

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# A nexus approach to transboundary cooperation

The experience of the Water Convention



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More information about the nexus assessments under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention): <http://www.unece.org/env/water/nexus.html>

The key references from ECE:

Methodology for Assessing the Water-Food-Energy-Ecosystems Nexus in Transboundary Basins and Experiences from its Application: Synthesis (United Nations, 2018)

Reconciling Resource Uses in Transboundary Basins: Assessment of the Water-Food-Energy-Ecosystems Nexus (United Nations, 2015)

Policy Guidance Note on the Benefits of Transboundary Water Cooperation (United Nations, 2015)

All publications are available from <http://www.unece.org/env/water/publications/pub.html>

## Why a “water-energy-food-ecosystems” nexus approach to foster transboundary cooperation?

**Every transboundary river basin or aquifer presents specific management-related challenges, and making a coordinated response to various pressures is beyond the means of water management alone.** For example, among the intersectoral challenges that call for coordinated solutions across sectors and borders are: flooding and sedimentation, water scarcity and pollution, unsustainable land use and agricultural practices, suboptimal use of existing infrastructure and impacts of new infrastructure, inefficient use of resources, and degradation of ecosystems and their services. Various drivers of change, economic strategies and sectoral policies result in pressures and impacts on water resources, and water management does not always have an influence on such factors.

**A “nexus approach” to managing interlinked resources has become recognized for its potential to enhance the closely interlinked aspects of water, energy and food security by increasing efficiency, reducing trade-offs, building synergies and improving governance, while also protecting ecosystems.** A common ground for compromise needs to be found to effectively address trade-offs between development and environment protection, and also between diverging interests of riparian countries and economic sectors. At the same time, applying a nexus approach can bring mutual benefits between energy and water efficiency, and also helps to establish coherence between sectoral policies. With a better understanding of the benefits for different sectors and the implications of sectoral developments for water resources, nexus considerations also provide a more solid basis for equitable water allocation between various uses in watercourse-sharing countries.

**Recognizing the need to strike a balance be-**

**tween different sectoral objectives, the international community explicitly calls for taking a nexus approach to implement the Sustainable Development Goals (SDGs).** In taking such an approach, cooperation in the management of natural resources is essential. The 2030 Agenda for Sustainable Development, adopted by the Member States of the United Nations in 2015, includes several goals (17) and a multitude of targets (169). In line with the spirit of the 2030 Agenda, these targets are highly ambitious, and many of them – notably those related to water and sanitation (SDG 6), food security (SDG 2), sustainable energy (SDG 7) and environmental protection (SDG 15) – draw from a common pool of natural resources that are globally finite, and sometimes locally scarce. Achieving all the SDGs simultaneously means reconciling different interests and taking into account these interdependencies when devising the implementation of sectoral policies and measures. Policymakers (and national authorities in particular) are therefore called to take a more sustainable and collaborative approach to resource management and then, crucially, to translate this collaboration into concrete actions.

**At present, policymakers around the world face common challenges: improving coherence between sectoral policies, balancing economic growth with environment and climate action, and using resources more efficiently.** In order to manage natural resources more responsibly and sustainably, Governments need to gain greater understanding – and control – of the dynamics linking policy decisions at different levels (basin, local, regional, national). What, for example, is the impact of a national strategy on climate change mitigation on river basin management planning? Are there trade-offs and synergies to be discussed? And if so, through which

mechanisms? Although integrated resource management approaches are not new, and many have become well established (e.g. Integrated Water Resources Management (IWRM) at the river-basin level), a nexus approach aims at taking integration a step further by promoting dialogue between different resource management fields, and across scales, in strategic policymaking and planning.

**Nexus dynamics are particularly complex in transboundary basins because intersectoral impacts can traverse borders, and governing such complexity requires international cooperation.** In fact, it was precisely an awareness – underpinned by evidence from regional assessments on transboundary waters – of the adverse effects of low policy coherence across sectors and countries that lay behind the decision of the Parties to the Water Convention in 2012 to look into assessing nexus issues. The Water-Energy-Food-Ecosystems Nexus approach applied under the Water Convention reflects, on the one hand, the mandate of the Water Convention to control and reduce transboundary impacts, to use transboundary waters in reasonable and equitable ways, and to ensure their sustainable management; and, on the other, the prominent role of the energy and agricultural sectors among large water users and other impact sources.

**The Water-Food-Energy-Ecosystems Nexus approach applied under the Water Convention reflects a variety of perspectives from different sectors.** The water sector, however, has played a prominent role in the development of a nexus approach from the beginning: this is mostly a response to the need to capture the multiplicity of drivers and pressures on one single resource, namely water. A greater awareness of nexus dynamics has evolved over time, thanks to the leading efforts of several international agencies. Highlighted efforts within the energy community include the work of the International Renewable Energy Agency (IRENA) on the im-

pact of renewables on water and land resources, and that of the International Energy Agency (IEA) on the interdependencies between energy and water utilities. In agriculture, the Food and Agricultural Organization of the United Nations (FAO) has provided technical support to set up “nexus-sensitive” policies. Furthermore, leading environmental organizations such as the International Union of Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) have contributed shared perspectives on the nexus, namely: environmental resilience is a function of sustainability, and a nexus approach can help in taking better account of environmental needs when planning for socioeconomic development.

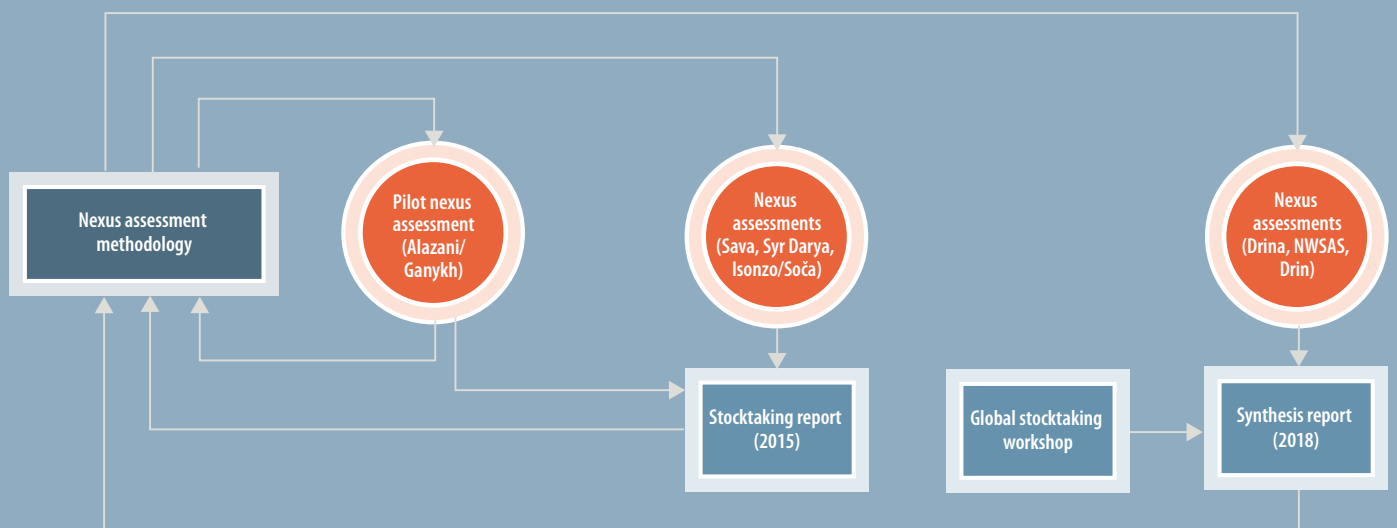
**Reflecting the specificities of the nexus in transboundary basins, the main objective of the work on the nexus carried out under the Water Convention is to foster cooperation.** In practice, this means supporting joint identification of synergies and actions that can reduce tensions related to the multiple needs for common resources; it also means assisting countries in optimizing resource use and in building capacities to address intersectoral and transboundary impacts. Water Convention work on the nexus thus far includes: the development and piloting of a methodology for participatory assessment of the nexus in transboundary basins (hereafter simply referred to as “the methodology”); a series of demand-driven basin assessments in close cooperation with the Governments of riparian countries; the facilitation of or contributing to national-level and regional-level dialogue; the dissemination of findings and experience from the assessments; and general advocacy for cooperation to address intersectoral issues in transboundary basins. It is the Task Force on the Water-Food-Energy-Ecosystems Nexus under the Water Convention that provides a devoted platform with a focus on transboundary settings for Governments who want to exchange experience on identifying, assessing and responding to complex intersectoral issues.

# The “transboundary basin nexus assessment” methodology

**The development of the methodology was iterative, involved a great deal of learning by doing, and resulted in a flexible, adaptable framework.** The first version of the methodology was developed between 2013 and 2015, with key expert input from the Royal Institute of Technology (KTH, Stockholm), and informed by feedback from its first applications in a set of representative transboundary basins in Southern Europe, the Caucasus, and Central Asia. From 2016 to the present, the methodology has been further refined, taking into account additional assessments (including the first aquifer, in North Africa), and with increasingly multidisciplinary input (see figure 1). In the course of conducting all of the basin assessment processes, close to 300 officials, experts, and other key stakeholders have contributed to shaping the methodology, whether directly or indirectly. Notably, each basin case has required some degree of adaptation, which effectively demonstrates the evolution of a flexible and adjustable framework.

**The nexus assessment of a basin is a highly participatory process that builds upon a frequent exchange of information between the analysts carrying out the assessment and the stakeholders involved in the process.** There is also a great variety of input (including opinions from different sectors and countries) to be collected, processed, analysed and discussed during the assessment. The ultimate goal of this participatory process is to generate a broad range of solutions and actions in response to pressing issues shared in common that are jointly identified by a representative group of stakeholders from key sectors in all riparians (see figure 2). Workshops are the backbone of the participatory process: they provide venues for direct consultation and – most importantly – intersectoral, transboundary dialogue. The workshops are explicitly designed to allow voices to be heard from all concerned sectors, to facilitate stakeholder dialogue, and to discuss possible solutions and associated benefits, informed by analysis.

**FIGURE 1**  
The iterative process of development of the methodology.



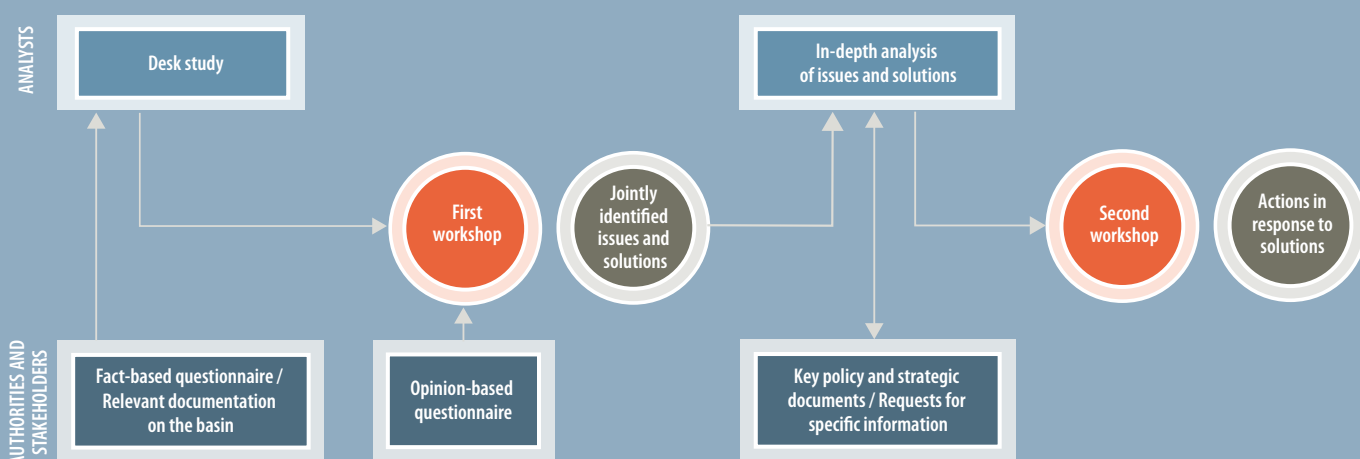
**For the analyst, a transboundary basin nexus assessment consists of six consecutive steps.** Starting from a broad understanding of the overall socioeconomic context of the basin, the riparians and the surrounding region, the assessment zooms in on the analysis of specific intersectoral issues of relevance. The first part of the assessment is basically diagnostic and is largely based on desk work (with limited input and guidance from local authorities and focal points, as needed); the second part, which delves into priority issues, requires a higher level of stakeholder engagement (see figure 3).

**Participatory methods provide for consultation of authorities and key stakeholders at crucial moments of the assessment process.** In fact, the effectiveness of participation can be a decisive factor in ensuring the relevance of conclusions and the uptake of findings. Key participatory methods used in the methodology are: stakeholder mapping of key sectors and actors (also to inform the selection of participants in the assessment); factual questionnaires to gather preliminary information; opinion-based questionnaires to reveal different views; brainstorming exercises to identify nexus issues; and a nexus dialogue to develop a shared understanding.

**The analytical work builds on two fully complementary tracks: the technical analysis and the governance analysis.** The first track is a technical assessment of natural resources in terms of their availability and quality, and considers the evolution of their multiple uses in terms of demands and impacts. The aim of second track, the governance analysis, is to understand how rules and actors determine the management of these resources. In-depth governance assessments include the consideration of organizations and other actors, the legal and regulatory basis, and relevant policies related to the key sectors. The scope includes considering different scales and cycles of decision-making, institutional arrangements and governance culture.

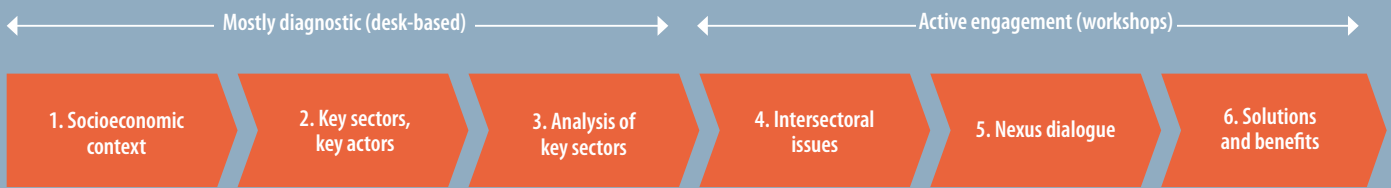
**The methodology enables stakeholders to jointly map positive linkages (synergies) and negative linkages (trade-offs, impacts) between sectors, with the possibility to account for future changes.** Working with officials and experts from the concerned sectors and countries, linkages are identified and mapped in a qualitative way and in a participatory manner (see figure 4). It is crucial that the perspectives of all key sectors are brought to the table: to this end, a brainstorming exercise in

**FIGURE 2**  
The participatory process of the methodology



**FIGURE 3**

**The six steps of the nexus assessment of a transboundary basin in the methodology**



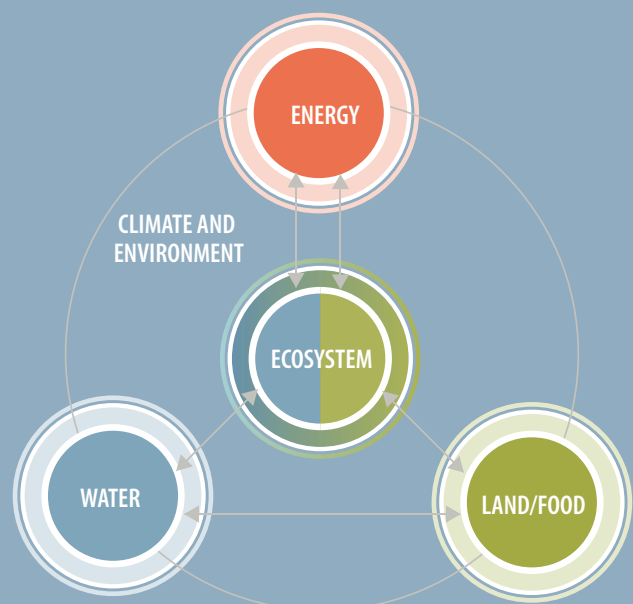
sectoral groups precedes the actual nexus dialogue during which interlinkages are jointly prioritized.

**A limited quantification of interlinkages is undertaken to motivate a more focused follow-up analyses.** Priority interlinkages (as defined by participants in the nexus assessment process) can be quantified as trade-offs, solutions or benefits, provided that data and applicable analytical tools are available. While some quantification is included in the assessment, this is mostly done to illustrate the potential of a quantitative assessment of the nexus and to establish a basis for more focused and advanced follow-up analyses (e.g. to compare different degrees of cooperation between hydropower operators along a river in terms of energy production, greenhouse gas emissions and flood response).

**Benefits of cooperation are made explicit for different sectors.** Looking at the range of benefits that can be generated by using a nexus approach helps to communicate the value of cooperation between sectors at the transboundary level. Pointing out the benefits of implementing nexus solutions provides additional incentives to put assessment recommendations into action; at the same time, the nexus assessment provides space for revealing previously overlooked benefits of possible coordinated actions in the basin (both from a national and a basin perspective). This can result in preparing common ground for broader cooperation: while each riparian will not gain in every respect, the sum of all benefits – also counting non-economic benefits, and across multiple sectors – is greater than it would be from just allocating water.

**FIGURE 4**

**Basic, adaptable workshop diagram to facilitate nexus dialogue**





## The importance of ownership, partnership and adaptability

**The participatory assessment process is driven by stakeholders from the riparian countries and overseen by a dedicated group of Government representatives.** All basin assessments were initiated upon expressions of interest from riparian countries or joint bodies for cooperation and carried out in close cooperation with the national authorities of riparian countries. Guidance and oversight is provided by the Task Force on the Water-Food-Energy-Ecosystems Nexus. The Task Force has met annually from 2013, and has seen increased participation from non-water actors. The Task Force provides a forum for the Governments involved in the assessments to shape the process, to review analytical results and draft

assessments, and to discuss findings and related recommendations. The forum has also been used by partner organizations, experts, development partners and civil society groups to exchange experiences in tackling nexus issues.

**It is the intention that the methodology used for the assessments be as conveniently flexible as possible.** In addition to assessing a nexus in highly diverse river basins (e.g. in terms of economic development and abundance or scarcity of resources), the methodology's application to an aquifer demonstrates its flexibility. Such flexibility is necessary and meaningful, given the unique circumstances of each transboundary basin (see



table 2). In different assessments this has allowed the Water Convention to forge partnerships – e.g. with the Global Environment Facility (GEF) – and to integrate additional scientific inputs (e.g. work by the Joint Research Centre (JRC) added to the breadth of analysis in the Sava River Basin). Furthermore, this flexibility offers a possibility to adjust the participatory process to different levels of resource availability.

**The methodology can be further improved with more application and through complementary work with partners.** From its inception, the development of the methodology has been a collective process that continuously gathers input from experts and gleans experience from practical application. Given the methodology's progressive refinement, the possibility exists to use different tools for carrying out analytical work. Partner organizations can therefore suggest their own tools and processes, and also draw upon their networks for expertise. Collaboration with the Global Water Partnership Mediterranean (GWP-Med) is the most far-reaching example. In the North-West Sahara Aquifer System, GWP-Med contributes with stakeholder mapping practices and, in the Western Balkans, with regional dissemination and linking to national-level assessment of nexus issues.

**Nexus assessments in transboundary basins often have synergies with other processes.** Assessments, for instance, have benefited from the joint organization of workshops in gaining a wider outreach, but they have also helped to shape or trigger subsequent activities in the regions in question (for example, by calling attention to the trade-offs and cooperation needs related to hydropower development in the Western Balkans, by contributing to the scoping of the European Commission-funded Regional Nexus Dialogue in Central Asia etc.). Nexus work under the Water Convention in general has led to synergies with other partners and activities, some within the ECE, such as: cooperation with the Sustainable Energy Division, or using the

National Policy Dialogues to discuss findings in inter-ministry settings.

**The nexus approach adds value to basin-based and water- and ecosystems-focused approaches by building a better understanding of the energy sector and agricultural trade dynamics.** Some key elements were found in the Syr Darya assessment, for example: accounting for trade of agricultural products, and modelling regional electricity system response to actions like improved energy efficiency and increased generation of renewable energy – notably non-hydro – which could then be translated into implications for the hydrological system. In the Drina River Basin, for instance, possible benefits to the energy system from the coordinated operation of hydropower plants were debated in the light of analytical findings. Such types of initial evidence that extend beyond water management are complementary to IWRM.

**From a river-basin perspective, the GEF also advocates for the importance of ecosystems to the water, energy and food security nexus.** Among possible means by which a nexus approach could complement GEF projects is the use of multi-resource tools for broader and more comprehensive diagnoses of issues. The nexus assessments already have a history of fruitful interaction with GEF International Waters projects, including in the Kura and Drina Basins. As the latest step, cooperation between the Water Convention and GWP-Med in the Drin GEF project is exploring cooperative opportunities through a nexus thematic study to contribute to the identification of a broad spectrum of root causes of transboundary issues deriving from the energy, forestry and agriculture sectors. The GEF IW Learning Exchange and Resource Network (IW:LEARN) is accelerating the sharing of experience between agencies and basins on how the nexus can best add value. The key challenge is to trigger actions in economic sectors that contribute to environmental and broader cooperation benefits.

## Passing on the experience from the assessment

**The design of the process is crucial, particularly when it comes to the identification of stakeholders and their involvement throughout the process.** Clearly, the official engagement of countries provides for ownership of the process by local stakeholders. Furthermore, carrying out a nexus assessment requires broad participation on the one hand and manageability of the process on the other (notably during the workshops). This is important because of the risk otherwise that the views of some sectors and countries will not be reflected (if, for example, their participation in the assessment is lacking or limited). So, for many reasons, the involvement of all basin countries, key sectors and interests is crucial.

**Communication is an important aspect throughout the assessment process.** Before the process, communication motivates involvement; during the process, it forms valuable networks across sectors and levels of administration, and reinforces the mutual understandings of different interests; afterwards, the communication of outcomes adds to the impact by informing other processes. In this respect, incorporating a “benefits of cooperation” perspective into communication advances the nexus assessments as a whole. It should be pointed out, however, that nexus assessments carried out with this methodology only lay out possible directions for nexus solutions, and that dialogue must continue – driven increasingly by the countries – in order to move forward with their implementation. Assessing the feasibility (technical, financial) and acceptability of priority solutions could be logical next steps in that direction. Some countries have also called for further guidance on implementation and application of a nexus approach.

**The right balance has to be struck between giving an overview of salient intersectoral issues and detailing priority issues, and also between**

**reflecting the complexity of resource dynamics and the clarity of messages.** Previous nexus assessment teams often struggled with navigating between comprehensiveness (i.e. covering all the relevant interlinkages) and focusing on priority issues. Many issues would have merited more study, and more investigation could have been channelled into the assessments, ideally alongside more local input and detailing. At the same time, nexus dialogue has benefited from a certain simplification and the development of clear storylines in the face of highly complex inter-resource dynamics. Technical and academic initiatives (which are encouraged as useful and complementary follow-up activities) can then extend the analysis of sensitive issues without carrying a heavy political charge.

**There is a need for fit-for-purpose nexus tools, as well as for more guidance on how to use and soft-link them to form effective toolkits. Better availability of data is another need.** Nexus assessments under the Water Convention have attempted to provide a space for multidisciplinary analysis to inform a transboundary dialogue, but there are several other approaches and methodologies that bring different merits and scales of focus, and concentrate on different sectors. The United Nations publication *Methodology for assessing the water-food-energy-ecosystems nexus in transboundary basins and experiences from its application: synthesis* (2018) lists some tools for quantitative nexus analysis, but with different sectors covered and different data and resource requirements. While the list is non-comprehensive, it does give a sense of the instruments available to quantitatively analyse the nexus at the transboundary level. A common problem facing analysts is the availability and accessibility of data on resources, their multiple uses, and sectoral plans.

**Appropriate institutional frameworks are crucial not only for carrying out an assessment, but also for fostering follow-up actions.** It is clear that there is a need for processes and frameworks through which analytical tools can be used to inform policy development and decision-making. The Water Convention framework, with its power to convene from the field of water resources management, was reinforced by connecting with regional and sectoral frameworks in order to enhance dialogue and broaden outreach. Notably, cooperation with the ECE Group of Experts on Renewable Energy helped to strengthen the participation of energy stakeholders in the Drina River Basin assessment. Because building upon existing governance structures is often the most effective option, the potential of basin organizations for intersectoral action should be considered when developing solutions. Furthermore, the integrated and intersectoral nature of solutions (thus presented as “packages”) requires partnerships beyond water management. For

instance, exploiting the synergy between ecotourism, sustainable agriculture promoting local products, and the development of renewable energy – as is recommended in the Drina Basin – would require concerted effort from a range of actors and institutions.

**Time and effort are required to effectively advocate for and promote the uptake of assessment conclusions.** The effective communication of nexus issues requires tailoring pertinent messages to their audience, while also considering sectoral and other interests, which requires a deep understanding of a given basin situation. Moreover, to allow the impact of nexus work to materialize (and to resonate beyond the basin level), international organizations need to devote adequate resources to these types of activities, while government officials and other local stakeholders also need to actively engage in peer-to-peer experience-sharing and in translating identified opportunities into practical actions.



**TABLE 1**

**The five categories of nexus solutions, as used in the nexus assessments, and selected examples**

TYPE OF NEXUS SOLUTION	EXAMPLES
<p><b>Institutions</b> Spanning from institutional reforms to improved institutional cooperation and governance culture.</p>	<ul style="list-style-type: none"> <li>• Clarify roles and responsibilities of organizations.</li> <li>• Set up or improve existing mechanisms for coordinating across sectors at the national and/or the transboundary level.</li> <li>• Ensure coherence between sectoral strategies.</li> </ul>
<p><b>Information</b> Improving collection, accessibility and communication of data, information and knowledge related to basin resources and their dynamics.</p>	<ul style="list-style-type: none"> <li>• Improve monitoring of resource availability, quality, uses etc., as well as forecasting and prediction.</li> <li>• Identify policy implementation barriers.</li> <li>• Introduce and improve standards (e.g. for efficiency) and develop and apply integrated planning principles and guidelines.</li> <li>• Share data across borders and with different users.</li> </ul>
<p><b>Instruments</b> Defining and implementing various instruments to address trade-offs and promote synergies in the management of natural resources and environmental protection.</p>	<ul style="list-style-type: none"> <li>• Policy instruments, targets and plans for key sectors</li> <li>• Economic instruments to provide incentives for rational and sustainable resource use, including tariffs by consumption and fees</li> <li>• Legal instruments such as agreements and protocols</li> </ul>
<p><b>Infrastructure (and investments)</b> Planning (i.e. designing, siting, financing) and modernizing or modifying existing infrastructure.</p>	<ul style="list-style-type: none"> <li>• Direct investments towards multi-purpose and environmentally sound infrastructure projects (both “grey” and “green”).</li> <li>• Improve resource efficiency in transmission and conveyance networks on the user side as well, taking into account indirect and cross-sectoral impacts.</li> <li>• Account for different needs (including environmental needs) in optimizing the use of existing structures.</li> </ul>
<p><b>International coordination and cooperation</b> The most cross-cutting category: solutions of this type are aimed at broadening the scope of transboundary cooperation and identifying common priorities.</p>	<ul style="list-style-type: none"> <li>• Improve basin-wide monitoring, data verification and exchange, as well as knowledge-sharing.</li> <li>• Define areas of common interest for regional development and potential complementarities of resources and between policy goals.</li> <li>• Facilitate trade to improve water, energy or food security; optimize the use of resources and infrastructure at the regional level.</li> <li>• Develop common rules and joint guidelines for key sectors.</li> </ul>

## Beyond the assessment: implementing “nexus solutions”

**While each basin nexus assessment concludes with the identification of possible “nexus solutions” to be implemented, it can only provide directions.** Nexus assessments aim to bring stakeholders together, to increase the knowledge base to support decision-making, to promote dialogue between the countries and sectors, and to identify nexus issues and solutions: however, the implementation of identified solutions goes beyond the aims of the assessment. Implementation will truly take off when identified nexus solutions and their related targets and instruments are taken on in the countries themselves and included in national and sectoral strategies and plans. Strong multisectoral planning enhances the effectiveness of implementing nexus solutions, and

this applies as well to transboundary planning and to national-scale coordination efforts.

**The “nexus solutions” as put forward in the assessments can be conveniently categorized into five groups** (or five I’s, as described in table 1). Solutions are tailored to each basin, and their formulation takes into account the existing resource- and governance base, as well as the specific opportunities available. They are directed in particular towards national and regional authorities and decision-makers. According to the Water Convention’s interpretation, a “nexus solution” can be defined broadly as “an intervention that would benefit more than one sector, in this context including also interventions that re-

**TABLE 2**  
Key features of basin assessments carried out so far<sup>1,2</sup>

	ALAZANI/GANYKH (2013–2015)	SAVA (2014–2015)	SYR DARYA (2014–2016)	ISONZO/SOČA (2015)	DRINA (2016–2017)	NORTH-WEST SAHARA AQUIFER SYSTEM (2017–2019)
<b>Basin size</b>	11,700 km <sup>2</sup>	97,700 km <sup>2</sup>	410,000 km <sup>2</sup>	3,400 km <sup>2</sup>	20,320 km <sup>2</sup>	1,000,000 km <sup>2</sup>
<b>River length</b>	391 km	945 km	3,019 km	140 km	346 km	---
<b>Countries sharing</b>	Azerbaijan, Georgia	Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia, (Albania)	Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan	Italy, Slovenia	Bosnia and Herzegovina, Montenegro, Serbia, (Albania)	Algeria, Libya, Tunisia,
<b>Climate</b>	Warm, temperate	Warm, temperate	Arid/semi-arid	Mediterranean-influenced, partly humid	Warm, temperate	Arid/hyper-arid
<b>Main nexus storylines</b>	<ul style="list-style-type: none"> <li>Lack of access to affordable energy aggravates deforestation, which increases the exposure to flash floods, erosion and landslides.</li> <li>A poor state and inadequate maintenance of irrigation systems aggravates the impact of flash floods on the loss of fertile soil and damage to settlements.</li> </ul>	<ul style="list-style-type: none"> <li>Energy production in the countries depends on water availability in the Sava River Basin.</li> <li>Targets for renewables and climate mitigation push countries to develop more hydropower.</li> <li>There are environmental concerns about dam construction in environmentally sensitive areas.</li> </ul>	<ul style="list-style-type: none"> <li>Energy and food insecurity are drivers for conflicting seasonal water uses and make countries prioritize self-sufficiency over cooperation.</li> <li>This aggravates the current situation of suboptimal use of resources.</li> </ul>	<ul style="list-style-type: none"> <li>Diverse ecosystem services need protection.</li> <li>Hydropeaking affects biodiversity and water availability for irrigation. Irrigation is reduced with water-efficient technology.</li> <li>Groundwater abstraction for irrigation needs energy and may cause seawater intrusion.</li> </ul>	<ul style="list-style-type: none"> <li>Water-flow regulation for power generation is suboptimal and has impacts on flood and drought risks.</li> <li>Application of environmental flows is challenging.</li> <li>Rural development is hampered by low agricultural productivity and a lack of infrastructure.</li> <li>Water quality is declining because pressures go unchecked (solid waste, wastewater).</li> </ul>	<ul style="list-style-type: none"> <li>Heavy and unsustainable use of the aquifer.</li> <li>Heavy use of irrigation with high losses.</li> <li>Water and soil salinization from irrigation and inadequate management of drainage.</li> <li>Water management (pumping from higher depth, treatment etc.) requires sustainable energy solutions.</li> </ul>
<b>Main nexus interlinkages</b>	<ul style="list-style-type: none"> <li>Water-Energy (flood risk, hydropower)</li> <li>Land-Energy-Water (biomass use, erosion/sedimentation, environmental flow)</li> </ul>	<ul style="list-style-type: none"> <li>Water-Energy (flood risk, hydropower)</li> <li>Land-Water (sediment management)</li> <li>Water-Food-Ecosystems (water quality, morphological alterations)</li> </ul>	<ul style="list-style-type: none"> <li>Water-Land-Ecosystems (irrigation, salination)</li> <li>Water-Energy (hydropower)</li> <li>Land-Water-Ecosystems (unsustainable agriculture, insufficient environmental flow)</li> </ul>	<ul style="list-style-type: none"> <li>Water-Energy-Ecosystems (river-flow continuity, hydropeaking)</li> <li>Water-Energy-Food (irrigation)</li> <li>Water-Energy (groundwater pumping, hydropower, cooling of thermal power plants)</li> </ul>	<ul style="list-style-type: none"> <li>Water-Energy (flood risk, cooling, uncoordinated hydropower operation)</li> <li>Water-Food (irrigation, flood risk)</li> <li>Water-Food-Ecosystems (water quality degradation from mainly wastewater and waste)</li> </ul>	<ul style="list-style-type: none"> <li>Water-Energy (groundwater pumping, water use for solar power, desalination)</li> <li>Water-Ecosystems-salinization, desertification)</li> <li>Water-Food (irrigation)</li> </ul>
<b>Examples of solutions</b>	Facilitate access to modern energy sources and energy trade; minimize impacts from new hydropower development, including through international guidelines; catchment management to control erosion; clarify mandates concerning repair of irrigation systems.	Develop hydropower sustainably and integrate other renewable energies; protect natural infrastructure assets such as floodplains and wetlands; develop a consultation process to review the impacts of national and sectoral development strategies.	Promote restoring and vitalizing energy markets; develop the currently minimal trade in agricultural products; improve efficiency in energy generation, transmission and use; improve efficiency in water use (especially in agriculture); reform water and energy pricing.	Link renewable energy generation to existing agriculture infrastructure (small hydropower, solar, biomass); improve river continuity and increase drought resilience; better monitor groundwater use; systematic use of Environmental Impact Assessments, Strategic Environmental Assessment and minimum environmental flows.	Coordinate operation of hydropower plants (for flood control, for energy system benefits, environmental flow) and take a basin-wide approach towards developing new capacities; exploit synergies between ecotourism, sustainable agriculture (local products) and renewable energy.	Modernize and improve sustainability of agricultural infrastructure and production, and increase the value and viability of agriculture; improve the reliability of the energy supply and optimize sources; rationalize water use.

<sup>1</sup> The published reports and policy briefs on the assessments of the water-food-energy-ecosystems nexus are available at: <http://www.uncece.org/env/water/publications/pub.html>

<sup>2</sup> The assessment of the Drin River Basin is not included in this table because the analysis of nexus issues was still ongoing and its respective participatory process was in progress at the time of finalizing this brochure.

duce the pressure on ecosystems (or the environment at large).” This means that nexus solutions can materialize not only as concerted action from multiple parties, but also as action from one sector that brings cross-sectoral benefits.

**The added value of the nexus approach (as opposed to sectoral approaches) is not so much in the identification of single solutions, but rather in their combination and coordination.**

Hence, in a nexus assessment solutions are typically presented as “packages” to be implemented in response to a specific issue. For instance, if a priority issue is “the impacts of flash-floods and sedimentation” (as in the case of the Alazani/Ganykh assessment) the package of nexus solutions will include actions from multiple sectors that can have either a direct impact (e.g. maintenance of riverbanks) or an indirect impact (e.g. energy policy aimed at switching away from fuel-wood, which would in turn reduce forest degradation, restore the capacity of forests to retain water, and reduce impacts from heavy rains and erosion).

**Among the diverse solutions from nexus assessments, there are some commonalities.**

Not all solutions are blueprints for any basin, but they may serve as sources of inspiration for facing common issues. Challenges related to hydropower, for example, are common to several river basins. In the short term, the use of existing reservoir capacity could be adjusted to better support multiple uses through a better coordination of flow regulation, while for future projects the distribution of benefits could be improved (or the negative impacts reduced) by: developing regional electricity grid connections, improving energy efficiency (as opposed to developing new generation capacity), integrating hydro with other renewables (e.g. wind, solar) and coordinating investments into these different technologies, and applying good international practices and instruments.

**There are various bottlenecks obstructing the implementation of nexus solutions.** National administration may be lacking appropriate capacity and the means of coordination, or

coordination may be a low priority. Other governance shortcomings can also complicate matters. Moreover, a lack of adequate data and information for proper analysis to inform policy and decision-making may complicate the processes of demonstrating value and motivating change. Follow-up action (which is fundamental, as the nexus assessment concludes with the identification of solutions) can be demanding, and often requires financial commitment. Last but not least, the transition from an external process with international facilitation to an internal, country-led process is typically challenging, as national and sectoral interests are difficult to reconcile and compromises difficult to strike.

**The progressive application of a nexus approach (or even partial solutions) can pave the way for more ambitious and comprehensive solutions.**

Gradual progress may be necessary in some cases. There are several limitations to the practical application of a nexus approach in that it requires new ways of thinking and working, new partnerships and different incentive structures. Nexus action can start, however, with national efforts – through improved efficiency in the use of water and electricity on shared resources, for example – and then build gradually to include favourable conditions for actions that require regional-level or basin-level coordination.

**The willingness of Governments, along with their decisions to respond to jointly developed conclusions and recommendations, are vital for the formulation and implementation of concrete policy and management responses.**

While international organizations can provide support, political willingness, informed decision-making and effective coordination of response measures are necessary to reap the benefits from the identified nexus solutions that can improve the quality of transboundary resources management. The integrated and intersectoral nature of packages of solutions makes it more complicated to champion their implementation, thereby making it necessary to form partnerships that extend beyond water management.



# A nexus approach to transboundary cooperation The experience of the Water Convention

## Nexus work under the Water Convention

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) aims to ensure the sustainable use of transboundary water resources by facilitating cooperation. The assessment of resources is of fundamental importance as it forms the basis for rational planning and decision-making by Governments, and in transboundary settings it also underpins effective cooperation.

The coordinated or joint assessment of transboundary waters is among the core obligations of the Water Convention. The Second Assessment of Transboundary Rivers, Lakes and Groundwaters, published in 2011, showed evidence of frequent intersectoral frictions in shared basins in the pan-European region and highlighted a low coherence between sectoral policies.

Subsequently, the Meeting of the Parties to the Water Convention (2012) decided to include in the Convention's work programme for 2013–2015 an assessment of the water-food-energy-ecosystems nexus in a representative set of transboundary basins. For this purpose, a participatory methodology was developed and applied in a first set of basin assessments: the Alazani/Ganykh, the Sava, the Syr Darya, and the Isonzo/Soča.

The experience from these first assessments was disseminated through the publication *Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus* (2015), and a global stocktaking workshop on the topic of transboundary nexus assessments was organized in 2016 in Geneva to share experiences with partners and nexus practitioners around the world.

The participatory methodology has been refined and further basin assessments have been initiated. In the period 2016–2018: the nexus assessment of the Drina was completed in 2017, and assessments of the Drin and the North-West Sahara Aquifer System were under preparation in 2018. Furthermore, several follow-up activities to previous nexus assessments were either being carried out or discussed, in synergy with other initiatives.

A synthesis of the nexus work was produced in 2018, at a request of the Parties, with the double objective of sharing on the one hand the updated methodology and its evolution over time (together with key lessons learned from its multiple applications), while on the other giving some directions to take the work forward (i.e. to promote the application of the methodology and to foster follow-up action to the nexus assessments).

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