

# We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index  
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?  
Contact [book.department@intechopen.com](mailto:book.department@intechopen.com)

Numbers displayed above are based on latest data collected.  
For more information visit [www.intechopen.com](http://www.intechopen.com)



# Integrated Water Resources Management as a Basis for Sustainable Development – The Case of the Sava River Basin

Dejan Komatina

*International Sava River Basin Commission  
Croatia*

## 1. Introduction

According to a widely used definition, the integrated water resources management (IWRM) „is a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare, paving the way towards sustainable development, in an equitable manner without compromising the sustainability of vital ecosystems“ (Global Water Partnership, 2000). The IWRM approach helps to manage and develop water resources in a sustainable and balanced way, taking account of social, economic and environmental interests. Although the IWRM concept has been formulated as early as in mid twentieth century (Biswas, 2004), the approach has been granted a due attention in early 1990-ies (*The Dublin Statement on Water and Sustainable Development*, 1992; UNECE, 1992) and, since then, a remarkable work has been done to examine different concepts of IWRM (for review, see Global Water Partnership & International Network of Basin Organizations, 2009).

Particular challenges of IWRM are associated with transboundary basins, especially due to decreasing resources and growing demands. A great number of international basin organizations have been established to manage water resources in transboundary basins. A general distinction can be made between implementation-oriented basin organizations, responsible for development, implementation and maintenance of joint projects, often having a development focus and going beyond pure water resources management, and coordination-oriented basin organizations, in charge of coordinating water resources management tasks that are developed and implemented on national level, but coordinated and harmonized on transboundary level (Schmeier, 2010).

Given the nature of the conventions dealing with transboundary basins in Europe, such as the Danube, Rhine or Elbe basins, the respective basin organizations are obviously focused, either on sustainability issues (i.e. protection of the rivers), or on development activities (i.e. development of navigation, or tourism). However, recent processes, led by European Union, namely the *EU 2020 Strategy* (EC, 2010a) and the *EU Strategy for the Danube Region* (EC, 2010b) yielded new frameworks tending to integrate sustainability and development.

In comparison with other European river basins, however, the situation in the Sava river basin was rather peculiar. The political changes in the region of the former Yugoslavia in

the 1990-ies, which turned the Sava river from the largest national river into an international river, challenged the water management in the Sava river basin substantially, by seriously affecting its basic elements (hydro-meteorological data exchange system, monitoring and early warning systems, etc.) and confining it to a national level, unlike the integrated approach, emerging in Europe at the same time. The changes have also caused a sharp decrease of economic activities in the region, such as navigation, unlike the other parts of Europe, where the inland waterway transport has proven to be a competitive transport mode, being environmentally friendly and capable of reducing congestion on densely used roads (EC, 2006). Since then, the Sava river has been hardly used for transport, for a number of reasons, including a lack of maintenance and investments, resulting in a poor quality of infrastructure, poor intermodal road and railway connections, as well as damaged ports and river infrastructure and presence of unexploded ordnances, endangering safe navigation.

For these reasons, a new international framework became necessary in order to ensure a sustainable use, protection and management of water resources in the Sava river basin, and thus enable better life conditions and raising the standard of population in the region. After a process of negotiations, the new framework has finally been provided by the development of the *Framework Agreement on the Sava River Basin* (FASRB, 2002), and subsequent establishment of the International Sava River Basin Commission (ISRBC), as an international organization with responsibility to coordinate the implementation of the FASRB.

The overall objective of the FASRB is to establish and maintain the transboundary cooperation in the water sector, in order to provide conditions for sustainable development of the region within the Sava river basin. The main purpose of this Chapter is to present the approach to water resources management, based on the FASRB, which appears to be a good basis for a progress toward sustainable development of the region within the basin.

## 2. Natural basis for cooperation in the Sava river basin

This part provides a review of basic facts on the basin, including the information on its biological and landscape diversity, as well as main uses of water resources in the basin, illustrating also the relevance of the Sava river as a Danube tributary (ISRBC, 2009d).

### 2.1 General characteristics of the basin

The Sava river basin is a major drainage basin of the South-Eastern Europe covering the **total area** of approximately 97,713 km<sup>2</sup>, and represents one of the most significant sub-basins of the Danube river basin, with the share of 12% (Fig. 1). The basin is **shared among five countries**, a negligible part of the basin area also extending to Albania (Table 1), and hosts the population of roughly 8.5 million.

The landscape within the Sava river basin is diverse, the **elevation** varying between approx. 71 m above sea level (m a.s.l.) at the mouth of the Sava river in Belgrade (Serbia) and 2,864 m a.s.l. (Triglav, Slovenian Alps). Mean elevation of the basin is approximately 545 m a.s.l. In terms of **land cover/land use**, most of the basin is covered by the forest and semi-natural areas (54.7%) and agricultural surfaces (42.4%), while the share of artificial surfaces is 2.2%.



Fig. 1. Location of the Sava river basin (ISRBC, 2009e)

	SI	HR	BA	RS	ME	AL
Total country area [km <sup>2</sup> ]	20,273	56,542	51,129	88,361	13,812	27,398
Share of national territory in the basin [%]	52.8	45.2	75.8	17.4	49.6	0.6
Area of the country in the basin [km <sup>2</sup> ]	11,734.8	25,373.5	38,349.1	15,147.0	6,929.8	179.0
Share of the basin [%]	12.0	26.0	39.2	15.5	7.1	0.2

Notation: SI – Slovenia; HR – Croatia; BA – Bosnia and Herzegovina; RS – Serbia; ME – Montenegro; AL – Albania.

Table 1. Share of the Sava countries belonging to the Sava river basin (ISRBC, 2009d)

The Sava river basin is situated within a wide region where the moderate **climate** of the northern hemisphere prevails. The average annual **air temperature** for the whole basin is 9.5°C. Mean monthly temperature in January falls to about -1.5°C, while in July it can reach almost 20°C.

**Precipitation** amount and its annual distribution are very variable within the basin (Fig. 2), while the basin average is about 1,100 mm/year. Spatial distribution of **unit-area-runoff** largely follows the pattern of precipitation spatial distribution. It varies from 150 mm/year (below 5 l/s/km<sup>2</sup>) up to 1,200 mm/year (almost 40 l/s/km<sup>2</sup>), as shown in Fig. 3. Spatial distribution of **evapotranspiration** is heterogeneous, too (Fig. 4), with the basin average of about 530 mm/year. The long-term average discharge of the Sava river at the mouth is about 1,700 m<sup>3</sup>/s, which is equivalent to effective rainfall of about 570 mm/year, and to the unit-area-runoff for the whole basin of about 18 l/s/km<sup>2</sup>.

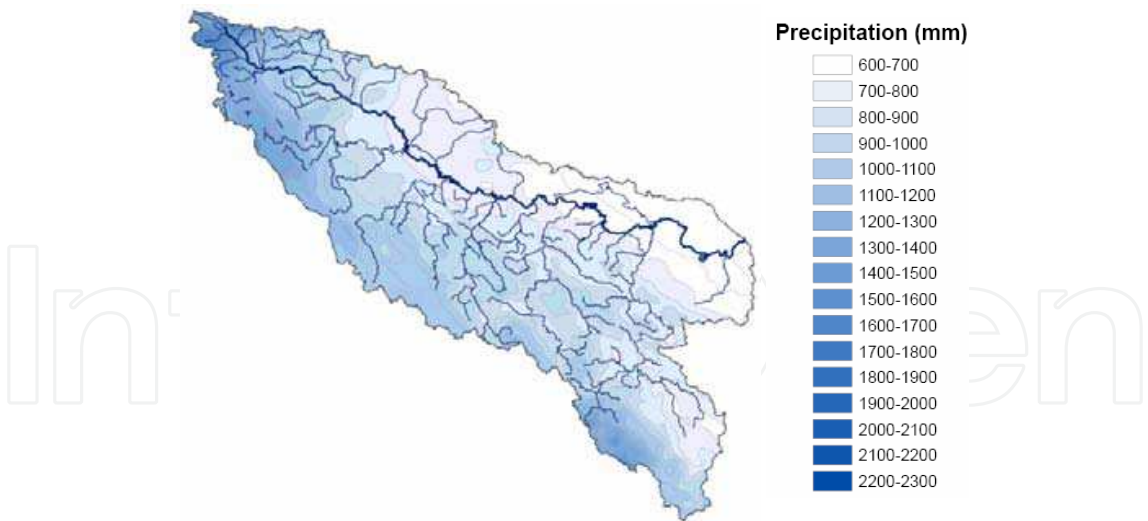


Fig. 2. Mean annual precipitation in the Sava river basin (UNESCO, 2006)

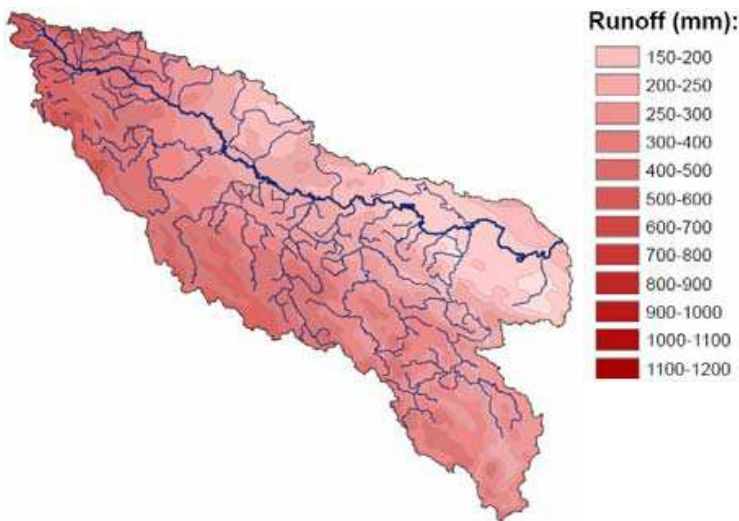


Fig. 3. Mean annual runoff in the Sava river basin (UNESCO, 2006)

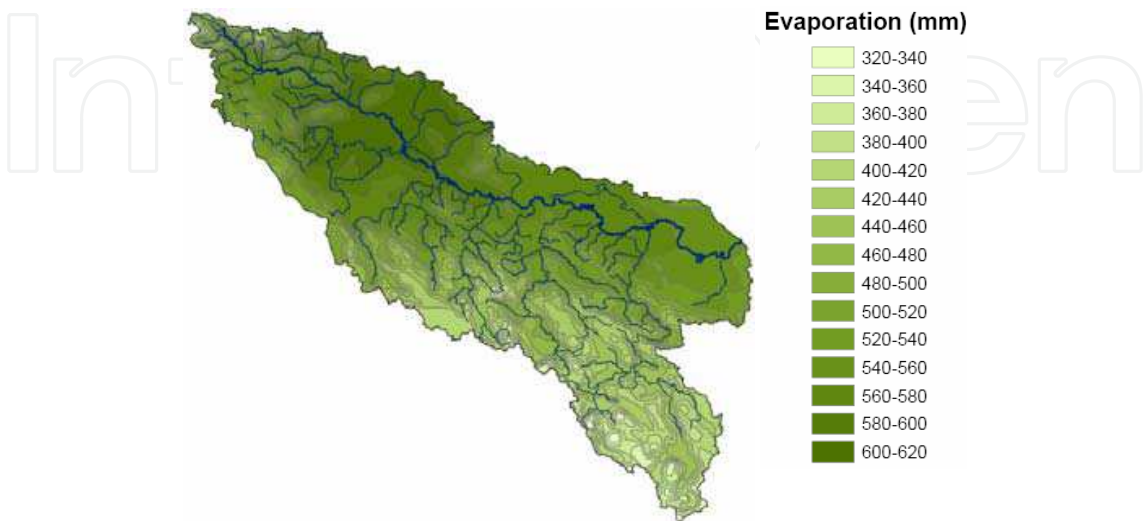


Fig. 4. Mean annual evapotranspiration in the Sava river basin (UNESCO, 2006)



The Sava river is formed by two mountainous streams: Sava Dolinka and Sava Bohinjka. From their confluence to its mouth to the Danube in Belgrade (Serbia), the Sava river is 945 km long, thus being the third longest tributary of the Danube. Together with its longer headwater, the Sava Dolinka river (Fig. 5), it measures 990 km. With its **average discharge** at the confluence of about 1,700 m<sup>3</sup>/s (Fig. 5), the Sava river represents the richest-in-water Danube tributary, contributing with almost 25% to the Danube's total discharge. The longitudinal presentation of annual discharges along the Sava river is given in Fig. 6.



Fig. 5. Source and mouth of the Sava river (Left photo: “Zelenci”, the Sava Dolinka source, Author: Milan Vogrin. Right photo: “Mouth”, Author: Vlada Marinković. Credit: ISRBC)

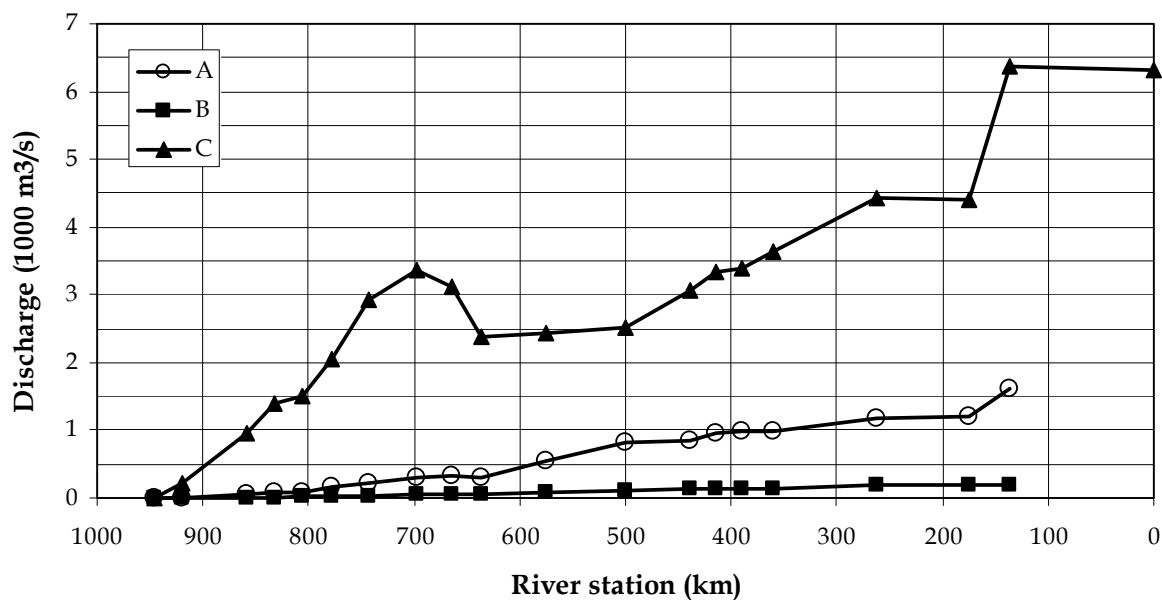


Fig. 6. Annual discharges along the Sava river: A - mean values; B - 100-year return period low flows; C - 100-year return period high flows (ISRBC, 2009d). Note: the river station is measured in the upstream direction (the zero station corresponds to the river mouth)

2.2 Environmental and socio-economic values of the basin

The Sava river basin is widely known for its high environmental and socio-economic values, associated not only with a natural beauty, an outstanding biological and landscape diversity (Fig. 7) and large retention areas along the river, but also with a high potential for

development of economic activities, such as the waterway transport of cargo and passengers, hydropower generation, tourism and recreation, as well as other activities related to the use of water.



Fig. 7. Tributaries of the Sava river, Una and Drina (Left photo: “Una – Martin Brod”, right photo: “Mouth of the Drina River”. Author: Miroslav Jeremić. Credit: ISRBC)

The basin hosts the largest complex of alluvial wetlands in the Danube basin and large lowland forest complexes, being a unique example of a river basin with some of the floodplains still intact, thus supporting biodiversity and flood alleviation (Fig. 8). For illustration, the drop of the 100-year high flow, shown in Fig. 6, happens between the river stations 700 km and 640 km, which correspond exactly to the location of Lonjsko polje, being associated with hydraulic effects of this retention area. There are 167 protected areas in total, including six Ramsar sites, eight national parks, as well as numerous important bird and plant areas, protected areas at the national level, and Natura 2000 sites.



Fig. 8. Lonjsko polje – a nature park and retention area (Left photo: “Lonjsko polje – Kratečko”, right photo: “Lonjsko polje – at gmajna”. Author: Boris Krstinić. Credit: ISRBC)

The total annual **water use** in the basin is estimated at about 4.8 billion m<sup>3</sup>. The overview of various types of the consumptive water uses is shown in Fig. 9. The non-consumptive uses include transportation, hydropower generation, recreation and fishing. The Sava river contributes to the Danube inland waterway transport network with 594 km of the waterway (Fig. 10), from Belgrade to Sisak (Croatia), and provides numerous sites and opportunities for different kinds of tourism and recreation along the whole watercourse of the Sava river (ISRBC, 2011c), as well as on the tributaries (Fig. 11).



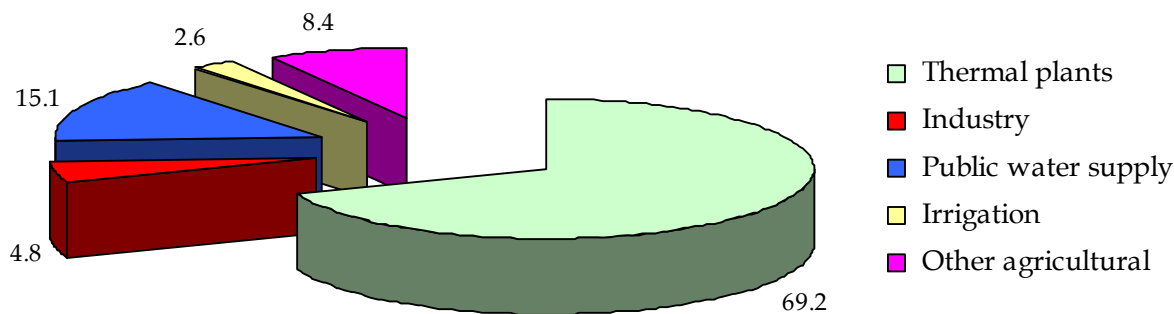


Fig. 9. Estimation of total water use in the Sava river basin (ISRBC, 2009d)



Fig. 10. Navigation on the Sava river (Left photo: Dragan M. Babović. Credit: ISRBC)



Fig. 11. Rafting on the Vrbas river, a Sava tributary (ISRBC, 2009d)

### 3. Legal and institutional framework for cooperation

After the political changes in the region in the early 1990-ies, the Sava river, which was the largest national river in the former country, has become an international river of a recognized importance. The establishment of the Stability Pact for South-Eastern Europe in 1999 provided a solid basis for triggering the cooperation of stakeholders in the region and, gradually, the creation of a new approach to water resources management in the Sava river basin. On these grounds, the four countries of the basin – Bosnia and Herzegovina, Federal Republic of Yugoslavia (later on Serbia & Montenegro, and then Republic of Serbia), Republic of Croatia and Republic of Slovenia, entered into a process of negotiations, with the primary aim to establish an appropriate framework for transboundary cooperation in the water sector, and thus foster sustainable development of the region.



As a key milestone of the process, the *Framework Agreement on the Sava River Basin (FASRB)* has been developed, as a unique international agreement integrating all aspects of water resources management and establishing the International Sava River Basin Commission (ISRBC) for implementation of the *FASRB*, with the legal status of an international organization. After signing the *FASRB* in December 2002, at Kranjska Gora (Slovenia), the Interim Sava Commission was formed to prepare all steps necessary for establishment of the permanent commission upon entry of the *FASRB* into force. Following the ratification of the *FASRB* by all Parties, and its entry into force in December 2004, the constitutional session of the ISRBC was held in June 2005, and subsequently, the permanent Secretariat of the ISRBC started to work in January 2006, with the seat in Zagreb (Croatia). Since then, the ISRBC has been a leader of cooperation of the Parties toward the *FASRB* implementation, the status of which is summarized in part 4.1.

### **3.1 Framework Agreement on the Sava River Basin (FASRB)**

The *FASRB* is an international agreement that integrates all aspects of water resources management – different kinds of water use, the water and aquatic ecosystem protection, as well as the protection against harmful effects of water due to extreme hydrologic events and accidents involving the water pollution.

The overall objective of the *FASRB* is to establish and maintain the transboundary cooperation in order to provide conditions for sustainable development of the region within the Sava river basin. The particular objectives of the *FASRB* (*FASRB*, 2002) include the establishment of:

- international regime of navigation on the Sava river and its navigable tributaries;
- sustainable water management in the basin, and
- sustainable management of hazards in the basin (i.e. floods, droughts, ice, accidents).

The basic principles stipulated by the *FASRB* include:

- cooperation based on sovereign equality, territorial integrity, mutual benefit and good faith in order to achieve the goals of the *FASRB*, as well as based on regular exchange of information within the basin, cooperation with international organizations, and being in accordance with the *EU Water Framework Directive (WFD)* and other EU directives and UNECE conventions, and
- reasonable and equitable use of the water resources, applying measures aimed at securing the integrity of the water regime in the basin and reduction of transboundary impacts caused by economic and other activities of the Parties, and respecting the “no harm rule”.

The *FASRB* implementation is being undertaken by the national institutions, officially nominated by the Parties, and is coordinated by the ISRBC.

The *FASRB* presents the first development-oriented multilateral agreement in the post-conflict period, concluded in the region of the former Yugoslavia after the *Dayton Peace Agreement* and the *Agreement on Succession*. By involving the whole water resources management and addressing both sustainability and development issues, the *FASRB* provides the ISRBC with the broadest scope of work among European basin organizations (i.e. river and lake commissions).

### 3.2 International Sava River Basin Commission (ISRBC)

The ISRBC is a joint institution established as an international organization with the international legal capacity necessary for exercising its functions.

In order to achieve the main goals of the *FASRB*, the following activities are coordinated by the ISRBC:

- preparation and implementation of joint or integrated plans for the basin (e.g. river basin management plan, flood risk management plan);
- preparation of development programs, e.g. for rehabilitation and development of navigation in the basin;
- establishment of integrated systems for the basin, such as geographical information system (GIS), river information services (RIS), flood forecasting and warning system, etc.;
- harmonization of national regulation with the EU regulation, and
- development of protocols for regulating specific aspects of the *FASRB* implementation.

In accordance with the mandate and responsibilities, the ISRBC is a central point in identification and implementation of projects of regional importance, aiming to strengthen the cooperation of the Sava countries and facilitate the fulfilment of the *FASRB* objectives.

The ISRBC is given the capacity for making decisions in the field of navigation (obligatory for the Parties) and providing recommendations on all other issues. Additionally, the ISRBC provides recommendations to the Meeting of the Parties, a ministerial-level body which makes decisions relating to strategic issues of the *FASRB* implementation and performs a general monitoring of the implementation process.

The ISRBC is composed of two representatives of each Party to the *FASRB*, one member and one deputy member of each Party, having one vote in the Commission. The Commission has a chairman who represents the ISRBC. The Secretariat is an administrative and executive body of the ISRBC.

In order to foster cooperation and ensure synergy in achieving its goals, the ISRBC has established permanent and *ad-hoc* expert groups, composed of delegated experts from each Party. There are four permanent expert groups, covering the key issues in the basin – river basin management, accident prevention and control, flood prevention, and navigation, as well as five *ad-hoc* expert groups, dealing with specific issues and tasks – legal issues, financial issues, hydro-meteorological issues, GIS and RIS.

## 4. Approach to sustainable development of the Sava river basin

Given the broad scope of the *FASRB*, the achievement of its principal objectives requires an integrated and sustainable approach, balancing the needs for development of economic activities such as navigation or tourism, against the needs of other water sub-sectors (i.e. other kinds of water use, protection against detrimental effects of water, and protection of water and aquatic ecosystem). The main features of the approach, as applied by the ISRBC, are illustrated in the following text, by reviewing the achievements and results, and presenting a vision of the future implementation of the *FASRB*.

#### 4.1 Current status of the *FASRB* implementation

This part provides a brief summary of the achievements made, not only in the fields of navigation, other water uses, water protection and hazard management, but also with regard to „cross-cutting issues“ (i.e. information management, hydrological and meteorological issues, cooperation, public participation and stakeholder involvement), which are dealt with in order to provide an overall support to the implementation process. Further information can be found elsewhere (Komatina and Zlatić-Jugović, 2010; Komatina, 2011a), or at the ISRBC web-site, [www.savacommission.org](http://www.savacommission.org), where majority of the documents, mentioned throughout the text, are available.

##### 4.1.1 Navigation and other water uses

Following the economic decline in the former Yugoslavia in the 1980-ies, the armed conflict in the early 1990-ies has caused an additional decrease of transport and navigation on the Sava river, reducing the cargo traffic, which was around 10 million tons in 1982, and 5.7 million tons in 1990, to less than 1 million tons. A lack of investments into the waterway maintenance and infrastructure development resulted in unfavourable navigation conditions, characterized by a limited draft during long periods, a limited fairway width and a limited height for passages under some bridges, as well as insufficient marking. Navigability of the waterway, which used to be a class IV waterway in the past, was reduced to class III at many sections of the river. Given such an initial situation, ratification of the *FASRB* and establishment of the ISRBC provided a good basis for rehabilitation and development of navigation on the Sava river, which was further strengthened by simultaneous ratification of the *Protocol on Navigation Regime to the FASRB* (2004).

Since the beginning of the *FASRB* implementation, considerable efforts have been invested by the ISRBC and the Parties to provide conditions necessary for the Sava river to become an important, environment-friendly and navigation-safe lifeline for inland transport (ISRBC, 2009b; Komatina, 2011b). The undertaken activities have been focused on two major issues: (a) planning for rehabilitation and development of the Sava river waterway infrastructure, and (b) improvement of technical standards and safety of navigation, with the aim to prevent the environmental risks associated with navigation.

With regard to **rehabilitation and development of the waterway infrastructure**, the preliminary documentation has been developed, and future steps have been agreed upon by the Parties (ISRBC, 2011a, 2011b). Based on the assessment of transport demand (Fig. 12) and economic analyses, the upgrade of the whole waterway to class Va was shown to be feasible, the costs being 10% higher than the costs of rehabilitation of the whole waterway to class IV (ISRBC, 2008a). Nevertheless, in order to minimize negative environmental impacts of the project, the ISRBC has decided to develop the waterway to class Va only at 40% of the total length (section Belgrade – Brčko), while the rest part will be rehabilitated to class IV. For the same reason, no change of the present watercourse (i.e. no straightening of the river) has been planned, so that, in sharp bends, only one-way navigation is foreseen. Additionally, several other activities have been performed, including a full restoration of the waterway marking system after 20 years, removal of unexploded ordnances from the river banks, and the initial phase of establishment of the Sava RIS in accordance with the *EU RIS Directive*.

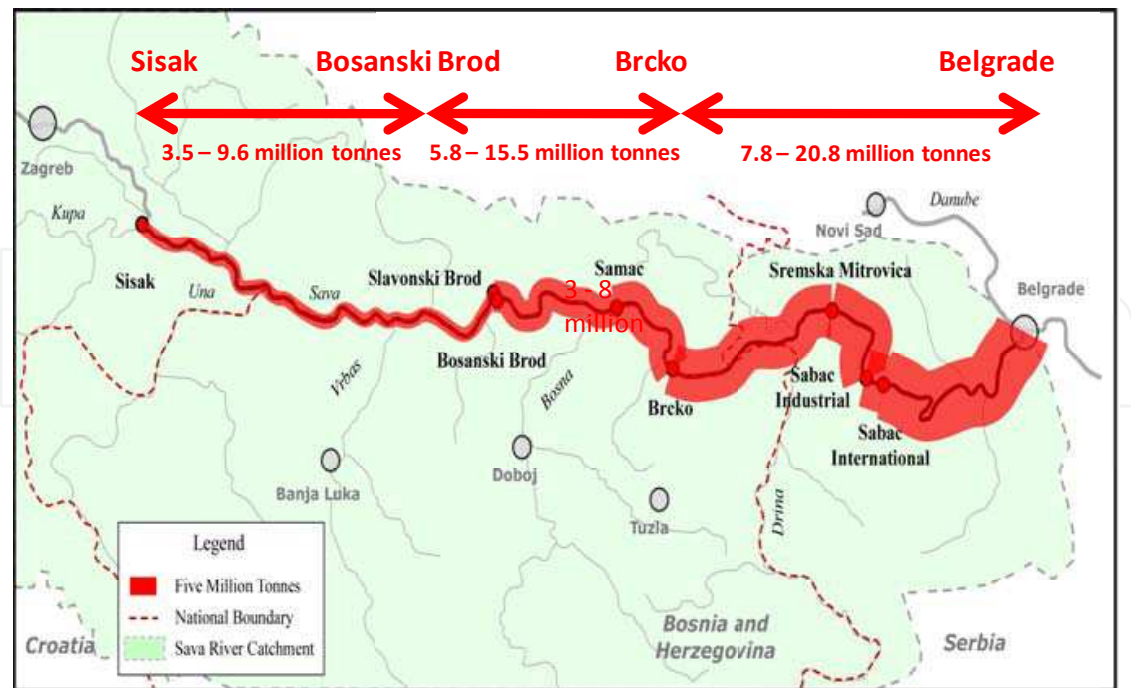


Fig. 12. Estimated margins of traffic volume on the Sava river for year 2027 (ISRBC, 2008a)

The **administrative and legal framework** has been strengthened by development of a set of rules and other documents related to technical issues and safety of navigation, harmonized with the corresponding EU and UNECE regulations (ISRBC, 2009b, 2009c). The *Protocol on Prevention of Water Pollution caused by Navigation to the FASRB* (ISRBC, 2009a) has been developed and signed, and is currently undergoing ratification. The *Protocol on Sediment Management to the FASRB*, aiming to regulate, *inter alia*, the sand and gravel exploitation in accordance with the *Sava River Basin Management Plan (Sava RBM Plan)*, has entered the process of final harmonization by the Parties.

In order to ensure **environmental sustainability**, the issue of navigation development is considered as an integral part of the *Sava RBM Plan*, which is being developed in accordance with the *EU WFD*. A considerable attention has been paid, as well, to the improvement of technical standards and safety of navigation, through implementation of concrete projects (restoration of the waterway marking system, development of the Sava RIS) and strengthening of the administrative and legal framework, including the protocols to the *FASRB*, fully in line with the corresponding EU and UNECE regulations. Finally, the waterway planning has been based on a clear intention to minimize negative environmental impacts of the rehabilitation works, and accompanied with an active involvement of the ISRBC in the relevant processes on Danube and European levels (International Commission for the Protection of the Danube River [ICPDR] et al., 2008; *Manual on Good Practices in Sustainable Waterway Planning*, 2010).

Partly as a consequence of the above mentioned achievements, there are already several indicators of development in traffic and opening of new cargo flows on the Sava river, such as opening of transport of oil products from (Bosanski) Brod, new developments in Serbian ports (Sremska Mitrovica, Šabac), as well as the first passenger cruise along the whole Sava river waterway after 150 years.



In addition to navigation, efforts have also been made to develop **other economic activities** that can benefit from the use of river infrastructure. Being aware of great potentials for development of tourism in the basin in an environmentally friendly manner, the first *Nautical and Tourist Guide of the Sava River* has been developed in cooperation with regional chambers of commerce of the Parties (ISRBC, 2011c), while the preparation of a master plan for development of nautical tourism in the basin is planned to be undertaken as the next step. The preparation of another project, focusing on the contribution of small and medium enterprises to sustainable development of the Sava river basin, which has recently been initiated, targets not only river transport and tourism, but also other economic activities, including fish farming and shipbuilding.

#### 4.1.2 Water protection and hazard management

The key activity in the field of **river basin management** has been the preparation of the first *Sava RBM Plan* in accordance with the *EU WFD*, given the commitment of the Parties to respect the *WFD*, although some of them (i.e. the non-EU member states) are not legally bound to do so. An important step in this regard was the development of the *Sava River Basin Analysis Report* (ISRBC, 2009d), a comprehensive document dealing with both water quality and quantity issues, hydrology and hydromorphology of the basin, and providing the first overview and thematic GIS maps of the basin (ISRBC, 2009e). To ensure an integrated approach from the very beginning of the *RBM Plan* preparation process, the Sava River Basin Analysis also included consideration of the flood management and navigation development issues. Further preparation of the first *Sava RBM Plan*, supported by the European Commission, is in progress. Following the drafting of the *Plan* in fall 2011, and the subsequent public consultation process, the *Sava RBM Plan* is expected to be finalized and adopted by the Parties in 2012.

As regional climate modelling suggests an overall reduction of around 15% to 30% in mean annual runoff in the Sava river basin by the middle of this century, which could be challenging for all investments made in the basin, the development of a *Climate Adaptation Plan for the Sava River Basin* has been undertaken by the World Bank. The main aim of this effort is to fill the knowledge gap on the climate change impact on the water sector in the basin and to show how to increase the climate resilience of critical water management infrastructure investments and of integrated water resource management in the region, by elaborating alternatives for adaptive management actions in water management sub-sectors, including navigation, hydropower, agricultural water use, flood protection and environmental protection.

In addition to these activities, the *Protocol on Sediment Management to the FASRB*, stipulating the preparation of a sediment management plan for the basin in accordance with the *Sava RBM Plan*, has been prepared and is undergoing final harmonization by the Parties, while the *Protocol on transboundary impact to the FASRB* is under development on the ISRBC level.

For the purpose of an efficient **accident prevention and control** in the Sava river basin, participation in testing of the existing Accident Emergency Warning System of the ICPDR is continuously being done, and efforts are being made to improve the work of the Principal International Alert Centres in the Parties to the *FASRB*, including the organization of training courses for the operational staff of the Alert Centres, in cooperation with the

ICPDR. The *Protocol on Emergency Situations to the FASRB*, aiming to enhance prevention, preparedness, response and mutual assistance of the Parties in case of emergency situations, has been drafted and entered the process of harmonization by the Parties. As an important future activity, development of a water contingency management plan for the basin is planned.

In the field of **flood management**, the *Flood Action Plan* for the Sava river basin (ICPDR & ISRBC, 2009) has been prepared in accordance with the *Flood Action Programme for the Danube River Basin* of the ICPDR, providing the first programme of measures for each Party to achieve the defined targets for flood management in its part of the Sava basin until 2015.

The *Protocol on Flood Protection to the FASRB* (ISRBC, 2010a), which aims to provide the legal basis for cooperation of the Parties in line with the *EU Flood Directive*, including the preparation of the *Flood Risk Management Plan* for the Sava river basin, has been developed and signed, and is currently under ratification. A number of preparatory activities toward the *Flood Risk Management Plan* have been performed so far, including an assessment of current flood management practices in the Parties, establishment of a database on the existing flood protection facilities, preparation of a GIS-based, indicative flood extent map for the whole Sava river (Fig. 13), development of a preliminary hydrological model of the Sava river basin and the hydraulic model of the Sava river, and launching an UNECE-supported project, aiming to assist linking the flood risk management planning and the climate change assessment in the basin.

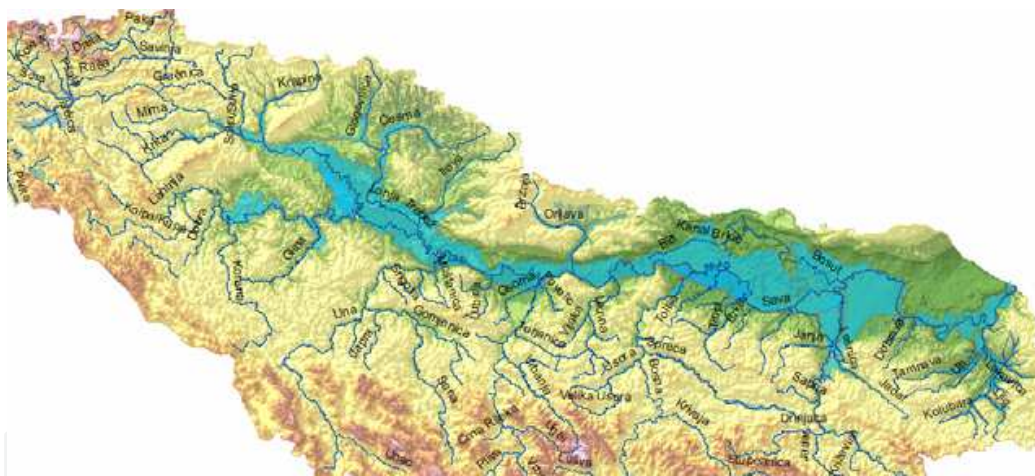


Fig. 13. Indicative map of important flood prone areas along the Sava river (ISRBC, 2009d)

#### 4.1.3 Cross-cutting issues

In the field of **information management**, the *Sava GIS Strategy* (ISRBC, 2008b) has been developed, taking into account the *EU INSPIRE Directive* and the Water Information System for Europe. Subsequently, the implementing documents for the Sava GIS establishment have been prepared, the funding for the initial phase of the GIS establishment secured, and the initial phase launched.

As for the **hydrological and meteorological issues**, advances in the exchange of hydro-meteorological information and data within the basin have been made, including a revival of the *Hydrological Yearbook of the Sava River Basin* (ISRBC, 2010b) after more than 20 years.

Preliminary agreements have been made upon basic elements of a system for the exchange of hydrological and meteorological information and data within the basin. Preparatory activities have been undertaken toward the implementation of two important projects, namely a new *Hydrological Study for the Sava River Basin* (to be the first study for the whole basin since 1976), and the development and upgrade of the hydro-meteorological information and flood forecasting and warning system for the basin.

**Cooperation** of the ISRBC with a large number of international organizations and institutions has been established and maintained, with a special emphasis on those specified in the *FASRB*. The basis for cooperation with the ICPDR and Danube Commission has been strengthened by signing memoranda of understanding on cooperation with each of the two commissions. The support of the European Commission to the *FASRB*-related projects is becoming steady and their recognition of several priority projects of the ISRBC in the context of the *EU Strategy for the Danube Region* indicates a good will for a continued support. A good cooperation with the UNECE and their support to the projects of the ISRBC should be mentioned, as well. Cooperation with the institutions of the Parties responsible for the *FASRB* implementation has been established and maintained, as well as with other national institutions, such as agencies, offices, services, institutes and universities.

In order to ensure **public participation and stakeholder involvement** in major activities related to the *FASRB* implementation, cooperation with non-governmental organizations and other institutions and local actors from the Sava river basin has been established, a network of observers to the ISRBC has been created, and a number of mechanisms for information and consultation of stakeholders and/or wide public have been established, including the official web-site, the *Sava NewsFlash* bulletin, publications and promotion material of the ISRBC, celebration of the Sava Day (June 1), press releases, press conferences and media briefings, organization of consultation workshops, public presentations and other meetings with stakeholders by the ISRBC, or participation in ceremonies, conferences and other events, and contributions to bulletins and web-sites of other organizations/ institutions.

A good example of stakeholder involvement is the process of development and implementation of the *Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin* (ICPDR et al., 2008), led jointly by the ICPDR, Danube Commission and the ISRBC, where the issue is continuously discussed by a variety of stakeholders from navigation and environmental sector.

#### **4.2 Vision of the future implementation of the *FASRB***

Since the beginning of the *FASRB* implementation, a wide range of activities have been undertaken or launched, as summarized in the previous text. However, in order to respond to a steady progress in the *FASRB* implementation during the last years, as well as to recent processes and initiatives on the Danube level (ICPDR et al., 2008; ICPDR, 2009, 2010) and European level (EC, 2010a, 2010b), relevant for the *FASRB* implementation, an updated *Strategy on Implementation of the FASRB* (ISRBC, 2011a) and the accompanying *Action Plan for the Period 2011-2015* (ISRBC, 2011b), have been developed to govern the future implementation. This part briefly outlines specific objectives in each priority area of the *FASRB* implementation, as well as measures for achievement of these objectives, in accordance with the *Strategy*.

Given the overall goal of the *FASRB* in the field of **navigation** (i.e. the establishment of the international regime of navigation on the Sava river and its navigable tributaries), as well as interests of the Parties related to other water uses, the future efforts should be oriented to:

- further unification and upgrading of the administrative and legal framework with the aim to increase navigation safety and remove administrative obstacles for navigation;
- rehabilitation, development and proper maintenance of the Sava river waterway with the aim to increase commercial traffic and improve navigation safety;
- establishment of an efficient system for the vessel waste management with the aim to protect the water against pollution from vessels;
- creation of a positive image of the inland navigation in general and promotion of the Sava river as an important regional transport corridor;
- development of nautical tourism in the Sava river basin, and
- consideration of other development activities in the basin (e.g. hydropower generation, water supply, agriculture, recreation, tourism), accompanied with careful analysis of their environmental sustainability, taking also climate change impacts into account.

Keeping in mind the overall goals of the *FASRB* in the fields of **water protection and hazard management**, i.e. the establishment of a sustainable water and hazard management in the Sava river basin, the future activities should be focused on:

- further efforts toward the achievement of the environmental objectives of the *EU WFD* in the Sava river basin, including the preparation and implementation of the *RBM Plans* and the accompanying *Programmes of Measures* for the Sava river basin, integration of water policy with other policies (i.e. navigation, climate change, hydropower generation, flood risk management), additional elaboration of the issues potentially important in future (sediment, water demand, groundwater quantity, etc.), as well as initiation of activities toward the establishment of sustainable management of sediment in the basin;
- establishment of a sustainable and efficient transnational system for management of accidental water pollution in the Sava river basin, through further improvement of functioning of the existing emergency warning system in the Parties and through development of a water pollution contingency management plan for the basin;
- establishment of a system for sustainable management of floods in the Sava river basin, by development of a common *Sava Flood Risk Management Plan* in accordance with the *EU Flood Directive* and in line with the *UNECE Water Convention*, as well as by adaptation of flood management to climate change.

In order to support the *FASRB* implementation and the achievement of its main objectives, the future activities related to the **cross-cutting issues**, should target:

- establishment of an integrated information system for the Sava river basin by development of the Sava GIS;
- strengthening of the platform for exchange and use of hydrological and meteorological information, including harmonization of national methodologies (e.g. related to data analysis), as well as development of the hydro-meteorological information and flood forecasting and warning system for the basin;
- facilitating the *FASRB* implementation related to navigation and other relevant economic issues by using statistical methods and techniques as tools, including



- development of a system for data collection, processing and analysis in line with the Eurostat, regular data collection and processing, and dissemination of the data to relevant stakeholders;
- strengthening of the public participation process for the purposes of preparation and implementation of the *Sava RBM Plan*, targeting primarily the key stakeholders, i.e. the main water users, in the Sava river basin, and
  - further improvement and broadening of stakeholder involvement in the *FASRB* implementation process, i.e. seeking a synergy of a top-down and a bottom-up approach, by exploring possibilities and elaborating options for the establishment of a multi-stakeholder platform that would facilitate, or further strengthen, the involvement of the civil, academic and business sectors, in addition to the existing involvement of stakeholders from the governmental and non-governmental sectors.

Accordingly, the main prerequisites for an effective further implementation of the *FASRB* include:

- further raising of awareness of benefits and the importance of the existing cooperation of the Parties in the framework of the *FASRB* implementation, not only in the institutions responsible for the implementation, but also in other national institutions;
- securing adequate human and financial resources in the Parties to follow up the activities coordinated by the *ISRBC*;
- providing adequate financial instruments for realization of respective activities and projects, especially those to be performed under the umbrella of the *ISRBC*;
- facilitating a free access to basic data needed for preparation of the studies coordinated by the *ISRBC*, with the special focus on the data owned by national institutions not officially nominated as responsible for implementation of the *FASRB*, and
- further developing the legal background and institutional arrangements in the Parties.

Additional strengthening of the capacity within the *ISRBC* framework, through a stronger support of the Parties to the members of the *ISRBC* expert groups in performing their obligations, as well as through further strengthening of the capacity of the *ISRBC* Secretariat, would certainly be of additional benefit for the *FASRB* implementation in future.

## 5. Conclusion

The so-far experience in the *FASRB* implementation indicates a number of advantages of the presented approach, showing that the approach is:

- cohesive, by providing conditions for the cooperation of the countries after a conflict, the implementation of joint, basin-wide projects, as well as the harmonization of national regulation, methodologies and procedures;
- integrated, not only in terms of the geographical scope (covering the whole basin and the related ecosystem), but also in terms of the scope of work (dealing with both sustainability and development aspects);
- transparent, as it is based on a number of public participation and stakeholder involvement activities;
- aligned with relevant EU and UNECE regulation;
- sub-regional, offering a "finer resolution" of results, that are complementary to those obtained on a regional (Danube) scale;

- pragmatic and practical, providing concrete “products” to the Parties, such as joint plans, development programs, protocols, harmonized regulation, integrated systems for the whole basin, etc.

The *FASRB* has proven to be a good platform for intensified contacts and an improved cooperation among the Parties, providing opportunities for exchange of experiences and an additional training of the experts from the region. It also provides for an improved inter-sectoral cooperation, especially among the competent authorities, within each of the Parties.

However, a number of challenges and (existing or potential) obstacles for the *FASRB* implementation have been identified. These are, generally, associated with:

- differences between the countries (i.e. EU membership status, eligibility for approaching funds, level of economic development, organizational structure in decision-making process, environmental awareness of the public);
- financing of major activities (e.g. priority projects, strategic studies, establishment of integrated systems for the basin), and
- resolving conflicts of interests of different users of water (on both transboundary and national levels), especially as they are likely to increase in future due to climate change.

Major obstacles and difficulties in the *FASRB* implementation are associated with a lack of human and financial resources of the Parties, as well as securing funds for implementation of the priority projects. The additional challenge is a limited access to basic data (topographic, hydrologic, etc.), needed for preparation of studies of common interest under the umbrella of the *ISRBC*, especially when the data are owned by national institutions not officially nominated as responsible for implementation of the *FASRB*.

Some challenges are associated with specific fields of the *FASRB* implementation. For example, on national level, the inland navigation is, although being the most efficient and environmentally-friendly mode of transport, generally underestimated in comparison with other modes of transport. Or, progress in the fields of water protection and hazard management, where requirements toward the Parties are based on recommendations and conclusions of the *ISRBC* (unlike the *ISRBC* decisions in the field of navigation, having a binding character for the Parties), is partly affected by a different perception of the requirements by the competent authorities of the Parties.

In some Parties, additional obstacles include lack of appropriate institutional arrangements and lack of harmonization of the legislation with the EU *acquis*. There is also a space for improvement of bilateral cooperation, where the *ISRBC* is perceived as a possible mediator.

The presented approach is considered as relevant to the processes on a wider (Danube and EU) scale, such as those associated with the *EU Strategy for the Danube Region (EUSDR)* and the *EU 2020 Strategy*, for several reasons:

- the overall objective of the *EUSDR* and *FASRB* is identical – sustainable development of the region they refer to;
- there is an obvious conformity of the *ISRBC* approach and its priority projects with the *EUSDR* priorities, and a high potential for synergy, as the implementation of the *ISRBC* projects within the *EUSDR* framework can contribute to implementation of both *EUSDR* and *FASRB*;

- the sub-regional level, such as the Sava river basin level, is likely to be the most effective level from the viewpoint of the *EUSDR* implementation;
- a majority of the ongoing activities of the ISRBC fully match the three main priorities of the *EU 2020 Strategy*, i.e. sustainable growth, smart growth and inclusive growth.

Given the existing interest of other regions (i.e. other parts of the South-Eastern Europe, Mediterranean region, Western Europe, Central Asia) in the Sava model of cooperation, the ISRBC approach seems to be an attractive example of good practice. In this context, a fundamental advantage of the *FASRB* is associated with the creation of a platform for transboundary cooperation, which is sufficiently broad to integrate all aspects of water management, and thus provide opportunities for specific interests of all Parties to be satisfied through the cooperation. It should be kept in mind, however, that providing the coordinating body with a twofold legal capacity (e.g. decisions in the field of navigation vs. recommendations in the fields of water protection and hazard management, as in the case of ISRBC) may, in some situations, challenge the efforts to find a right balance in satisfying the interests of all Parties.

Despite of all challenges, the *FASRB* is considered as a solid basis for the integrated water resources management in the Sava river basin. Although rather demanding in terms of the need for resources and continuous, joint efforts of the Parties, the *FASRB* implementation is perceived as a process providing multiple benefits, and making a steady progress toward the key objective – sustainable development of the region within the basin.

## 6. Acronyms and abbreviations

AL	Albania
BA	Bosnia and Herzegovina
EC	European Commission
EU	European Union
Eurostat	EU Statistical Office
<i>EUSDR</i>	<i>EU Strategy for the Danube Region</i>
<i>FASRB</i>	<i>Framework Agreement on the Sava River Basin</i>
GIS	Geographical Information System
HR	Croatia
ICPDR	International Commission for the Protection of the Danube River
INSPIRE	Infrastructure for Spatial Information in the European Community
ISRBC	International Sava River Basin Commission
IWRM	Integrated Water Resources Management
ME	Montenegro
RBD	River Basin District
RBM	River Basin Management
RIS	River Information Services
RS	Serbia
SI	Slovenia
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	<i>Water Framework Directive</i>

## 7. References

- Biswas, A.K. (2004). Integrated Water Resources Management: A Reassessment, A Water Forum Contribution, IWRA, *Water International*, Vol. 29, No. 2, June 2004, 248-256
- EC. (2006). *NAIADES – An Integrated European Action Programme for Inland Waterway Transport*, Available from:  
[http://ec.europa.eu/transport/inland/promotion/promotion\\_en.htm](http://ec.europa.eu/transport/inland/promotion/promotion_en.htm)
- EC. (2010a). *Europe 2020 – A European Strategy for Smart, Sustainable and Inclusive Growth*, Available from: [http://europa.eu/press\\_room/pdf/complet\\_en\\_barroso\\_\\_007\\_-\\_europe\\_2020\\_-\\_en\\_version.pdf](http://europa.eu/press_room/pdf/complet_en_barroso__007_-_europe_2020_-_en_version.pdf)
- EC. (2010b). *EU Strategy for the Danube Region*, Available from:  
[http://ec.europa.eu/regional\\_policy/cooperation/danube/index\\_en.htm](http://ec.europa.eu/regional_policy/cooperation/danube/index_en.htm)
- Framework Agreement on the Sava River Basin*, 2002, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- Global Water Partnership. (2000). *Integrated Water Resources Management, Technical Advisory Committee Background Paper No. 4*, Global Water Partnership, Stockholm
- Global Water Partnership & International Network of Basin Organizations. (2009). *A Handbook for Integrated Water Resources Management in Basins*, Global Water Partnership & International Network of Basin Organizations, ISBN: 978-91-85321-72-8, Stockholm
- ICPDR. (2009). *Danube River Basin Management Plan*, Available from:  
[http://www.icpdr.org/icpdr-pages/danube\\_rbm\\_plan\\_ready.htm](http://www.icpdr.org/icpdr-pages/danube_rbm_plan_ready.htm)
- ICPDR. (2010). *Danube Basin: Shared waters – Joint responsibilities*, Danube Declaration adopted by the Ministers of Environment on 16 February 2010, Available from:  
<http://www.icpdr.org/icpdr-pages/mm2010.htm>
- ICPDR, Danube Commission & ISRBC. (2008). *Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin*, Available from [http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- ICPDR & ISRBC. (2009). *Flood Action Plan – Sava River Basin*, Available from:  
<http://www.savacommission.org/publication>
- ISRBC. (2008a). *Feasibility Study for Rehabilitation and Development of Navigation and Transport on Sava River Waterway*, Available from <http://www.savacommission.org/project>
- ISRBC. (2008b). *Sava GIS Strategy*, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- ISRBC. (2009a). *Protocol on Prevention of Water Pollution caused by Navigation to the FASRB*, Available from [http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- ISRBC. (2009b). *Rehabilitation and Development of Navigation in the Sava River Basin*, ISRBC, Zagreb
- ISRBC. (2009c). *Set of rules related to safety and technical issues of navigation*, Available from <http://www.savacommission.org/decision>
- ISRBC. (2009d). *Sava River Basin Analysis Report*, Available from:  
<http://www.savacommission.org/publication>
- ISRBC. (2009e). *Sava River Basin Overview Map*, Available from:  
<http://www.savacommission.org/publication>
- ISRBC. (2010a). *Protocol on Flood Protection to the FASRB*, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)



- ISRBC. (2010b). *The 2006 Hydrological Yearbook of the Sava River Basin*, Available from:  
<http://www.savacommission.org/publication>
- ISRBC. (2011a). *Strategy on Implementation of the FASRB*, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- ISRBC. (2011b). *Action Plan for the Period 2011-2015*, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- ISRBC. (2011c). *Nautical and Tourist Guide of the Sava River*, Available from:  
<http://www.savacommission.org/publication>
- Komatina, D. (2011a). The Framework Agreement on the Sava River Basin – a basis for sustainable development of the region, submitted for publication in *Danube News*
- Komatina, D. (2011b). Development of navigation on the Sava River – an integrated approach, submitted for publication in *Danube News*
- Komatina, D. & Zlatić-Jugović, J. (2010). Transboundary cooperation in the Sava River Basin in the field of water management. *Hrvatske vode*, Water Management Journal, Vol. 18, No. 73, (September 2010), pp. 249-258, ISSN 1330-1144 (in Croatian)
- Manual on Good Practices in Sustainable Waterway Planning*, 2010, Available from:  
[http://transfer.message.at/\\_ZJyVSK80VdDitR](http://transfer.message.at/_ZJyVSK80VdDitR)
- Protocol on Navigation Regime to the FASRB*, 2004, Available from:  
[http://www.savacommission.org/basic\\_docs](http://www.savacommission.org/basic_docs)
- Schmeier, S. (2010). *The Organizational Structure of River Basin Organizations – Lessons Learned and Recommendations for the Mekong River Commission (MRC)*, Technical Background Paper, Available from [http://www.mrcmekong.org/download/free\\_download/MRC-Technical-Paper-Org-Structure-of-RBOs.pdf](http://www.mrcmekong.org/download/free_download/MRC-Technical-Paper-Org-Structure-of-RBOs.pdf)
- The Dublin Statement on Water and Sustainable Development*, 1992, Available from:  
<http://www.wmo.ch/web/homs/documents/english/icwedece.html>
- UNECE. (1992). *Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention)*, Available from:  
<http://live.unece.org/env/water/text/text.html>
- UNESCO. (2006). *The Danube and its Basin – Hydrological Monograph*, Follow-up Volume VIII, *Basin-Wide Water Balance in the Danube River Basin*, Regional Cooperation of the Danube Countries in the Frame of the International Hydrological Programme of UNESCO and Water Research Institute Bratislava, Slovakia



## **Current Issues of Water Management**

Edited by Dr. Uli Uhlig

ISBN 978-953-307-413-9

Hard cover, 340 pages

**Publisher** InTech

**Published online** 02, December, 2011

**Published in print edition** December, 2011

There is an estimated 1.4 billion km<sup>3</sup> of water in the world but only approximately three percent (39 million km<sup>3</sup>) of it is available as fresh water. Moreover, most of this fresh water is found as ice in the arctic regions, deep groundwater or atmospheric water. Since water is the source of life and essential for all life on the planet, the use of this resource is a highly important issue. "Water management" is the general term used to describe all the activities that manage the optimum use of the world's water resources. However, only a few percent of the fresh water available can be subjected to water management. It is still an enormous amount, but what's unique about water is that unlike other resources, it is irreplaceable. This book provides a general overview of various topics within water management from all over the world. The topics range from politics, current models for water resource management of rivers and reservoirs to issues related to agriculture. Water quality problems, the development of water demand and water pricing are also addressed. The collection of contributions from outstanding scientists and experts provides detailed information about different topics and gives a general overview of the current issues in water management. The book covers a wide range of current issues, reflecting on current problems and demonstrating the complexity of water management.

### **How to reference**

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Dejan Komatina (2011). Integrated Water Resources Management as a Basis for Sustainable Development – The Case of the Sava River Basin, Current Issues of Water Management, Dr. Uli Uhlig (Ed.), ISBN: 978-953-307-413-9, InTech, Available from: <http://www.intechopen.com/books/current-issues-of-water-management/integrated-water-resources-management-as-a-basis-for-sustainable-development-the-case-of-the-sava-ri>

**INTECH**  
open science | open minds

### **InTech Europe**

University Campus STeP Ri  
Slavka Krautzeka 83/A  
51000 Rijeka, Croatia  
Phone: +385 (51) 770 447  
Fax: +385 (51) 686 166  
[www.intechopen.com](http://www.intechopen.com)

### **InTech China**

Unit 405, Office Block, Hotel Equatorial Shanghai  
No.65, Yan An Road (West), Shanghai, 200040, China  
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元  
Phone: +86-21-62489820  
Fax: +86-21-62489821

© 2011 The Author(s). Licensee IntechOpen. This is an open access article distributed under the terms of the [Creative Commons Attribution 3.0 License](https://creativecommons.org/licenses/by/3.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

IntechOpen

IntechOpen