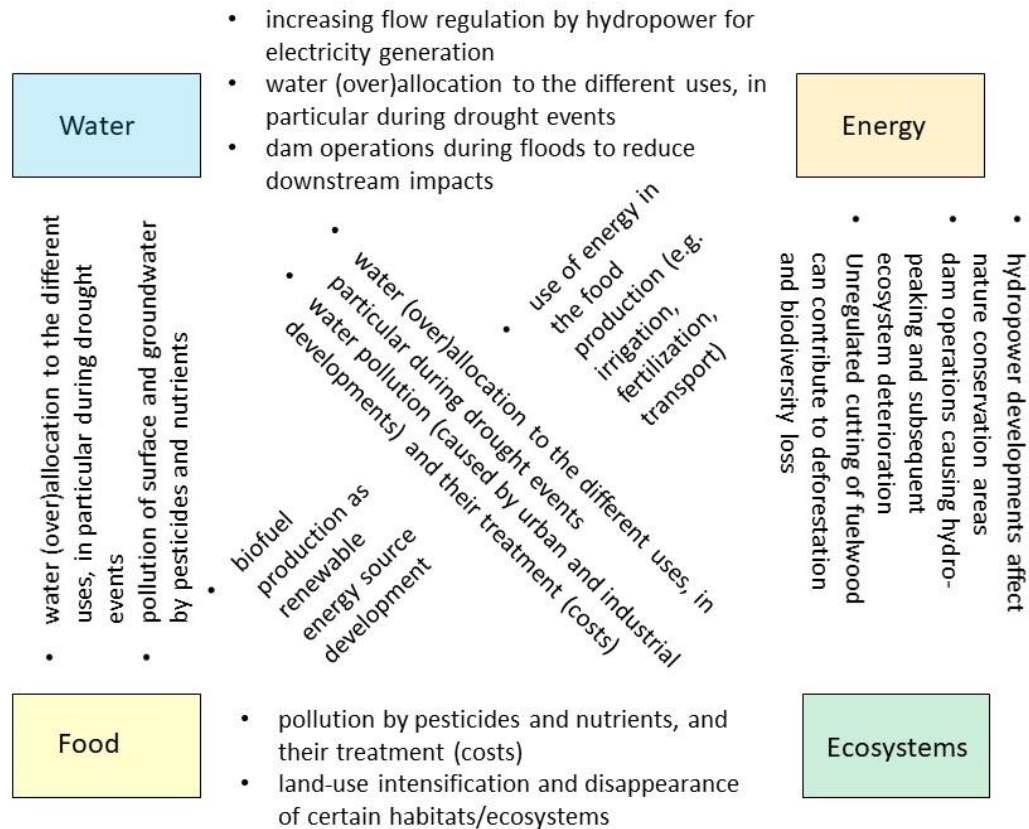


Figure 37: Main conflicts and trade-offs between the Nexus sectors⁶⁷.

- **Water-Energy:** The main conflicts are about a) increasing flow regulation by hydropower for electricity generation, b) water (over)allocation to the different uses, in particular during drought events, and c) dam operations during floods to reduce downstream impacts. These conflicts can lead to energy production reduction during times of limited or high water availability, such as droughts or floods, and to negative effects on the freshwater ecosystems.
- **Water-Food,** with conflicts on a) water (over)allocation to the different uses⁶⁸, in particular during drought events, b) pollution of surface and groundwater by pesticides and nutrients. Such conflicts can be created by building up too high water demand expectations and result in water shortages, in particular during droughts. Water pollution can have effects on all (other) water uses, including drinking water, but also water-related economic and social activities such as recreation and fisheries.
- **Energy-Food,** with a) biofuel production as renewable energy source development; and b) an increasing use of energy in the food production (e.g. irrigation, fertilization, transport). As consequence of such conflicts, the agricultural energy demand can place supply risks to all users and increase the costs of farming. Biofuel

production might compete with food production, and thus result in gaps in food availability.

- Energy-Ecosystems, with main conflicts on a) hydropower developments affect nature conservation areas, and b) dam operations causing hydro-peaking and subsequent ecosystem deterioration. The effects might be a deterioration of freshwater ecosystems, and their related ecosystem services. In chapter 3.1.3, information on the magnitude and examples of this conflict have been provided.
- Food-Ecosystems, with main conflicts on a) pollution by pesticides and nutrients, and their treatment (costs), b) land-use intensification and disappearance of certain habitats/ecosystems. Agricultural intensification can lead to a deterioration of ecosystems and biodiversity loss, and a deterioration of related ecosystem services, which have been previously provided.
- Water-Ecosystems, with main conflicts on a) water (over)allocation to the different uses, in particular during drought events, b) water pollution (caused by urban and industrial developments) and their treatment (costs), and c) unregulated cutting of fuelwood can contribute to deforestation and biodiversity loss. The main effects of these conflicts are the deterioration of ecosystems and biodiversity loss, as well as deterioration of related ecosystem services, which have been previously provided.

Hydropower is a key driving force causing river and habitat continuity interruption in the Sava river basin, representing 78% of all interruptions. Of the 31 barriers, 28 are dams. Significant number of hydropower dams is also present in the Drina River sub-basin (sub-basin of the Sava river basin). Chain of dams on the Drina River consists of large dams Višegrad (Bosnia and Herzegovina), Bajina Bašta and Zvornik (Serbia). Zvornik is a single dam equipped with fish migration aid, but its performance should be monitored. The key migration route for migratory fish species in the Upper Sava (between 42.9 and 189.7 km from the river source) is interrupted, impacting the development of self-sustaining populations. Fish migratory routes are also interrupted in the tributaries, e.g. by dams on tributaries: Sotla/Sutla, Kupa/Kolpa, Dobra, Una, Vrbas, Pliva, Lašva, Spreča, Bosut (gate), Drina, Čehotina, Piva, Uvac, and Lim.

Box 1: Examples of trade-offs from hydropower in SEE

Trade-offs usually result in a deterioration of those sectors and services which are less politically/economically powerful and/or present a weaker regulation/implementation. Usually trade-offs over-use provisioning services (e.g. freshwater abstraction, energy generation and fish captures) on the expense of the other ecosystem services (such as Regulating services: climate, water, natural hazard and disease regulation, water purification and waste treatment; Supporting services: nutrient cycling and primary production which underlie the delivery of all the other services but are not directly accessible to people; and Cultural services: Recreation and ecotourism services), and easily result in ecosystem deterioration as a first step. Conflicting uses and trade-offs call for concerted efforts to accommodate the different sectors needs and to promote synergies.

3.2.3. Insecurities

Nexus insecurities are negative effects of the relation between the different Nexus sectors, which usually affect the poorest first and most. The following specific **Nexus sector insecurities** have been detected during this study in the SEE2020 region:

- Energy insecurity during drought time in those areas/economies, where hydropower plays a relevant role (i.e. Albania, The Former Yugoslav Republic of Macedonia), and which is (partly) being overcome by additional energy imports. The magnitude of electricity generation affected is up to 50% of the production during years with lower water availability.
- Food insecurity during drought time as a result of limited irrigation water availability, reported for Albania and The Former Yugoslav Republic of Macedonia, with no indication of magnitude, and temperature increases; since evaporation increases with temperature, aridity will increase in many areas, which will have direct negative impact to agricultural activities.
- Food insecurity as a result of floods and agricultural land (in floodplains) being flooded, with no indication of magnitude.
- Increased water insecurity due to changed climate, including more powerful, intense storms and floods and more intense droughts; it is predicted that extreme events will occur more often; floods and droughts that previously occurred once in a lifetime, every 50 years, may now occur every 5 or 10 years. Lack of water will be especially significant in summers, during tourist season and intensification of water consumption⁶⁹.
- Biodiversity loss and associated deterioration of ecosystem services.

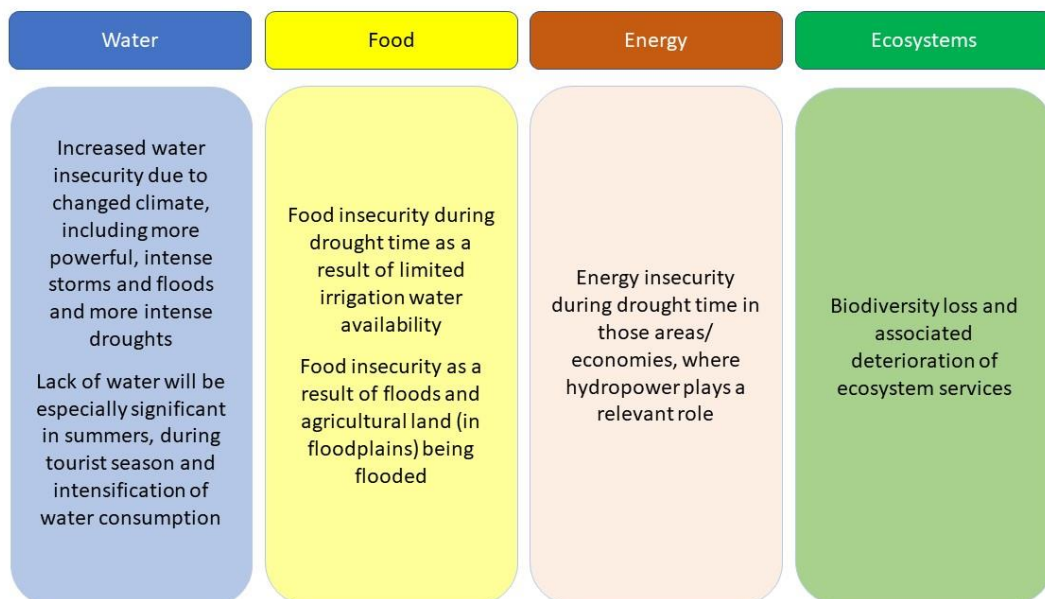


Figure 38: Nexus insecurities are negative effects of the relation between the different Nexus sectors.

SEE2020 economies provided data, analysis and proposed measures related to climate change issues, adaptation and mitigation that reflect an extra effort to protect small stakeholders⁷⁰.

3.3. Policy and institutional integration of the Nexus approach in natural resources management

Following the established principles, opportunity areas, recommended actions and benefits, this Study examines in detail the following actions, which can be taken to address Nexus conflicts:

- Establishment of coordination bodies or instruments, as well as changes in the **administrative set-up**, including Capacity Building;
- Consideration of people's needs e.g. by the active involvement of **stakeholders** and the establishment and use of multi-stakeholder platforms;
- Turning **Nexus trade-offs to synergies** - including nature-based solutions and green infrastructure - within policy, regulation and management, by properly considering the (other) sectors;
- Integration of **climate resilience** aspects in sector policy, regulation and management;
- Integration of **resource use efficiency** aspects – including circular economy like water reuse - in policy and regulatory development, including management decisions;
- Contributions made by **international institutions** and their initiatives/projects;
- Changes driven in/by **transboundary water management**.

The following efforts and initiatives of integration of the Nexus in the management of natural resources in the region have been identified, with overall a rather limited impact.

3.3.1. Establishment of coordination bodies or instruments

In general, the assessed SEE2020 economies have an established administrative system where several authorities share the competencies for the specific Nexus sectors, with one 'line' authority leading initiatives. At the highest level, this is usually a Ministry, with a number of agencies and institutions in supporting roles, e.g. for monitoring (Albania). Some interesting cases are:

- Bosnia and Herzegovina: Given the unique administrative complexity of Bosnia and Herzegovina, the administrative set-up for the different Nexus sectors involves a large variety of administrations. There is no overall coordinating institution to address the Nexus interactions, and additional need for coordination is likely needed.

- Kosovo* has a rather traditional set-up with the water resources management split between different Ministries: The Ministry of Environment and Spatial Planning (MESP) is legally assigned with the key responsibilities in the areas of environment and spatial planning, including also water resources. The Ministry of Economic Development is responsible to prepare policies on Energy Efficiency and Renewable Energy Sources in compliance with respective EU Directives. The mandate of the Ministry of Agriculture, Forestry and Rural Development covers irrigation development, and it takes part in activities of protection of the environmental that have to do with forestry, hunting, fishing and the management of resources of the water.

The Agency for Water Resources of the Albanian Water Council has been established with the Water Council and has been the executive body of the NWC since 1996. By decision no. 775 dated 28.10.1996 the Council of Ministers decided to establish the Water Council as the central decision-making body for the management of water reserves. Also, with this decision, the Technical Secretariat was established as the executive body of the NWC.

The Albanian Government, after 2014, developed a new approach to sector coordination. Thus, by decision no. 230 dated 23.04.2014 "On the composition and manner of organization and functioning of the Technical Secretariat of the Water Council" changed the structure and organization of the Secretariat, recently renamed as Agency for Water Resources. It is a public legal institution with headquarters in the Prime Minister.

Subsequently, by decision of NWC no. 1 dated 09.07.2014, the internal regulation on the organization and functioning of the Water Council Technical Secretariat was also approved. Based on this regulation, the Secretariat has as its object the design and establishment of the integrated water system as well as monitoring and guaranteeing the efficient functioning of integrated management of this system.

Box 2: Albania's Water Secretariat

- Montenegro: There is a line ministry for water affairs (Ministry of Agriculture and Rural Development - MARD), which is authorized to propose the establishment of water policy and to implement it, and to perform international cooperation. The Ministry of Sustainable Development and Tourism (MSDT) through the Directorate for Environment and the Directorate for Utility Services is responsible for reporting on the quality of environmental segments, including water as utility activities, water supply and urban waste water treatment and treatment (Directive 91/271 / EEC), as well as the Marine Strategy Directive 2008/56 / EC. The Ministry of Economy is in charge of the energy sector, including energy efficiency. Furthermore, there is an inter-ministerial Council for Sustainable Development and Climate Change, which has recently met the last time (end 2017), as official body for intersectoral coordination.
- The Former Yugoslav Republic of Macedonia: The new Law on Waters (2008), which transposes the EU WFD, transferred competencies on water resource management from the Ministry of Agriculture, Forestry and Water Economy to the Ministry for

Environment and Physical Planning. The Law on determination of the water services pricing included an additional institution in the water management system. It tasks the Energy Regulatory Commission (ERC) of The Former Yugoslav Republic of Macedonia with competences to determine tariffs for water and energy management services.

- Serbia: The Ministry of Agriculture, Forestry and Water Management holds strong competencies in the Nexus, and the Ministry of Environmental Protection and the Ministry of Mining and Energy deal (mainly) with the rest of Nexus competences.

The economies usually lack Nexus coordination bodies and instruments, which could manage trade-offs and promote synergies. In some administrative set-ups, partial coordination bodies have been identified:

In order to advance the water sector reform, the Government of Kosovo* has established the Water Task Force (WTF) in 2008. WTF was an inter-ministerial decision-making body with the tasks to advance the water sector related policy and strategy framework and related action plans and to serve as platform coordinating the efforts of the domestic and external actors in reforming the sector (<http://www.kryeministri-ks.net/tfu/?page=2,1>).

During the 3rd meeting of the WTF on March 24th, 2010 it was agreed that the WTF should be transformed in a more permanent institution. Accordingly, an Inter-Ministerial Water Council (IMWC) was introduced in the draft of the new water law that was ultimately approved by the Parliament in March 2013 and promulgated by the President in April 2013. Consequently, the Government of Kosovo* decided to establish the IMWC in its Cabinet meeting of September 19th, 2013. Based on this decision, the IMWC is anchored at Prime Minister Level, made up of Ministers and ensures the overall coordination of water sector development.

According to the provisions of the water law (articles 15-19), the “IMWC is a coordinating and decision-making body that examines the systematic issues of water, harmonization of the different needs and interests, and proposes measures for the development, utilization and protection of water resources and system of Kosovo”*. In terms of highest pertinence, the IMWC members shall consist of the Ministers of Economic Development, of Environment and Spatial Planning, of Local Government Administration and of European Integration (four Line Ministries) and headed by the Prime Minister. Donors (Switzerland as lead coordinator of water donor community, plus another active sector donor) are non-voting members of the IMWC.

The Council has its Secretariat which is supported by the Swiss Cooperation Office through two full-time permanent advisors and two part-time intermittent advisors (a legal expert and a water economics expert) seconded to the Office of the Prime Minister, as well as an administrative assistant and other international and short-term experts, as per needs. These advisors and experts shall actively and regularly assist on demand the IMWC in its work and report to the IMWC Chairperson.

Box 3: Kosovo’s “Inter-Ministerial Water Council”

- Albania: The Water Secretariat – recently renamed as “Agency for Water Resources” - is the main inter-institutional body responsible for drafting policies and plans for integrated water resources management, acting under the law 111/2012. It is chaired by the Prime Minister of Albania and composed of seven main stakeholder

ministries. River Basin Councils headed by prefects of the regions, act as the administrative bodies; each is responsible for the protection, development, distribution and operation of water resources within its own basin boundaries. Furthermore, an “Inter-ministerial Working Group on Climate Change” aims to coordinate different energy/emission related policies, which also affect water and agriculture.

- Bosnia and Herzegovina: There is no officially established body that coordinates the relationship between entity and government in a state. However, an inter-entity body dealing with environmental issues has been formed, involving representatives of the Ministry of Foreign Trade of Environmental Relations, the Ministry of Physical Planning of Construction and Ecology in the Government of the Republic of Srpska and the Federal Ministry of Environment and Tourism (FBiH).
- Kosovo*: Article 15 of the new Law on Waters defines the establishment of an Inter-Ministerial Water Council (IMWC) as an independent body that shall act as coordinating and decision-making body in order to further promote the development of Kosovo’s* water sector.
- Montenegro: Though the Water Council was created in the Water Directorate, its formation is still in the planning procedure, and there is no information on criteria for the selection of representatives of various sectors.
- The Former Yugoslav Republic of Macedonia: In the agricultural sector, partly vertical and horizontal coordination is achieved through the Council for Agriculture and Rural Development. The Council of Water is established with the aim of consideration of water management issues, harmonization and coordination of different needs and interests regarding waters, as well as proposing various measures for preserving the protection and continuous improvement of the water regime in the territory of The Former Yugoslav Republic of Macedonia. It is an advisory body consisted from 9 representatives from different institutions; and the mandate of the representatives is of 3 years. The Council for nature protection is established for the purpose of monitoring, achieving, and promoting the protection of nature and the utilization of natural wealth.

The Council for Agriculture and Rural Development of The Former Yugoslav Republic of Macedonia is a consultative mechanism for policies and programs. The Council encompasses participation of a variety of stakeholders (19-members) as representatives of agricultural associations, central government institutions, economic chambers, and representatives of academic institutions in the agriculture sector, processing and wine sector, association of consumers, association in the area of environmental protection and representative of LSG units. The Council gives an opinion in the area of agriculture and rural development, especially for the Strategy for rural development and Programs, the proposed significant regulations and international agreements, separate projects and other issues in the field of agriculture and rural development. The mandate of the representatives in the Council is 5 years.

Box 4: The “Council for Agriculture and Rural Development” of the Former Yugoslav Republic of Macedonia: A body to overcome Nexus trade-offs

- Serbia: Connections between different ministries are established based on current problems in the sectors. There is no official established body that coordinates connectivity between institutions. However, the sector of environment is working closely with sectors of agriculture and energy due to the activities related to Chapter 27 (negotiation for pre-accession of Serbia to the European Union).

Specific coordination action has furthermore been in place for the set-up of strategies and plans, such as the drafting of the Sava River Basin Management Plan or the Rural Development Programmes, though it is unclear how strong the integration of the different Nexus sectors has been and how it has focused on synergies beyond negotiations/trade-offs. Policy development via regulation, strategies or plans is characterised by:

- More or less formal cooperation, which does however not necessarily translate into policy integration;
- Isolated efforts;
- Lack of common targets;
- Overlapping responsibilities and competing objectives among local and central governments.

The following overview can be provided:

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Nexus coordination body	no	no	no	yes	no	no
Coordination between some Nexus sectors	no	yes	no	yes	yes	yes
Multi-sector Water Council	yes	no	yes	no	yes	yes
Consultative Council for Agriculture and Rural Development	no	no	no	no	yes	no
Climate change coordination body	yes	no	no	no	yes	no
Nexus coordination instruments	no	no	no	no	no	No?
One authority for several Nexus sectors	no	no	no	yes	no	yes
Recent new administrative structures	no	no	yes	no	yes	no
Recent new distribution of competences	no	no	yes	no	no	no

Table 7: Overview on the administrative setup and coordination instruments for the Nexus in the SEE2020 region.

The capacities of management authorities are limited, in terms of human resources as well as regarding data and information. This has been detected during the data collection in the frame of this study and is also reported by other sources⁷¹.

Cross-sectoral and multisectoral analysis brings attention to the fact that the participation of a particular NGO or group of individuals tends to be focused on a narrow range of issues within the core interests of the participant. It is rare for example that a member of the

public has the capacity or the resources to dedicate participation in the full range of issues that are pertinent – though adjunct – to his or her campaign. This is true even where there is awareness of and familiarity with multisectoral approaches such as the nexus. It is more a matter of efficiency and the need to focus limited resources on priority matters than anything else. Consequently, the involvement of NGOs and the public take on a different character as the complexity of platforms and analytical frameworks increases. NGOs that attempt to have a representative character at such a complex level may witness a rise in challenges to their legitimacy and representativeness.

3.3.2. Consideration of people's needs

The Balkan Opinion Barometer⁷² provides useful insights to the people's needs. The majority is not satisfied with the economic situation (in particular in Bosnia and Herzegovina and Serbia), though a slight positive trend can be drawn since 2015; and the majority considers that the financial and economic growth situation will be similar within a year, except for Kosovo* where expectations are higher. The majority is either mostly satisfied or neither satisfied nor unsatisfied with the major problems of the economy, like health, education or services.

Products from domestic sources are strongly preferred above products from other SEE2020 economies or Western Europe; and the vast majority supports that governments give priority to local suppliers – though with a declining trend since 2015.

Regarding the environment, only a 36% of the surveyed 7,000 people for the Balkan Opinion Barometer considered climate change as a very serious problem, and in Kosovo* and Montenegro more than 20% consider it 'not a problem at all'. 65% of the respondents in 2016 would rather buy environmentally friendly products even if they cost a little bit more, whilst 30% would rather not. The overall figure can be considered as rather positive, but the previous Barometer in 2015 reflected a much more positive response (73% vs. 24%), showing a significantly lower interest in environmental topics in just one year, with marked negative changes in Albania, Bosnia and Herzegovina and Serbia, and positive trends in Kosovo* and The Former Yugoslav Republic of Macedonia.

The Barometer also assesses the willingness of SEE2020 citizens to take action for sustainability, and the responses reflect a rather low profile, with 21% not willing to take any action (ranging from 8% in Kosovo* to 30% in Bosnia and Herzegovina), and 32% willing to reduce or recycle waste (Albania 11% vs. Kosovo* 39%), 33% cutting down consumption (Kosovo* 35% vs. Albania 22%), 23% installing energy efficient household appliances and 2% moving to an energy supplier which offers energy from renewable sources. In general, Kosovo* respondents are more willing to take action, whilst willingness is low in Bosnia and Herzegovina and Albania.

The following insecurities (see chapter 3.2) shall be addressed in the integration of the Nexus:

- External energy and food dependency, and insecurities as consequences of drought and flood events;
- Water supply 'when needed';
- Safe sanitation.

The Aarhus Convention and EU legislation both provide an additional measure of support for coordination and cooperation across water-related sectors. The Sava River Basin Economies have developed extensive practice in the implementation of provisions related to access to environmental information and public participation in environmental decision-making. The definition of environmental information in the Aarhus Convention is broad enough to encompass most of the activities relevant to the nexus assessment. Aarhus Parties⁷³ are obliged to promote the application of the Aarhus Convention in international processes⁷⁴.

3.3.3. Turning Nexus trade-offs to synergies

In order to avoid trade-offs and foster synergies between the different Nexus policies, regulation, strategies and plans shall promote an early and wide integration of the aspects and concerns of the related Nexus sectors in own developments.

This assessment however shows that the integration is still at a rather low level:

- Usually the related Nexus sectors are briefly mentioned in the documents, as topics relevant to the concerned sectors strategy.
- A majority of documents provide a wider reference to the concerns of the proper sector regarding others (e.g. an agricultural strategy referring to needs such as water supply or risks as water availability reduction due to climate change; an ecosystem strategy requesting other sectors to take action for reducing impacts).
- Only a few documents address the effects of the own strategy on other Sectors (e.g. an energy strategy referring to ecosystem deterioration; or a biodiversity document to land-use restrictions for agriculture) and identify and assess opportunities (for establishing joint objectives and targets) or alternatives to overcome trade-offs.

Recent policy developments in the Water and Food/Agriculture sectors show a higher integration of objectives and targets of the other sectors, than Energy or Ecosystems, being the latter focused on ways to minimize the negative impacts of economic development on biodiversity.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water integrates Energy	medium	low	high	high	high	medium
Water integrates Food/Agriculture	low	low	high	high	high	medium
Water integrates Ecosystems	medium	high	low	low	low	high
Energy integrates Water	low	no	low	low	medium	no
Energy integrates Food/Agriculture	low	no	no	medium	low	no
Energy integrates Ecosystems	no	no	low	low	no	medium
Food/Agriculture integrates Water	high	no	low	high	low	no
Food/Agriculture integrates Energy	no	no	high	no	no	no
Food/Agriculture integrates Ecosystems	high	no	no	high	no	no
Ecosystems integrates Water	low	no	low	low	low	no
Ecosystems integrates Energy	no	no	no	medium	low	no
Ecosystems integrates Food/Agriculture	low	no	no	medium	low	no

Table 8: Integration of Nexus aspects in recent regulation, strategies or plans for the Nexus in the SEE2020 region.

Explanation: "high" indicates identification of synergies, "medium" indicates identification and assessment of conflicts, risks and constraints; "low" indicates inclusion of concerns, needs or supply aspects; and "no" none of the previous (only textual mentioning). Note that a more detailed analysis can lead to a higher scoring.

In the six economies, the following key references have been identified, and used to fill Table 8:

3.3.3.1. Albania

In Albania, integration is limited. Recent legislative changes include the 2014 Law on Territorial Planning, which aims for overall integrated development; the 2012 Law for Integrated Water Resources which refers e.g. to the use of water for the environment, economy and power generation; the 2015 Renewable Energy Law which refers to hydropower and water resources; and the 2013 Law on Permitting which also addresses water pollution.

The Albanian Water Resource Management Strategy describes in its chapter 1.3.5 the expected climate change effects on water resources. The main sources of information that were used to prepare the table with water used and water that will be used in 2027 are: a) the Master Plan for Water Supply and Sewerage for Albania - January 2013; b) the Third Communication of Albania for the UNFCCC (third draft); and c) Eftimi "Hydrogeological Characteristics of Albania" AQUA mundi (2010), including general information on hydrology and water resources of Albania. The main expected changes are that water resources are expected to decrease by 14% (EVN/Starkraft, 2009) by 2050; the frequency of high-impact flood event will be duplicated, seawater level will raise 1-2 cm by 2025 and 3-15 cm by 2050. However, the determination of the sector-specific impact and the mode of calculation is missing in the Strategy.

Box 5: Albania's Water Resource Management Strategy: how have projections been developed

Regarding strategies and plans, the Water Resource Management Strategy (2017-2027) of the Economy includes references to all other sectors (and includes significantly increasing

water demand forecasts, which pose ‘severe stress’ on the water resources); the Action Plan for Renewable Energy Resources in Albania (2015-2020) includes biofuel production; the Document of Strategic Policies for the Protection of Biodiversity in Albania (2015) asks to be an integral part of the planning and activities of other sectors. The Rural Development Programme (2014-2020) aims towards ‘sustainable utilisation of resources and climate action by forest and water resource management’ and is the only strategy/plan which refers to contributions to other sectors’ policies.

3.3.3.2. Bosnia and Herzegovina

Plans and strategies of the different sectors mention the other Nexus sectors, but do not provide an integration or the inclusion of strategies which can foster synergies. The exceptions are a) the ratification of the Protocol on Energy Efficiency and Related Environmental Aspects (thus addressing resource efficiency) and b) the adoption of the Sava River Basin Management Plan, aligned with the Water Framework Directive, and thereby integrating other sectors’ interests and concerns.

3.3.3.3. Kosovo*

The legislation on the different Nexus sectors in Kosovo* is mainly from the beginning of the 2000 decade; except the 2013 Law on the Water Information System. Numerous mentions and cross-references are included in the regulation, such as e.g. reference to Drainage and Irrigation management in Law 02/L-9, the references to sustainable protection of the environment and irrigation water management in L03/098 (Agriculture and Rural Development) and the Forest Law (2003/3) referring to biodiversity protection. However, the references focus mainly on concerns, thus have a low level of integration.

Regarding strategies and plans, all sectors have been subject of recently developed documents. The main purpose of the Kosovo* Water Strategy 2017-2036 is to provide sustainable development and utilization of water resources that are necessary for public health, environmental protection and socio-economic development, as well as to ensure water conservation. Integration is included in the Program for Agriculture and Rural Development 2015 as to produce renewable energy.

3.3.3.4. Montenegro

The hydropotential of the rivers is analysed in the Water Management Strategy (2017) through the total hydropotential of the rivers and technical feasibility, and it analyses required amount of water for irrigation of agricultural land. The Water Management Plan is in developing phase and it will include energetic aspect of the water use. Water resources planning and management is also characterised by weak integration of requirements to protect biodiversity (an example is issuance of concessions for the extraction of materials from river courses). The Energy Development Strategy of Montenegro by 2030 considers in detail the availability of water resources, and its potential as a renewable energy resource

on the main rivers as well as on the small basins for the mini hydropower plants. The energy development strategy only partially integrates agriculture through an analysis of the estimated energy consumption by 2030. Regarding biodiversity, the energy strategy aims to meet the needs for energy by minimizing costs and environmental impact, and to promote increased energy efficiency, increased security and quality of the electricity power supply. However, low success with mainstreaming biodiversity was achieved in the energy sector and spatial planning. The energy strategy and spatial plans for the development of large energy facilities have failed to provide for adequate assessment of important biodiversity features in proposing specific energy development projects. This, in particular, refers to planned utilisation of hydropower.

Additional biodiversity surveys were initiated after the release of draft Detailed Spatial Plan and related SEA (Strategic Environmental Impact Assessment) for Morača hydropower system as response to omitted biodiversity impact assessment. Surveys were done with the aim to strengthen the principles of biodiversity protection in preparing Environmental Impact Assessment studies for Morača hydropower plants. The monitoring was more concentrated on species inventories than on monitoring the state because of the lack of historical data on biodiversity.

WWF and Green Home have commissioned three studies to simulate the impact on Morača river and Skadar lake of four dams to be built on Morača river: 1) Hydrology of Skadar lake and Morača river and predicted impact of dams on Skadar water regime; 2) Bird fauna of Morača river and Skadar lake and 3) Fish fauna on Morača river and Skadar lake. These three studies show direct impact of the dams on Morača river natural values and an indirect impact on the natural values of Skadar lake and its fishery economy. Therefore, hydropower development shall look at local and downstream impacts and plan mitigation measures to ensure the least possible damage if SEA will prove the dams on Morača as the best possible option.

The Strategy of Agriculture and Rural Development 2014-2020 integrates the water through an analysis of its availability but also through numerous problems related to their use such as: discharge of waste water, excessive and irrational use; it aims at Nature and biodiversity protection, minimizing air pollution, and protection of water quality; however, mainstreaming of biodiversity in fishing and hunting strategies and plans is not satisfactory. Biodiversity plans aim for the implementation of instruments to ensure access to genetic resources and equitable sharing of benefits (ratification and implementation of Nagoya Protocol).

3.3.3.5. The Former Yugoslav Republic of Macedonia

Several pieces of legislation have been reviewed in 2016, namely (i) the Law on Waters transposing the EU WFD which thereby considers other sectors; the (ii) Law on Energy which includes conditions for achieving energy efficiency and the promotion of the use of

renewable energy sources; (iii) the Law on Spatial and Urban Planning 2016; (iv) the Law on Agricultural Land which addresses the rational use of agricultural land as a limited natural resource; (v) the Law on Agriculture and Rural Development which refers to the optimal utilization of natural resources with respect to the principles for the protection of nature and the environment; (vi) the Law for Forests which aims to ensure sustainable management, planning, forest management and preservation of forests and forest land in a manner and extent that permanently maintains and promotes their production ability, biodiversity, renewable and vitality in the interest of current and future development of the economic, ecological and social functions of the forest, without disruption of the ecosystem; (vii) the Law on Environment which promotes rational and sustainable utilization of natural resources; (viii) implementation and improvement of measures aimed at addressing regional and global environmental problems; and (ix) the Law on Nature Protection aiming to address spatial planning and organization.

Regarding strategies: The Water Strategy (2012-2042) aims to provide the necessary quantities of water of adequate quality for various purposes, including irrigation i.e. modernization and installation of new equipment, applied water saving techniques and flow control in the main channels and ecosystems. This includes the construction of new hydropower plants. However, the strategy does not provide any further information about the implementation of the proposed activities, their effect on the water abstraction, potential pollution and effects on ecosystems. The objective of the Strategy for the use of renewable energy sources until 2020 is to increase the use of biofuels by 2020 to 10% and by 2030 to 20% from the total fuel consumption in the transport sector; the consequences of impacts have not been assessed, nor quantified. The Strategy for Agriculture and Rural Development for the period 2014-2020 addresses soil conservation, water efficiency and pollution, as well as conditions for nature protection.

3.3.3.6. Serbia

In general, policy coherence between sectors is not strong. strategic documents for a particular sector do not take into account goals, demands and recommendations from other Nexus sectors, and other Nexus sectors are often not mentioned.

The Report on Strategic Assessment of the influence of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030 deals with overall assessment of energy resources and potentials in Serbia. It also marks priorities in further development of energy sector, economic efficiency and energy market. Within the report, the legal, institutional, social and economic framework is presented along with international obligations and development of institutional component. The final part of the assessment presents the development projections in the energy sector until 2030. Focusing on priorities and since 30% of electricity production is with hydro power plants, the development is focused on rehabilitation of existing hydro power plants (HPP) and construction of new ones. Also, one of the demands for the energy sector is to be cleaner e.g. focuses on renewable energy sources (RES) and use of green energy. This has a lower impact on the environment, water, air, land, biodiversity and human health. The downside of the energy sector is the very high dependency on conventional energy sources, very low use of RES (hydro energy, wind, biomass, solar energy) and the low level of investments in research of energy potential. As there are global differences in opinion regarding the policy of climate changes and strategies of 'cleaner' energy sector, focus should be on the use of fresh water resources and its environmental impact on biodiversity at local and regional levels. The consideration of fish paths and other impact mitigation measures are necessary in order to protect and preserve ecosystems.

Box 6: The “Report on the Strategic Assessment of the Influence of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030 on the environment

It is important to state that Serbia is in the process of accession to the European Union, which will produce a review of policy documents. An example is the Law on Water, (2010/2012) transposing the EU WFD, which thereby considers other sectors. A “Report on the Strategic Assessment of the Influence of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030 on the environment” has been developed and addresses the interaction between energy and ecosystems. The solutions outlined in this Report are focused on reduction of GHG by constructing more efficient lignite-thermal power plants. This does however not provide solutions to the trade-off between hydropower development and freshwater ecosystem conservation.

3.3.4. Integration of climate resilience aspects in sector policy, regulation and management

Climate change resilience can be fostered by a varied set of measures addressing aspects like water scarcity, droughts or floods, temperature increase⁷⁵, heat waves, plagues and diseases, and ranging from efficiency increases to changes in production or management. Lists of options for action are usually included in the reporting to the UNFCCC.

Overall, climate change resilience has only partially been included in the sector-specific strategies/plans of the SEE2020 economies. With few exceptions, the sectors do not seem ready to deal appropriately with climate change.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water	no	no	no	no	low	no
Energy	yes	yes	no	yes	low	yes
Food/Agriculture	yes	no	no	no	yes	no
Ecosystems	no	yes	no	yes	no	no

Table 9: Overview on the integration of climate resilience in recent regulation, strategies or plans in the SEE2020 region.

Explanation: “yes” indicated climate change being integrated; “high” indicates contributions to climate change resilience, “low” indicates recognition of climate change constraints; and “no” none of the previous (only textual mentioning). For some of the documents, a screening assessment whether the considerations are of ‘high’ or ‘low’ relevance has been carried out.

In the different economies, the following integration has been identified:

3.3.4.1. Albania

A specific coordination body for climate change is in place, in order to ensure coherence among the targets identified in the INDC, the Action Plan on Energy Efficiency, the Action Plan for Renewable Energy, the draft Strategy on Energy and relevant legislation on energy and climate change. The 2015 Law on Renewable Energy refers to hydropower development, and the Action Plan for Renewable Energy Resources in Albania 2015-2020 to biofuel production. The Rural Development Programme 2014-2020 aims at ‘sustainable utilisation of resources and climate action by forest and water resource management’. The Strategy ‘Climate Change Adaptation in the Drini Mati River Delta and Beyond’ (2013) proposes policy strategies to mainstream climate change adaptation considerations into Economy level, regional and community-level development planning.

3.3.4.2. Bosnia and Herzegovina

Bosnia and Herzegovina will face significant climate change effects in the sectors of agriculture, water management, health, forestry and tourism⁷⁶. Out of the climate-change driven extreme events, the two most remarkable were the drought in 2012 and the flood in 2014. The Climate Change Adaptation and Low-Emission Development Strategy includes adaptation measures for a low-carbon economy, which is not sufficiently integrated into sectoral policies. Regarding the energy sector, significant integration is expected through the implementation of energy sustainability projects of public institution buildings, which is being implemented in Bosnia and Herzegovina. Also, in the Biodiversity Conservation Strategy (ecosystem sector), more intensive integration is expected, especially in the part

relating to climate change. An example of good practice is the integration of climate change into the Spatial Plan of the Republic of Srpska. The spatial plan includes issues related to climate change, in particular extreme, and climate projections of air temperature and precipitation levels by the end of the 21st century.

3.3.4.3. Kosovo*

The Program for Agriculture and Rural Development 2015 addresses the production of renewable energy, and the reduction of emissions, but no adaptation activities for increased resilience.

3.3.4.4. Montenegro

The Water Management Strategy only treats in principle the problem of the impact of climate change on water resources. As this is a complex problem, future water management documents are expected to study more in detail the effects of climate change on the regime and balance of water resources. The key document, the Strategy for Climate Change by 2030, which was adopted in September 2015, defines climate policy, establishes the guidelines and a roadmap towards climate-resilient, low-carbon society. The Strategy for Agriculture and Rural Development 2014-2020 considers climate change as an impact on air quality, fertility of land, erosion, usage and water availability. The Action Plan of the Biodiversity Strategy 2010 – 2015 recognizes the problem of climate change. One of its strategic targets is that specific mechanisms and the impact of climate change needs to be explored thoroughly, and particularly on sensitive areas/ecosystems (primarily marine and Alpine), and to propose measures for their mitigation.

3.3.4.5. The Former Yugoslav Republic of Macedonia

Whilst the Energy Strategy (2010) contributes to climate change mitigation by fostering renewable energies and efficiency, the strong promotion of hydropower does not assure proper adaptation and increased resilience to the climate change effects e.g. on water availability, in particular bearing in mind the existing water abstraction levels and decreasing flows. The Water Strategy (2012-2042) sets flexible targets in order to adapt to climate change and other pressures built through the water sector. However no overall figures/scenarios are provided for water consumption in the future.

3.3.4.6. Serbia

Climate change regulation set-up is currently in process. The Energy Sector Development Strategy includes projections up to 2030 and the scenarios developed take into account energy efficiency measures; this is directly connected to climate change regarding GHG emissions.

3.3.5. Integration of resource use efficiency aspects

Resource efficiency is the maximising of the supply in order to function effectively, with minimum wasted natural resource expenses, and this concept can be applied to water, energy, food and biodiversity within the Nexus. Circular economy is an approach aiming to keep resources within the economy when products no longer serve their function so that materials can be used again and therefore generate more value (Di Maio et al., 2017); and thereby supports resource use efficiency.

Improving the efficiency of water use is usually presented as an opportunity for large water savings, particularly in the agricultural sector. The recent modernisation of irrigation practices in Spain highlights the rebound effect of Jevons paradox – the fact that efficiency increase does not translate into reduced consumption - is one of many possible consequences of efficiency improvements (Dumont et al., 2013).

Policies that encourage the adoption of more efficient irrigation technology may be appealing under the premise that they will decrease the amount of applied water required to maintain current crops and yields. However, this ignores the possibility that farmers may adjust their behaviour in response to the change in irrigation efficiency, for example by switching to higher-revenue crops that are more water intensive, or by irrigating previously unirrigated land, resulting in an increase rather than a decrease in water consumption (Sears et al., 2018).

Box 7: Water efficiency, water savings and the Jevons paradox

Resource use efficiency is included in the competencies of the sector administrations in place. However, resource efficiency seems to be so far only relevant for the energy sector, and some minor consideration is given to water use efficiency in irrigation, but not to water reuse, as a component of circular economy. Additionally, energy efficiency initiatives are often secondary when compared with the generation of new renewable energy.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water efficiency	no	no	yes	yes	yes	no
Water reuse	no	no	no	no	no	no
Renewable energy sources	high	no	yes	yes	high	no
Energy efficiency	low	yes	yes	yes	yes	high
Land/soil conservation	no	no	no	low	yes	no
Organic farming	no	no	yes	no	yes	no
Food waste reduction	no	no	no	low	no	no

Table 10: Overview on the resource efficiency considerations in recent regulation, strategies or plans in the SEE2020 region⁷⁷.

Under the ‘Sustainability Eventually’ scenario, the SCENES project proposes significant water abstraction reductions for the electricity and domestic sectors as targets for 2030:

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	Serbia	The Former Yugoslav Republic of Macedonia
Electricity sector	Decrease >50%	Decrease >50%	Decrease >50%			Decrease >25%
Manufacturing sector	Decrease >10%	Increase >25%	Decrease <50%			Increase >25%
Irrigation	No/slight change	Decrease >10%	No/slight change			No/slight change
Domestic	Decrease >50%	Decrease >50%	Decrease >50%			Decrease >50%

Table 11: Percentage change in water abstractions for the SEE2020 region⁷⁸ as per the 'Sustainability Eventually' scenario under the SCENES project

The (few) projections and quantifications included in the strategies and plans of the economies indicate that such a scenario will likely not be achieved; thus, leading to water use unsustainability in at least part of the region.

3.3.5.1. Albania

Albania has adopted a Action Plan on Energy Efficiency. The Action Plan for Renewable Energy, and the 2015 Law on Renewable Energy refer to hydropower development, and the Action Plan for Renewable Energy Resources 2015-2020 to biofuel production.

3.3.5.2. Bosnia and Herzegovina

The ratification of the Protocol on Energy Efficiency and Related Environmental Aspects leads to addressing resource efficiency.

3.3.5.3. Kosovo*

The Kosovo* Water Strategy 2017-2036 addresses water efficiency. The Energy Strategy of Kosovo* 2017-2026 aims at achieving effective management of existing energy resources and protection of the environment, and at stimulating rational utilisation of energy, promoting energy efficiency and the development of renewable energy resources; the latter is also included in the Program for Agriculture and Rural Development 2015. The promotion of organic farming is considered as one of the options in the Climate Change Strategy 2014-2024. However, its relevance has not been assessed in this study.

3.3.5.4. Montenegro

The Water Management Strategy aims, as one of the key issues in the efficient use of water resources, to reduce losses in public water supply systems to less than 30%. The Energy Development Strategy of Montenegro by 2030 greatly focuses on renewable energy sources. The focus of implementation of the Economy level energy efficiency policy in Montenegro is on the public sector. Actual barriers that slow down or impede the implementation of energy efficiency measures in the public sector are significant. The Strategy of Sustainable Development stated that separation of domestic consumption of

materials from gross added values in the agricultural sector is not achieved, and concludes that this sector should be a priority for resource efficiency.

3.3.5.5. The Former Yugoslav Republic of Macedonia

The Water Strategy (2012-2042) and the Strategy for agriculture and rural development for the period 2014-2020 both address efficient water use for irrigation purposes. The Strategy for energy development until 2030 includes 'energy efficiency' as one of several topics to be addressed. However, the larger share of the investments is dedicated to promoting renewable energy production, including primarily hydropower. The Former Yugoslav Republic of Macedonia's Third Communication on Climate Change addresses energy efficiency improvements in the building sector, various measures in the transport sector for low carbon fuels, awareness raising for efficient driving, changed travel behaviour, improvement of the vehicle fleet, and advancement of vehicle equipment, as well as improvements in industrial processes for improving energy efficiency. It also refers to the promotion of organic farming as a more efficient agro-system. The 2016 Law on Agricultural Land and the Strategy for Agriculture and Rural Development for the period 2014-2020 address the rational use of agricultural land as a limited natural resource.

3.3.5.6. Serbia

The Energy Sector Development Strategy includes projections up to 2030. The scenarios developed take into account energy efficiency measures though with a lower priority than other actions such as modernization and revitalization of hydropower plants and the installation of new small hydropower plants.

3.3.6. Consideration of nature-based solutions

Nature-based solutions are defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits"⁷⁹ and include different concepts such as planning approaches (Integrated Water Resources Management) and infrastructure (Green Infrastructure, Natural Water Retention Measures). As climate change, population growth, and increasing consumption of resources create new threats with implications across the Nexus, nature-based solutions provide flexibility that enables adaptive management that is necessary to cope with changing conditions, and is more likely to sustain benefits in the midst of uncertainty and increased variability⁸⁰.

Nature-based solutions are not reflected as a priority within the assessed strategies/plans, and are usually not even reflected.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Water	no	no	no	no	no	no
Energy	no	no	no	no	no	no
Food/Agriculture	no	no	no	yes	no	no
Ecosystems	no	no	no	yes	no	yes

Table 12: Overview on the consideration of nature-based-solutions in recent regulation, strategies or plans in the SEE2020 region.

The following relevant details for the assessed economies are highlighted:

- Kosovo*: The Strategy for Environment Protection (2013-2022) refers to rather old-fashioned ‘riverbed regulation and protection’ but does not address nature-based solutions.
- Montenegro: The Strategy for the Development of Agriculture and Rural Areas 2015-2020 considers the nature-based solutions through the sustainable development.
- The Former Yugoslav Republic of Macedonia: The Strategy for Agriculture and Rural Development for the period 2014-2020 proposes activities for “green” agriculture, the efficiency of the use of natural energy resources, using water from irrigation systems and protecting irrigation and drainage facilities and application of fertilizers of organic origin and mineral fertilizers. Serbia is part of the Horizon 2020 project ‘Regenerating Ecosystems with Nature-based solutions for hydro-meteorological risk rEDuCTION (RECONNECT)’, which has recently started.

3.4. The role of international action

International agreements, decisions or actions can influence the way that SEE2020 economies address the Nexus. There are three main pathways:

- By ratification of international agreements or conventions and the implementation of corresponding action plans;
- Via the process of EU accession, and the subsequent changes in institutions, regulation, planning, financing and management; and
- By means of projects or initiatives developed with the support or involvement of international bodies.

Regarding the first of the three elements, the SEE2020 economies have ratified a large number of Nexus-relevant agreements and conventions. In the frame of this study, the implementation details have not been assessed.

	Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia
Convention on Environmental Impact Assessment in a Transboundary Context	1997	2009		2009	1999	2010
Protocol on Strategic Environmental Assessment	2005	2017		2009	2013	2010
Multilateral Agreement among the Economies of South-Eastern Europe for implementation of the Convention on Environmental Impact Assessment in a Transboundary Context	2015	-		2008	2011	2008
Rio Convention on Biological Diversity	1994	2002		2006	1997	2002
Convention on International Trade in Endangered Species of Wild Fauna and Flora	2003	2009		2007	1999	2006
Convention on Conservation of Migratory Species of Wild Animals	2001	2008		2009	1999	2008
Convention on the Conservation of European Wildlife and Natural Habitats	1999	2008		2016	1997	2008
Helsinki Convention on Watercourses and International Lakes	1994	2009		2014	2015	2010
Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat	1996	2001		2016	1997	1992
Aarhus Convention on access to information, public participation in decision-making and access to Justice in environmental matters	2001	2008	-	2009	1999	2009
Protocol on pollutant release and transfer registers (to the convention on public participation)	2009	2003		2009	2010	2012
United Nations Framework Convention on Climate Change	1995	2000		2006	1997	2001
Kyoto Protocol	2005	2008		2007	2005	2007
Energy Community Agreement	2006	2006	2005	2007	2006	2006
WHO Framework Convention on Tobacco Control	2006	2009		2006	2006	2006

Table 13: International multi- or bilateral agreements/conventions undersigned by the SEE2020 economies in the different Nexus fields (indicating the year of ratification/adoption)

The impact of the EU accession process on integration of the Nexus is also relevant and reflected in chapter 3.3.3.

International initiatives have made significant contributions to addressing the Nexus in the SEE2020 region, and – in some cases - to promote decisions that foster synergies. The following table provides an overview on 29 initiatives identified and shows that these initiatives address usually several of the Nexus sectors, and with a strong aspect of capacity building/institutional set-up. In several of the initiatives, resource efficiency, nature-based solutions and climate change adaptation have been addressed. However, this Study does not aim for a full review of the previous studies, thus uncertainties are marked in Table 14.

Institution	Start/End	Nexus-related initiative	Economies						Nexus sectors					Policies		
			Albania	Bosnia and Herzegovina	Kosovo*	Montenegro	The Former Yugoslav Republic of Macedonia	Serbia	Water	Energy	Food	Ecosystems	Institutional capacity building	Resource efficiency	Nature-based solutions	Climate resilience
World Bank	2014-19	Drina Flood Protection Project		x				x	x		x	?		?	?	?
World Bank	2012-17	Irrigation Development Project in Bosnia and Herzegovina IDP		x					x		x	?		x		?
World Bank	2014-18	Bosnia and Herzegovina Floods Emergency Recovery Project		x					x		x	?			?	?
World Bank	2007-16	Agriculture and Rural Development Project		x					x		x	?		?	?	?
UNDP Bosnia and Herzegovina	2012-16	Integrated Local Development Project ILDP		X									x			
UNDP Bosnia and Herzegovina	2013-18	Green Economic Development GED		X						x			x	x		?
UNDP Bosnia and Herzegovina	2009-15	Bosnia and Herzegovina Biomass Energy for Employment and Energy Security Project		x						x		?	x	x		x
GIZ	2010-16	Energy efficiency advice		x					x	x			x	x		?
GIZ	2014-17	High-quality, GMO-free soya from the Danube region		x				x	?	?	x	x		?		
GIZ	2008-15	Open regional fund – Energy Efficiency	x	x	x	x	x	x	?	x			x	x		?
World Bank	2012-15	Danube Region Water Supply and Wastewater Sector Capacity Building Program		x	?	?	x	x	x	?			x		?	?
		MoU Environment (No. 591/12)			x		x		x		x	x	x		?	X
ENVSEC	2014	Lepenc River protection via Introduction of Integrated Water Management			x		x		x		?	?				
UNDP-GEF/GIZ	2006-12	Integrated ecosystem in Management in the trans boundary Prespa Park Region	x				x		x			x	x		x	?

Institution	Start/End	Nexus-related initiative	Economies						Nexus sectors					Policies		
GIZ	2012-17	Protection and sustainable use of biodiversity in the territory of Lakes Ohrid, Prespa and Shkodra	x			x	x		x			x	x		?	?
SECO	2012-16	River Basin Management Plan for Bregalnica					x		x	?	?	?	?	?	x	?
IPA	2009-	River Basin Management Plan for Vardar					x		x	?	?	?	x	?	?	?
UNDP/GEF	2015-19	Enabling Transboundary Cooperation and Integrated Water Resources Management in the Extended Drin River Basin”					x		x				x ⁸¹			
SDC	2015-21	River Basin Management Plan for Strumica					x		x				?			?
World Bank	?	Green Growth Strategy					x		x	x	x	?	x	?	?	?
?	?-2020	Establishment of Water Information System				x			x				x	?		?
EU?	2014-20	IPARD	?	?	?	x	x	?	?	?	x	?	?	?	?	?
WWF	2009-?	Activities on establishing Natura 2000				x			?	?	?	x	x	?	?	?
UNDP/GEF	2010-14	DIKTAS: Protection and Sustainable Use of the Dinaric Karst Aquifer System	x	x		(x)	x	(x)	x	x		x	x	x		X
UNECE	-2017	Assessment of the water-food-energy-ecosystems nexus in the Sava River Basin							x	x	x	x				
UNECE	-2017	Assessment of the water-food-energy-ecosystems nexus and benefits of transboundary cooperation in the Drina River Basin		x		x		x	x	x	x	x				
GEF/UNDP	2009	Prespa Watershed Management Plan					x		x						x	
EU IPA	2017-	River Basin Management Plan for Vardar					x		x						x	
BMZ/RCC	2015-2018	Open Regional Fund for South East Europe – Energy Efficiency					x			x				x		

Table 14: Overview on the current Nexus-related initiatives at the regional level

Indicating the economies involved and which Nexus elements are being addressed. The table includes also information on which Nexus-relevant key policies the initiative has been active

3.4.1. Nexus approach in the transboundary water management

The SEE2020 region has transboundary river basins or aquifers that drain either to the Mediterranean, the Aegean or the Black Sea. The following overview maps illustrate these areas:



Figure 39: Transboundary river basins and aquifers in the SEE region draining towards the Mediterranean Sea⁸².



Figure 40: Transboundary river basins and aquifers in the SEE region draining towards the Aegean Sea⁸³.



Figure 41: Transboundary river basins and aquifers in the SEE region draining towards the Black Sea⁸⁴.

The Danube and its sub-basins – namely the Tisza and Sava – flowing to the Black Sea, as well as six basins flowing to the Mediterranean Sea (Krka, Drin, Aoos/Vijosa, Vardar/Axios and Struma/Stymonas) are transboundary river basins. They all have associated aquifers, which together with seven additional transboundary aquifers not associated to the

mentioned river basins, form the transboundary groundwater resources. The following transboundary basins and aquifers have been identified in the SEE2020 region:

Transboundary river basins	Aquifers	Economies covered
Krka	Krka (Bosnia and Herzegovina, Croatia)	Bosnia and Herzegovina, Croatia
Neretva	Neretva Right coast, Trebišnjica/ Neretva Left coast (Bosnia and Herzegovina, Croatia), Bileko Lake (Bosnia and Herzegovina, Montenegro)	Bosnia and Herzegovina, Croatia, Montenegro
Drin	Beli Drim/Drini Bardhe (Albania, Kosovo*), Prespa and Ohrid Lakes (Albania, Greece, The Former Yugoslav Republic of Macedonia), Skadar/Shkoder Lake, Dinaric east coast aquifer (Albania, Montenegro)	Albania, Greece, Kosovo*, The Former Yugoslav Republic of Macedonia, Montenegro
Aoos/Vijosa	Nemechka/Vjosa-Pogoni (Albania, Greece)	Albania, Greece
Vardar/Axios	Gevgelija/Axios-Vardar, Dojran Lake (Greece, The Former Yugoslav Republic of Macedonia)	Greece, The Former Yugoslav Republic of Macedonia
Struma/Stymonas	Sandansky-Petrich (Bulgaria, Greece, The Former Yugoslav Republic of Macedonia),	Bulgaria, Greece, The Former Yugoslav Republic of Macedonia, Serbia
	Pelagonia-Florina/Bitolsko	Greece, The Former Yugoslav Republic of Macedonia
	Cetina	Bosnia and Herzegovina, Croatia
	Dinaric Littoral (West Coast)	Croatia, Montenegro
	Metohija	Kosovo*, Montenegro
	Pester	Montenegro, Serbia
	Korab/Bistra – Stogovo, Jablanica/Golobordo	Albania, The Former Yugoslav Republic of Macedonia
	Mourgana Mountain/Mali Gjere	Albania, Greece
Danube	South Western Backa/Dunav aquifer (Serbia, Croatia), Northeast Backa/ Danube -Tisza Interfluve or Backa/Danube-Tisza Interfluve aquifer (Serbia, Hungary)	Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldavia, Montenegro, Romania, Serbia, Slovenia, Switzerland, Ukraine
Tisza	North and South Banat or North and Mid Banat aquifer (Serbia, Romania)	Hungary, Romania, Serbia, SK, Ukraine
Sava	Srem-West Srem/Sava (Croatia, Serbia), Posavina I/Sava, Kupa, Pleševica/ Una (Bosnia and Herzegovina, Croatia), Macva-Semberija (Bosnia and Herzegovina, Serbia), Lim (Montenegro, Serbia), Tara massif (Bosnia and Herzegovina, Serbia)	Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia
Velika Morava	Stara Planina/Salasha Montana (Bulgaria, Serbia)	Bulgaria, The Former Yugoslav Republic of Macedonia, Montenegro, Serbia
Timok		Bulgaria, Serbia

Table 15: Transboundary river basins and aquifers in the SEE region⁸⁵.

Based on UNECE Second Assessment of Transboundary Rivers, Lakes and Groundwaters it can be stated that both the quantity and quality of transboundary water resources in SEE are under significant stresses.

Agriculture, domestic use, industry and tourism are the main users influencing withdrawal rates of water resources. Inefficiencies in water use and losses due to ageing and sub-

optimal infrastructure are significant, most prominently so in the agriculture sector where the majority of farmers apply unsustainable irrigation practices.

Agricultural activities also contribute significantly to the worsening of the quality of water resources through chemical pollution from the use of fertilisers and pesticides leading to loss of biodiversity and deterioration of ecosystems.

Another cause of pollution is insufficient or lacking wastewater treatment including illegal discharges from industry and erroneous use of septic tanks in rural areas. Mining activities are also having negative impacts on several basins in SEE. Additionally, illegal or uncontrolled waste disposal sites are contributing to the pollution of both surface and groundwaters.

Seasonal impacts on water use, generation of waste and wastewater originate from tourism, as well as illegal construction on the banks of water bodies for recreational purposes.

Hydropower is the main non-consumptive water user in most of the transboundary basins in the SEE. Cooling for energy production, agriculture, domestic use, industry and tourism are the main consumptive users influencing withdrawal rates of water resources. The construction and operation of hydropower plants on waterways in SEE both pose challenges, ecological and socio-economic, and create benefits e.g. job creation, flood regulation, water diversion, irrigation, drinking water supply and recreational purposes. The challenges are multifaceted and range from bio-physical impacts, such as hydrological and morphological alteration, fragmentation of habitats, erosion linked to soil and land loss, changes in sediment transport capacity and deposition, impacts on water quality and landscapes; to social impacts related to resettlement, loss of cultural and historic sites, land-use changes and alterations of livelihoods of local communities⁸⁶. Furthermore, concerns about impacts of human health due to water storage in large reservoirs have also been expressed⁸⁷.

The least understood constituent of SEE water resources are aquifers. Knowledge has significantly improved in recent years⁸⁸ for the Dinaric Karst region of the Balkan peninsula⁸⁹.

Climate change impacts on water resources in SEE can be observed already with altered water regimes and runoffs in the area⁹⁰. That is in line with IPCC projections of SEE being a region to be severely hit by climate change in the future. The area will be faced with decreasing summer rainfall, increasing frequency and severity of droughts, risk of floods and extreme weather events. This may lead to secondary impacts of deteriorating water availability and quality, damages to human health, negative impacts on industry, forest fires, soil degradation, desertification, loss of land and habitats. Climate change will thus

exacerbate the tensions between competing water uses and between users at different parts of the basins within the region, further complicating cross-border cooperation.

Out of the above list of transboundary river basins or aquifers, those that are transboundary within the SEE2020 economies have been further assessed regarding their Nexus-related conflicts, trade-offs and actions to overcome them, taken at the transboundary water management level:

Transboundary river basins or aquifer	Nexus-related challenges	Transboundary actions taken or planned	Nexus addressed
Neretva: Bilećko Lake aquifer	>75% water use for hydroelectric power, small amounts for drinking water and irrigation.	Bosnia and Herzegovina monitors groundwater quality in Bilećko Lake aquifer; improvements are, however, necessary.	no
Drin	<p>The significance of the Drin River and its main tributaries in terms of hydropower production is major, and further developments are planned. The alteration of the hydrological characteristics of the Drin, has had an impact in the distribution of sediments, and on ecosystems supported. Biological corridors that facilitate migration have been interrupted.</p> <p>Abstraction of groundwater in Kosovo* and waste disposal, sanitation and sewer leakage in Albania are the main pressure factors on Beli Drim/Drini Bardhe aquifer. Nitrogen, pesticides and pathogens (only locally in Albania) have been recorded. In the Black Drin sub-basin (The Former Yugoslav Republic of Macedonia), there is extensive cattle production. The expected increase in water demand in the Black Drin sub-basin catchment area for drinking water, irrigation and fisheries will result in increased pressure on the system. Whereas agriculture is the main source of nitrogen and phosphorus in the river system as a whole, the source distribution varies geographically.</p> <p>Agricultural as well as industrial pollution of Lake Skadar,</p>	<p>Pogradec (Albania) newly built sewage collection and treatment facilities, which allow treatment of the wastewaters of some 25,000 inhabitants, with further stages planned, are expected to improve the situation. Reduction of pollution from municipal wastewaters has been achieved in The Former Yugoslav Republic of Macedonia's side of the lake, where a sewerage system was constructed. There are plans for the construction of additional systems in the area. The Former Yugoslav Republic of Macedonia and Albania have harmonized procedures for water quality monitoring in the Lake Ohrid and its tributaries⁹¹. The 2004 Agreement for Lake Ohrid and its Watershed is operational. Regarding Lake Skadar/Shkodar, wastewater collection and treatment facilities have been constructed in Albania and are planned for the reconstruction of existing facilities in Montenegro (Podgorica). The Skadar/Shkoder Lake Commission has developed work since 2009.</p>	Water and Energy addressed in studies and plans, considering nature-based solutions and climate resilience
Metohija	Agriculture and local small industries in Albania, resulting in pesticides and industrial organic compounds in the groundwater. No transboundary pressures	No transboundary action	
Pester	No Nexus-related pressures	No transboundary action	
Korab/Bistra – Stogovo, Jablanica/Golobordo	In The Former Yugoslav Republic of Macedonia, groundwater abstraction for agriculture can affect the discharge of springs (reduced locally), with transboundary impacts related to groundwater quantity. In Albania, local and moderate degradation of ecosystems is an issue related to the quantity of groundwater.	Improvements are needed in The Former Yugoslav Republic of Macedonia for the monitoring of the aquifer and the protection zone system in place. Measures needed in Albania: detailed hydrogeological and vulnerability mapping, delineation of protection zones, wastewater treatment and public awareness campaigns. Enhanced cooperation, setting up of transboundary institutions and creation of a joint	No

		programme for quantity and quality monitoring of the sulfur thermo-mineral springs are needed. Data are exchanged.	
Sava, incl. Macva-Semberija (Bosnia and Herzegovina, Serbia), Lim (Montenegro, Serbia), Tara massif (Bosnia and Herzegovina, Serbia)	<p>Hydropower generation, agriculture and industry are the main economic sectors, sharing the major part of the available water resources in the sub-basin. The construction of water regulation structures and weirs at its tributaries; drainage networks, and flood protection systems, in combination with water abstractions, have caused hydrological and morphological alterations, including disconnection of adjacent wetland/floodplains. Interruption of river and habitat continuity and loss of wetland areas in the lower-middle and lower Sava areas are among the impacts. Organic, nutrient and hazardous substances pollution are also important pressure factors.</p> <p>Regarding Macva-Semberija, local and moderate nitrogen and pesticides from agriculture are reported (Serbia, Bosnia and Herzegovina); no water quantity problems.</p> <p>Regarding the Lim aquifer, 12/ <25% of the total abstraction is for agriculture.</p> <p>Regarding the Tara massif aquifer, moderate to strong environmental impacts are reported related to the Bajina Basta reversible hydropower plant system (Serbia).</p>	<p>Sava River Basin Management Plan. Sava River Basin Flood Risk Management Plan. The Geographical Information System, the River Information Services (for the improvement of navigation safety), and the Flood Forecasting and Early Warning System are planned to be prepared by 2012.</p> <p>1. Development of the Hydrological Model for the Sava River Basin (SRB) in August 2015 as a product of the World Bank WPP, with external contribution.</p> <p>2. Guidance note on adaptation to climate change for flooding, hydropower, navigation, agriculture, and economic evaluation in August 2015 (WB WPP) when is also accomplished the final report on Water and Climate Adaptation Plan for the SRB.</p> <p>3. The project in 2017: "Outline of the Climate Adaptation Strategy and basin-wide priority measures for the SRB" supported by International Office for Water (IOWater). The main project deliverable was the report on Outline of the Climate Change Adaptation Strategy and priority measures for the SRB.</p> <p>The Accident Emergency Warning System is in place. Cooperation among the Parties to the FARSB through the ISRBC represents the most advanced effort of its kind in the South-Eastern Europe, Montenegro has already been approached by the ISRBC for integration. However, Montenegro is not a Party of the FARSB as it is not riparian economy. Cooperation between ISRBC and Montenegro has been based on MoU that was signed in Belgrade on December 9, 2013⁹².</p> <p>Regarding Macva-Semberija, groundwater abstraction regulation and quantity monitoring, protection zones, and good agricultural practices used and effective, water use efficiency, public awareness, wastewater treatment need to be applied.</p> <p>For the Lim aquifer, abstraction management, protection zones and vulnerability mapping for land use planning need</p>	<p>Sava river aspects have been addressed in the RBMP.</p> <p>No information on actions on aquifers.</p>

		to be applied, together with monitoring of groundwater quantity and quality. For the Tara massif aquifer, groundwater abstraction management and quantity monitoring in use needs improvement. An integrated monitoring system is needed.	
Velika Morava		None specific within the SEE2020 region; action is reported for Serbia-Bulgaria cooperation.	

Table 16: Nexus-relevant challenges and corresponding transboundary actions in river basins and aquifers in the SEE region⁹³.

4. Conclusions and recommendations

This Chapter first assesses approaches and past recommendations for strengthening the Nexus approach, with a particular look at the SEE2020 region, and then assesses and recommends actions and pathways.

4.1. Approaches and past recommendations

The Bonn 2011 conference⁹⁴ identified for the Nexus approach 1) overarching principles⁹⁵, 2) Opportunity Areas⁹⁶, and 3) Actions to be taken, e.g. as in this case by Governments⁹⁷. In the context of this study, the most relevant of the proposed actions:

- Consider the trans-Economy consequences and externalities of trade policy on water, energy and food security: (i) Collect data that describe the extent that export and import of food and other products utilize natural resources and their availability for other economic purposes and impinges on sustainable extraction limits and access by local communities. One part of this approach is reporting on water, energy and land use footprints. (ii) Further develop instruments which promote sustainable production and reduce shifting of environmental burdens (e.g. certification schemes).
- (i) Adopt both a regional and a basin-wide perspective reflecting the principles of integrated water resources management and influences that go beyond the boundaries of a river basin. (ii) Extend current water resources management approaches to more effectively engage with energy and food sectors and take into account contemporary challenges such as regional power trading, foreign direct investment in land and agriculture and the increasing pressure on productive ecosystems and biodiversity. (iii) For international basins, review and make an informed decision on ratification of the 1997 UN Convention on Non-navigational Uses of Trans-boundary Watercourses and go beyond considerations of water sharing to incorporate benefit sharing.

Furthermore, the following region-specific Recommendations for Nexus synergies have been made since 2013 by different projects, initiatives or institutions, covering either Nexus-overall aspects, or specific conflicts between different sectors, and addressing different aspects such as knowledge generation, institutional development or management actions at different levels. The below table also includes information on which of these recommendations have been implemented in the meantime in the economies:

Main specific Nexus conflicts	Recommendations for Nexus synergies	Implementation
Hydropower development affects nature conservation areas	<ol style="list-style-type: none"> 1. To improve/upgrade the existing power plants (capacity, multi-purpose, generation efficiency) and invest in energy efficiency as the first steps that contribute to sustainability⁹⁸ 2. To designate hydropower “no go” areas, e.g. for nature conservation priority zones⁹⁹ 3. To increase the network of protected areas focusing in particular on the currently underrepresented natural and moderately modified rivers and streams, and on wetlands, as part of establishing representative networks of EU Natura 2000¹⁰⁰ 4. To implement biodiversity mitigation measures¹⁰¹ at existing and planned dams 5. To establish ecologically meaningful environmental flows¹⁰² 6. To increase the deployment of solar and wind generators (which however could result in need for pumped storage hydro plants)¹⁰³ 	<p>The total capacity of small power plants that produce energy from water potential is 120,399 MW, wind parks have an installed capacity of 50 MW, and photovoltaic power stations have an installed capacity of 16.713 MW.</p> <p>Energy efficiency is included in different ratified agreements (e.g. Protocol on Energy Efficiency and Related Environmental Aspects, Bosnia and Herzegovina), legislation and plans/strategies however, it remains unclear if it is considered as a ‘first step’.</p> <p>Regarding environmental flows, an analysis by WWF demonstrated that a small hydropower plant in the Crnojevića River (Montenegro) operating on an e-flow regime would produce 2.4% electricity per annum less than if operating on a biological minimum¹⁰⁴.</p> <p>Based on represented multidisciplinary researches’ results, the team of experts developed the general procedure and methodology for ecologically-acceptable flow assessment in Montenegro which was later transformed into a by-law proposal (2016). The Ramsar Secretariat congratulated the Government of Montenegro for adopting this new forward-looking rulebook, which directly contributes to implementing the goal of the Resolution 12 on ‘protecting the water requirements of wetlands for the present and the future’ adopted by the 12th Ramsar Conference¹⁰⁵</p>
Water (over)allocation to the different uses, in particular during drought events	<ol style="list-style-type: none"> 7. To draft and implement (transboundary) River Basin Management Plans (Drin, Albania, The Former Yugoslav Republic of Macedonia, Montenegro, Kosovo*)¹⁰⁶ 8. To draft and implement (transboundary) Drought Management Plans or (as preliminary step) to use hands-on operational (IT) tools for decision-making, coordination and communication before and during drought events 9. To create future projections of water demands depending on socio-economic analysis for the Bilecko Lake and its aquifer (Bosnia and Herzegovina, Montenegro)¹⁰⁷ 	<p>Declaration on the management of the extended Drin River Basin, 18th April 2011</p> <p>Memorandum of Understanding for the Management of the Extended Transboundary Drin Basin (Drin MoU), between Montenegro, Greece, Albania, The Former Yugoslav Republic of Macedonia and Kosovo* (24th November 2011)</p> <p>Pursuant to the Agreement, the Commission has been established, with the aim of jointly understanding and resolving all problems related to the management of international river basins¹⁰⁹</p> <p>To support their cooperation, projects funded by the Global Environmental Facility are being implemented by the Global</p>

Main specific Nexus conflicts	Recommendations for Nexus synergies	Implementation
	10. To increase water management flexibility by multipurpose operations of dams ¹⁰⁸	<p>Water Partnership and Global Water Partnership - Mediterranean in partnership with UNECE.</p> <p>In total the funding for 2016-2019 is US\$ 5.5 million. The projects aim to improve the joint analysis and understanding of transboundary issues and have set up pilot projects to demonstrate sustainable development along the river and lakes and contribute to the development and implementation of a Strategic Action Plan decided on by the Riparians¹¹⁰.</p> <p>Drought Management Centre for South East Europe – DMCSEE has been established in Ljubljana¹¹¹. DMCSEE focuses its work on monitoring and assessing drought and assessing risks and vulnerability connected to drought.</p> <p>The Regional Strategy on Drought Management in the Danube Region is one of the outputs of the ongoing project DriDanube (Drought Risk in the Danube Region) lead by ARSO from Slovenia¹¹².</p>
Dam operations causing hydro-peaking and subsequent ecosystem deterioration	11. To setup flagship projects (such as reintroduction of sturgeons in the river basin or return of the eel and marble trout to the upper White and Black Drin catchments) ¹¹³ 12. See above (bullet 4)	
Dam operations during floods to reduce downstream impacts	13. To develop Flood Risk Management Plans ¹¹⁴ 14. To identify and apply nature-based solutions ¹¹⁵ and green infrastructures (e.g. Natural Water Retention Measures) ¹¹⁶ to reduce flood risks 15. To improve up and downstream communication and coordination	In Serbia, the Horizon 2020 RECONNECT project has recently started.
Pollution of surface and groundwater by pesticides and nutrients, and their treatment (costs)	16. To harmonise transboundary criteria for the establishment and implementation of drinking water protected areas and their safeguard zones ¹¹⁷ 17. To promote organic farming and agricultural biodiversity ¹¹⁸ and afforestation	Organic farming considered in Albania RDP and the Former Yugoslav Republic of Macedonia and Kosovo* Climate Change Strategies

Main specific Nexus conflicts	Recommendations for Nexus synergies	Implementation
Water pollution (caused by urban and industrial developments) and their treatment (costs)	<p>18. To create an inventory of non-point and point sources of pollution (landfills, septic tanks, quarries, wastewater discharges and others) for the (shared Dinaric) aquifers¹¹⁹</p> <p>19. To improve the information available on the use of hazardous substances and their emissions¹²⁰</p> <p>20. To agree on and implement (transboundary) water monitoring programmes¹²¹, and to improve the exchange of data</p> <p>21. To identify permanent and local sources of pollution, investigate systematically groundwater-dependent ecosystems and implement specific protection measures, and establish a proper and transboundary monitoring network for the Cijevna/Cemi karstic aquifer (Montenegro/Albania)¹²²</p> <p>22. To agree, regulate and implement EU/transboundary standards for wastewater discharges¹²³</p> <p>23. To construct and operate more/all wastewater treatment plants</p> <p>24. To ban Phosphates' containing laundry detergents by 2012 and dishwasher detergents by 2015 (Phosphate Ban Scenario-Nutrients¹²⁴)</p>	<p>Construction of 6 new waste water treatment plants has begun in the Former Yugoslav Republic of Macedonia</p> <p>About 500 farmers are registered in the Former Yugoslav Republic of Macedonia for organic production, mostly for cereal and horticultural crops on a total area of about 3,000 ha</p>
Land-use intensification and disappearance of certain habitats/ecosystems	25. See above and below (bullets 17 and 28)	
Increased energy consumption	26. Install energy-efficient wastewater treatment plants ¹²⁵ and water supply systems	There are 31 projects in progress in the Former Yugoslav Republic of Macedonia on construction of water and sewage networks
Cross-sector governance, transparency and accountability	<p>27. To improve available datasets and their accessibility¹²⁶</p> <p>28. To systematically employ Strategic Environmental Assessment (SEA) and Environmental Impact Assessments (EIA) to preliminarily assess effects of infrastructure developments (incl. hydropower), including scenario development and SWOT assessments for awareness-raising¹²⁷ and the informed involvement of stakeholders and the local communities</p>	

Main specific Nexus conflicts	Recommendations for Nexus synergies	Implementation
	<p>29. To examine the experience with SEA with the aim of expanding the use of nexus analysis within it¹²⁸.</p> <p>30. To reconsider the mandates of ministries and intersectoral bodies¹²⁹</p> <p>31. To analyze and coordinate/integrate the different timeframes and geographic scales for planning in different sectors¹³⁰.</p> <p>32. To improve access to environmental justices (Aarhus convention)</p> <p>33. To link spatial planning with river basin management and integrate adaptation to climate change¹³¹</p> <p>34. To implement more effectively (e.g. protection measures for ecosystems and biodiversity¹³²)</p> <p>35. To aggregate the outcomes of public participation at specific decision-making levels in order to take these into account at more strategic levels¹³³</p> <p>36. To develop broad, open, transparent and efficient platforms for reliable, high-quality data to serve as the foundation for high-quality decision-making¹³⁴</p>	

Table 17: Main Nexus conflicts in the SEE2020 region, and past recommendations to overcome them

In general, the follow-up implementation of recommended actions by internationally-supported projects is rather low, and many recommendations from the past decade are still to be implemented.

4.2. Implementation strategy

Ten main Nexus conflicts/trade-offs have been identified for all sector relations for the SEE2020 region; they apply to all economies though their presence is stronger or weaker in some. Furthermore, insecurities have been detected for water, energy and food, as well as references to biodiversity decline.

Approaches to address the Nexus in an integrated way e.g. administrative coordination, resource use efficiency, nature-based solutions and climate change resilience are known and used in some cases in the SEE2020 region, but not systematically applied.

Specific actions and pathways to address Nexus conflicts/trade-offs, insecurities and approaches have been identified throughout the study either as recommendations from previous assessments and projects, cases and good practice identified within the SEE2020 economies and literature.

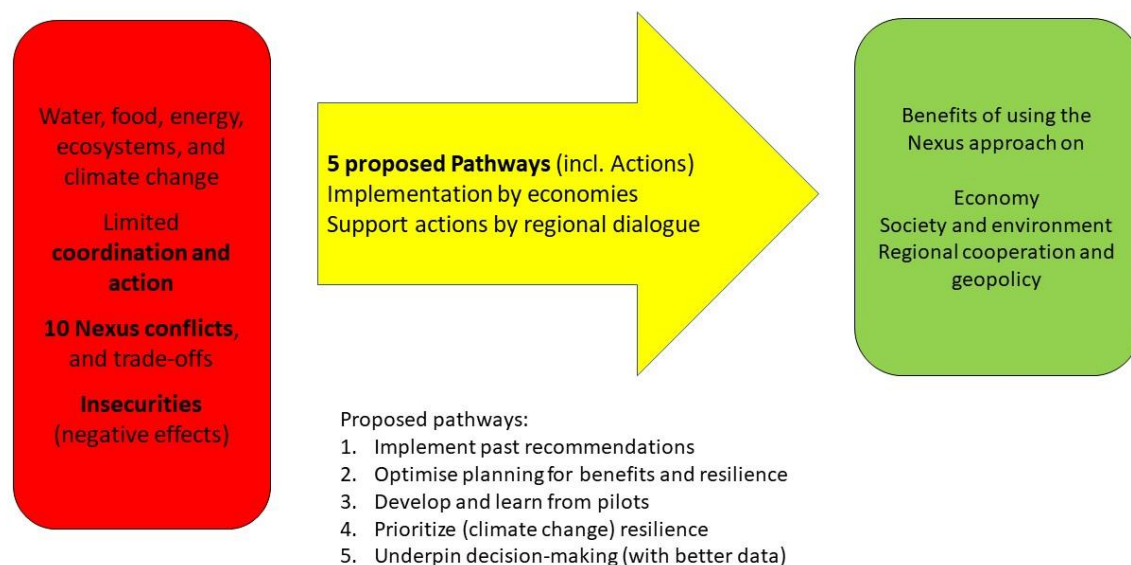


Figure 42: Proposed strategy to turn Nexus conflicts, trade-offs and insecurities to Benefits, by implementing actions in the SEE2020 region in five prioritised pathways

This study proposes implementing a Strategy from Nexus conflicts, trade-offs and insecurities towards benefits, by implementing Nexus approach and actions, prioritising five pathways.

4.2.1. Actions to address the challenges

The following overview presents how the challenges can be linked with actions to address the Nexus in a more integrated and synergistic way.

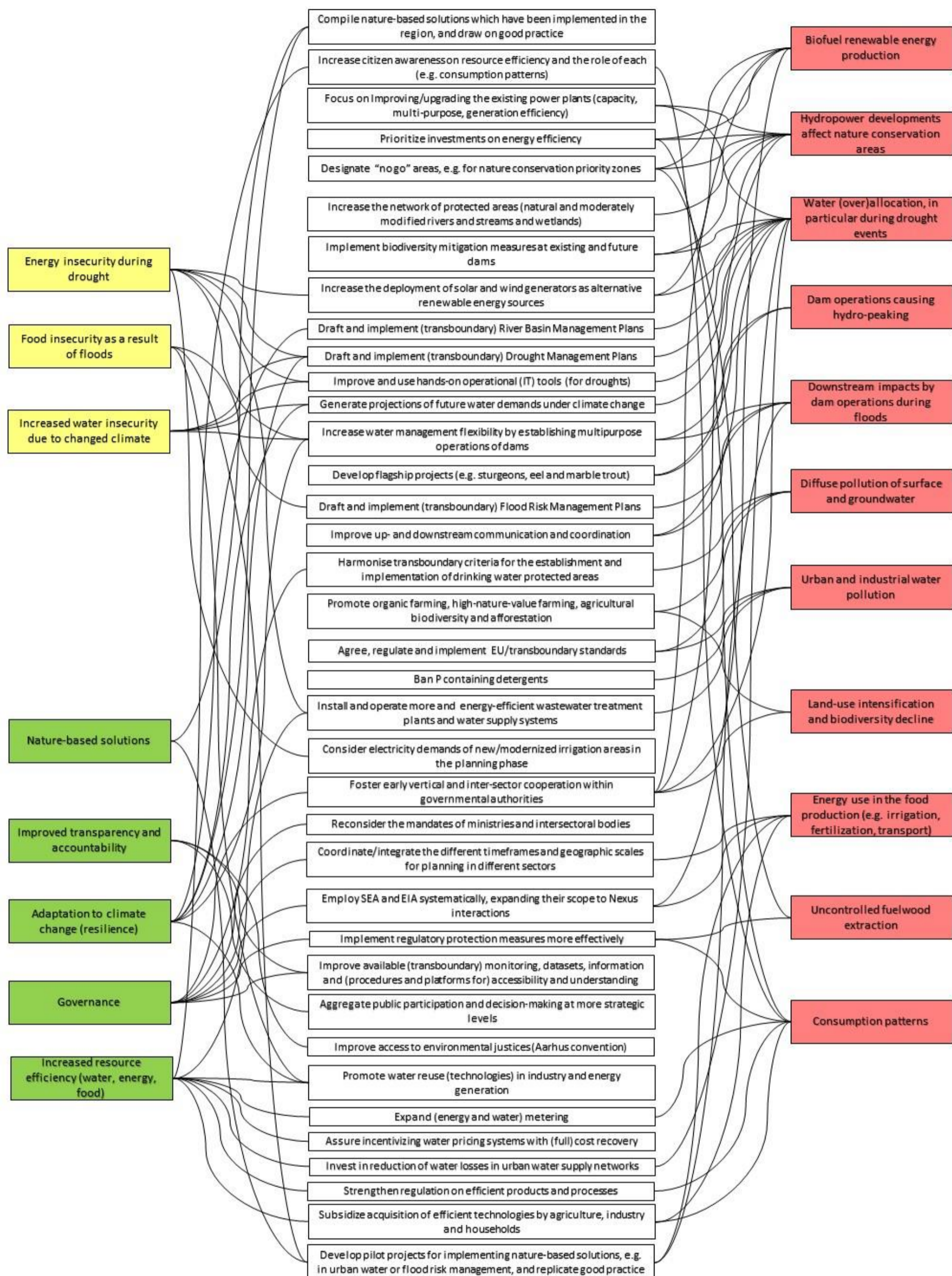


Figure 43: Specific proposed actions for improving Nexus integration within the SEE2020 region

Actions could be taken to address Nexus conflicts/trade-offs (red), Insecurities (yellow) and Approaches to address the Nexus in an integrated way (green)

4.2.2. Entry-points or priority pathways for action

Given the significant interactions between the Nexus sectors, related conflicts/trade-offs, and insecurities, being considered as negative effects, this Study recommends to implement further actions and measures under the Nexus approach, thus fostering integration and cross-sectors benefits.

The study proposes to prioritise 5 major pathways with associated steps and actions. These pathways focus on:

- Implement past recommendations
- Optimise planning for benefits and resilience
- Develop and learn from pilots
- Prioritize climate change resilience
- Underpin decision-making with better data

The following recommendations for entry points for action can be made:

Pathways	Steps and actions
Implement past recommendations	<ul style="list-style-type: none"> - Implementation by concerned economies - Self-assessment of implementation and barriers - Regional identification/establishment of further funding sources for implementation - Regional exchange and monitoring on good practices and lessons learned during implementation
Optimise planning for benefits and resilience	<ul style="list-style-type: none"> - Foster early vertical and inter-sector cooperation within governmental authorities - Coordinate/integrate the different timeframes and geographic scales for planning in different sectors
Develop and learn from pilots	<ul style="list-style-type: none"> - Set up pilot experiences on the different actions in the economies - Draw lessons learned - Share and compare the experiences at regional level - Upscale implementation after learning - Document the process and experiences at regional level
Prioritize (climate change) resilience	<ul style="list-style-type: none"> - Develop planning based on resource availability and demand projections - Promote climate-resilient and no-regret measures (resource efficiency and nature-based solutions)
Underpin decision-making with better data	<ul style="list-style-type: none"> - Improve available monitoring, datasets, information - Promote procedures and platforms for accessibility and understanding

Table 18: Proposed steps and actions towards a Nexus Strategy/Roadmap in the SEE2020 Region

The study identifies the possible support roles the Regional Dialogue can provide to the implementation of these pathways; it is focused on 4 key actions, as shown in Figure 44, addressing:

- Serve as a platform to assess how the economies perceive their position regards the implementation of past recommendations
- Support the development of pilot projects

- Promote good practices
- Identify or establish further funding sources for implementation

Possible support actions by the Regional Dialogue

- ➡ Serve as a **platform to assess** how the economies perceive their position regards the implementation of past recommendations
- ➡ Support the **development of pilot projects**, e.g.:
 - Stimulate and map interest to share and learn from pilot experiences across the region
 - Identify and collect pilot experiences already in place or planned in the economies
 - Agree on topics/issues and focus (technologies, governance) of major interest
- ➡ **Promote good practice**, e.g.:
 - Monitor good practice and lessons learned during implementation
 - Follow-up on lessons learned, and barriers identified
 - Share experiences and tools, e.g. for developing resource availability and demand projections under climate change
 - Exchange on climate resilience approaches to maximise benefits and avoid negative effects on the Nexus sectors, the wider economy or population
 - Support the integration of resource efficiency and nature-based solutions in planning and management of the different sectors
- ➡ Identify or establish further **funding sources** for implementation

Figure 44: Possible support actions by the Regional Dialogue

Further details and their possible integration in the Regional Dialogue are provided below.

4.2.2.1. To implement past recommendations

As indicated in Table 17, there is a major gap in implementing the recommendations from previous Nexus assessments and initiatives. This long list of recommendations from past projects is reflected below and shall be prioritised by the economies (or at regional level) for implementation, unless there are significant barriers which had not been identified in the corresponding Nexus assessment/initiative. The list of recommendations from past projects includes the following:

- Cross-sector recommendations
 - To improve available datasets and their accessibility
 - To systematically employ Strategic Environmental Assessment (SEA) and Environmental Impact Assessments (EIA) to preliminarily assess effects of infrastructure developments (incl. hydropower), including scenario development and SWOT assessments for awareness-raising and the informed involvement of stakeholders and the local communities
 - To examine the experience with SEA with the aim of expanding the use of Nexus analysis within it
 - To reconsider the mandates of ministries and intersectoral bodies

- To analyze and coordinate/integrate the different timeframes and geographic scales for planning in different sectors
- To improve access to environmental justices (Aarhus convention)
- To link spatial planning with river basin management and integrate adaptation to climate change
- To implement more effectively (e.g. protection measures for ecosystems and biodiversity)
- To aggregate the outcomes of public participation at specific decision-making levels in order to take these into account at more strategic levels
- To develop broad, open, transparent and efficient platforms for reliable, high-quality data to serve as the foundation for high-quality decision-making
- Mainly focused on Water
 - To draft and implement (transboundary) River Basin Management Plans
 - To draft and implement (transboundary) Drought Management Plans or (as preliminary step) to use hands-on operational (IT) tools for decision-making, coordination and communication before and during drought events
 - To create future projections of water demands depending on socio-economic analysis for the Bilecko Lake and its aquifer (Bosnia and Herzegovina, Montenegro)
 - To increase water management flexibility by multipurpose operations of dams
 - To develop (transboundary) Flood Risk Management Plans
 - To identify and apply nature-based solutions and green infrastructures (e.g. Natural Water Retention Measures) to reduce flood risks
 - To improve up and downstream communication and coordination
 - To harmonise transboundary criteria for the establishment and implementation of drinking water protected areas and their safeguard zones
 - To create an inventory of non-point and point sources of pollution (landfills, septic tanks, quarries, wastewater discharges and others) for the (shared Dinaric) aquifers
 - To improve the information available on the use of hazardous substances and their emissions
 - To agree on and implement (transboundary) water monitoring programmes, and to improve the exchange of data
 - To identify permanent and local sources of pollution, investigate systematically groundwater-dependent ecosystems and implement specific protection measures, and establish a proper and transboundary monitoring network for the Cijevna/Cemi karstic aquifer (Montenegro/Albania)
 - To agree, regulate and implement EU/transboundary standards for wastewater discharges

- To construct and operate more/all wastewater treatment plants
 - To ban Phosphates containing laundry detergents by 2012 and dishwasher detergents by 2015 (Phosphate Ban Scenario-Nutrients)
- Mainly focused on Land
 - To promote organic farming and agricultural biodiversity and afforestation
- Mainly focused on Energy
 - To improve/upgrade the existing power plants (capacity, multi-purpose, generation efficiency) and invest in energy efficiency as the first steps that contribute to sustainability
 - To designate hydropower “no go” areas, e.g. for nature conservation priority zones
 - To increase the deployment of solar and wind generators
 - Install energy-efficient wastewater treatment plants and water supply systems
- Mainly focused on Ecosystems
 - To increase the network of protected areas focusing in particular on the currently underrepresented natural and moderately modified rivers and streams, and on wetlands, as part of establishing representative networks of EU Natura 2000
 - To implement biodiversity mitigation measures at existing and future dams
 - To establish ecologically meaningful environmental flows
 - To setup flagship projects (such as reintroduction of sturgeons in the river basin or return of the eel and marble trout to the upper White and Black Drin catchments)

As a step to facilitate their implementation, the Regional Dialogue might serve as a platform to assess how the economies perceive their position regards the implementation of these recommendations, distinguishing if:

- the recommendations are already being addressed by (recent) action taken
- the recommendations have been partially implemented however, further action is needed
- there are (significant) financial barriers impeding the implementation
- there are other barriers (than financing) impeding the implementation, and which support from good practice case studies is required for supporting the implementation
- recommendations are not relevant, and why

Based on such a self-assessment, further actions at the regional level could be taken, such as:

- identification/establishment of further funding sources for implementation
- exchange and monitoring on good practice and lessons learned during implementation

4.2.2.2. To optimise planning for benefits and resilience

The assessment of the current practice in the SEE2020 economies shows that most planning processes remain without integrating objectives and identifying synergies. Given the significant (international) investments that will shape the evolution of the economies, planning processes shall maximise benefits (from different sector viewpoints) and be resilient to climate change.

Early coordination between different political levels (vertical coordination) is needed alongside horizontal coordination to guarantee a conflict-free implementation of policy projects. In federally structured systems where entity's or regional governments are involved in legislative processes, vertical coordination is a prerequisite in the realisation of political projects¹³⁵.

The main actions recommended are:

- Foster early vertical and inter-sector cooperation within governmental authorities
- Coordinate/integrate the different timeframes and geographic scales for planning in different sectors.

Hydropower water abstraction is one of the most relevant pressures in Austrian rivers, with 10% of the rivers to fail GES. The majority (>85%) of the ~2000 existing hydropower plants are abstraction plants and lacks regulatory requirements for ecological flow, as it is obligatory only since 1990. Studies were carried out to evaluate the impacts of the existing pressure (water abstractions/reduced flow, hydropowering, dams/migration barriers) on the environment (on biological elements) as well as the impact of measures necessary to achieve good ecological status (GES) on hydropower sector. By using scenarios, possible impacts like loss of electricity production (base load as well as peak load/regulation services), investment costs, and financial losses were evaluated on different scales and for the subsectors (small HP < 10 MW, large hp > 10 MW, storage plants). Based on the results, and to minimise the negative effects on the hydropower sector, a stepwise restoration including an ecological prioritisation approach was decided. For water abstractions in the first step, flow conditions have to be improved to allow fish migration (basic flow value and regulations for minimum depth and minimum flow velocity). In the second step, flow conditions have to be further improved to achieve good ecological status for the biological elements. It was evaluated that the restoration of the ecological flow to achieve GES in water bodies affected by water abstractions due to hydropower use would lead to production losses of 3% of the total hydropower generation in the Economy.

Box 8: Ecological flows: Strategic Approach in Austria

Source: European Commission, 2015

The key questions to identify and assess the (shared/transboundary) objectives and trade-offs/synergies that shall/will characterize the implementation of plans/strategies are:

- In which way will the plan/strategy benefit the leading sector?
- How can the plan/strategy contribute to overcome people's insecurities related to water, energy, food, biodiversity, and maybe other aspects as health?
- Which opportunities can be created to contribute to the objectives/targets of other sectors?

- Which are the concerns that the plan/strategy can hamper achieving other sector's objectives/targets (e.g. to consider electricity demands of new/modernized irrigation areas in the planning phase)?
- Which are the risks related to climate change, and how can the plan/strategy be more resilient?
- How can the potentials of resource efficiency and nature-based solutions be maximised in the plan/strategy?
- Which institutions shall be involved (and how) in the plan/strategy development process, to ensure the opportunities can be maximised and trade-offs avoided?

A pragmatic way of implementation could be to establish kick-off planning processes with an inter-administrative discussion on the above-listed questions.

The Regional Dialogue might wish to follow-up on such approaches to better identify and discuss case studies, good practice, lessons learned, and barriers identified.

Regarding the integration of different timeframes and geographic scales for planning in different sectors, it is unlikely that a full coordination can be achieved in short time. However, plans and strategies will gain in coherence and resilience if they address different timeframe steps (e.g. 2025, 2030, 2035, 2050) and geographic units (e.g. administrative, river basins) in projections, scenarios and target setting, in particular if these can be provided on a quantitative basis.

Further actions to be considered, in particular if the previous actions are unsuccessful, are the following:

- Reconsider the mandates of ministries and intersectoral bodies
- Aggregate public participation at more strategic levels

4.2.2.3. To develop and learn from pilots across the region

Given the large list of possible actions to overcome Nexus trade-offs, we recommend implementing them in a process of 'learning by doing' steered by the regional level.

Such a step-wise approach would include:

- to set up (short-term) pilot experiences on the different actions (e.g. on alternative technologies or governance set-ups) in the economies
- to draw lessons learned (e.g. costs, benefits, barriers, risks and opportunities of upscaling)
- to share and compare the experiences at regional (transboundary) level
- to upscale implementation after such a learning exercise
- to document the process and experiences at regional level

As a starter, the Regional Dialogue might address the following questions:

- Is there interest to share and learn from pilot experiences across the region?

- Which pilot experiences are already in place or planned in the economies?
- Which topics/issues and focus (technologies, governance) would be of major interest for such a regional activity?

4.2.2.4. Prioritize (climate change) resilience

Climate change will likely have significant effects in the SEE2020 region, affecting for sure water and food, and likely also energy and biodiversity. All policies, plans and strategies shall be as climate resilient as possible, to maximise benefits and avoid negative effects on the Nexus sectors, the wider economy or population. There are two major means of assuring climate change resilience:

- Develop planning based on resource availability and demand projections
- Promote climate-resilient and no-regret measures

Proper information for a climate-resilient planning includes projections of future resource availability and demand; with water availability and demands under climate change - including detailed information on geographical and time distribution – being the most critical factor, and water demands being the most unknown element.

Climate-resilient and no-regret measures will orient plans and strategies into the right direction, considering the forecasted changes in resource availability and the increased costs for risk reduction and mitigation. These target i.e. resource efficiency and nature-based solutions, and can address the following actions:

- **Resource efficiency**
 - Increase citizen awareness on resource efficiency and the role of each (e.g. consumption patterns)
 - Strengthen regulation on efficient products and processes
 - Prioritize investments on energy efficiency
 - Subsidize acquisition of efficient technologies by agriculture, industry and households
 - Promote water reuse (technologies) in industry and energy generation
 - Install and operate more and energy-efficient wastewater treatment plants and water supply systems
 - Invest in reduction of water losses in urban water supply networks
 - Expand (energy and water) metering
 - Assure incentivizing water pricing systems with (full) cost recovery
- **Nature-based solutions**
 - Compile nature-based solutions which have been implemented in the region, and draw on good practice
 - Develop pilot projects for implementing nature-based solutions, e.g. in urban water or flood risk management, and replicate good practice

The Regional Dialogue might support the process by:

- Sharing experiences and tools for developing resource availability and demand projections under climate change
- Exchanging on climate resilience approaches to maximise benefits and avoid negative effects on the Nexus sectors, the wider economy or population
- Supporting the understanding and integration of resource efficiency and nature-based solutions in planning and management of the different sectors

4.2.2.5. To underpin decision-making (with better data)

The Study has shown that access to relevant Nexus sector information is often limited, and cannot fully cover the conflicts/trade-offs, insecurities and to underpin solutions. However, available information is considered reliable.

This study proposes to systematically address data management and information to assure improved decision-making. The priority action to be implemented is:

- Improve available (transboundary) monitoring, datasets, information and (procedures and platforms for) accessibility and understanding

Further actions to support are:

- Aggregating public participation and decision-making at more strategic levels
- Improving access to environmental justices (Aarhus convention)

The Regional Dialogue can contribute to this topic by:

- Supporting the harmonization of datasets
- Identifying/promoting financial resources for monitoring and data management
- Promoting specific regional/transboundary studies and assessments

5. Annexes

5.1. Summary of Nexus Mapping in the SEE2020 economies

This study is based on an mapping of the Nexus at the level of the six SEE2020 economies; and a summary of the findings is presented.

5.1.1. Albania

Albania's economic indicators show a steady positive trend since 2003, with slowly reducing patters in terms of GDP, employment and (less) poverty. The economy is not self-sufficient in terms of energy and food production, and imports both; these imports will continue in future as energy consumption increases steadily and agricultural areas are under pressure from urbanisation and flooding. Furthermore, the area preserves a rich biodiversity, with increasing protected areas and numerous endangered species.

Water resources are currently “stressed” due to high exploitation and the official planning will lead to a “severe stress” in 2027, mainly by hydropower, and less by irrigation agriculture. Water quantity and quality are managed by different Ministries, with further agencies being involved. Relevant transboundary coordination activities have taken place between 2000 and 2010, but no new or ongoing significant activities have been identified. Regarding the strategies and measures, the Water Resource Management Strategy (2017-2027) includes references to all other sectors and includes significantly increasing water demand forecasts; regarding flood risk mitigation, no relevant reference has been found to use Nature-Based Solutions as a tool for addressing these risks whilst assuring integration of other Nexus sectors.

Increased energy production by renewable energies is one of the major action lines of the sector, with (small) hydropower being its main focus. However, the effects on the status of water bodies and on ecosystems/biodiversity are not clearly identified and considered within the strategies, though this issue is of high importance due to the free-flowing rivers remaining in Albania. Energy efficiency appears to play a minor role in Albania's strategy; and the economy is likely to not to achieve the CO₂ emission target committed for 2030.

Agricultural area and production is under decline in Albania, due to economic aspects, urban growth and flood risks; however, it is one of the most relevant sectors. The Rural Development Plan provides opportunity to contribute to Water, Ecosystems/biodiversity and Climate change resilience by actions taken within the agricultural sector. Energy aspects do not appear integrated in the existing strategy.

Overall, it is unclear how the competent authorities (and stakeholders) in Albania coordinate policies to ensure a Nexus approach. Coordination bodies are in place for some

cross-cutting topics: The Water Secretariat is the main inter-institutional body responsible for drafting policies and plans for integrated water resource management, acting under the law 111/2012. It is chaired by the Prime Minister of Albania and composed of seven main stakeholder ministries. River Basin Councils headed by prefects of the regions, act as the administrative body; each is responsible for the protection, development, distribution and operation of water resources within its own basin boundaries. Furthermore, an “Inter-ministerial Working Group on Climate Change” aims to coordinate different energy/emission related policies, which also affect water and agriculture.

Regarding legislation, the most relevant changes since 2010 address the adaptation to the EU Water Framework Directive, the 2015 regulation to foster renewable energies, and the 2013 Law on Strategic Environmental Assessments. However, the legislative set does not proactively address Nexus conflicts and trade-offs, nor prioritises policies to develop synergies between the Nexus sectors.

5.1.2. Bosnia and Herzegovina

The economy in Bosnia and Herzegovina has recorded significant growth in the last 15 years. GDP grew more than double in the period 2003-2016. There is a trend of increasing employment and an even more intensive trend of unemployment reduction. Economic exchange (import-export) has also significantly increased. Trade exchange with Economies from the region (Croatia, Serbia and Montenegro) are around 25% per year. Socio-economic development follows the harmonization of legal regulations with the EU. In addition, in the last few years cross-border cooperation with other Economies in the region, especially with Serbia, Croatia and Montenegro, has increased.

Water resources and their use are not well monitored and documented in Bosnia and Herzegovina. However, water resources do not seem to experiment stressed situations. Transboundary coordination is needed for addressing water quality aspects, but no new or ongoing significant activities have been identified. Regarding the strategies and measures to address flood risk mitigation, no relevant reference has been found to use Nature-Based Solutions as a tool for addressing these risks whilst assuring integration of other Nexus sectors. Increased energy production by renewable energies is one of the major action lines of the sector, with (small) hydropower being one of the development areas. However, the effects on the status of water bodies and on ecosystems/biodiversity are not clearly identified and considered within the strategies.

Bosnia and Herzegovina has a constant trend of increasing production and consumption of electricity. Coal is the main energy source for generating electricity. Production of hydroelectric power plants also recorded growth, but production is directly related to the amount of precipitation. During the drought years (e.g. 2008, 2011, 2012, 2017), production from hydroelectric power plants was significantly reduced. There is a very slight

increase in energy generation from renewable sources. Energy efficiency is clearly included in the Bosnia and Herzegovina strategies.

Food production in the agricultural sector in Bosnia and Herzegovina depends to a large extent on other environmental factors, and especially on climate conditions and water availability. Thus, in very droughty years (eg 2007, 2011, 2012), lower food production was recorded up to 40% in relation to the average. By implementing the planned irrigation and climate change management adaptation, food production would be much more stable. The strategy focuses on alignment with the European Union, but the integration of water, energy and ecosystem/biodiversity aspects does not appear clearly documented.

No harmonization of development goals at the state level and inadequate representation of nature protection in sectoral development plans and sectoral policies result in degradation of natural habitats, excessive exploitation of natural resources, continuous pollution of all spheres of the environment, fragmentation and weakening of ecosystem functions and the spread of invasive species. The multiple impact of anthropogenic factors, together with the effects of climate change, already has visible effects on the state of forests in Bosnia and Herzegovina. Drying of individual trees of spruce, fir, white and black pine, spruce, and even horticultural conifer species in urban areas has been observed (Cero, M et al, 2016).

Climate change is one of the biggest ecological and socio-economic challenges in Bosnia and Herzegovina. Climate change has a strong impact on the water, energy, land use and ecosystems. A very small amount of precipitation caused large losses and production of electricity in the hydro power plant during 2017. Production in 2017 was 3831 GWh compared to 2016 when it was 5641 GWh. Bosnia and Herzegovina are committed to future development based on the green economy. The key leverage in this development consists of projects in the area of mitigation and adaptation to climate change.

Given the administrative complexity of Bosnia and Herzegovina, the administrative set-up for the different Nexus sectors involves a large variety of administrations. There is no overall coordinating institution to address the Nexus interactions, to overcome trade-offs and to promote synergies.

Regarding legislation, there have only been a few changes in the past years, e.g. on the Energy Law (addressing renewable energy sources, CO₂ emission reduction and energy efficiency), and regarding the Spatial Planning and Use of land of the Republic of Srpska. However, none of the sector legislative sets does proactively address Nexus conflicts and trade-offs, nor prioritises policies to develop synergies between the Nexus sectors.

Regarding plans and strategies of the different sectors, these mention the other Nexus sectors, but do not provide an integration or the inclusion of strategies which can foster synergies. The exceptions are a) the ratification of the Protocol on Energy Efficiency and Related Environmental Aspects (thus addressing resource efficiency) and b) the adoption of

River Basin management Plans, aligned with the Water Framework Directive, and thereby integrating other sector interests and concerns. A flood defence plan has been adopted, but no references have been identified regarding the promotion of nature-based solutions for flood management, such as natural water retention measures.

Regarding economic development, infrastructure and climate change, data are accessible and considered reliable; accessibility is more limited regarding water, energy, food and ecosystems/biodiversity.

Significant further steps are needed in legislation, administrative coordination and the development of strategies and plans as well as related investments to ensure a synergistic approach towards the water-Energy-Food-Ecosystem Nexus.

5.1.3. Kosovo*

Kosovo*'s economic indicators show a steady positive trend since 2003, with slowly reducing patters in terms of GDP, (GDP has doubled from 2003 to 2016), employment and (less) poverty. The economy is not self-sufficient in terms of energy and food production, and imports both; these imports will continue in future as energy consumption increases steadily and agricultural areas are under pressure from urbanisation and flooding. Furthermore, the area preserves a rich biodiversity, with increasing protected areas and numerous endangered species.

Kosovo* is not yet recognized by the United Nations system, so it is not a signatory to international conventions such as the UN Framework Convention on Climate Change (UNFCCC). In 2015, Kosovo* signed a Stabilization and Association Agreement with the European Union, and is working to align its legislation with EU legislation as part of the EU approximation process, including environment and disaster risk reduction.

Kosovo* has insufficient water resources, and in the future, this will likely be a limiting factor for economic and social development of the economy. It is estimated that Kosovo* has only 1,600 m³/water/year per capita. Groundwater reserves are limited and are found mainly in the western part of Kosovo*, where surface water resources are larger - compared to the eastern part, where water demands are very high, for urban supply, irrigation and industry.

Kosovo* has difficulty in meeting peak demand for electricity. Energy predominantly comes from coal-fired power plants. Hydropower supplies 3–6 percent and its expansion is limited by the unequal distribution and inadequacy of water resources. The production of renewable energy sources and energy efficiency are both considered in the sector strategy.

53% of Kosovo* is agricultural land. The sector provides food and income security for Kosovo*'s rural population, although its share of GDP dropped from 25 percent to 14 percent in the last 25 years. The sector is mostly semi-subsistent and small-scale – 97

percent of holdings are under 5 hectares. Half of farms are active in livestock production, especially of dairy cows. Main agricultural products are corn, wheat, barley and milk. Sector growth is limited by inadequate irrigation, which covers only 17 percent of agricultural land. Fluctuations in rainfall leave regions without irrigation exposed to drought or flood conditions. The sector strategy aims primarily for the increase of the agricultural competitiveness and production.

Kosovo* has an important biodiversity, which is yet to be fully discovered. Woodcutting and wildfires are amongst the most relevant threats to it.

Regarding the institutional set-up, there are leading Ministries for Water & Environment, Agriculture and Energy (Ministry of Economic Development), with several new structures and competencies. However, there is no inter-governmental coordination body set up; except for the Water sector, with the Inter-Ministerial Water Council (IMWC) allocated at the Prime Minister's Office.

The Nexus sector regulation has been adopted a decade ago, and offers numerous references to the other sectors, thus enabling cooperation.

However, the recently adopted strategies and plans do only make limited use of integration of the Nexus; with the exception of the water sector, which provides resources for energy and agricultural development, and the agricultural plans aiming for the production of renewable energy.

Whilst resource efficiency is somehow addressed in strategies and plans (energy, water, renewable energy and organic farming), climate change resilience or nature-based solutions are not covered by strategies or plans from the different sectors, thus limiting the Nexus approach.

Significant further steps are needed in administrative coordination and the development of strategies and plans as well as related investments to ensure a synergistic approach towards the water-Energy-Food-Ecosystem Nexus.

5.1.4. Montenegro

The economic development in Montenegro shows a gross income tendency to increase, although it is still below the period 2004-2008. Poverty is still relevant, with the biggest poverty rates in households with six members, and least in households which have as head employed persons or pensioner. The employment rate linearly increases from the 2010 (22.6%) to the 2016 (28.6%). The governmental budget is mostly in deficit during the period 2003-2017, although it tends to increase from the last three years (2015-2017). It was in surplus only three years (2006-2008). The external debt reached 53.1% of GDP in 2016 what is the highest since 2003, with the minimum in 2008 (15.6%). Export slowly decreases while import increases; while in 2003 the import was 2.3 times higher than export, in 2016

it reached the value of 5.8 times. The key import partners from Europe are Germany, Italy and Greece; and the largest import in SEE region is from Serbia, followed by Bosnia and Herzegovina, a relation similar for the export.

Key branches of industrial production in Montenegro include electricity production, mining and the metal industry. The most important branches of the metal industry are the production of aluminium and steel. Economic development in Montenegro until 1990 was characterized by intensive industrial production and industry's share in the gross domestic product (GDP) was about 30% until 1991. Since that time there has been a continuous decline in industrial production and in 2011 the level of manufacturing as represented in GDP was only about 5%.

The volume of water abstractions has stabilized at around 110 mil m³/yr, with a total delivered and water consumption of around 50 mil m³/yr, and a big difference because of losses in the public water supply systems. Urban supply uses 70% and for industry, agriculture and other 30% of the delivered water. For the production of energy, there is no data on the amount of water used. Groundwater is mainly used for irrigation.

There are two important sources of energy which have been explored so far in Montenegro - hydro-electricity (with a technical potential of 14.1-5 TWh) and coal. Concerning other renewables, technical wind potential has been estimated as being approximately 900 GWh/yr; the potential of solar radiation could be about 20 PWh/yr and the estimated average consumption of firewood in 2008 was 560 GWh/year, and this is expected to increase to 620 GWh/yr by 2030.

During the period 2006-2015, Montenegro's Ecological Footprint increased for 45% from 2.7 to 3.9 gha/person, while its biocapacity remained almost constant (shifting from 2.70 to 2.67 gha/person). In 2015, Montenegro was characterized by an ecological deficit as its biocapacity was able to satisfy around 70% of the overall demand for resources and services of its residents. The assignment of roles for managing biodiversity data with an appropriate institutional set-up is generally defined, but lacks precise procedures for data flow between governmental institutions and is therefore inappropriate for assessing the Nexus trade-offs.

Regarding the institutional set-up, and on the positive side, there is one line-ministry for food/agriculture and water affairs (Ministry of Agriculture and Rural Development - MARD). However, other Nexus coordination institutions or instruments are not existing or – as the Water Council – not operational.

The consideration given by the Water Management Strategy (2017) to energy and food/agriculture is high, as the sector requests have been incorporated; and this happens vice versa for the Strategy of Agriculture and Rural Development 2014-2020 regarding

water and biodiversity. However, further strategic planning of the Nexus remains weak, and it is unclear if synergies have been identified and operationalised in practice.

Climate change resilience has been incorporated in the energy and ecosystem strategies, whilst this approach is (yet) lacking for water and food/agriculture. On the positive side, it can be noted that (domestic) water and energy efficiency, as well as renewable energy sources have been incorporated in the planning. Nature-based solutions are included in the Strategy for the Development of Agriculture and Rural Areas 2015-2020.

5.1.5. The Former Yugoslav Republic of Macedonia

The Former Yugoslav Republic of Macedonia has a steady growing economy, with a strong tertiary sector and a slowly declining relevance of the primary sector. Employment is growing, with a growing equality of wealth distribution amongst the population.

Water is a resource of growing scarcity in The Former Yugoslav Republic of Macedonia, which is the economy with the highest levels of exploitation. Further increased usage of water is foreseen in the Economy's Strategy – in particular for energy and agricultural production – without providing quantitative projections or scenarios, and likely with decreasing water availability due to climate change.

The Former Yugoslav Republic of Macedonia is strongly energy import dependent. It imports its entire demand for oil and petroleum products and natural gas, and starting from 2000 electricity. The energy imports have grown during the past period, and during the latest few years the imports of electricity have grown rapidly.

About half of the total land area is classified as agricultural (1.26 million ha), out of which 40% is cultivated land and 49% permanent pastures. Upland or mountainous forests cover 37% of the economy. Food production in 2016 is based on fruits and vegetables by 51%, followed by grains and cereals by 29% and dairy products with 19%; the economy is a food net importer.

The biodiversity is rich with important endemism (e.g. 150 endemic algae, 120 vascular plants, over 700 invertebrate species and 27 endemic fish species) and the network of protected areas comprises 86 areas, covering 8,9% of the territory. The main causes for biodiversity loss are land abandonment and river regulation, in particular by small hydropower plants.

In the past years, The Former Yugoslav Republic of Macedonia has updated its legislation in all Nexus sectors (Water, Energy, Food and Ecosystems) and included links to the other sectors, thus enabling coordination. The review has been significantly driven by the transposition of EU legislation, and the adoption of international agreements and conventions.

The institutional setting of the Nexus sectors in The Former Yugoslav Republic of Macedonia has been established at Economy and local level; with cooperation established in the regulation. As coordination bodies, a multi-sector Water Council and a Consultative Council for Agriculture and Rural Development are in place; however, they do not fully cover all Nexus sectors. The Ministry of Environment and Physical Planning shares since recent times responsibilities with other Ministries (MAFWE, Montenegro, MF, and MH) for the water sector. The recently established Energy Regulatory Commission (ERC) determines tariffs for water and energy services

The Former Yugoslav Republic of Macedonia has developed Strategies for all Nexus sectors, which in some cases contain targets and measures for other sectors. The Water strategy supports the objectives of the agricultural and energy sectors in terms of production and refers (less integrative) to biodiversity. The Strategy for Energy development points out the water pollution and impacts on wildlife, flora and fauna from the thermal power facilities, but does not establish synergies on hydropower development with ecosystems/biodiversity concerns. The integration of other strategies (e.g. Strategy for agriculture and rural development) is rather focused on overcoming constraints and risks of the proper sector than contributing to the objectives and targets of other sectors.

Agricultural and Energy legislation and strategies/plans address climate change adaptation well, and water efficiency, energy efficiency, renewable energy sources, land/soil conservation and efficient organic farming are included in different strategies, whilst with different relevance. It is however unlikely that the current strategies will lead to a sustainable use of water resources, but rather increase conflicts and trade-offs. The consideration of Nature-based solutions e.g. in Strategy for agriculture and rural development is unclear.

5.1.6. Serbia

In the past decade, the Republic of Serbia has seen a situation of economic growth (e.g. GDP), though with variations, and the Nominal GDP is in the upper range of the SEE2020 region. The primary sector share of the economy has steadily decreased, and the secondary sector has increased, whilst services remain at a stable level, below the proportion it has in other SEE2020 economies.

Based on analysed data, the main Nexus-related challenges are on hydropower (energy-water-ecosystems) and water pollution (food-water-ecosystems); no relevant challenges have been detected between agriculture and energy directly.

Regarding the water sector, there is decline of water consumption, but increase of water usage, mainly due to the increased number of hydropower plants. Furthermore, (transboundary) conflicts on water exist on hydropower generation and on agricultural pollution with nitrates and pesticides. A new Water Law has been recently adopted 2012.

The Water strategy adopted in 2015 gathers priorities and goals up to 2034. The main targets are: improved and integrated water use, water protection, monitoring, and creation of water information system, improved international cooperation and flood protection. This document creates a pathway within the water sector, for the reorganization, reinforcement of institutional capacities on Economy's and local level. Regarding flood risk management, its planning and forecasting is improving at the international level in the Sava river; however, no indications have been found for the increased adoption of nature-based solutions for flood management – such as natural water retention measures – in the relevant strategies and plans. Nature based solutions are about to come through different future projects under the Horizon 2020 research and innovation actions. However, in order to come to integration phase, the Water strategy should be updated.

Serbia is the main energy and electricity producer and consumer in the SEE2020 region, with approx. three times as high electricity consumption as the other economies. Further production increase is foreseen for energy, including the modernization and revitalization of hydropower plants and the installation of new small hydropower plants. These developments can have significant effects on other Nexus sectors, such as water and ecosystems/biodiversity; no full integration of these concerns has been found in the relevant documents. Increase of energy efficiency is also included in Economy level strategies, but with a lower priority.

Serbia has 57% of agriculture land and a significant production compared to consumption.

Regarding ecosystems and biodiversity, Serbia's protected areas cover 6.61% of total territory. There are two Economy level reserves located on border of the economy. Biodiversity data management is not on high level while the strategic documents are adopted (Biodiversity Strategy, Forestry Strategy, Strategy on sustainable use of resources).

The planning and management of the Nexus sectors is competence of different administrations, including a set of Ministries at the Economy level, with several of them having responsibilities e.g. for water and ecosystems. No official body has been appointed to assure cross-Nexus sector coordination at the Economy level, nor have relevant coordination mechanisms been established. However, the sector of environment is working closely with sectors of agriculture and energy due to the activities related to Chapter 27 (negotiation for pre-accession phase of entering Serbia into the European Union).

Regarding the legislation, the most recent new adoptions refer to water (2012), nature protection (2016) and environmental impacts (2013); no cross-sector integration has been identified for the Nexus sectors.

Strategies and plans are in place for all sectors (e.g. water 2015, energy 2013), but cross-sector integration is rather scarce. However, a "Report on the Strategic Assessment of the Influence of the Energy Development Strategy of the Republic of Serbia until 2025 with

projections until 2030 on the environment” has been developed and addresses the interaction between energy and ecosystems. The solutions outlined in this Report are focused on reduction of GHG by constructing more efficient lignite-thermal power plants (which does however not provide solutions to the trade-off between hydropower development and freshwater ecosystem conservation).

As conclusion, the Republic of Serbia should explore further ways to strengthen legislatively, administratively and for planning and implementation purposes the Nexus between water, energy, food and ecosystems, aiming for synergies, as e.g. via climate change adaptation, nature-based solutions (NBS) or energy efficiency approaches.

5.2. References

5.2.1. Acronyms

The following acronyms have been used in the development of this Study:

Acronym	
ATC	Agency for Treatment of Concessions
BHD	Birds and Habitats Directives
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)
ca.	circa
CAP	Common Agricultural Policy
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
DCM	Decision of Council of Ministers
DG	Directorate General
e.g.	For example
EC	European Commission
EEA	European Environmental Agency
EGFC	Energy Gross Final Consumption
EIA	Environmental Impact Assessment
ENVSEC	Environment and Security Initiative
EPD	Environmental Protection Department Kosovo*
Et al	And others
etc.	etcetera
EU	European Union
EU ETS	European Emission Trading System
EUR	Euro (currency)
FAME	Fatty Acid Methyl Ester (Biofuels)
FAO	Food and Agriculture Organization
FD	Floods Directive
FRMP	Flood Risk Management Plan
GDP	Gross Domestic Product
GDWA	General Directorate of Water Administration
GEF	Global Environment Facility
gha	Global hectare

GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
Gwh	Giga Watt hour (10 ⁹)
GWP-Med	Global Water Partnership - Mediterranean
ha	hectare
HMIK	Hydro Meteorological Institute of Kosovo*
i.e.	For example
IEA	International Energy Agency
IGSEWE	Institute of Geological Science Energy, Water and Environment
IMWC	Inter-Ministerial Water Council Kosovo*
INDC	Intended Determined Contribution
IPA	Instrument for Pre-Accession Assistance
IWLEARN	International Waters: Learning Exchange and Resources Network
IWRM	Integrated Water Resource Management
K	Kilo
KEPA	Kosovo* Environmental Protection Agency
KSEI	The Kosovo* Environmental Inspectorate
kWh	Kilo watt hours (10 ³)
m³	Cubic meter
MAFRD	Ministry of Agriculture, Forestry and Rural Development Kosovo*
MED	Ministry of Economic Development Kosovo*
MESP	Ministry of Environment and Spatial Planning Kosovo*
MF	Ministry of Finance Kosovo*
MIE	Ministry of Infrastructure and Energy
MoARDWA	Ministry of Agriculture Rural Development and Water Administration
MoEPP	Ministry of Environment and Physical Planning (The Former Yugoslav Republic of Macedonia)
MoTE	Ministry of Tourism and Environment
MS	Member State
Mtoe	Million Tonnes of Oil Equivalent
NAMA	Appropriate Mitigation Actions
NATP	Agency of Territorial Planning
NBS	Nature-based solutions
NEA	Environmental Agency
NIPHK	Institute of Public Health of Kosovo*
NLC	Licensing Centre
NSDI	Strategy for Development and Integration
NTC	Territory Council
OECD	Organisation for Economic Co-operation and Development
PWh	Petawatt hour (10 ¹⁵)
RBA	River Basin Agency/Authority
RBC	River Basin Council
RBMP	River Basin Management Plan
RCC	Regional Cooperation Council
RENA	Regional Environmental Network for Accession
RES	Renewable Energy Sources
RIWMFA	Regional Integral Water Management Framework Agreement
SDG	Sustainable Development Goal
SEA	Strategic Environmental Impact Assessment
SECO	State Secretariat for Economic Affairs
SEE	South East Europe
SEE2020	Regional growth strategy „SEE 2020 – Jobs and Prosperity in European Perspective“, endorsed in Sarajevo (November 2013)

SEE2020 Economy	Economy included in the SEE2020 Region, namely Albania, Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia, Kosovo*, Montenegro and Serbia
SEE2020 Region	Region covered by the above-listed economies
SOER	State of the Environment Report
T	Ton
ToC	Table of Contents
ToR	Terms of Reference
TWh	Terawatt Hour (10 ¹²)
TWRM	Transboundary water resources management
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP-WCMC	United Nations Environmental Programme – World Conservation Monitoring Centre
UNFCCC	United Nation Framework Convention on Climate Change
UNICEF	United Nations Children’s Fund
WCMC	World Conservation Monitoring Centre
WD	Water Department Kosovo*
WEFE	Water-Energy-Food-Ecosystems (Nexus)
WFD	Water Framework Directive
WGE	Working Group on Environment
WHO	World Health Organisation
WSRA	Water Services Regulatory Authority Kosovo*
WWF	World Wide Fund for Nature
yr	Year

Table 19: Acronyms

5.2.2. Glossary

The following terms have been widely used in the document, and are explained to ensure a common understanding.

Term	Explanation
Circular Economy	A circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing energy and material loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling. This is in contrast to a linear economy which is a 'take, make, dispose' model of production ¹³⁶ .
Climate resilience	the capacity for a socio-ecological system to: (1) absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and (2) adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts ¹³⁷
Conflict	the general pattern of groups dealing with disparate ideas ¹³⁸
Demand management	In natural resources management, demand management refers to policies to control consumer demand for environmentally sensitive or harmful goods such as water and energy ¹³⁹
Governance	The processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions ¹⁴⁰

Natural resource management	The management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations (stewardship) ¹⁴¹
Nature-based solutions	Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits ¹⁴²
Nexus	The interaction between policies and management of the different Nexus elements (in this study, water, energy, food and ecosystems)
Nexus approach	The Nexus approach has been introduced in the natural resources management agenda to facilitate the enhancement of water, energy and food security, while preserving ecosystems and their functions, and increasing climate resilience, by reducing trade-offs, shifting towards more sustainable consumption patterns and improving demand management, building synergies and improving governance across sectors
Nexus fields/sectors of focus	Fields or sectors of the Nexus are in this case Water, Energy, Food and Ecosystems. Other institutions or projects work with different combinations of the Nexus fields or sectors
No-regret measures	No regret measures are measures which are worth implementing no matter which event actually happens whenever consequences are uncertain ¹⁴³ .
Resource efficiency	Resource efficiency is the maximising of the supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively, with minimum wasted (natural) resource expenses. It means using the Earth's limited resources in a sustainable manner while minimising environmental impact ¹⁴⁴
Sustainable consumption patterns	Sustainable consumption relies on certain premises such as (1) Wise use of resources, and minimisation of waste and pollution; (2) Use of renewable resources within their capacity for renewal; (3) Fuller product life-cycles; and (4) Intergenerational and intragenerational equity ¹⁴⁵
Synergies	The creation of a whole that is greater than the simple sum of its parts ¹⁴⁶
Trade-off	A trade-off is a situation that involves losing one quality, aspect or amount of a Nexus element (e.g. water) in return for gaining another quality, aspect or amount of another Nexus element (e.g. energy). ¹⁴⁷

Table 20: Glossary of key terms

5.2.3. Literature references

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5.2.4. Regional information sources

This Annex includes the information sources identified in Task 2.

5.2.4.1. Albania

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- Action Plan for Renewable Energy Resources in Albania 2015-2020
- Rural Development Programme 2014-2020
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- Communications Regulatory Agency of Bosnia and Herzegovina,
<https://www.rak.ba/eng/>
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5.2.4.3. Kosovo*

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- Sector Development Strategy of The Republic of Serbia for the Period up to 2020 with projections up to 2030 (2016)
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- Strategy on Forestry,
- Strategy on biodiversity
- Strategy on sustainable use of resources
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- <http://www.nbs.rs/internet/cirilica/80/index.html>
- webrzs.stat.gov.rs
- BuR Biannual Update Report to the UNFCCC
- Climate change mitigation
<http://www4.unfccc.int/sites/nama/SitePages/SearchResults.aspx?k=serbia&cs=This%20Site&u=http%3A%2F%2Fwww4.unfccc.int%2Fsites%2Fnama>
- The First report of the Republic of Serbia under the UN Framework Convention on Climate Change (2010)
- The Second report of the Republic of Serbia under the UN Framework Convention on Climate Change (2017)
- Communication on Climate Change
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- Report 'Serbia Floods 2014'
http://www.sepa.gov.rs/download/SerbiaRNAreport_2014.pdf
- AERS annual report (2016):
<https://aers.rs/Files/Izvestaji/Godisnji/Eng/AERS%20Annual%20Report%202016.pdf>
- Macroeconomy indicators: <http://www.nbs.rs/internet/cirilica/80/index.html>
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(<http://www.klimatskepromene.rs/vesti/strategija-komunikacije-za-oblast-klimatskih-promena/>)

5.2.5. Institutions contacted

The following institutions have been contacted in the development of the study:

Institution contacted	Details
Institute for the development of Water Resources "Jaroslav Cerni", Serbia	Zivanovic Snezana
The Republic Fund for Development and Restructuring of Economy, Serbia	Aleksandra Uzelac
State Statistical Office, The Former Yugoslav Republic of Macedonia	Katerina Dafkova (Sectors - Energy, Transport, Agriculture, GDP)
Ministry of Environment and Physical Planning, The Former Yugoslav Republic of Macedonia	Teodora Grncarovska Obradovic (Climate Change)
Ministry of Environment and Physical Planning The Former Yugoslav Republic of Macedonia	Ljupka Dimovska Zajkov (Water Sector)
Ministry of Environment and Physical Planning The Former Yugoslav Republic of Macedonia	Vlatko Trpevski (Nature Sector)
Ministry of Economy The Former Yugoslav Republic of Macedonia	Ismail Ljuma, Manager of the sectors Energy and Economic Development
Ministry of Physical Planning, Construction and Ecology in the Government of Republika Srpska	Svjetlana Radusin, Assistant Minister, focal point BiH for the UNFCCC- Information about sector Climate Change
Ministry of Foreign Trade and Economic Relations (MOFTER) Bosnia and Herzegovina	Senad Oprasic, Head of the environmental department, Information about sector Climate Change, Agriculture and international agreements
Federal Ministry of Environment and Tourism	Mehmed Cero, Assistant Minister, focal point BiH under CBD, Information about sector Ecosystem and Biodiversity
Ministry of Agriculture, Forestry and Water Management in the Government of the Republika Srpska	Boris Pasalic, Assistant minister, Information about sector Agriculture
Found for the environment and energy efficiency of the Republika Srpska	Srdjan Todorovic, Director, Information about sector Energy and Ecosystem
UNDP Bosnia and Herzegovina	Raduska Cupac, Project manager, Information on strategic documents in the area of adaptation to climate change
Faculty of Natural science and mathematics University of Banja Luka	Cedomir Crnogorac, Full professor, Information about sector Water and Environment Drasko Marinkovic, Full professor, Information about Demographic statistics Radoslav Dekic, Associate professor, Information about Biodiversity
Faculty of Agriculture University of Banja Luka	Mihajlo Markovic, Full professor and focal point under UNCCD BiH, Information about sector Agriculture
Faculty of Economics University of Banja Luka	Goran Popovic, Full professor, expert for macroeconomy, Information about economic trends in BiH
Institute of Statistics Republika Srpska	Rajko Vranjes, expert for demographic statistics
Water Management (Montenegro)	Natasa Rakocevic, Milo Radovic
COTEE (Crnogorski Operator Trzista Elektricne Energije) Montenegro	Jovan Pavicevic

Directorate for Environmental Protection,
Ministry of Sustainable Development and
Tourism
Montenegro

Vasilije Buskovic

Table 21: Institutions contacted

¹ Sources: latest available data from the economies' statistical sources, complemented with FAO Aquastat, Worldbank, IEA and UNEP-WCMC. Further details are available in the specific chapters of the Study.

² Source: Suggests.Me. <http://suggests.me/geographic-map-of-europe.html/europe-physical-map-of-maps-and-in-geographic>

³ Note that draft texts for each of the economies have been shared previously with the corresponding authorities, with the aim of gathering comments and completing information.

⁴ Drincorda (2018)

⁵ <https://www.ceicdata.com/en/indicators>

⁶ Sources: Albania:

<https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2016&locations=Albania&start=2003&view=chart> ; Bosnia and Herzegovina: The projections were carried out on the basis of the official document of the Economic Reform Program of Bosnia and Herzegovina 2017-2019; Kosovo*:

https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2016&locations=Kosovo*&name_desc=true&start=2003&view=chart ; Montenegro: <https://www.monstat.org/eng/page.php?id=163&pageid=19> ; The Former Yugoslav Republic of Macedonia: Serbia:

<http://data.stat.gov.rs/Home/Result/09020101?languageCode=sr-Cyrl#>

⁷ <https://ec.europa.eu/> (2014)

⁸ Sources: Albania: <http://www.financa.gov.al/en/reports/economic-fiscal-program/basic-macroeconomic-indicators> ; Bosnia and Herzegovina: <https://www.statista.com/statistics/453901/bosnia-herzegovina-gdp-distribution-across-economic-sectors> ; Kosovo*:

https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=Kosovo*&view=chart ; Montenegro: https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=Montenegro&name_desc=false&view=chart ; The Former Yugoslav Republic of Macedonia: <http://www.stat.gov.mk/Publikacii/SG2017/09-NacEk-NatEc.pdf> ; Serbia:

<http://webzrzs.stat.gov.rs/WebSite/Public/ReportResultView.aspx?rptKey=indId%3d0902010301IND01%26101%3dA%2cB%2cC%2cD%2cE%2cF%2cG%2cH%2cI%2cJ%2cK%2cL%2cM%2cN%2cO%2cP%2cQ%2cR%2cS%2cT%2cU%262%3d200300%2c200400%2c200500%2c200600%2c200700%2c200800%2c200900%2c201000%2c201100%2c201200%2c201300%2c201400%2c201500%2c201600%26102%3dRS%266%3d2%26sArealId%3d0902010301%26dType%3dName%26IType%3dSerbianLatin>

⁹ Sources: Albania <http://www.financa.gov.al/en/reports/economic-fiscal-program/basic-macroeconomic-indicators> ; The Former Yugoslav Republic of Macedonia: <http://www.stat.gov.mk/Publikacii/SG2017/09-NacEk-NatEc.pdf> ; Bosnia and Herzegovina: <https://www.statista.com/statistics/453901/bosnia-herzegovina-gdp-distribution-across-economic-sectors> ; Kosovo* https://data.worldbank.org/indicator/NV.IND.TOTL.ZS?locations=Kosovo*&view=chart ; Montenegro: https://data.worldbank.org/indicator/NV.IND.TOTL.ZS?locations=Montenegro&name_desc=false&view=chart ; The Former Yugoslav Republic of Macedonia: <http://www.stat.gov.mk/Publikacii/SG2017/09-NacEk-NatEc.pdf> ; Serbia:

<http://webzrzs.stat.gov.rs/WebSite/Public/ReportResultView.aspx?rptKey=indId%3d0902010301IND01%26101%3dA%2cB%2cC%2cD%2cE%2cF%2cG%2cH%2cI%2cJ%2cK%2cL%2cM%2cN%2cO%2cP%2cQ%2cR%2cS%2cT%2cU%262%3d200300%2c200400%2c200500%2c200600%2c200700%2c200800%2c200900%2c201000%2c201100%2c201200%2c201300%2c201400%2c201500%2c201600%26102%3dRS%266%3d2%26sArealId%3d0902010301%26dType%3dName%26IType%3dSerbianLatin>

¹⁰ Sources: Albania <http://www.financa.gov.al/en/reports/economic-fiscal-program/basic-macroeconomic-indicators> ; Bosnia and Herzegovina: <https://www.statista.com/statistics/453901/bosnia-herzegovina-gdp-distribution-across-economic-sectors> ; Kosovo* <https://data.worldbank.org/indicator/NV.SRV.TETC.ZS?locations=Kosovo> ; Montenegro: <https://data.worldbank.org/indicator/NV.SRV.TETC.ZS?locations=Montenegro> ; The Former Yugoslav Republic of Macedonia: <http://www.stat.gov.mk/Publikacii/SG2017/09-NacEk-NatEc.pdf> ; Serbia: <http://webzrzs.stat.gov.rs/WebSite/Public/ReportResultView.aspx?rptKey=indId%3d0902010301IND01%26101%3dA%2cB%2cC%2cD%2cE%2cF%2cG%2cH%2cI%2cJ%2cK%2cL%2cM%2cN%2cO%2cP%2cQ%2cR%2cS%2cT%2cU%262%3d200300%2c200400%2c200500%2c200600%2c200700%2c200800%2c200900%2c201000%2c201100%2c201200%2c201300%2c201400%2c201500%2c201600%26102%3dRS%266%3d2%26sArealId%3d0902010301%26dType%3dName%26IType%3dSerbianLatin>

[1%3dA%2cB%2cC%2cD%2cE%2cF%2cG%2cH%2cI%2cJ%2cK%2cL%2cM%2cN%2cO%2cP%2cQ%2cR%2cS%2cT%2cU%262%3d200300%2c200400%2c200500%2c200600%2c200700%2c200800%2c200900%2c201000%2c201100%2c201200%2c201300%2c201400%2c201500%2c201600%26102%3dRS%266%3d2%26sAreaId%3d0902010301%26dType%3dName%26lType%3dSerbianLatin](https://data.worldbank.org/indicator/SL.EMP.TOTL.SP.ZS?end=2017&locations=Albania&start=2003&view=chart)

¹¹ Sources: Albania:

<https://data.worldbank.org/indicator/SL.EMP.TOTL.SP.ZS?end=2017&locations=Albania&start=2003&view=chart> ; Bosnia and Herzegovina: http://www.bhas.ba/?option=com_content&view=article&id=113=ba ;

Kosovo*:

<https://data.worldbank.org/indicator/SL.EMP.TOTL.SP.NE.ZS?end=2016&locations=Kosovo&start=2003> ;

[http://askdata.rks-](http://askdata.rks-gov.net/PXWeb/pxweb/en/askdata/askdata_Labour%20market_02%20Annual%20labour%20market/lfs01.px/table/tableViewLayout1/?rxid=8304ffb6-edc9-)

[gov.net/PXWeb/pxweb/en/askdata/askdata_Labour%20market_02%20Annual%20labour%20market/lfs01.px/table/tableViewLayout1/?rxid=8304ffb6-edc9-](http://askdata.rks-gov.net/PXWeb/pxweb/en/askdata/askdata_Labour%20market_02%20Annual%20labour%20market/lfs01.px/table/tableViewLayout1/?rxid=8304ffb6-edc9-) ; Montenegro:

<https://www.monstat.org/eng/page.php?id=23&pageid=23>, <https://www.monstat.org/eng/page.php?id=234&pageid=48> ; The Former Yugoslav Republic of Macedonia: <http://www.stat.gov.mk/pdf/2006/2.1.6.07.pdf> ;

<http://www.stat.gov.mk/pdf/2007/2.1.7.14.pdf> ; <http://www.stat.gov.mk/pdf/2008/2.1.8.07.pdf> ;

<http://www.stat.gov.mk/pdf/2009/2.1.9.08.pdf> ; <http://www.stat.gov.mk/pdf/2010/2.1.10.07.pdf> ;

<http://www.stat.gov.mk/pdf/2011/2.1.11.03.pdf> ; Serbia:

<http://webzrzs.stat.gov.rs/WebSite/Public/ReportView.aspx>

¹² Sources: Albania:

<https://data.worldbank.org/indicator/Slovenia.POV.GINI?end=2012&locations=Albania&start=2003&view=chart> ; Bosnia and Herzegovina: Employment data is taken from the state statistical agency

<http://www.bhas.ba/index.php?lang=en> ; Kosovo*:

https://data.worldbank.org/indicator/Slovenia.POV.GINI?locations=Kosovo*&view=chart ; Montenegro:

<https://data.worldbank.org/indicator/Slovenia.POV.GINI?locations=Montenegro&view=chart> ; The Former Yugoslav Republic of Macedonia: <https://www.indexmundi.com/>;

¹³ Sources: Albania: Institute of Statistics (INSTAT) <http://www.instat.gov.al> ; Bosnia and Herzegovina:

http://www.bhas.ba/index.php?option=com_publicakcija&view=publicakcija_pregled&ids=2&id=7&n=Vanjska%20trgovina ; Kosovo*: <http://askdata.rks-gov.net> ; Montenegro:

<https://www.monstat.org/eng/page.php?id=171&pageid=171> ; The Former Yugoslav Republic of Macedonia:

http://makstat.stat.gov.mk/PXWeb/pxweb/mk/MakStat/MakStat_NadvoresnaTrgovija_KumulativniPod/125_zemji_kumulativ_ml.px/table/tableViewLayout2/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef ;

¹⁴ Sources: Albania: Institute of Statistics (INSTAT) <http://www.instat.gov.al> ; Bosnia and Herzegovina:

http://www.bhas.ba/index.php?option=com_publicakcija&view=publicakcija_pregled&ids=2&id=7&n=Vanjska%20trgovina ; Kosovo*: <http://askdata.rks-gov.net> ; Montenegro; The Former Yugoslav Republic of Macedonia:

¹⁵ Vukovic & Vujadinovic (2018), page 7

¹⁶ with respect to the baseline period (1986-2005) according to the RCP4.5 (top row) and RCP8.5 (bottom row); statistical significance is marked with dots. Source: Vukovic & Vujadinovic (2018, page 55)

¹⁷ Sources: Albania: Strategjia Kombëtare për Menaxhimin e Integruar të Burimeve Ujore, 2016; Bosnia and Herzegovina:

http://www.bhas.ba/dokumenti/EPR_2_001_01-en.pdf ; Kosovo*: Water Strategy Document

2015-2034; Montenegro: there is no data; The Former Yugoslav Republic of Macedonia:

http://www.stat.gov.mk/PublikaciiPoOblast_en.aspx?id=34&rbrObl=37 ; Serbia: Statistical Office of the Republic of Serbia

¹⁸ <https://www.eea.europa.eu/data-and-maps/indicators/use-of-freshwater-resources-2/assessment-2>;

‘stressed’ beyond 20% and ‘severely stressed’ beyond 40%: The water exploitation index has been calculated as a multi-annual average per river basin district, for the years 2002-2012, as defined in ECRINS. The ECRINS delineation of river basin districts differs from those defined by Member States under the Water Framework Directive, particularly for trans-boundary river basin districts. The regionalised Water Exploitation Index (WEI+) is calculated as the ratio of water use over renewable water resources (see Indicator Methodology chapter for further clarification). Raskin et al. (1997) suggests a WEI value above 20 % indicates water scarcity whereas a value higher than 40% indicates severe water scarcity.

¹⁹ Sources: Statistical data, FAO/Aquastat

²⁰ Indicating the water consumption proportion of the available water resources. The WEI+ has been calculated as the quarterly average per river basin district. Source: EEA, <http://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-exploitation-index-for-river-1>.

²¹ Source: Flörke et al., 2011, page 70

²² EEA, 2010, page 24

- ²³ Source: EEA, 2017, <https://www.eea.europa.eu/data-and-maps/indicators/urban-waste-water-treatment/urban-waste-water-treatment-assessment-4>
- ²⁴ <https://washdata.org/>
- ²⁵ WHO/UNICEF, 2017, Annex 3
- ²⁶ Vukmir et al., 2009, page 36
- ²⁷ WHO/UNICEF, 2017, page 21
- ²⁸ WHO/UNICEF, 2017, page 39
- ²⁹ WHO/UNICEF, 2017, page 25
- ³⁰ Vukmir et al., 2009, page 85
- ³¹ UNISDR, Record floods challenge Serbia and Bosnia and Herzegovina (United Nations Office for Disaster Risk Reduction, Regional Office for Europe, 2014).
- ³² BBC News Online, Balkan Floods: Fears of new surge on Serbia's River Sava, 18 May 2014.
- ³³ For the RCP4.5 scenario: 2071–2100 versus 1981–2010 (average of KNMI, Swedish Meteorological and Hydrological Institute, IPSL and DMI models). Only main rivers displayed. Source: UNECE, 2017a, page 48
- ³⁴ De Roo et al., 2016, page 79
- ³⁵ IEA, 2017
- ³⁶ UNECE, 2017a, page 53
- ³⁷ Source: IEA, 2017
- ³⁸ Sources: Albania: Institute of Statistics (INSTAT) <http://www.instat.gov.al>; Bosnia and Herzegovina: http://www.bhas.ba/tematskibiltini/NUM_00_2017_TB_0_BS.pdf; Kosovo*: Statistical Year Book of Kosovo* – 2017; Montenegro: <http://www.mek.gov.me/files/1202471750.pdf>, <https://www.monstat.org/eng/page.php?id=1314&pageid=39>; The Former Yugoslav Republic of Macedonia: http://mepso.com.mk/CMS/Content_Data/Dokumenti/%D0%94%D0%B8%D1%81%D0%BF%D0%B5%D1%87%D0%B5%D1%80%D1%81%D0%Bosnia%and%Herzegovina%D0%B8%20%D0%B8%D0%B7%D0%B2%D0%B5%D1%88%D1%82%D0%B0%D0%B8/MESECEN%2OIZVESTAJ%20ZA%20EPS%2012.2017.pdf
- ³⁹ Weiss et al., 2018; note this study covers the whole of the Balkans and is not limited to the SEE2020 region.
- ⁴⁰ Source: <https://balkanrivers.net/en/vmap>
- ⁴¹ Source: Schwarz, 2017.
- ⁴² Vukovic & Vujadinovic (2018), page 7
- ⁴³ Source: Flörke et al., 2011, page 81
- ⁴⁴ Calculation based on median ensemble results from LISFLOOD linked to projections for population and TEP from SCENES scenarios. Source: Flörke et al., 2011, page 88
- ⁴⁵ EEA, 2010, page 92
- ⁴⁶ Source: IEA; www.iea.org
- ⁴⁷ Source: IEA, www.iea.org
- ⁴⁸ Sources: Albania: Statistical Yearbook 2010-2014-2016-2017; Bosnia and Herzegovina: <https://tradingeconomics.com/bosnia-and-herzegovina/arable-land-percent-of-land-area-wb-data.html>; Kosovo*: Land cover 2012; Montenegro: https://www.theglobaleconomy.com/Montenegro/Percent_agricultural_land/, https://www.theglobaleconomy.com/Montenegro/forest_area/, <https://www.indexmundi.com/facts/montenegro/indicator/SP.URB.TOTL.IN.ZS>; The Former Yugoslav Republic of Macedonia: http://www.moepp.gov.mk/?page_id=3036&lang=en; http://www.moepp.gov.mk/?page_id=5721&lang=en; <http://www.stat.gov.mk/Publikacii/PDFSG2016/02-ZivotnaSr-Environment.pdf>; Serbia: <http://www.sepa.gov.rs/index.php?menu=204&id=2002&akcija=showExternal>; http://www.rdvode.gov.rs/doc/Strategija_FINAL.pdf page 24
- ⁴⁹ EEA, 2010, page 124
- ⁵⁰ Daccache et al., 2014, pages 4 and 10
- ⁵¹ DrinCorda, 2018
- ⁵² Vukovic & Vujadinovic (2018), page 7
- ⁵³ EEA, 2010, page 25
- ⁵⁴ http://ec.europa.eu/eurostat/statistics-explained/index.php/Organic_farming_statistics (2016 data)
- ⁵⁵ https://ec.europa.eu/agriculture/sites/agriculture/files/bilateral-relations/pdf/kosovo*_en.pdf (2014)
- ⁵⁶ <https://ec.europa.eu/agriculture/enlargement/>
- ⁵⁷ EEA, 2010, page 87

- ⁵⁸ <http://www.fao.org/faostat/en/#data/FS>
- ⁵⁹ WHO. <http://apps.who.int/gho/data/view.main.BMIPLUS2C10-19v?lang=en>, data referring to the age group of 10-19 year old, both sexes.
- ⁶⁰ EEA, 2010, page 123
- ⁶¹ UNEP-WCMC, 2018.
- ⁶² Sources: 2018 data taken from UNEP-WCMC, 2018. Montenegro data from <https://www.indexmundi.com/montenegro/habitat-protection.html> except 2020 data from Economy's Strategy.
- ⁶³ Based on Harmel et al, 2017, p.113ff
- ⁶⁴ https://ec.europa.eu/clima/policies/strategies/2050_en
- ⁶⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015&locale=en>
- ⁶⁶ Based on UNECE, 2017a, page 84
- ⁶⁷ Source: Own preparation based on Dworak (2013), EEA (2010) and UNECE (2011)
- ⁶⁸ DrinCorda (2018) refers to "The majority of the impact resulting from climate change in agriculture, will be manifested through the us-age and availability of water. Climate change is expected to result in a decrease in annual water quantities available to agriculture in many areas due to a decrease in summer rainfalls."
- ⁶⁹ Vukmir et al, 2009, page 76, referring to Bosnia and Herzegovina. Duel & Meijer, 2011 (page 30) considers however that impacts in the Western Balkans will be lower than in Greece or Spain.
- ⁷⁰ Vukovic & Vujadinovic (2018), page 16
- ⁷¹ E.g. UNECE, 2017a, page 26
- ⁷² <https://www.rcc.int/seeds/results/2/balkan-opinion-barometer> including some survey questions which allow for assessing trends in answers. However, as the surveys have only been carried out since 2015, listed trends might not be too reliable.
- ⁷³ All economies except Kosovo*; https://treaties.un.org/pages/viewdetails.aspx?src=treaty&mtdsg_no=xxvii-13&chapter=27&lang=en
- ⁷⁴ UNECE, 2017a, page 26
- ⁷⁵ Climate change scenarios for The Former Yugoslav Republic of Macedonia and Kosovo* indicate overall increases in air temperature (DrinCorda, 2018)
- ⁷⁶ TNC Bosnia and Herzegovina, 2017
- ⁷⁷ For some of the documents, a screening assessment whether the considerations are of 'high' or 'low' relevance has been carried out; for others a 'yes' or 'no' is stated
- ⁷⁸ Compared to the base year 2000, under the Sustainability Eventually Scenario. Source: CESR, 2007 quoted in EEA, 2010, page 129.
- ⁷⁹ IUCN, 2018
- ⁸⁰ Ozment, DiFrancesco & Gartner, 2015
- ⁸¹ Including multi-stakeholder dialogue
- ⁸² Source: UNECE, 2011
- ⁸³ Source: UNECE, 2011
- ⁸⁴ Source: UNECE, 2011
- ⁸⁵ Source: UNECE, 2011
- ⁸⁶ IEA (2000b)
- ⁸⁷ Further details in IEA (2000b)
- ⁸⁸ DIKTAS, 2014
- ⁸⁹ UNESCO-IHP (2012)
- ⁹⁰ UNECE (2011)
- ⁹¹ in the framework of the GEF Lake Ohrid Conservation Project (ended in 2004).
- ⁹² http://www.savacommission.org/event_detail/0/0/303/3). Source: 2nd Sava River Basin Analysis, 2016
- ⁹³ Source: UNECE, 2011, updated
- ⁹⁴ NEXUS (2012a and b)
- ⁹⁵ Putting people and their basic human rights at the centre of the Nexus; Creating public awareness and the political will to establish effective legislative frameworks, promoting good governance, greatly reducing and eventually eliminating corruption; and Involving local communities, including indigenous and women's groups fully and effectively in the planning and implementation processes related to water, energy and food nexus for local ownership and commitment
- ⁹⁶ Increase policy coherence; Accelerate access; Create more with less; End waste and minimize losses; Value natural infrastructure; Mobilize consumer influence

⁹⁷ Make the sectors work for the poor; Assess the potential for a more interlinked approach by preparing a medium to long-term “Nexus Strategy” based on cross-sectoral knowledge base - a Water, Energy and Food “Outlook”; Establish an enabling framework for policy dialogue and coherence across sectors; Build coherence in regulatory, planning and management frameworks and incentivize nexus outcomes; Sector-based actions based around the dimensions of policy, institutions and finance; Adopt conventional and innovative financing arrangements to achieve water, energy and food security and implement a nexus approach that also reflects the value and services provided by the natural environment; Improve governance arrangements through more open, participatory processes, recognition of human rights and adoption of accountability and monitoring mechanisms; Consider the trans-Economy consequences and externalities of trade policy on water, energy and food security; Adopt both a regional and a basin-wide perspective reflecting the principles of integrated water resources management and influences that go beyond the boundaries of a river basin; Provide the learning and knowledge management opportunities necessary to create a cadre of leaders to think interlinked; and Establish monitoring systems.

⁹⁸ Euronatur and ECA Watch (Schwarz, 2012) reports; and UNECE, 2017a, page 54

⁹⁹ Recommendations of the 2010 EU Water Directors Statement (Kampa, et al. 2011)

¹⁰⁰ Harmel et al, 2017, p.144 referring to the Drin river

¹⁰¹ For example taken from the IEA guidelines for decision-making first published in 2000 and updated in 2010 or the European funded SHERPA project or the South-East-Europe Cooperation Programme, co-funded by the European Regional Development Fund has issued a series of recommendations and handbooks on sustainable management of hydropower as part of the SEE HydroPower Project.

¹⁰² UNECE, 2017a, page 67

¹⁰³ UNECE, 2017a, page 54

¹⁰⁴ UNECE, 2017a, page 67. Note it is not clear if the regime has been implemented in practice.

¹⁰⁵ <http://www.greenhome.co.me/index.php?IDSP=849&jezik=eng>

¹⁰⁶ Harmel et al, 2017, p.134 referring to the Drin river. UNECE, 2011, p.277 refers to such an approach as “The Petersberg Phase II/Athens Declaration Process (coordinated by Germany, Greece and the World Bank, supported technically and administratively by GWPMed), acting in cooperation with UNECE, GEF and UNDP, facilitates a regional multi-stakeholder dialogue process, aiming to explore possibilities of moving the level of cooperation from the sub-basin to the Drin Basin level.”

¹⁰⁷ DIKTAS, 2014, p22

¹⁰⁸ UNECE, 2017a, page 73

¹⁰⁹ WFD-eu.me

¹¹⁰ <http://drincorda.iwlearn.org/gef-supported-drin-project>

¹¹¹ www.dmcsee.org

¹¹² <http://www.interreg-danube.eu/approved-projects/dridanube>

¹¹³ Harmel et al, 2017, p.144 referring to the Drin river

¹¹⁴ UNECE, 2017a, page 76

¹¹⁵ WWAP/UN, 2018

¹¹⁶ www.nwrm.eu

¹¹⁷ DIKTAS, 2014, p.22

¹¹⁸ Harmel et al, 2017, p.134

¹¹⁹ DIKTAS, 2014, p.22

¹²⁰ UNECE, 2011, referring to the Danube river, p.173

¹²¹ DIKTAS, 2014, p.22

¹²² DIKTAS, 2014, p.20

¹²³ DIKTAS, 2014, p.22

¹²⁴ UNECE, 2011, p.173

¹²⁵ UNECE, 2017a, page 63

¹²⁶ E.g. UNECE, 2011, p.272: „Numerous measures are needed with regard to Beli Drim/Drini Bardhe aquifer (No. 133); priority should be given to monitoring groundwater quantity and quality, detailed hydrogeological and vulnerability mapping, delineation of protection zones, construction of wastewater treatment facilities as well as to public.”

awareness campaigns.

¹²⁷ E.g. UNECE, 2011, p.272 re Beli Drim/Drini Bardhe aquifer

¹²⁸ UNECE, 2017a, page 77

¹²⁹ UNECE, 2017a, page 77

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- ¹³⁰ UNECE, 2017a, page 77
¹³¹ Harmel et al, 2017, p.134
¹³² Harmel et al, 2017, p.134
¹³³ UNECE, 2017a, page 26
¹³⁴ UNECE, 2017a, page 26
¹³⁵ Blumstein et al 2017, p24-25
¹³⁶ Wikipedia, https://en.wikipedia.org/wiki/Circular_economy
¹³⁷ Wikipedia
¹³⁸ Wikipedia
¹³⁹ Wikipedia
¹⁴⁰ Wikipedia quoting Hufty, Marc (2011).
¹⁴¹ Wikipedia
¹⁴² IUCN, 2018
¹⁴³ <https://en.glosbe.com/en/en/no%20regrets%20measure>
¹⁴⁴ Wikipedia, https://en.wikipedia.org/wiki/Resource_efficiency
¹⁴⁵ Wikipedia
¹⁴⁶ Wikipedia
¹⁴⁷ Adapted from Wikipedia