

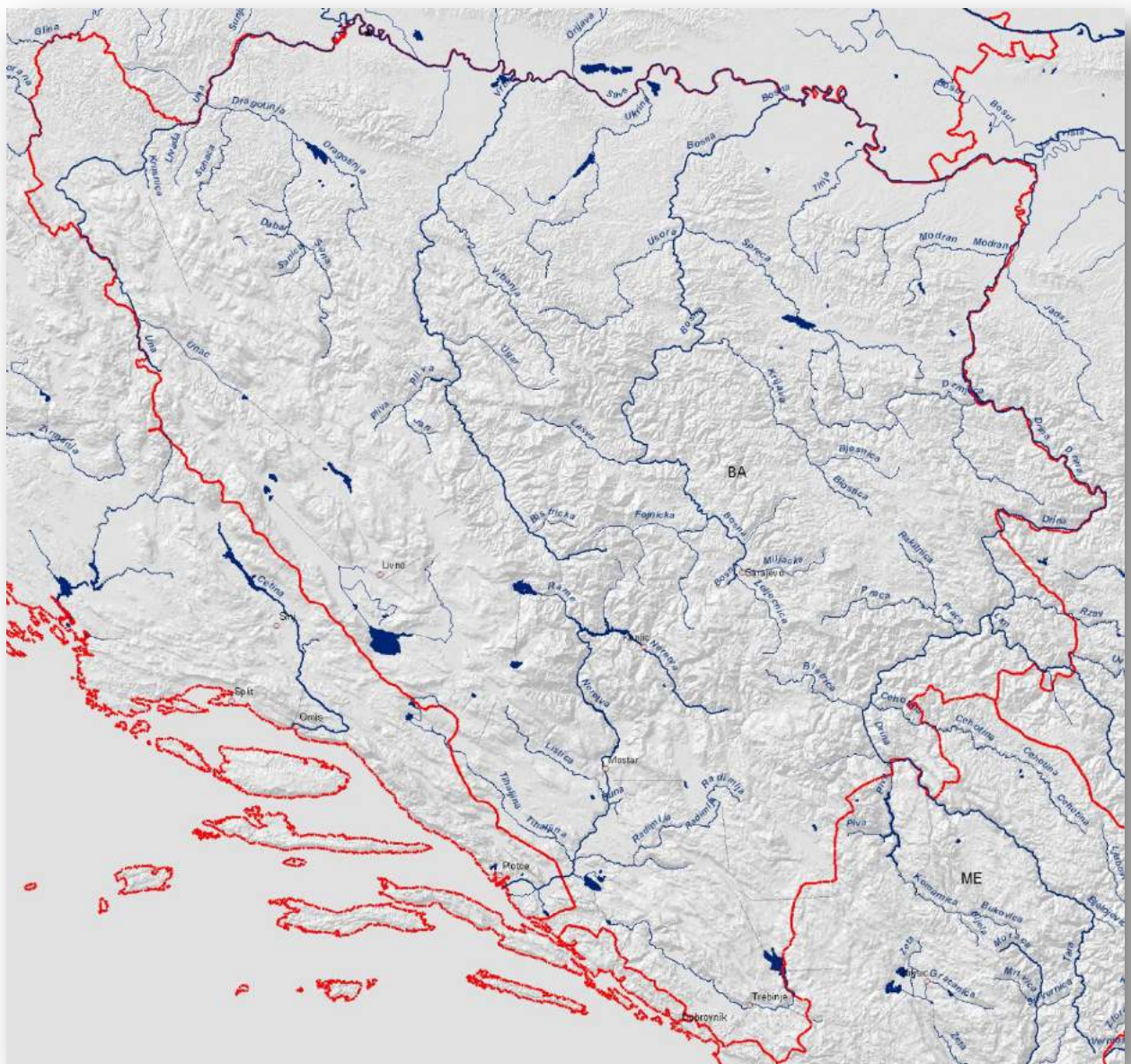


## **Outstanding Balkan River landscapes – a basis for wise development decisions**

**Bosnia & Herzegovina**

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## 1. Hydromorphological intactness of rivers

There are four classes characterising the different levels of hydromorphological intactness: Class 1 shows in blue colour (near-natural conditions). Class 2-3 is characterised by slightly to moderately modified status, indicated in light green. Class 4 for river stretches which are extensively altered are orange and class 5 (red) indicates stretches with severe modifications in particular impoundments. Lakes and rivers outside of the project areas are visualised in dark blue.

### LEGEND

#### Hydromorphological assessment

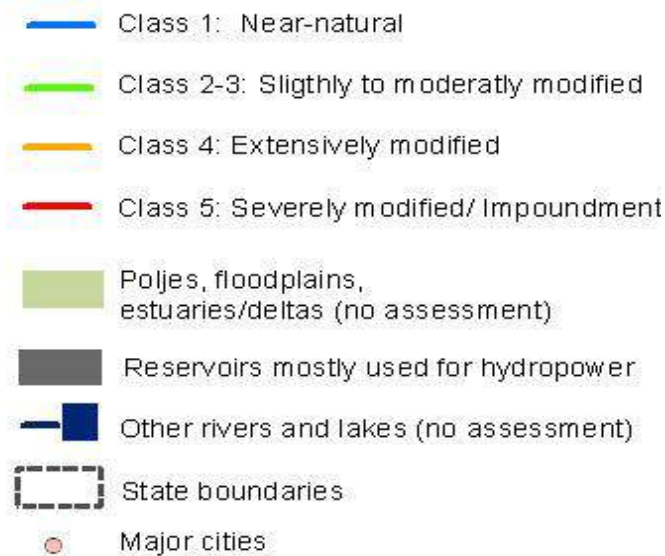


Fig. 1: Legend for the hydromorphological assessment map on next page



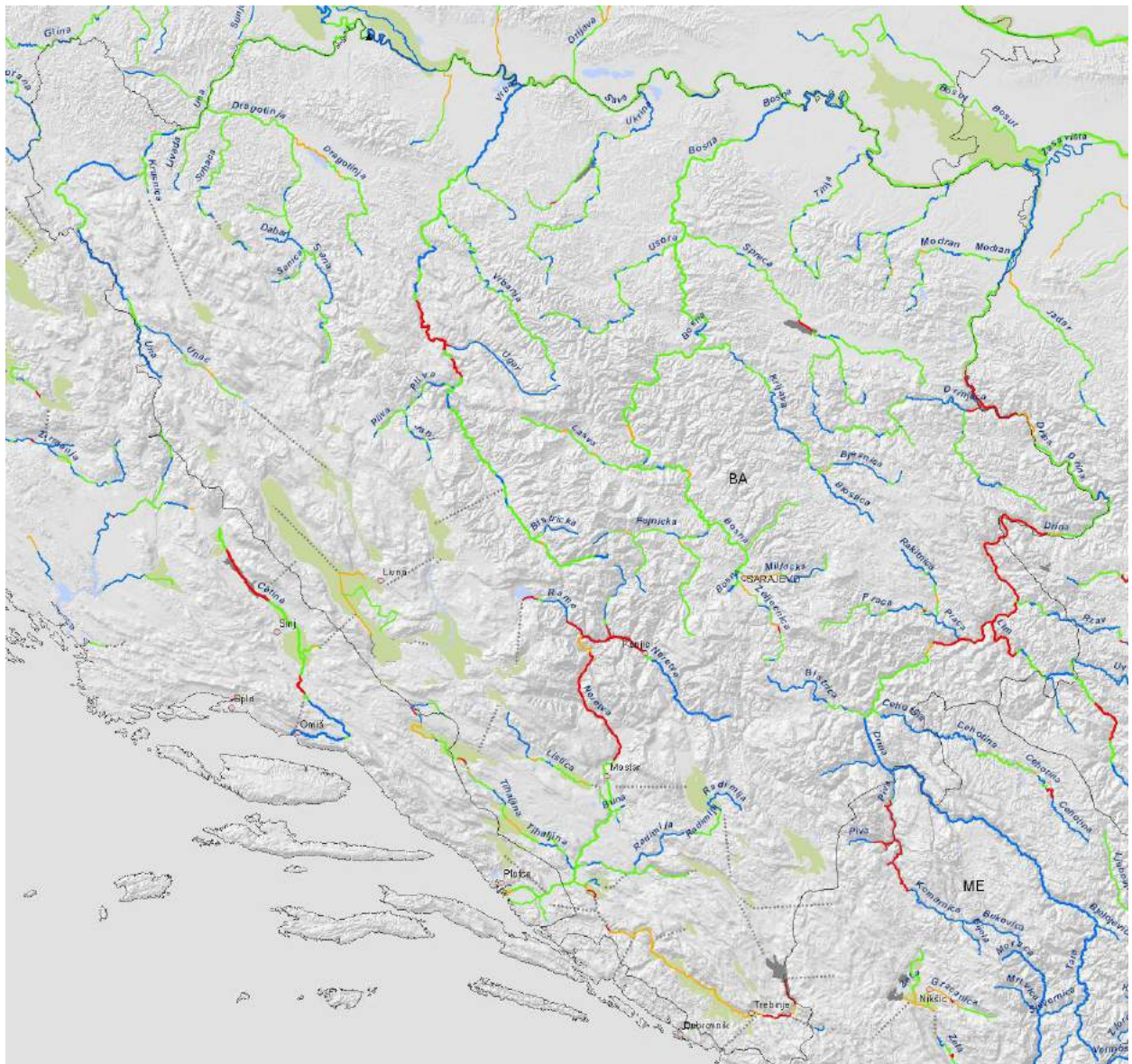


Fig. 2: Hydromorphological assessment for Bosnia & Herzegovina.

Bosnia and Herzegovina is entirely within the geographical Balkan and hosts all major tributaries of Sava river. In particularly the upper Una and the lower Vrbas as well as lower Drina fall still in the highest class, which is remarkable as most of the lower courses of comparable rivers in Europe are subject of strong changes. The major karst and Mediterranean river, the Neretva is altered by a chain of major hydropower plants. On the other side the headwaters and some of the lower tributaries provides still very good hydromorphological conditions (compare e.g. the cover image, water falls on Kravica). Even the densely settled Bosna valley still provides good to moderate hydromorphological conditions (still entirely free flowing, which has significance for sturgeon and Danube salmon populations).

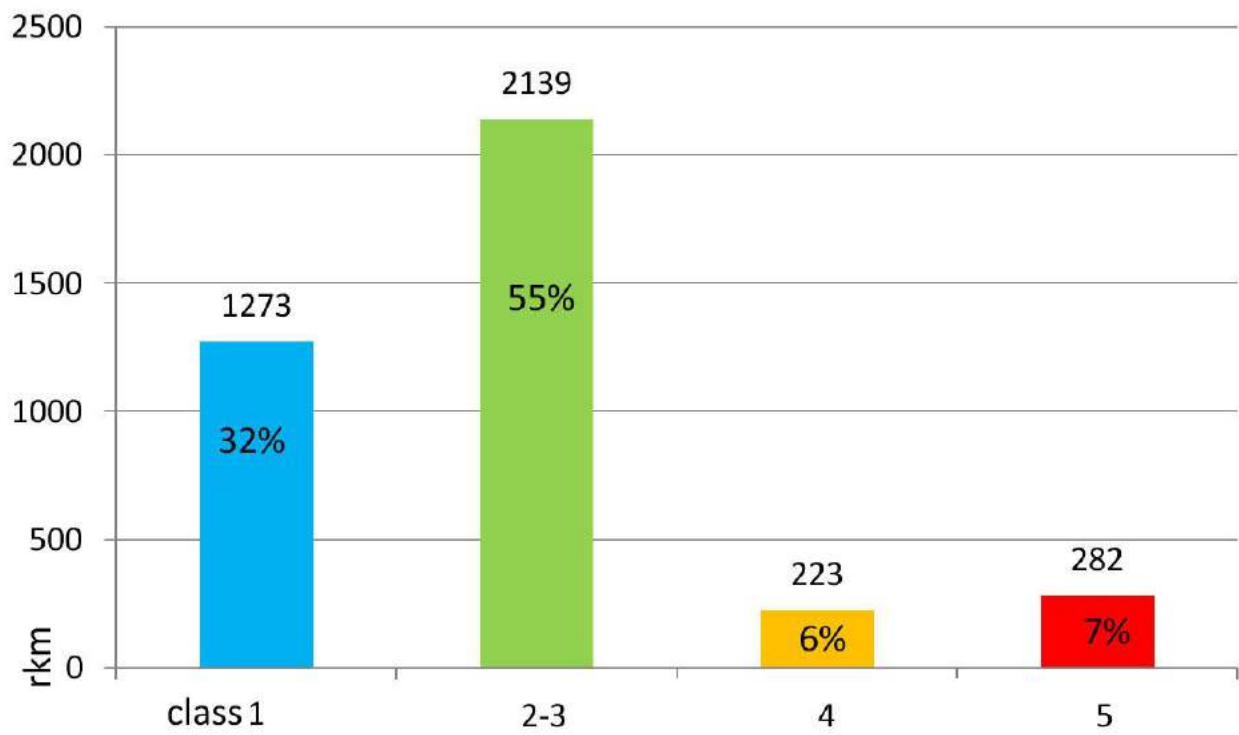


Fig. 3: Hydromorphological assessment in rkm and percentage for BA.



## *2. Protected areas, karst poljes, estuaries/deltas and important floodplains*

The inventory of protected areas contains in particular Natura2000 for EU Member States (EC 2010) and Croatia (State Institute for Nature protection Croatia 2010), national parks, biosphere reserves, nature reserves, EMERALD network areas (as far as available) and Important Bird Areas as well as Ramsar sites for other countries.

Major important floodplains were used continuously, meaning for the large rivers such as Danube, Drava and Sava they are subdivided in upper, middle and lower parts. In addition the map includes all assessed karst poljes, estuaries/deltas as well as other wetlands.

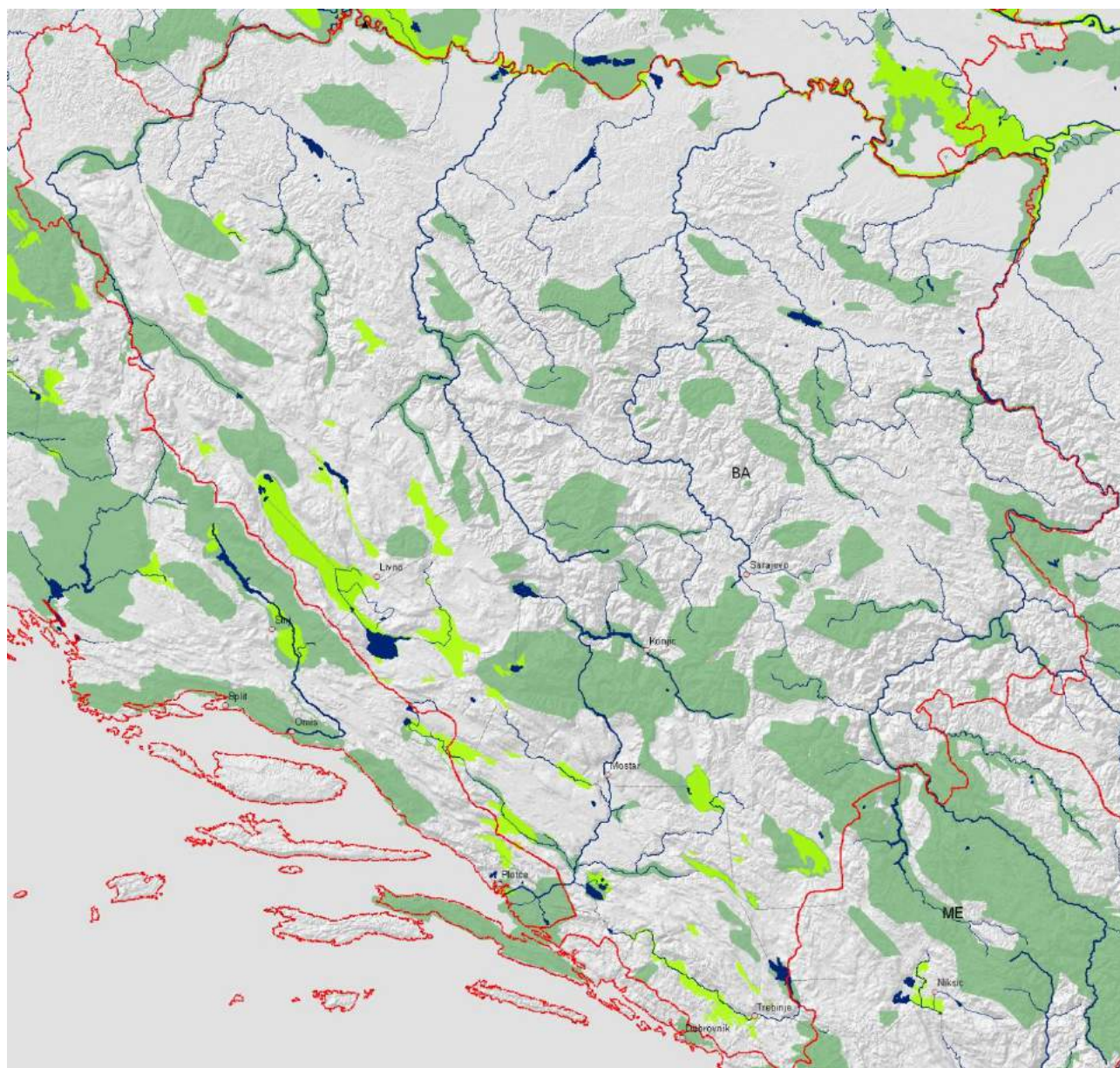


Fig. 4: Protected areas (incl. planned and proposed areas) in dark green (light green are poljes and large floodplain areas)

### 3. Conservation value of rivers

The conservation value is assessed in three levels: Very high conservation value (in blue), high conservation value (in dark green) and low conservation value (in light green). Karst poljes, major floodplains as well as deltas and estuaries with very high conservation value are visualized in dark blue-green and high conservation value in light green and low in light turquoise. Karst poljes and deltas are from particular interest for nature protection, therefore nearly all fall in the first two conservation classes.

	<b>Hydro-morphological assessment class</b>	<b>Conservation value</b> (assessment as result of overlay of hydromorphological assessment + protected areas + floodplains)
<b>Class 1</b>	Near-natural	<b>Very high</b>
<b>Class 2-3</b>	Slightly to moderately modified	<b>High</b> (river stretches crossing important floodplains/poljes/estuaries/deltas <b>or</b> overlapping with protected areas <b>or</b> both belonging to the “Very high” conservation value stretches)
<b>Class 4</b>	Extensively modified	<b>Low, but important for longitudinal continuum</b> (river stretches crossing important floodplains/poljes/estuaries/deltas <b>or</b> overlapping with protected areas <b>or</b> both belonging to the “High” conservation value stretches)
<b>Class 5 Impoundments</b>	Severely modified	<b>Not assessed</b>

Fig. 5: Definition of conservation value

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Conservation value for rivers (left) and poljes, estuaries/deltas and floodplains (right)











-  Very high conservation value 
-  High conservation value 
-  Low conservation value 
-  Impounded stretches and hydropower reservoirs
-  Other rivers and lakes (no assessment)
-  State boundaries
-  Major cities

Fig. 6: Legend for the map on conservation value on next page



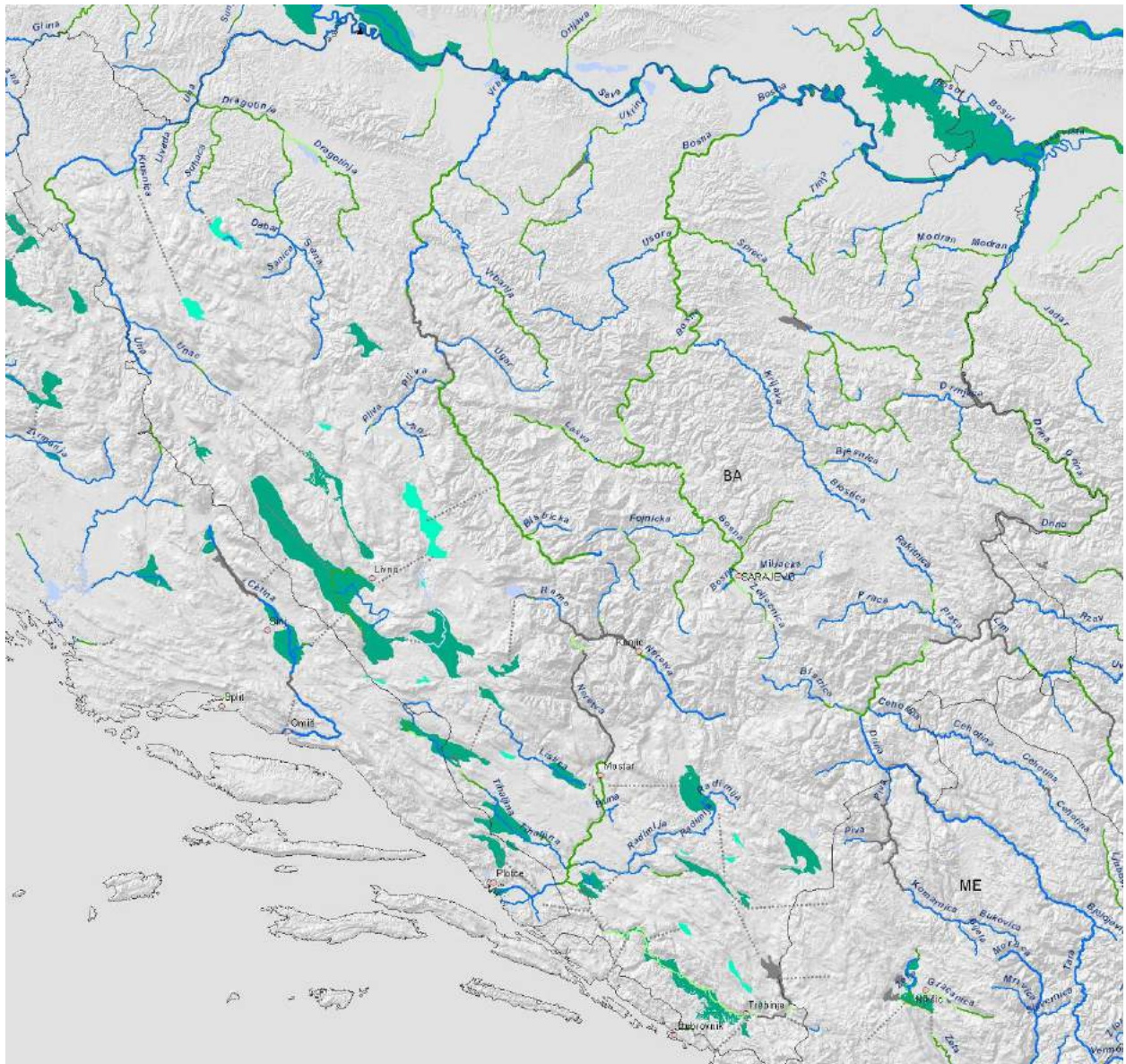


Fig. 7: Conservation value for BA.

Regarding karst poljes in Bosnia & Herzegovina has an outstanding importance. One of the largest karst polje worldwide is the Livanjsko Polje in the Cetina basin, keeping in larger parts its original characteristics of regular flooding it falls into the highest conservation value class.



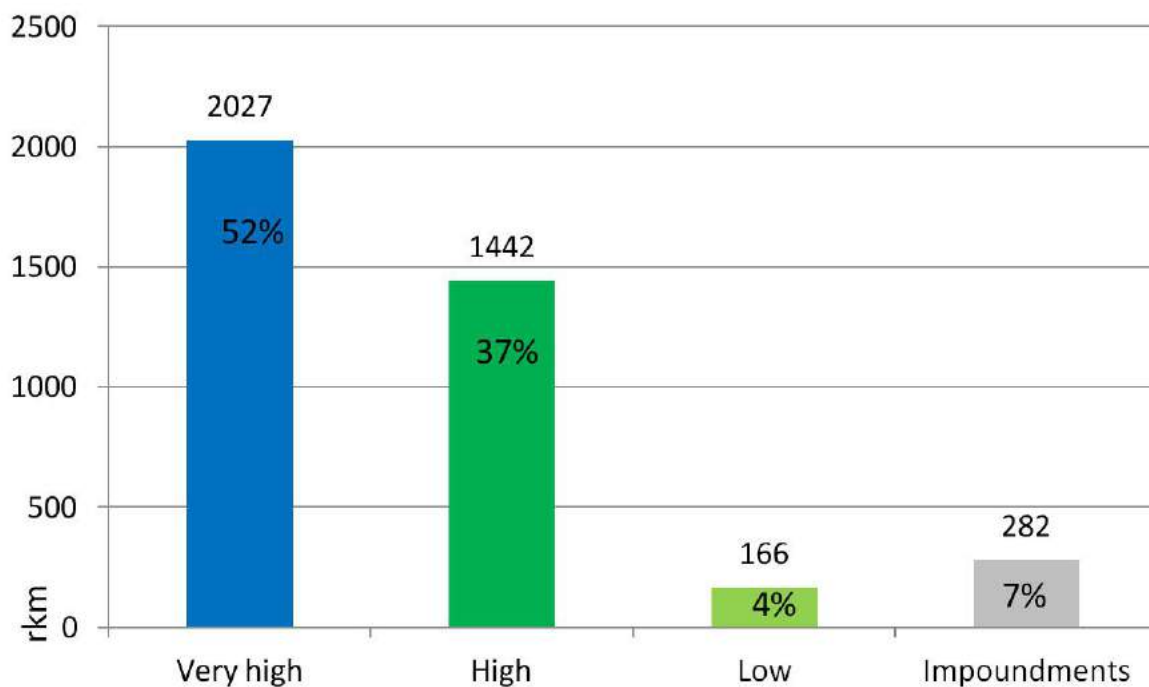


Fig. 8: Conservation value in rkm for BA.

#### 4. Hydropower plants

Hydropower plants were recorded firstly along the “status type” into “existing/operating”, “under implementation” and “planned”. Further dams are classified in three size classes: 1-10 MW, 10-50 MW, and > 50 MW.

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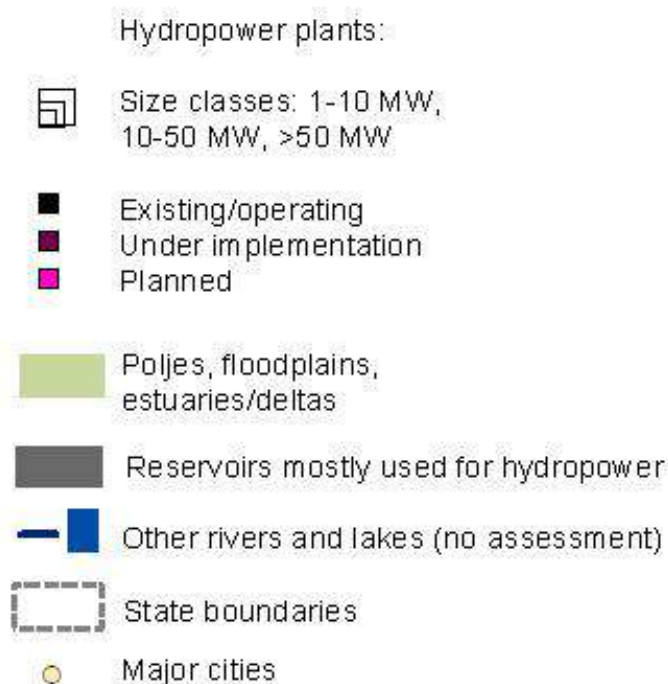


Fig. 9: Legend for the dam map on next page

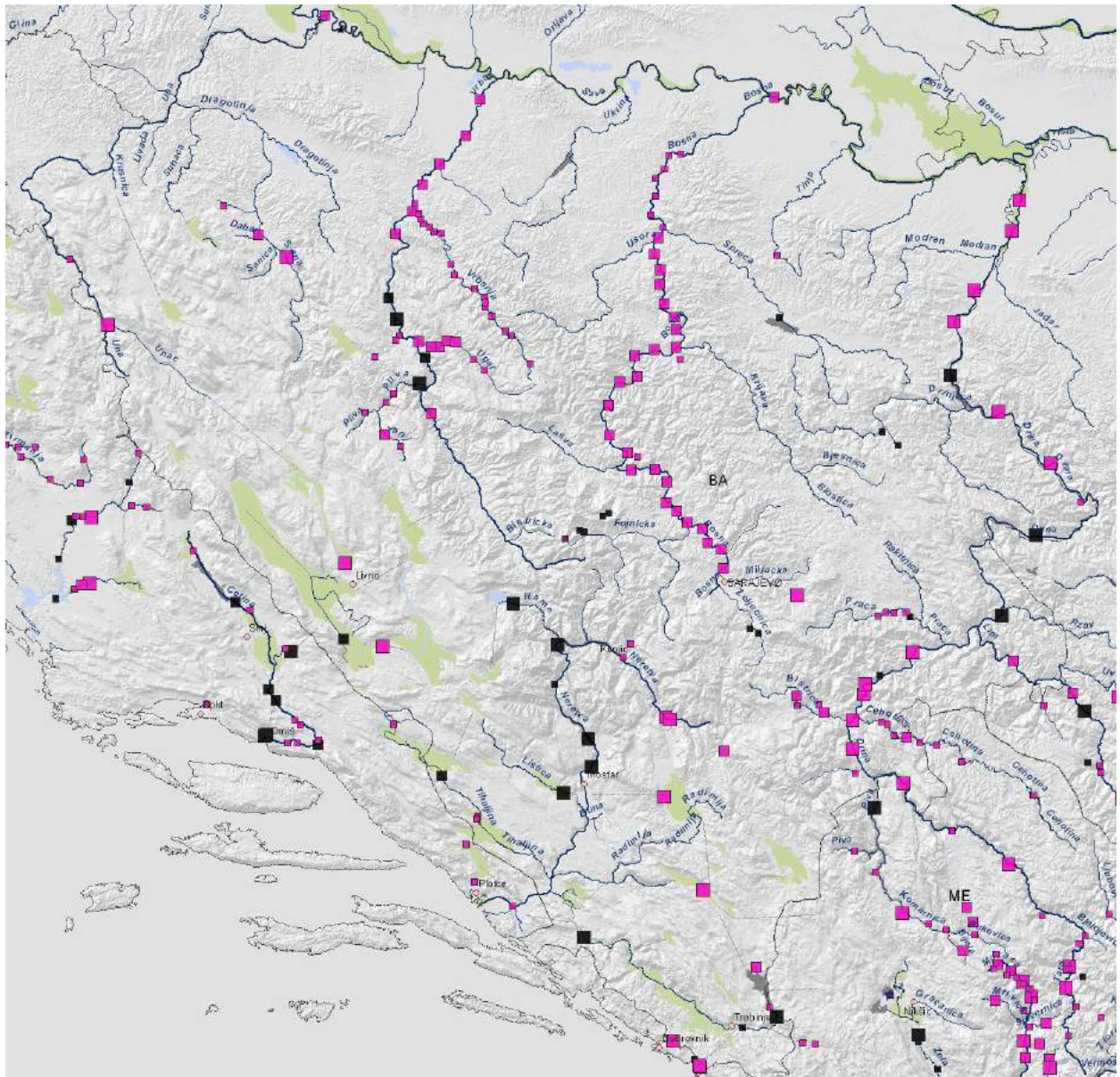


Fig. 10: Hydropower plants for BA.

So far only some larger HPP's can be find on Vrbas and Drina rivers. New plans focus on Vrbas, Bosna and Drina.



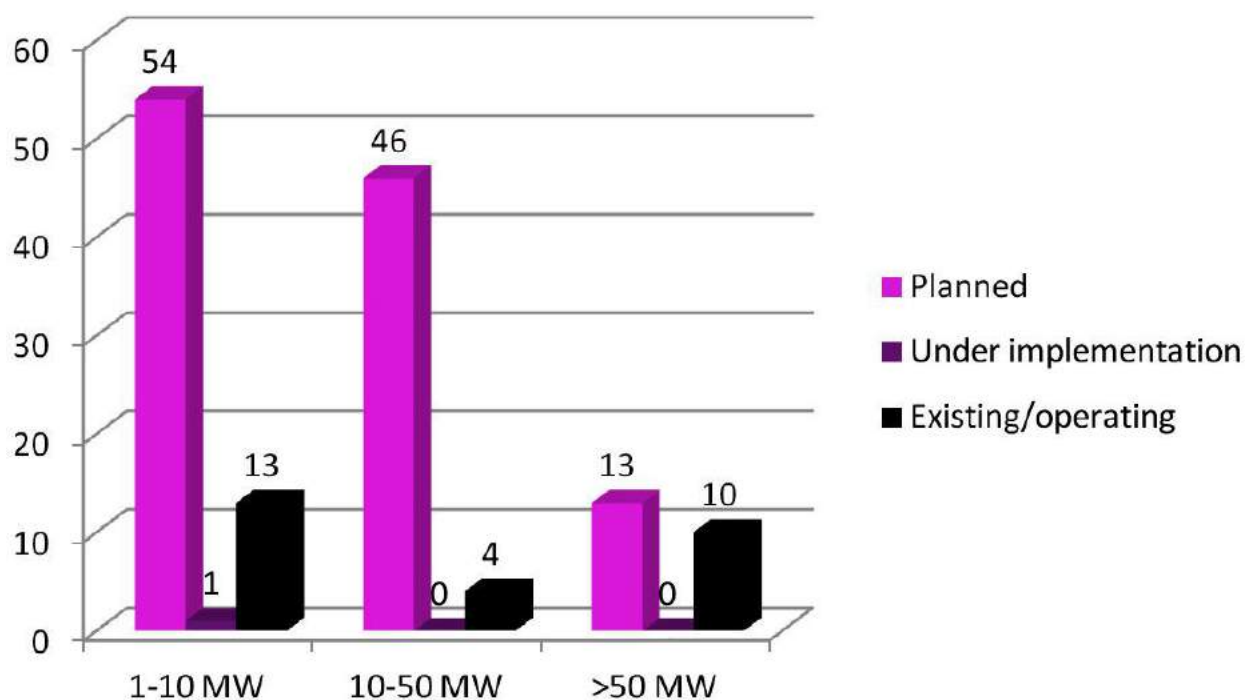



Fig. 11: Distribution of hydropower plants for BA.

### 5. Affected river stretches with conservation value by hydropower

This chapter combines the information of the “Conservation Value” with the planned hydropower plants.



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Hydropower plants:

 Size classes: 1-10 MW, 10-50 MW, >50 MW

 Planned

Conservation value for rivers (left) and poljes, estuaries/deltas and floodplains (righth):

 Very high conservation value 

 High conservation value 



 Low conservation value 

Fig. 12: Legend for the “conflict map” on next page

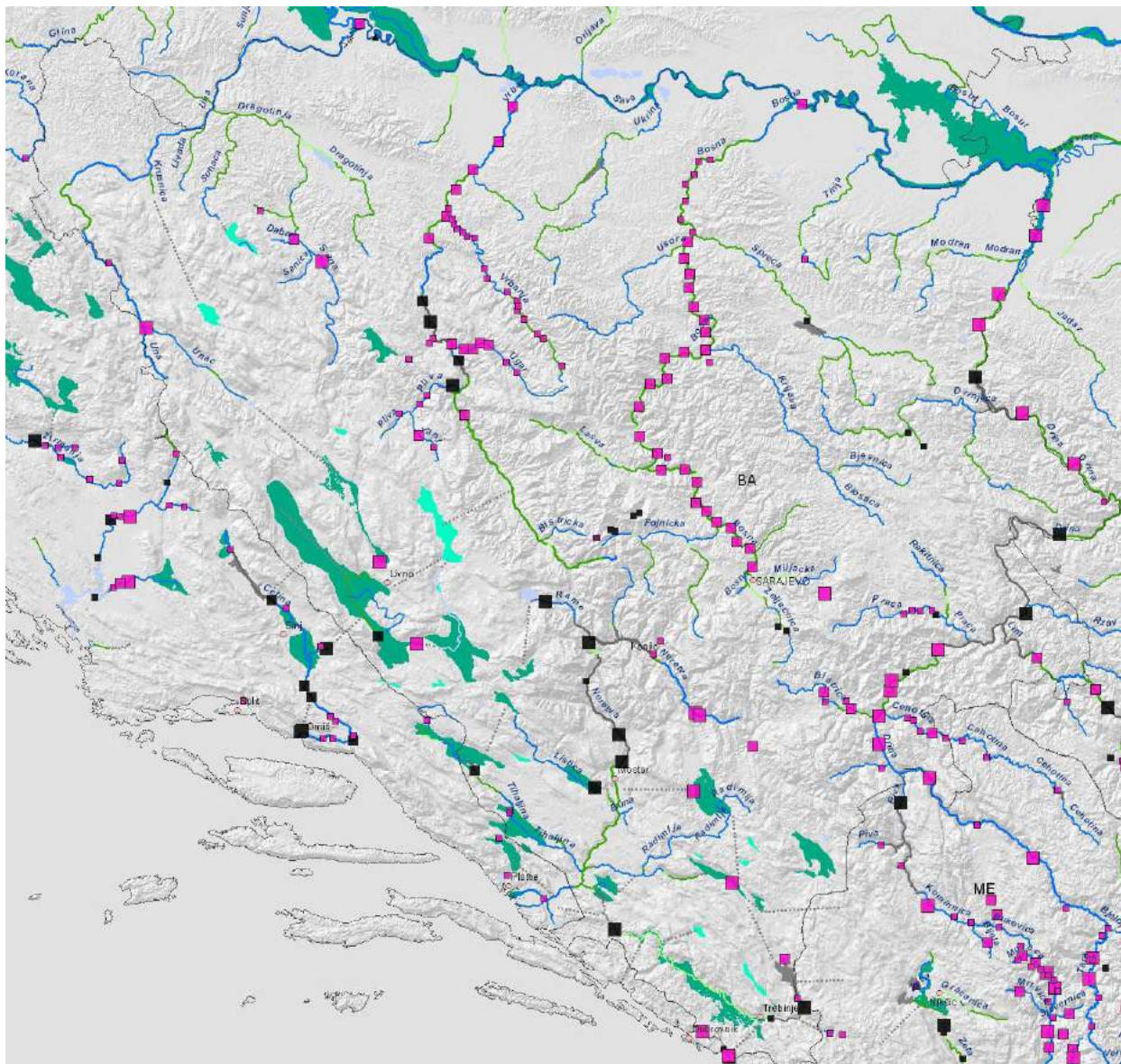


Fig. 13: Affected very high and high conservation stretches by planned hydropower plants for BA.

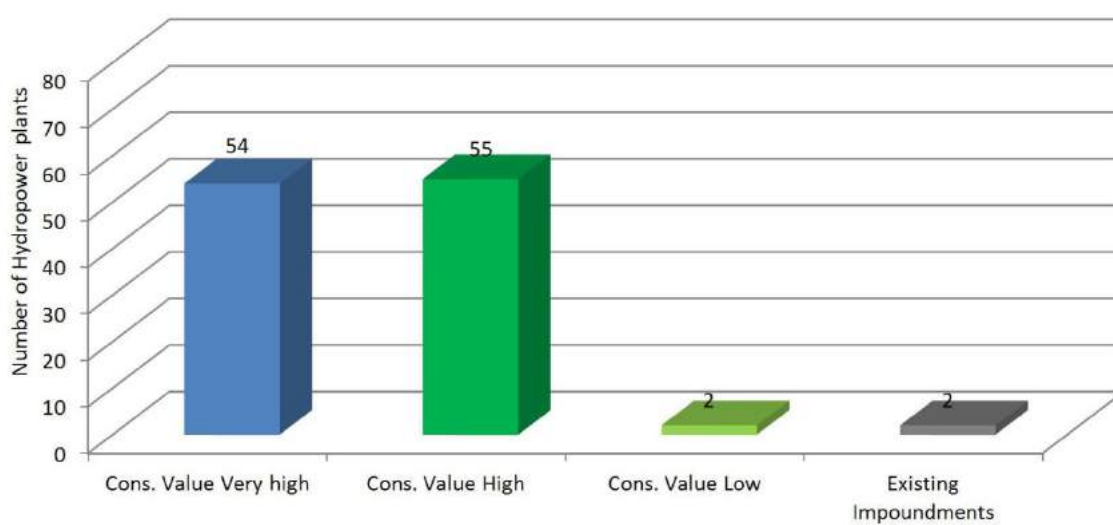


Fig. 14: Number of planned hydropower plants that would affect very high, high and low conservation stretches for BA.



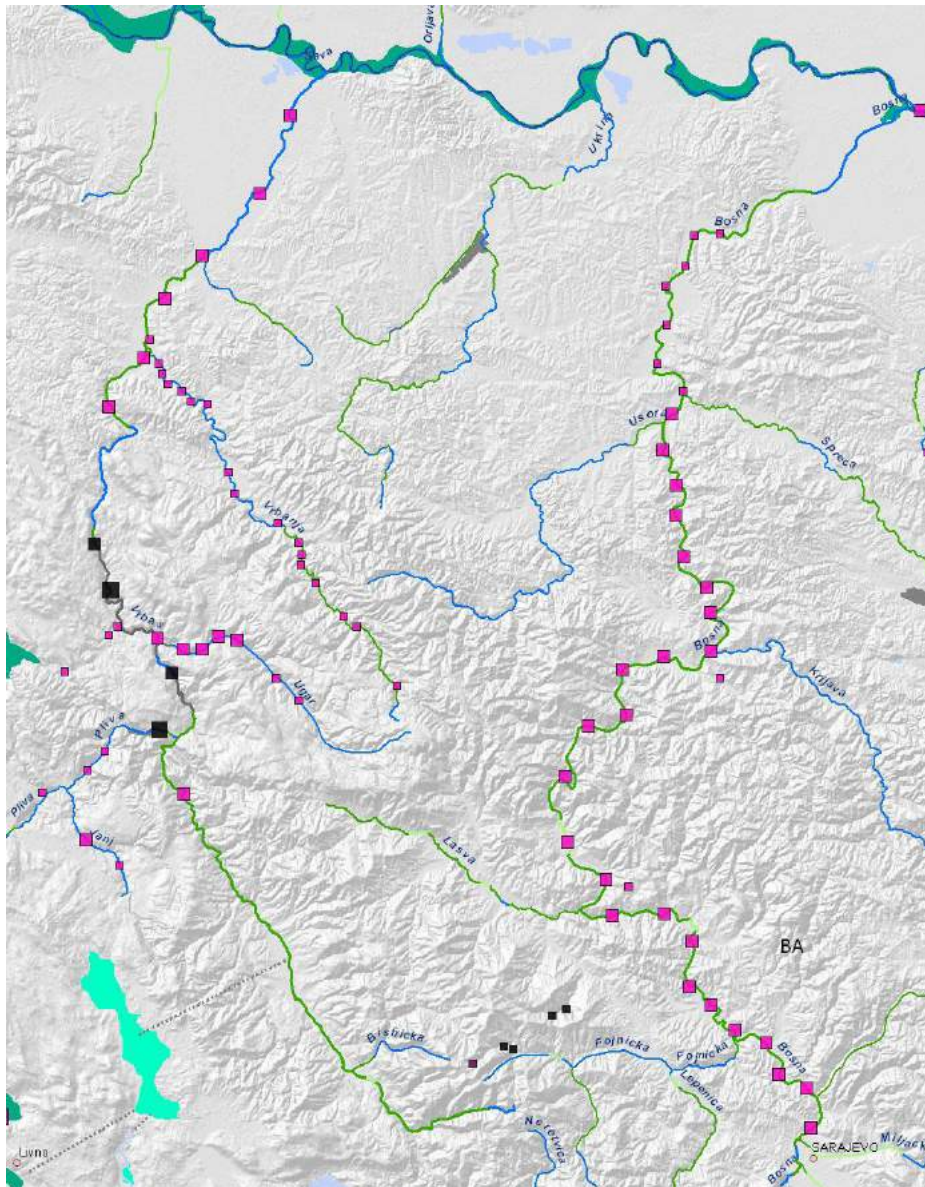


Fig. 15: Map zoom on Vrbas (left) and Bosna (right): Planned chains of hydropower plants will impact both river systems systematically. For Bosna further the regulation from 200 to 30 m width is foreseen, a complete canalization of the river.

Karst systems with significant altitude levels of different poljes (900 to 200 m above sea

level) in combination with power stations at sea level are rather attractive for hydropower generation. In the past, this has led to the development of a complex system of reservoirs, tunnels, canals and power plants. In the Neretva basin, several projects aim to improve water availability through storage and drainage systems in poljes, new tunnels and power stations. In the Cetina basin, the situation is similar. In the example below, a tunnel connection between Dabarsko and Fatničko polje transfers most flood water into a different subbasin (from Neretva to Trebišnica and the HPP Dubrovnik/Adria). This is impacting river Bregava (estimated loss > 50% of flow), the Ramsar site Hutovo Blato (BA) and the whole Neretva Delta (HR). In the Cetina basin (HR, BA), the situation is similar. Here new planned projects endanger the natural connections of Ramsar Site Livanjsko Polje (BA) and threaten endemic fish species.



Overview map of Neretva karst basin with poljes and underground water system as well as hydropower use. The red arrow is marking the violated basin border. (Powerpoint presentation: Primer primene UNESCO-vog principa PCCP STUDIJA UTICAJ PREVOĐENJA VODA KROZ TUNEL FATNIČKO POLJE ⇄ AKUMULACIJA BILEĆA NA REŽIM VODA REKE BREGAVE).



Dabarsko polje to Fatničko polje tunnel connection reducing flood dynamics in poljes and rivers collecting water for hydropower (Martin Schneider-Jacoby, Euronatur).



## 6. List of planned Hydropower dams

ID_HP	Rivers Poljes	Name Location HPP	Installed MW	Affected River Jewels
BA/RS_HP_451	Drina	Tegare	> 50	
BA/RS_HP_452	Drina	Dubravica	> 50	
BA/RS_HP_453	Drina	Kozluk	> 50	
BA/RS_HP_454	Drina	Drina 1	> 50	
BA/RS_HP_455	Drina	Drina 2	> 50	T_BA-RS_RJ_609; BA_RJ_361
BA/RS_HP_456	Drina	Drina 3	> 50	T_BA-RS_RJ_609; BA_RJ_361
BA/RS_HP_762	Drina	Rogacica	1-10	
BA_HP_373	Drina	Ustikolina	> 50	
BA_HP_380	Drina	Foča / Srbinje	> 50	
BA_HP_359	Drina	Buk Bijela	> 50	BA_RJ_664
BA_HP_361	Drina	Paunci	> 50	
BA_HP_662	Drina	Goražde	> 50	
BA_HP_362	Sutjeska	Sutjeska	1-10	
BA_HP_372	Sana	Vrhpolje	> 50	
BA_HP_374	Neretva	Glavatičevo	> 50	BA_RJ_665
BA_HP_1039	Neretva	Ulog	10-50	BA_RJ_665
BA_HP_629	Neretva	Bjelimići	> 50	BA_RJ_665
BA_HP_703	Neretva	Konjic Mini	1-10	
BA_HP_377	Trebišnjica	Dabar	> 50	BA_RJ_364
BA_HP_378	Nevesinjsko	Nevesinje	> 50	BA_RJ_363
BA_HP_379	Trebišnjica	Bileća	10-50	
BA_HP_413	Pliva	Glavica 1	1-10	
BA_HP_414	Pliva	Duljci	1-10	
BA_HP_416	Janj	Janjske Otoke	10-50	
BA_HP_417	Janj	Bašići	1-10	
BA_HP_419	Ugar	Melina	1-10	BA_RJ_652
BA_HP_420	Ugar	Zapeče	1-10	BA_RJ_652
BA_HP_421	Ugar	Vrletna kosa	10-50	BA_RJ_652
BA_HP_939	Ugar	Ivik	10-50	BA_RJ_652
BA_HP_360	Ugar	Ugar 1	10-50	BA_RJ_652
BA_HP_940	Ugar	Ugar 2	10-50	BA_RJ_652
BA_HP_360	Ugar	Ugar 1	10-50	BA_RJ_652
BA_HP_422	Ugar	Ugar-Ušće	10-50	BA_RJ_652
BA_HP_423	Crna	Mrkonjić Grad	1-10	
BA_HP_424	Crna	Staro Selo	1-10	
BA_HP_425	Vrbanja	Divič	1-10	
BA_HP_427	Vrbanja	Siprage	1-10	
BA_HP_428	Vrbanja	Stopan	1-10	
BA_HP_430	Vrbanja	Koritine	1-10	
BA_HP_431	Vrbanja	Jurići	1-10	
BA_HP_432	Vrbanja	Orahovo	1-10	
BA_HP_433	Vrbanja	Obodnik	1-10	
BA_HP_434	Vrbanja	Vrbanjci	1-10	BA_RJ_653
BA_HP_435	Vrbanja	Kotor Varos 1	1-10	BA_RJ_653
BA_HP_436	Vrbanja	Sibovi	1-10	BA_RJ_653
BA_HP_437	Vrbanja	Celinac 1	1-10	
BA_HP_438	Vrbanja	Gradina	1-10	
BA_HP_439	Vrbanja	Rudine	1-10	
BA_HP_440	Vrbanja	Vrbanja 1	1-10	

ID_HP	Rivers Poljes	Name Location HPP	Installed MW	Affected River Jewels
BA_HP_1534	Bosna	Bosna1	10-50	
BA_HP_1535	Bosna	Bosna2	10-50	
BA_HP_1536	Bosna	Bosna3	10-50	
BA_HP_1537	Bosna	Bosna4	10-50	
BA_HP_1538	Bosna	Bosna5	10-50	
BA_HP_1539	Bosna	Bosna6	10-50	
BA_HP_1540	Bosna	Bosna7	10-50	
BA_HP_1541	Bosna	Bosna8	10-50	
BA_HP_1542	Bosna	Bosna9	10-50	
BA_HP_1543	Bosna	Bosna10	10-50	
BA_HP_1544	Bosna	Bosna11	10-50	
BA_HP_1545	Bosna	Bosna12	10-50	
BA_HP_1546	Bosna	Bosna13	10-50	
BA_HP_1547	Bosna	Bosna14	10-50	
BA_HP_1548	Bosna	Bosna15	10-50	
BA_HP_1549	Bosna	Bosna16	10-50	
BA_HP_1550	Bosna	Bosna17	10-50	
BA_HP_1551	Bosna	Bosna18	10-50	
BA_HP_1552	Bosna	Bosna19	10-50	
BA_HP_1553	Bosna	Bosna20	10-50	
BA_HP_1554	Bosna	Bosna21	10-50	
BA_HP_1555	Bosna	Bosna22	10-50	
BA_HP_1556	Bosna	Bosna23	10-50	
BA_HP_627	Bosna	Vranduk	10-50	
BA_HP_747	Bosna	Cijevna 1	1-10	
BA_HP_748	Bosna	Cijevna 2	1-10	
BA_HP_749	Bosna	Cijevna 3	1-10	
BA_HP_750	Bosna	Cijevna 4	1-10	
BA_HP_751	Bosna	Cijevna 5	1-10	
BA_HP_752	Bosna	Cijevna 6	1-10	
BA_HP_941	Bosna	Doboj	1-10	
BA_HP_1557	Bosna	Bosna24	10-50	
BA_HP_704	Bosna tributary	Moscanica 2	1-10	
BA_HP_441	Vrbanja	Vrbanja 2	1-10	
BA_HP_442	Vrbanja	Vrbanja 3	1-10	
BA_HP_444	Vrbas	Novoselija	10-50	
BA_HP_445	Vrbas	Delibašino selo	1-10	
BA_HP_446	Vrbas	Trn	10-50	
BA_HP_447	Vrbas	Laktaši	10-50	
BA_HP_448	Vrbas	Kosjerevo	10-50	BA_RJ_654
BA_HP_382	Vrbas	Banja Luka	10-50	
BA_HP_449	Vrbas	Razboj	10-50	BA_RJ_654
BA_HP_502	Vrbas	Han Skela	10-50	
BA_HP_457	Lim	Mrsovo	10-50	BA_RJ_662
BA/ME_HP_749	Tara	Bijeli Brijeg	> 50	ME_RJ_020
BA_HP_458	Cehotina	Vikoc	10-50	BA_RJ_663
BA_HP_460	Cehotina	Prvnice	1-10	BA_RJ_663
BA_HP_461	Cehotina	Hreljava	1-10	BA_RJ_663
BA_HP_462	Cehotina	Brioni	1-10	BA_RJ_663
BA_HP_496	Bistrica	Bistrica B1	10-50	
BA_HP_497	Bistrica	Bistrica B2-a	1-10	
BA_HP_498	Bistrica	Bistrica B3	10-50	



ID_HP	Rivers Poljes	Name Location HPP	Installed MW	Affected River Jewels
BA_HP_499	Janjina	Janjina J1	1-10	
BA_HP_500	Šuica	Vrilo	> 50	BA_RJ_107
BA_HP_501	Glamočko Polje	Kablić	> 50	BA_RJ_362
BA_HP_503	Tihaljina	Klokun	1-10	BA_RJ_374; BA_RJ_668
BA_HP_504	Tihaljina	Kocusa	1-10	BA_RJ_374; BA_RJ_668
BA_HP_628	Una	Unac	> 50	BA_RJ_650
BA_HP_670	Miljacka tributary	Pale	> 50	
BA_HP_695	Crna	Crna Rijeka	1-10	
BA_HP_701	Bliha	Hatiraj	1-10	
BA_HP_938	Sana	Caplje	10-50	
BA_HP_980	Prača	Prača 1	1-10	
BA_HP_981	Prača	Prača 2	1-10	
BA_HP_982	Prača	Prača 3	1-10	
BA_HP_983	Prača	Prača 4	1-10	
HR/BA_HP_542	Sava	Samac	10-50	T_HR-BA_RJ_627; T_SI-HR-RS_RJ_422

Pictures cover: Left: GoogleEarth 2014 (Vrbas mouths into Sava), Right: Marjan Petrovski on Google Panoramio (Kravice waterfalls)

Prepared by FLUVIUS, Vienna 2010-2014