



# Hydropower Projects on Balkan Rivers

## 2020 Update

November 2020

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for



**euRONATUR** & **RiverWatch**

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**Foto credit**

Front page: Moglicë HPP, Albania © Google Earth.

**Impressum**

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## 1. Summary

In 2020, **3,431 hydropower plants (HPPs) are planned, 108 under construction and 1,480 are operational in the Balkans**. Small-scale hydropower plants (SHPs) make up by far the largest share: 92% of the planned projects have an installed capacity of less than 10 Megawatt (MW).

Since the last update of this kind in 2018, another 300 HPPs came into operation, leaving hundreds of kilometres of rivers and streams devastated, most of them in Albania and Bosnia & Herzegovina. The vast majority of them are small-scale dams (278).

There has been a significant increase in overall hydropower development, with numbers of operating plants doubling between 2015 and 2020 (from 714 to 1.480). Looking only at SHPs (< 10 MW) the increase is even stronger (from 590 to 1.324).

On the country level, the numbers of projects planned and currently under construction are as follows

Slovenia:	375 planned, 3 under construction
Croatia:	147 planned, 1 under construction
Bosnia & Herzegovina:	390 planned, 35 under construction
Serbia:	824 planned, 14 under construction
Kosovo:	87 planned, 10 under construction
Montenegro:	92 planned, four under construction
North Macedonia:	193 planned, 12 under construction
Albania:	410 planned, 24 under construction
Greece (only northern part):	565 planned, two under construction
Bulgaria:	323 planned, two under construction
Turkey (European part only)	25 planned, one under construction

Another key finding of this assessment: **1,595 HPPs (45%) are planned or constructed inside protected areas**, including 245 in national parks and 597 in Natura 2000 sites (in the Balkan EU countries Greece, Bulgaria, Croatia and Slovenia).

## 2. Introduction

Between 2010 and 2012, the first inventory of existing and projected hydropower plants (HPPs) in the Balkan region was carried out within the “Save the Blue Heart of Europe” campaign (Schwarz 2012). The data was updated in 2015 (Schwarz 2015a), including for protected areas (Schwarz 2015b), in 2017 (Schwarz 2017) and in 2018 in the frame of the Eco-Masterplan for Balkan Rivers (Riverwatch & EuroNatur 2018).

The initial inventory included only larger plants with an installed capacity of above 1 MW. However, the analysis of planned projects in protected areas indicated a particularly alarming amount of small hydropower plants (SHPs; Schwarz 2015b). Therefore, the SHP category (0.1-< 1MW) was included in the 2015 update. In this 2020 update, the category of large-size HPPs (> 50) was further divided into the categories 50-<100 and >100 MW respectively.

The continuous update of the database allows a comparison of HPP development from 2012 to 2015, 2017, 2018 and finally 2020.

## 3. Data preparation

The study area comprises the EU countries Slovenia (SI), Croatia (HR), Bulgaria (BG) and the northern Balkan area of Greece (GR), as well as the non-EU countries Bosnia & Herzegovina (BA), Serbia (RS), Montenegro (ME), Kosovo (KV), North Macedonia (MK), Albania (AL), and the European part of Turkey (TR).

The update was carried out according to the following approach:

1. High resolution satellite data allows the systematic scan of all HPPs in the existing database to see if any status must be changed from “planned” to “under construction” or from “under construction” to “operating”. Over the past two years, the seamless and quick streaming of high-resolution data provided by Google Earth has facilitated a reliable comparison of changes in HPP status within the time span of 2018-2020. In addition, Sentinel II scenes are checked regularly to detect recent construction works for medium and large-scale projects (for SHPs the optical resolution is insufficient).
2. Deep data mining in form of examining lists, newspapers, planning studies, projects by investment groups, or other inventories is necessary to get an overview of currently planned HPPs or those under construction. The category “planned” comprises projects in every step of the planning stage, from feasibility and hydroelectric potential studies -to approved (licensed) ones. Further, existing national NGO-HPP inventories such as for Bosnia & Herzegovina<sup>1</sup>, Bulgaria<sup>2</sup> and Albania<sup>3</sup> are explored providing often much more detailed information on individual HPPs.

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<sup>1</sup> [http://voda.ekoakcija.org/bs/map/sve\\_mhe](http://voda.ekoakcija.org/bs/map/sve_mhe)

<sup>2</sup> <https://dams.reki.bg/Dams/About>

<sup>3</sup> [https://www.ecoalbania.org/wp-content/uploads/2017/05/HPPs\\_al\\_final-report\\_me-kapak.pdf](https://www.ecoalbania.org/wp-content/uploads/2017/05/HPPs_al_final-report_me-kapak.pdf)

3. Based on the five inventories 2012, 2015, 2017, 2018 and 2020, a comparison of data was prepared.
4. In addition to the update of HPP status, the data on protected areas (PA) in non-EU countries was updated and improved. However, many protected areas in non-EU countries are still provisional and in planning stage. Protected areas are divided in the following categories: 1. National parks, 2. Ramsar sites, Biosphere reserves and World heritage sites, 3. Natura2000 areas, 4. Nature reserves, 5. Emerald areas and protected areas proposed for the Natura2000 network, and 6. Landscape protection areas.
5. Finally, the data was provided in GIS formats and maps (as included in this report) and the interactive online map on [www.balkanrivers.net](http://www.balkanrivers.net) was updated with the new data.

Some technical issues explaining slight differences between the single datasets from 2012-2020 must be pointed out. In regards to transboundary issues (e.g. planned HPP on Drina and Kupa), a pragmatic approach has been applied by attributing projects only to one country, even when they are developed bilaterally. Furthermore, by applying the most recent precise border polygons, some borders have shifted slightly in the database and thus HPPs located close to borders have been attributed to the neighboring country. Another aspect of the regular updates is a slight shift for individual HPPs in their size class (e.g. a HPP was planned in size class <1 MW but was built >1 MW or vice versa). It must also be emphasized that the completeness of small plant data (SHPs 0.1-< 1 MW) is not guaranteed due to the absence of national inventories as well as missing information on operation, e.g. of old mills/turbines. Finally, changes in names and the position (e.g. of dam/water abstraction points/powerhouse) as well as the merging of turbines can lead to numbers differing slightly from official lists.

Data of protected areas (PAs) in the non-EU countries has been updated for Albania, North Macedonia and Bosnia & Herzegovina. The most recent available datasets of Natura2000, World Database on Protected Areas (WDPA)<sup>4</sup> and Ramsar as well as Emerald have been applied for all countries. Natura2000 is an EU protection category and thus, proposed Natura2000 networks in non-EU countries are only preliminary designations – “candidate Nature 2000 networks”, in other words. Their factual protection is weak, similar to most of the Emerald areas in those countries. Furthermore, in many cases, the definition of final boundaries has often not been decided. In contrast to Bosnia & Herzegovina, no recent additional proposals for Natura2000 sites are available for Serbia (only Emerald areas).

Problematic is the overlay of several categories (polygons) for protected areas and different types of zoning (not only for national parks), in combination with the HPP inventory. Many protected areas overlap, resulting in the same HPPs being attributed to two or more protection categories. For overall results, duplicates were eliminated, so that projects, which fall in two or more categories are only counted in the highest category (e.g. 1. National park). Of course, the data provides also total numbers for a specific category.

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<sup>4</sup> <https://www.protectedplanet.net/en/thematic-areas/wdpa>

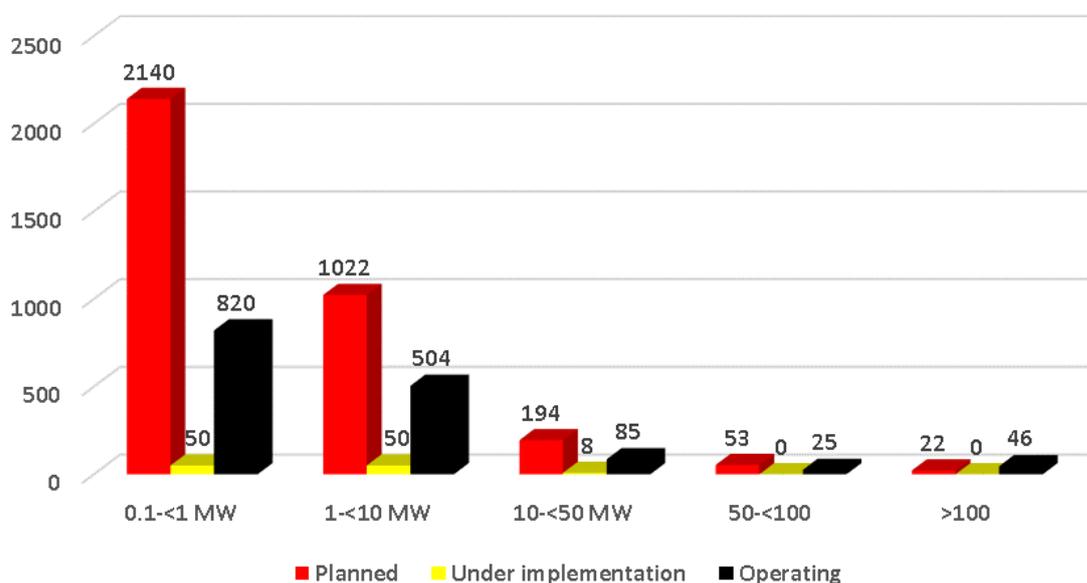
## 4. Results

### 4.1 Overall distribution of HPPs, overlay with protected areas and comparison in the time span of 2012 - 2020

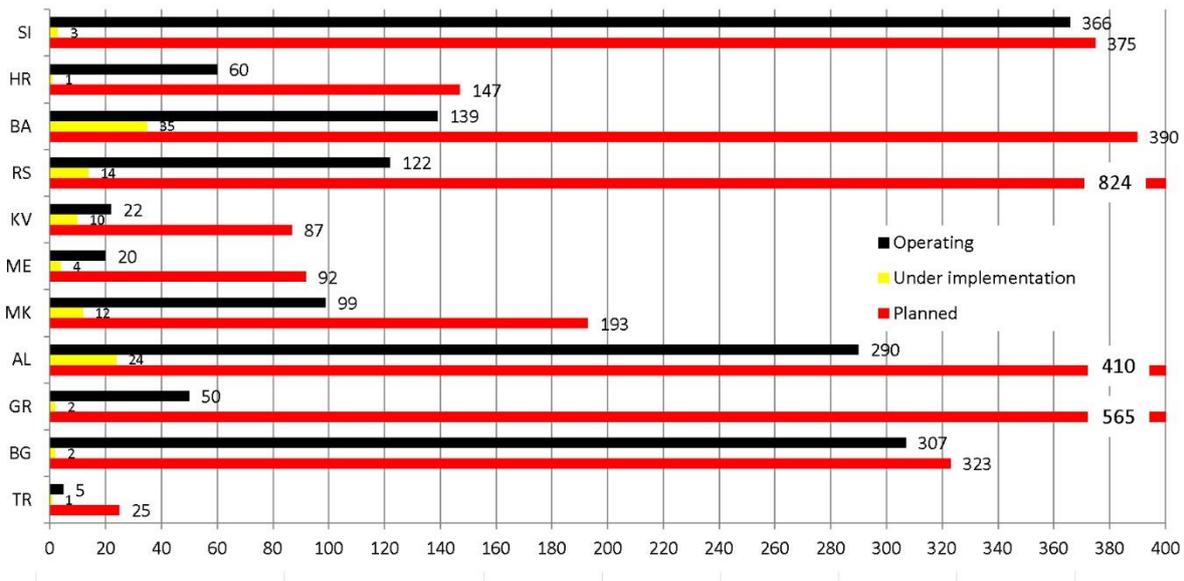
In the entire project region, the total number of recorded and projected HPPs increased to 5,019, whereas 1,480 HPPs are operational. In the categories > 1 MW a considerable increase of existing dams can be recorded since 2012, due to the completion of 390 plants.

The number of planned projects (3,431 in total) increased significantly for smaller HPPs, while no further large projects have been added. Progress in planning and construction cannot be assumed for all projects recorded previously, but there is no evidence that these projects have been abandoned, even though some of the them are politically no longer in discussion. In regards to very small HPPs, it is often very difficult to verify their status (even with satellite images) and most probably some more plants have already moved from the planning to the implementation phase.

Most projected HPPs fall in the categories 0.1-<1 and 1-<10 (a total of 3,162 projects or 92%). These plants, though small or medium, cause significant damage since they extend to almost every river in the region and are unfortunately often projected on rivers with high ecological value or even within protected areas (see fig. 1).

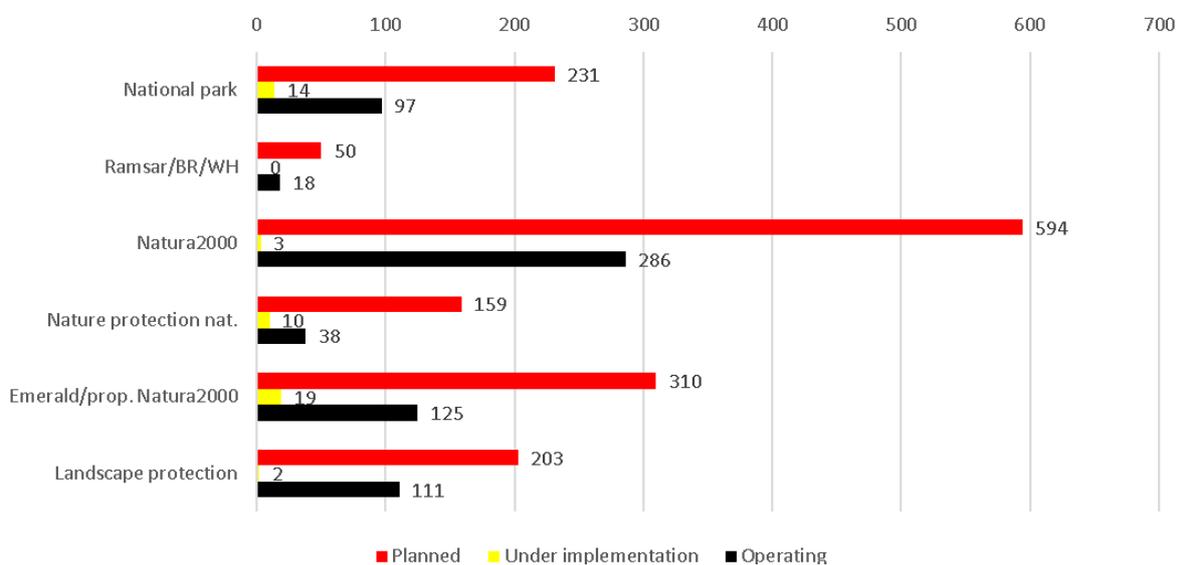


**Figure 1:** Total distribution of hydropower plants for entire project area.



**Figure 2:** Country distribution of hydropower plants for entire project area.

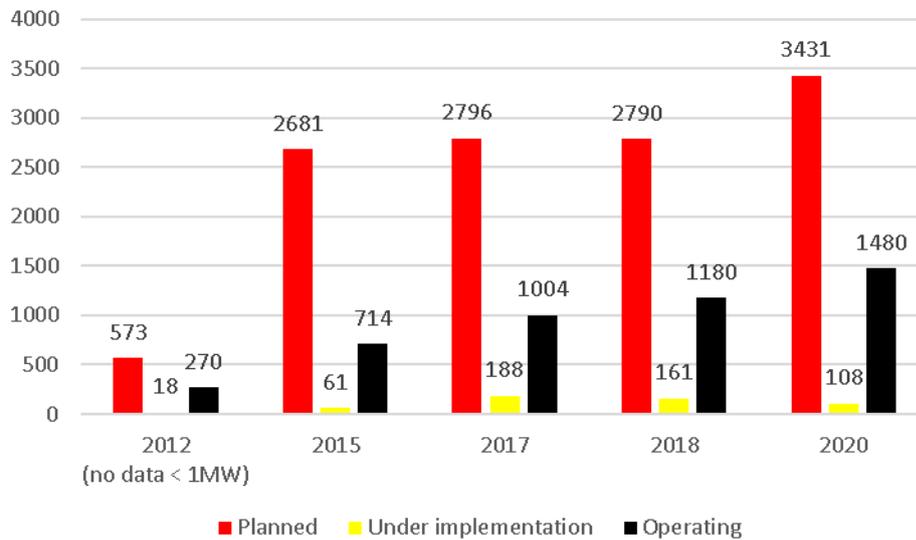
Figure 2 compares hydropower development between countries. Bosnia & Herzegovina, Albania, Serbia and North Macedonia are current hotspots of HPP construction, while the lists of projects in planning are considerably longer in all countries. Slovenia being an Alpine country has the largest number of operating plants, but the increase of additional projects planned is most marked in Albania, Serbia, and Bosnia & Herzegovina.



**Figure 3:** Overview of hydropower plants in protected areas.

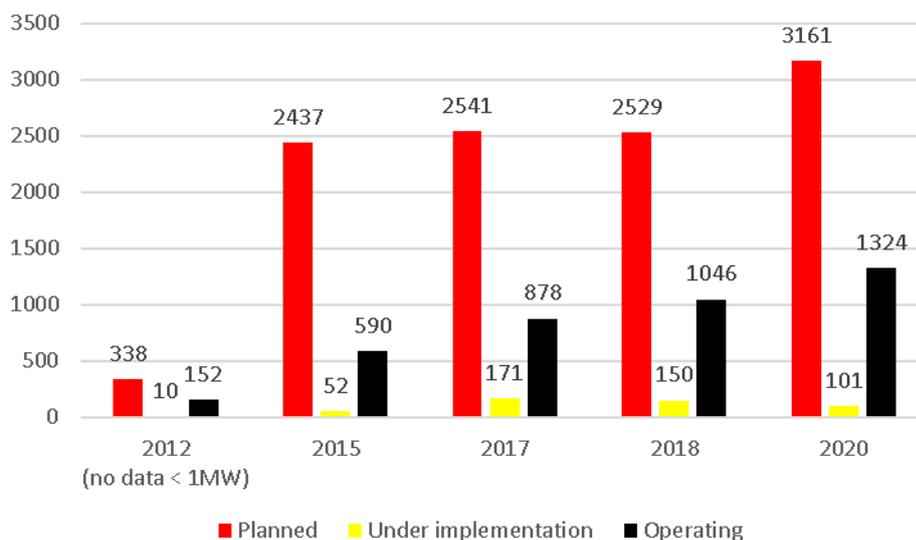
The numbers of hydropower plants in protected areas increases also. Despite the provisional designation of protected areas, previously planned HPPs are now falling within protected area boundaries, as for example in Albania, North Macedonia or Bosnia & Herzegovina. The high number of projects under implementation in Emerald/proposed

Natura2000 areas reflects this. Although the allocation and protection status and regime are very heterogeneous, 45% of all hydropower plants fall in protected areas.



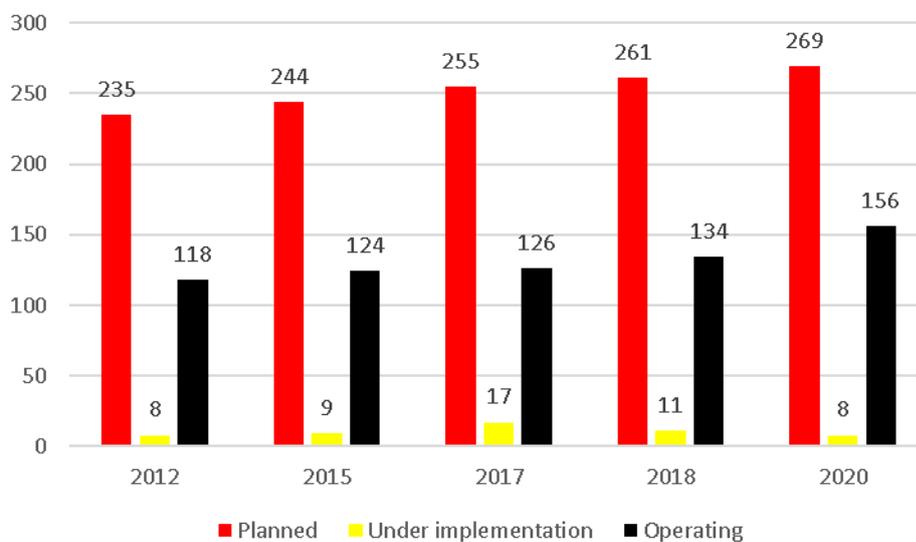
**Figure 4:** Overall comparison between years (2012-2020).

Figure 4 shows overall hydropower development since 2015. In 2012 no data on small hydropower was included. There has been a significant increase in hydropower development, with numbers of operating plants doubling between 2015 and 2020. The decrease of HPPs indicated as being “under implementation” cannot be understood as a reverse trend for the booming development. Especially in the case of SHPs it is difficult to recognize construction sites on satellite imagery, and moreover this class is of high fluctuation. Small projects are often implemented within months, changing from the “planned” class directly to “operating” one.



**Figure 5:** Overall comparison for SHPs (0.1- <10 MW) between years (2012-2020).

Figure 5 focuses on HPPs between 0.1 and 10 MW. These plants have been increasing even more, from 590 in 2015 to 1324 in 2020, and the number continues to rise. The development of small and medium-sized HPPs in Albania and Bosnia & Herzegovina leads to dozens, even hundreds of kilometres of abstracted rivers, and the water is conveyed through pipes partially across catchment boundaries. Nearly all rivers are affected and each year new SHPs of 1MW or just below appear, often summing up to class 1-10 MW over entire valleys or smaller catchments. Most probably, the number for SHPs of 0.1- < 1MW is even higher.



**Figure 6:** Overall comparison for HPPs >10 MW for 2012, 2015, 2017, 2018 and 2020.

Figure 6 summarizes the development of larger dams for the full range of time steps. The number of operating plants increases by 32%, from 118 in 2012 to 156 in 2020, including many medium and large river stretches in the project area. Plants on larger, water-rich rivers are still primarily planned in narrow valleys in the upper catchment, but there are also sites in the lower river courses, such as those foreseen on Bosna, Drina or Morača. Two huge dams realized in the past years are those on Sava (Brežice HPP) and on Devoll (Moglicë HPP, compare cover image). New “old” projects appeared also in the Greenfield lists of the EU, such as those on Morača and Lim for Montenegro.

# Overview of Hydropower plants in the Balkan countries 2020

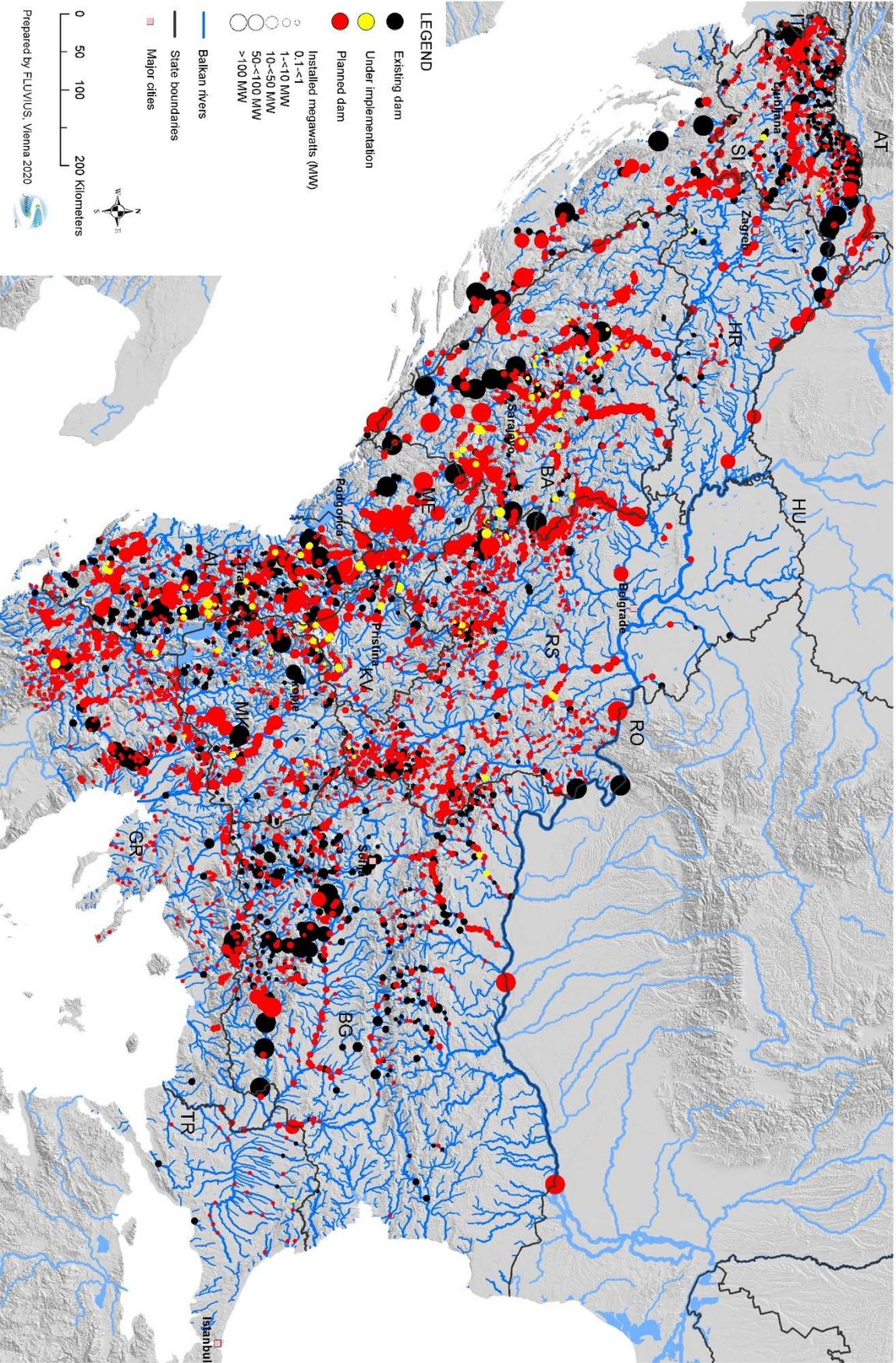
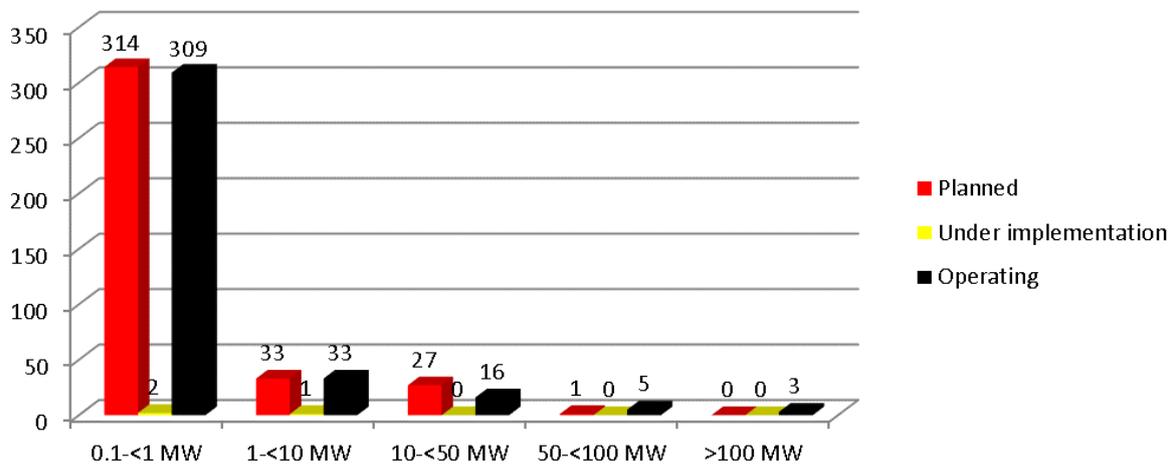


Figure 7: Overview of the distribution of HPPs in the Balkan region.

## 4.2 Distribution of HPPs in Slovenia

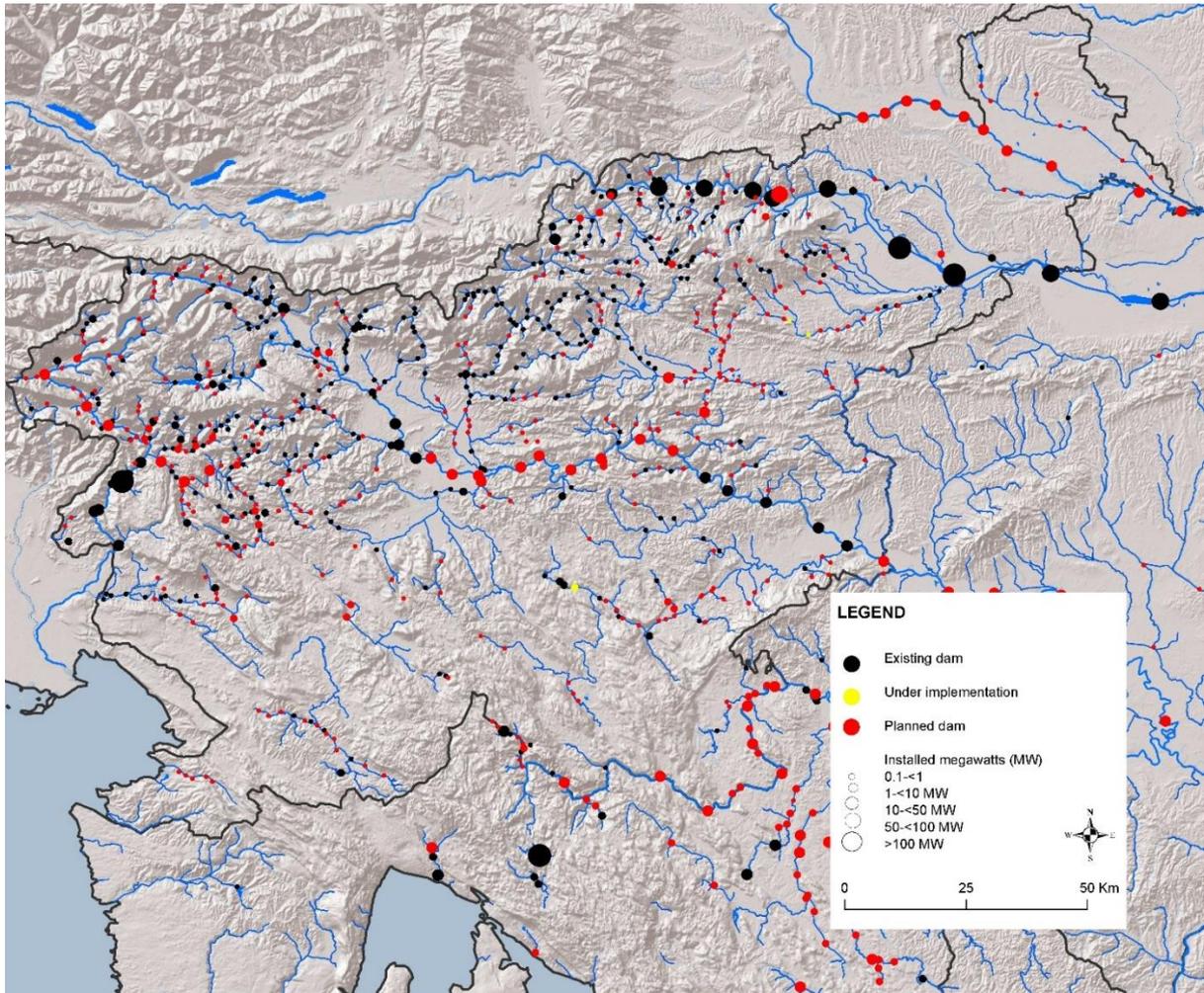
The biggest hydropower plant completed in Slovenia in recent years is Brežice HPP on Sava. In general, the development slowed down, but numerous plans exist. Completion of the HPP chain on upper Sava is stalled and the expected planning horizons become longer due to extended environmental obligations and increasing public awareness.



**Figure 8:** Distribution of HPPs in Slovenia.



**Figure 9:** Brežice HPP at the mouth of Krka river (Natura2000) is the youngest major hydropower plant on Sava river (GE 2020).



**Figure 10:** Distribution map of HPPs in Slovenia.

### 4.3 Distribution of HPPs in Croatia, including within protected areas

Similar to Slovenia, the development of larger HPPs on Sava, Kupa and Karst areas is very slow currently. Likewise, the designation of many rivers as Natura2000 areas has led to a reduced development of SHPs.

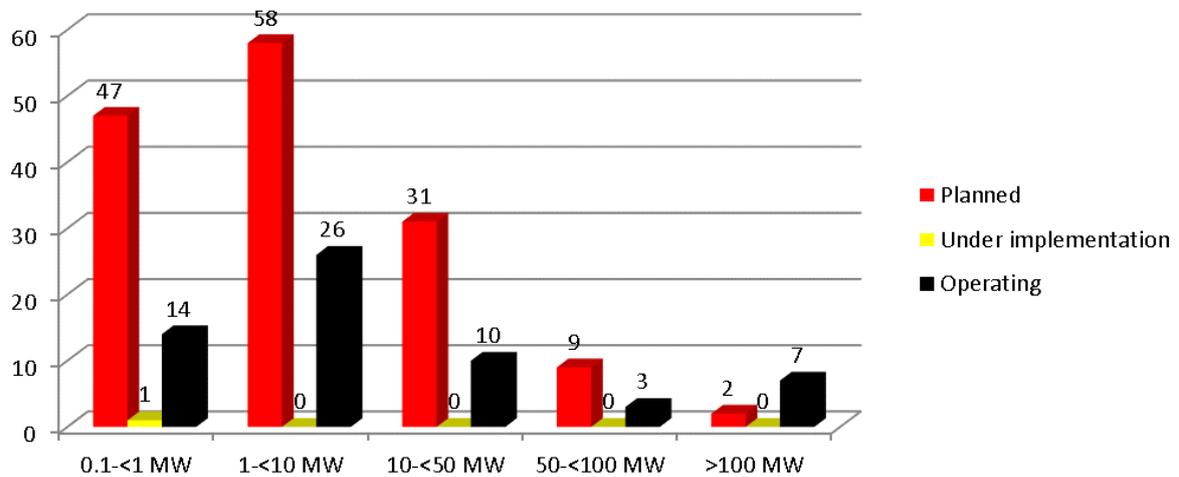
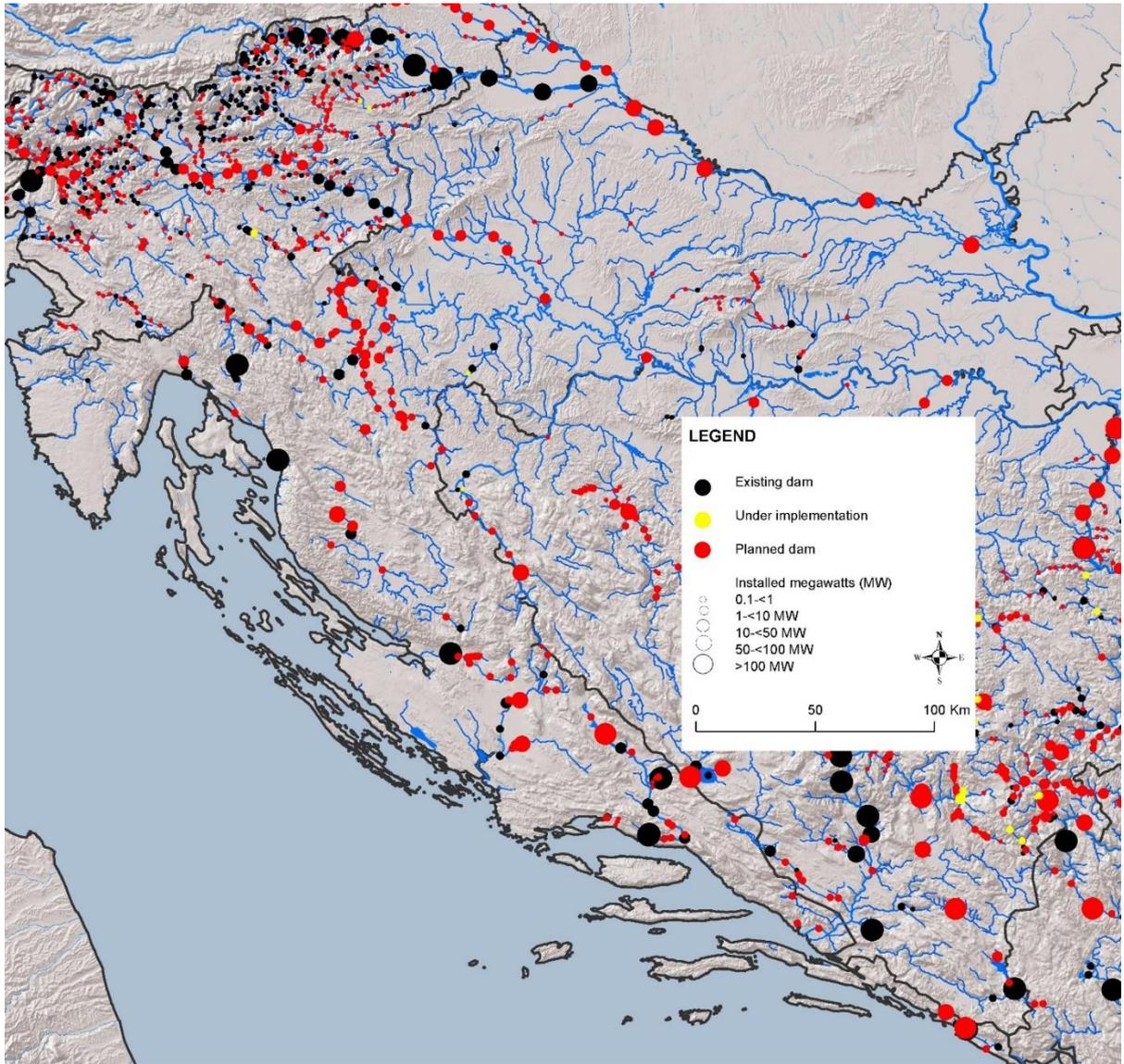


Figure 11: Distribution of HPPs in Croatia.



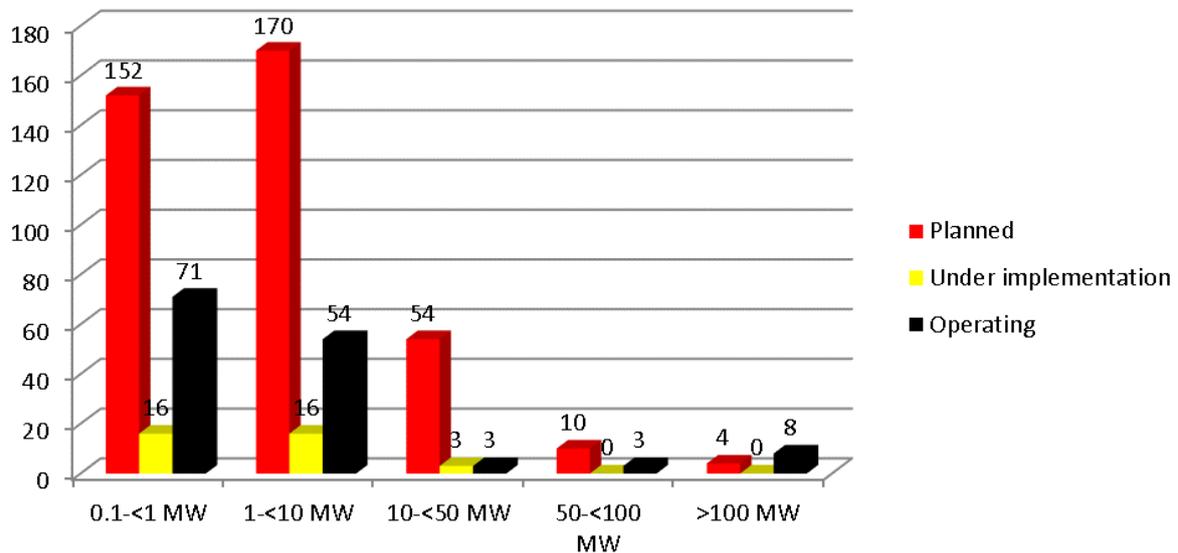
Figure 12: Several smaller HPPs were implemented even in lowlands in recent years, e.g. north of Karlovac, Kupa catchment (GE 2020).



**Figure 13:** Distribution map of HPPs in Croatia.

#### 4.4 Distribution of HPPs in Bosnia & Herzegovina

No other country with the exception of Albania is subject to such intensive hydropower exploitation as Bosnia & Herzegovina. Especially the construction of smaller HPPs (0,1-10 MW) has been booming in recent years. Also two bigger projects on Bosna are under implementation, even though construction seems to have been stalled in recent months.

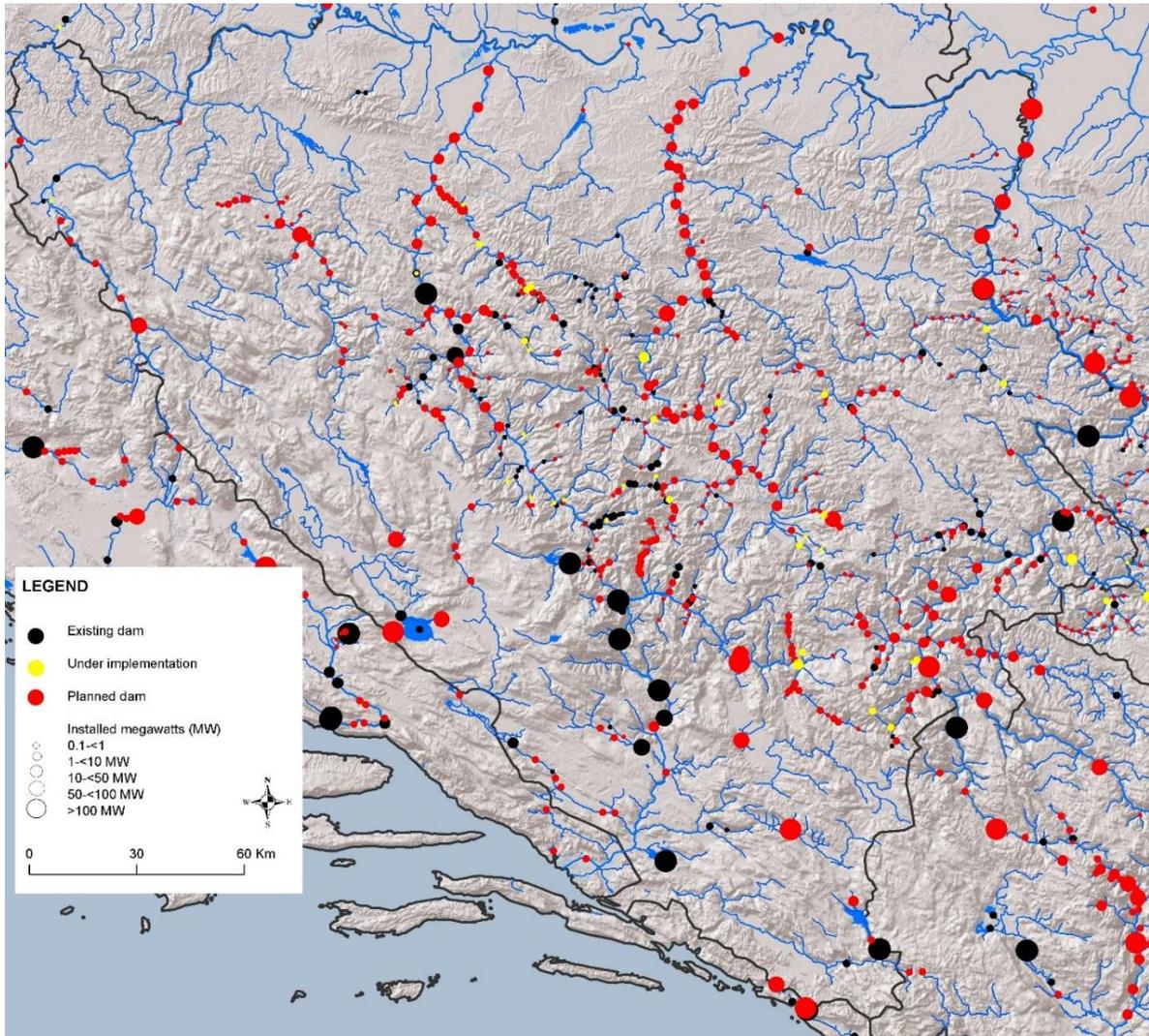


**Figure 14:** Distribution of HPPs in Bosnia & Herzegovina.

Critical examples for new dams can be found on many medium-sized rivers, such as the Lašva or Fojnica. The projects in the pristine headwaters of Neretva seem to have been stopped for now, but projects close to the Sutjeska National Park are under implementation. Several HPPs have also been built on large tributaries of Vrbas and Bosna.



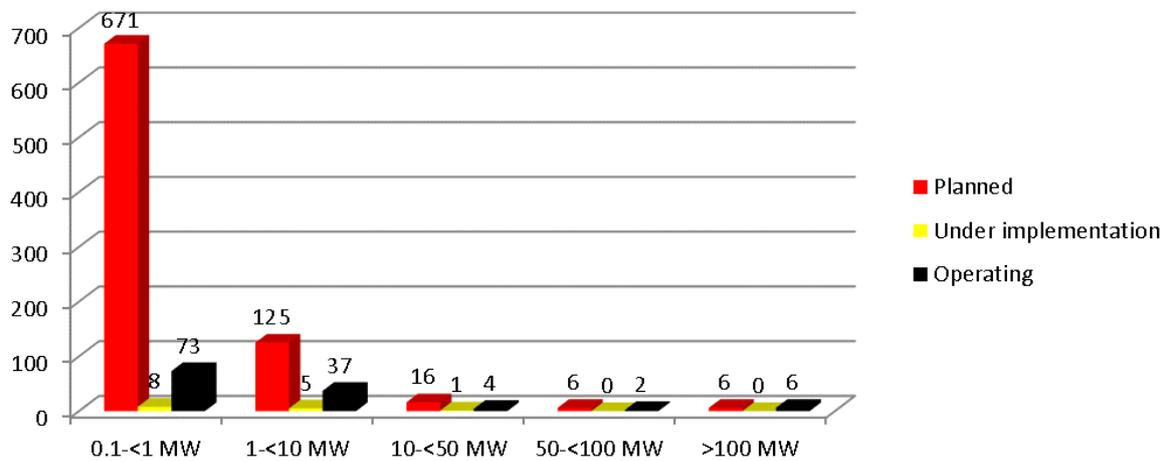
**Figure 15:** Lašva HPP (2.5 MW) on Lower Lašva river, close to the mouth of Bosna river.  
© <http://voda.ekoakcija.org>



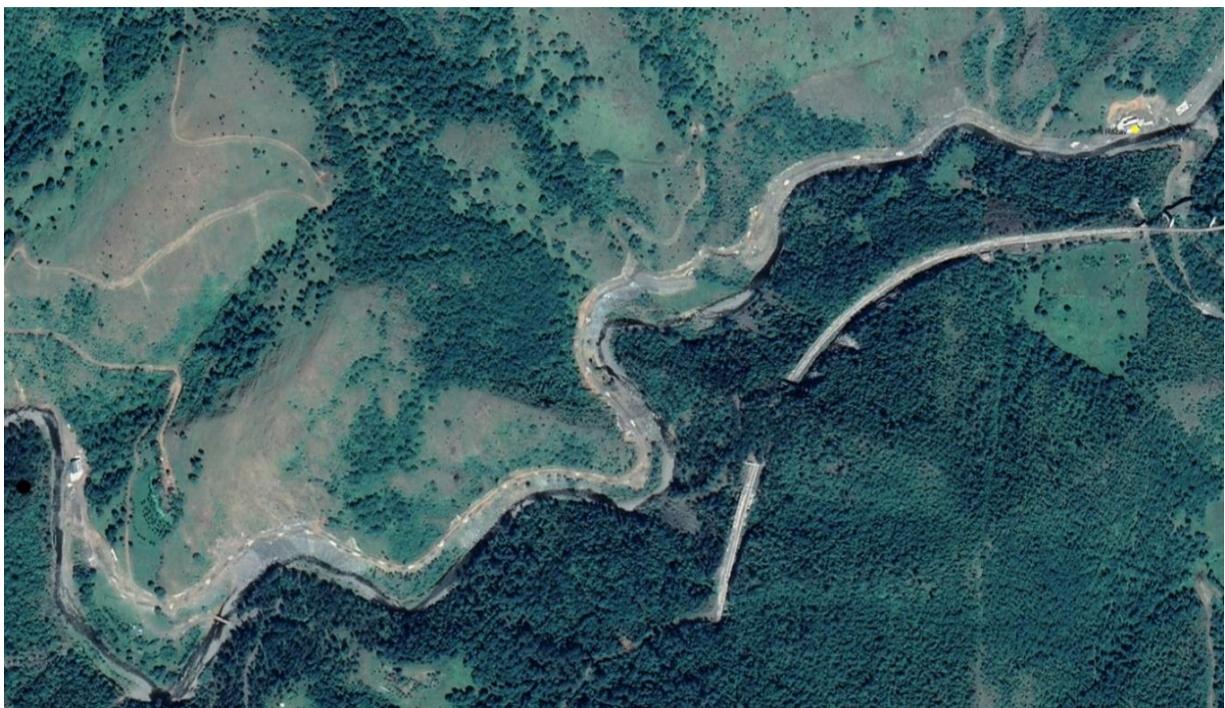
**Figure 16:** Distribution map of HPPs in Bosnia & Herzegovina.

## 4.5 Distribution of HPPs in Serbia

Similar to Bosnia & Herzegovina, Serbia is subject to extensive SHP development, mainly in some southern districts. Larger projects such as on Ibar or Morača are slowly developing, but could be commissioned soon.



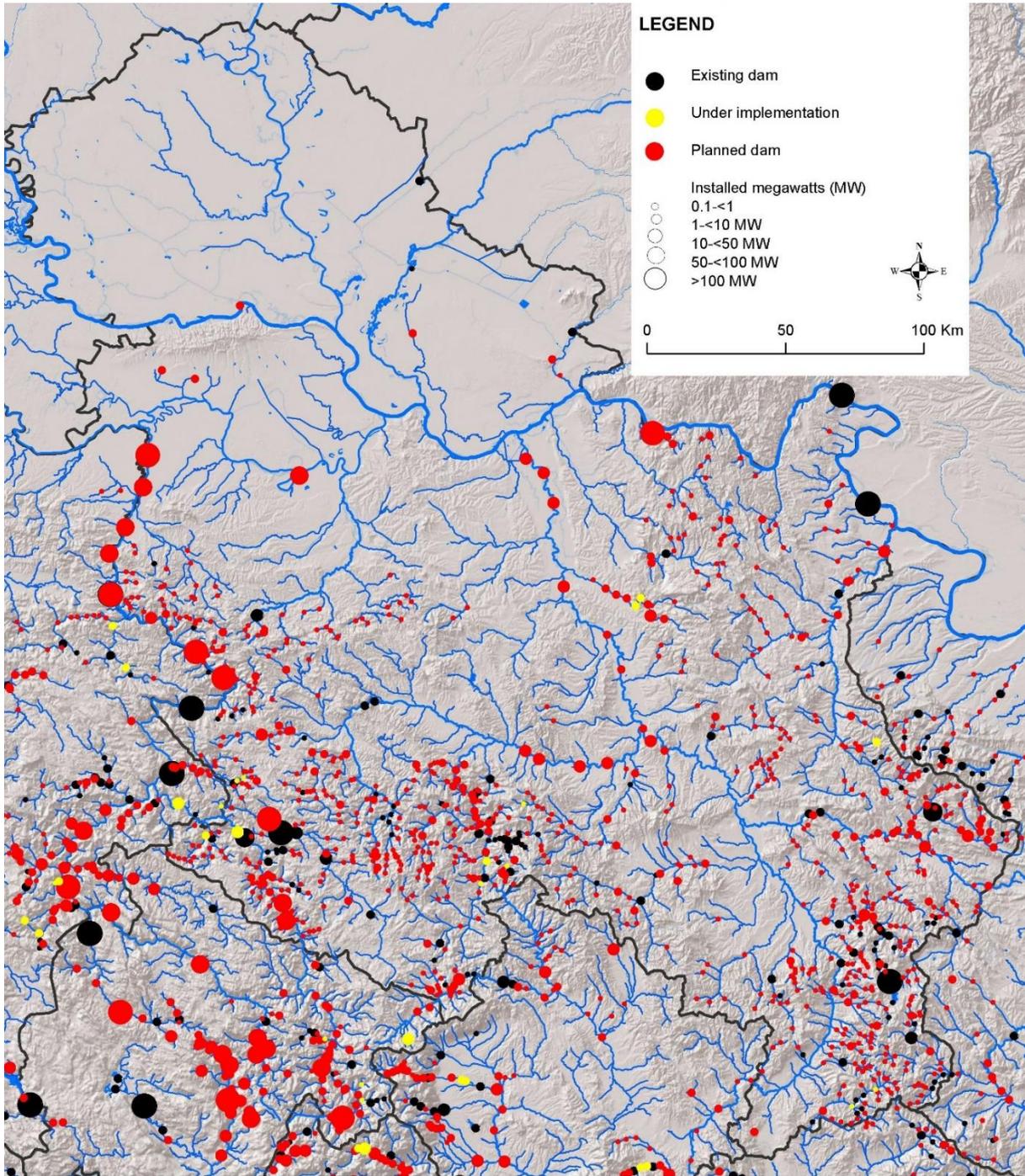
**Figure 17:** Distribution of HPPs in Serbia (the chart is rather distorted due to the extraordinary high number of SHPs).



**Figure 18:** The upper Black Rzav, a *Hucho hucho* river, is subject to constriction of several SHPs (GE 2020).



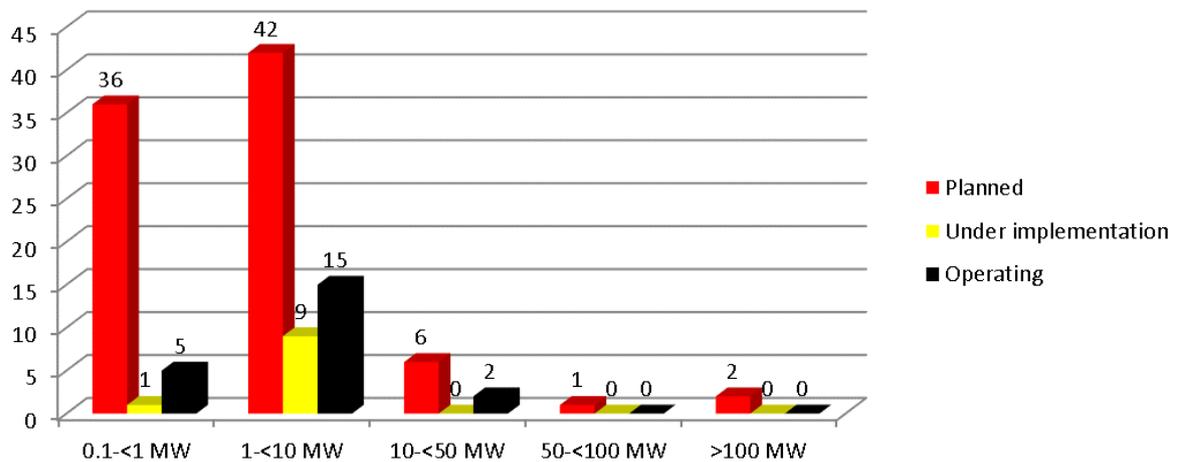
**Figure 19:** Several SHPs are implemented along the rivers coming from Kopaonik National Park. Along with water abstraction, the regulation of rivers and reinforcements of steep banks (light white lines on river banks) are frequent (GE 2020).



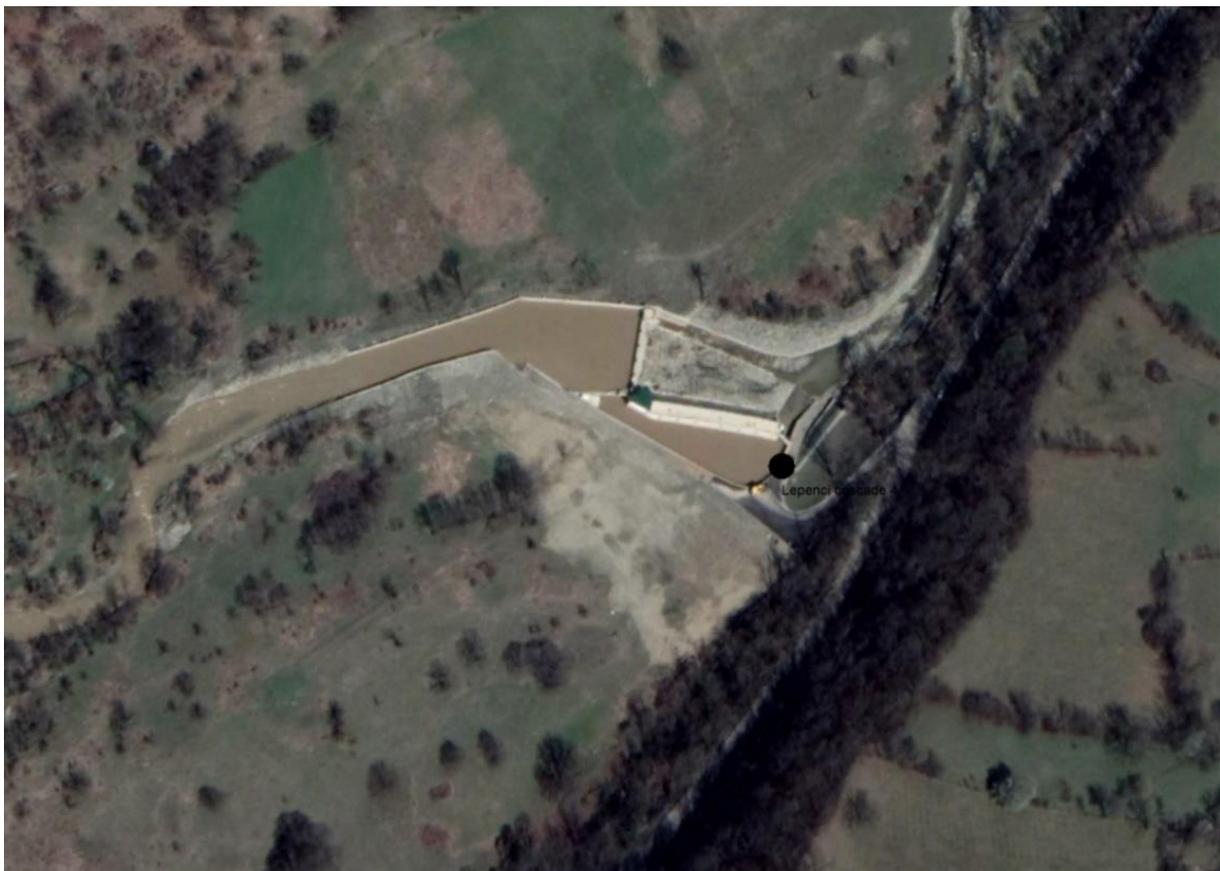
**Figure 20:** Distribution map of HPPs in Serbia

## 4.6 Distribution of HPPs in Kosovo

On selected rivers of Kosovo, SHP development has been accelerating. It seems that companies from Albania are now investigating hydropower exploration in Kosovo, but also Austrian subsidiary companies are planning and constructing new plants.



**Figure 21:** Distribution of HPPs in Kosovo.



**Figure 22:** Recently completed HPP on Lepenica (one of at least 10 HPPs planned on that river) (GE 2020).

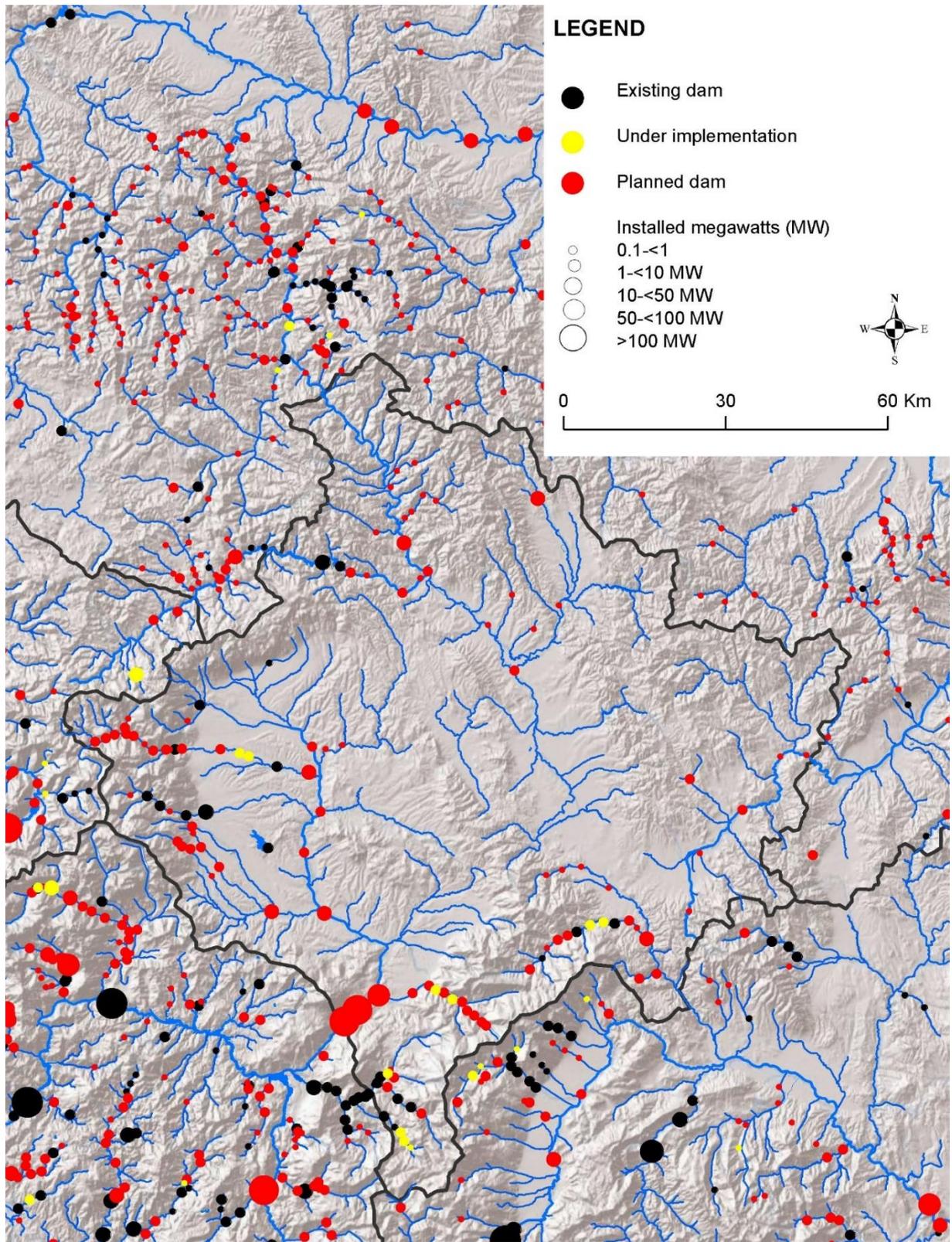


Figure 23: Distribution map of HPPs in Kosovo.

## 4.7 Distribution of HPPs in Montenegro

In general, the further development of SHPs in Montenegro is rather slow. However, there are some large-scale projects in planning, such as those on Morača.

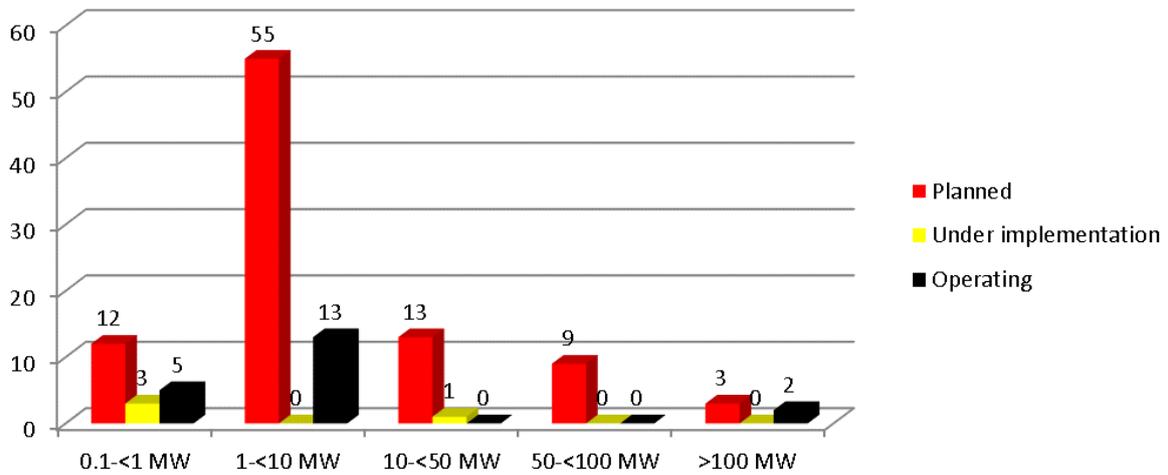
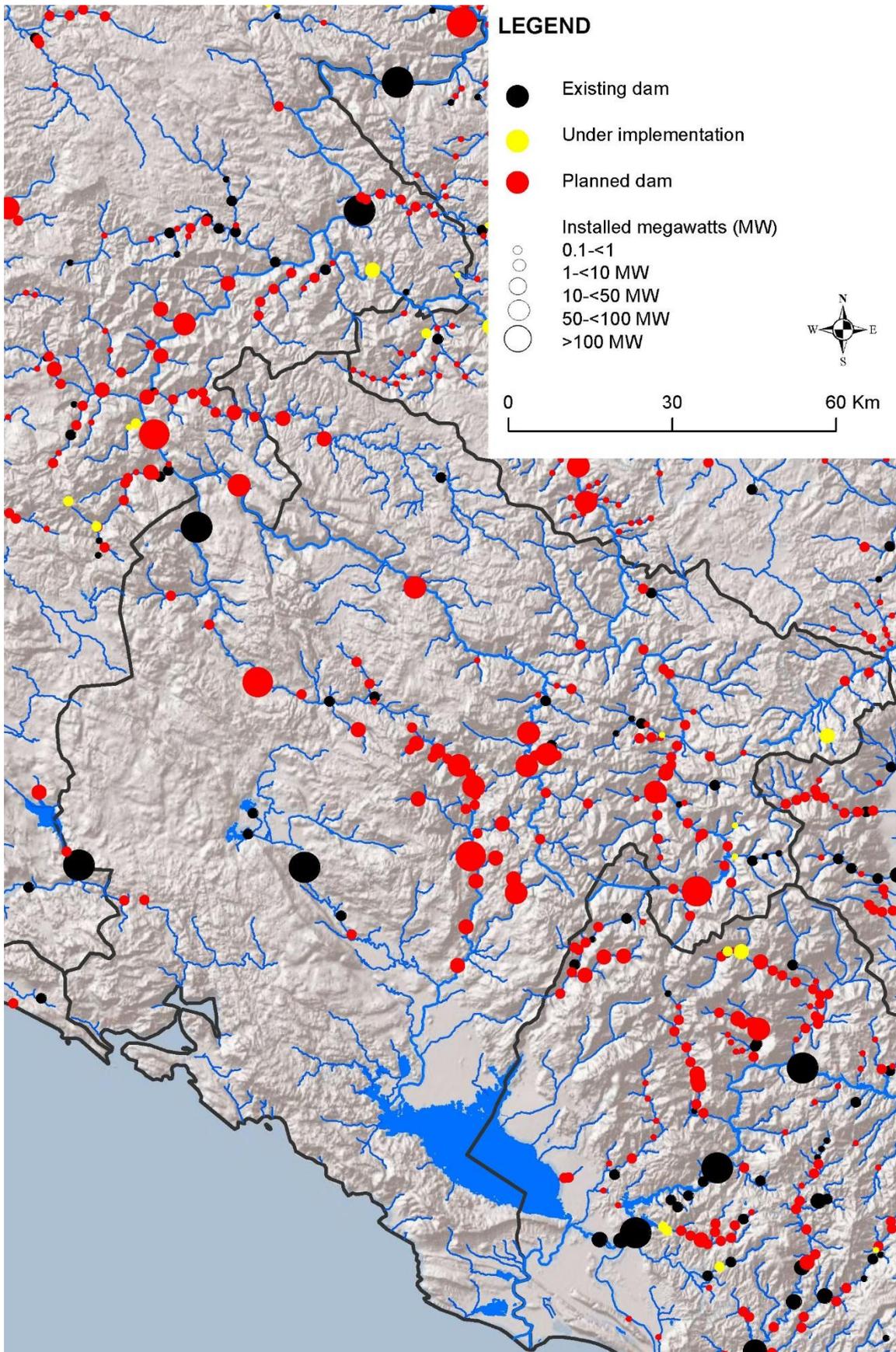


Figure 24: Distribution of HPPs in Montenegro.



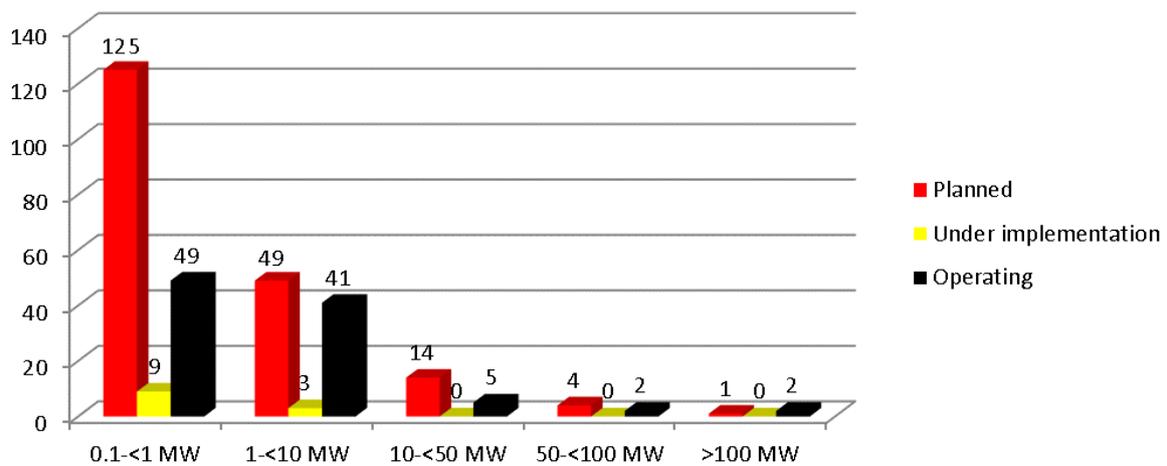
Figure 25: Several SHPs have been constructed in recent years near Babino Polje, at the boundary of Prokletje National Park (GE 2020).



**Figure 26:** Distribution map of HPPs in Montenegro.

## 4.8 Distribution of HPPs in North Macedonia

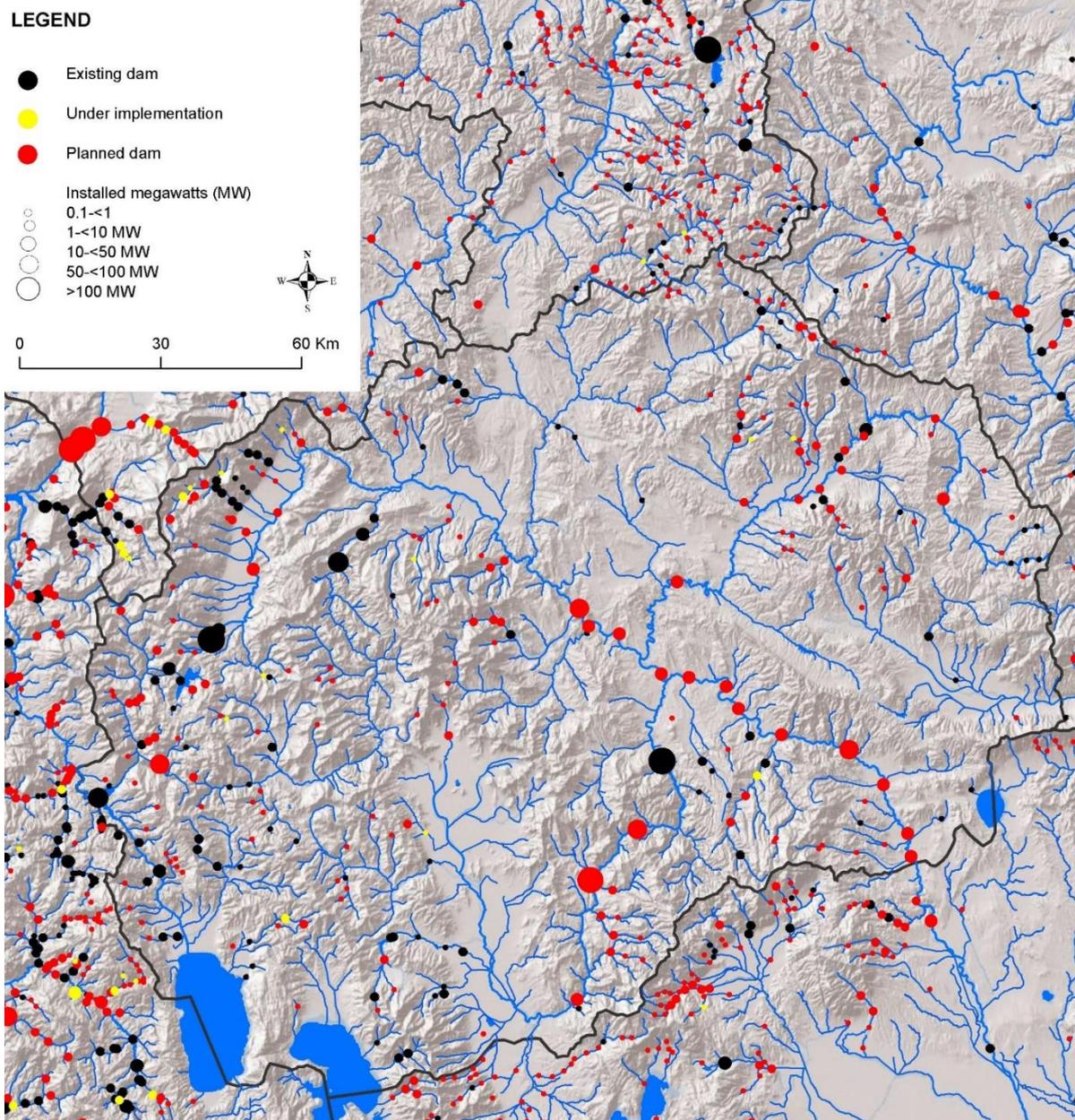
The development of SHPs in North Macedonia is slow but steady and numerous projects already exist. In the context of developing a national extract of the Eco Master Plan for Balkan Rivers (Riverwatch & Euronatur 2018), local colleagues have been discussing the problem of water abstraction from several smaller catchments and the general problem of precise localization of abstraction points, pipes and power houses. This seems to be a general problem for most of the neighboring countries, too, as these types of HPP are complex, causing serious damages over dozens of kilometres of small rivers and creeks, even entire small catchments.



**Figure 27:** Distribution of HPPs in North Macedonia.



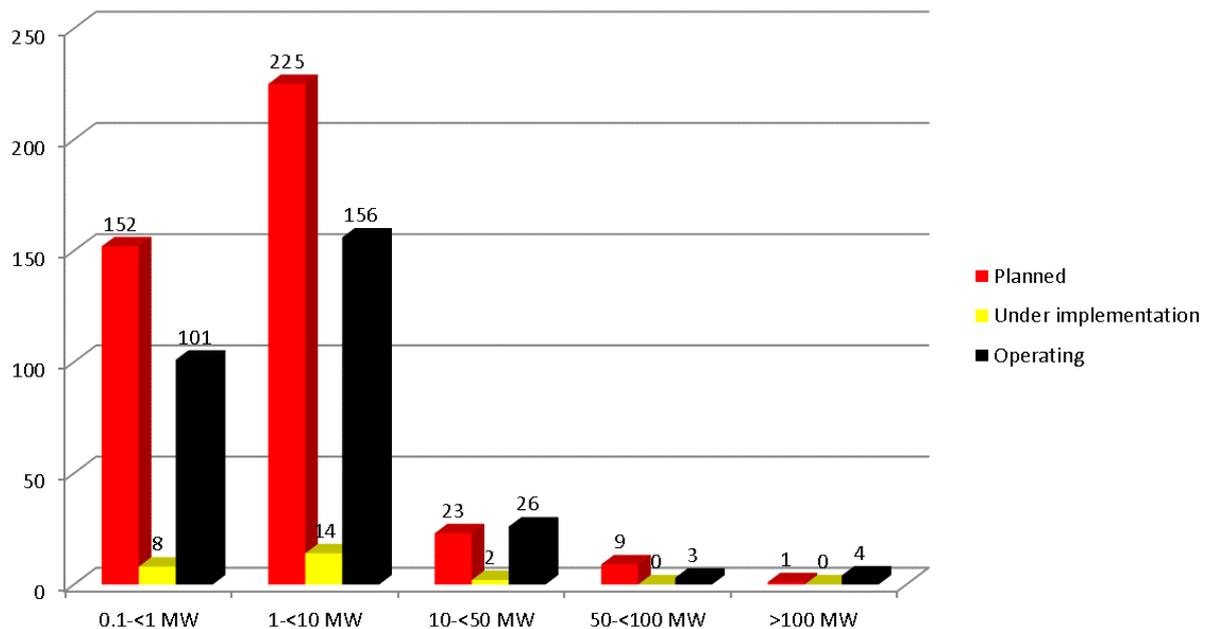
**Figure 28:** Completed Padaliska HPP: In the lower right corner is the inlet and under the cleared open linear area the pipes are positioned, completely removing the river and its riparian forests (GE 2020).



**Figure 29:** Distribution map of HPPs in North Macedonia.

## 4.9 Distribution of HPPs in Albania

Albania remains the top country in terms of hydropower development. Dozens of medium-sized projects have been implemented in recent years, and even “planned” projects previously marked red in the database have already switched to black – “operating”.



**Figure 30:** Distribution of HPPs in Albania.



**Figure 31:** In the Upper Mati catchment, water abstraction for a HPP has completely dried out the river (GE 2020).



**Figure 32:** HPP reservoir on Fan river (compare also cover image for the even larger Moglicë HPP built in recent years on Devoll river; GE 2020).

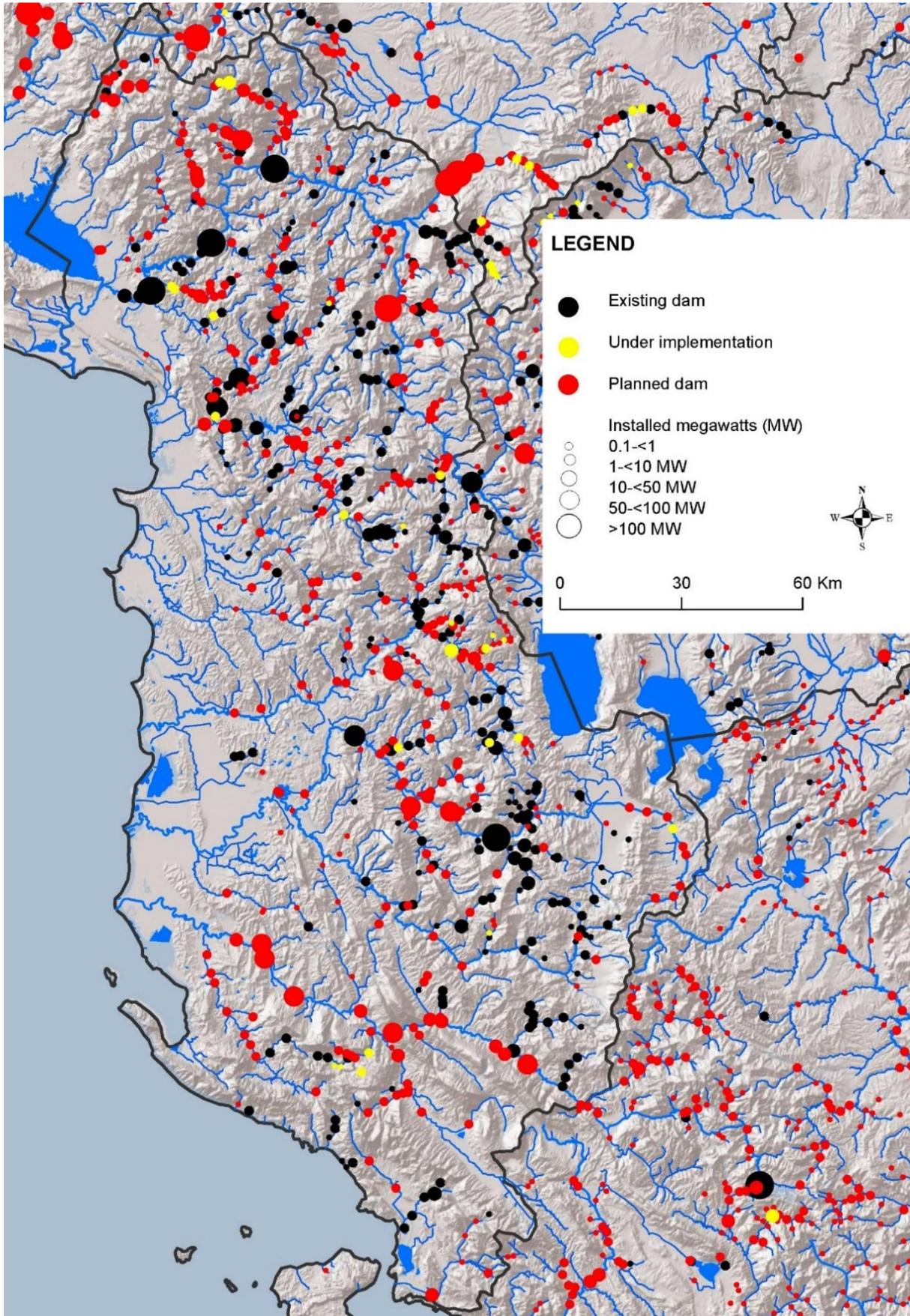
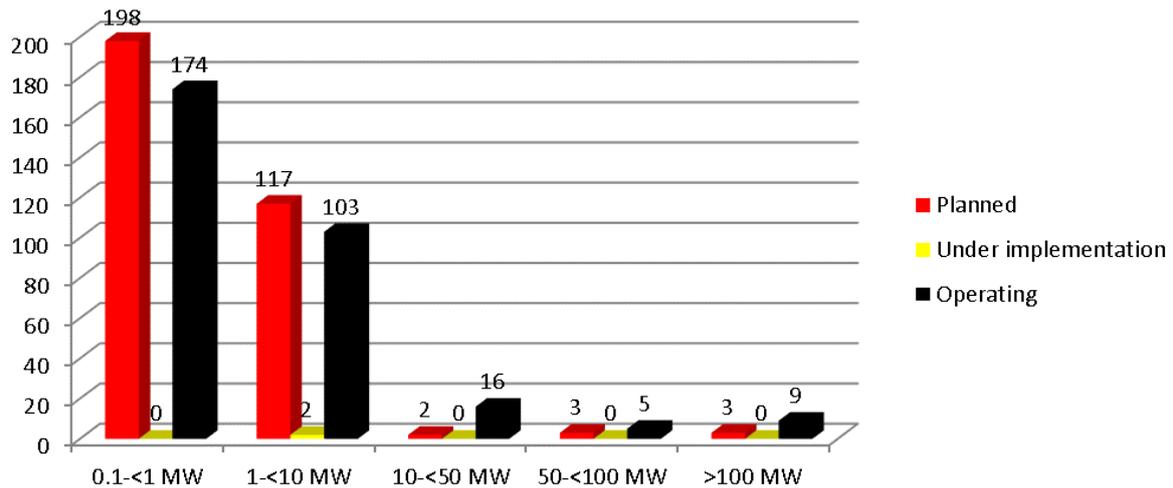


Figure 33: Distribution map of HPPs in Albania.

## 4.10 Distribution of HPPs in Bulgaria

In Bulgaria, too, there are many plans for further development of SHPs, as well as for the extension of already existing, huge pumped-storage plants. Moreover, some further projects have been implemented on Iskar river. Nevertheless, there has been a slight decrease in hydropower development overall lately.



**Figure 34:** Distribution of HPPs in Bulgaria.



**Figure 35:** Current examples for the construction of new HPPs can be found on river Ogosta, a Danube tributary in the northwestern part of the country (GE 2020).

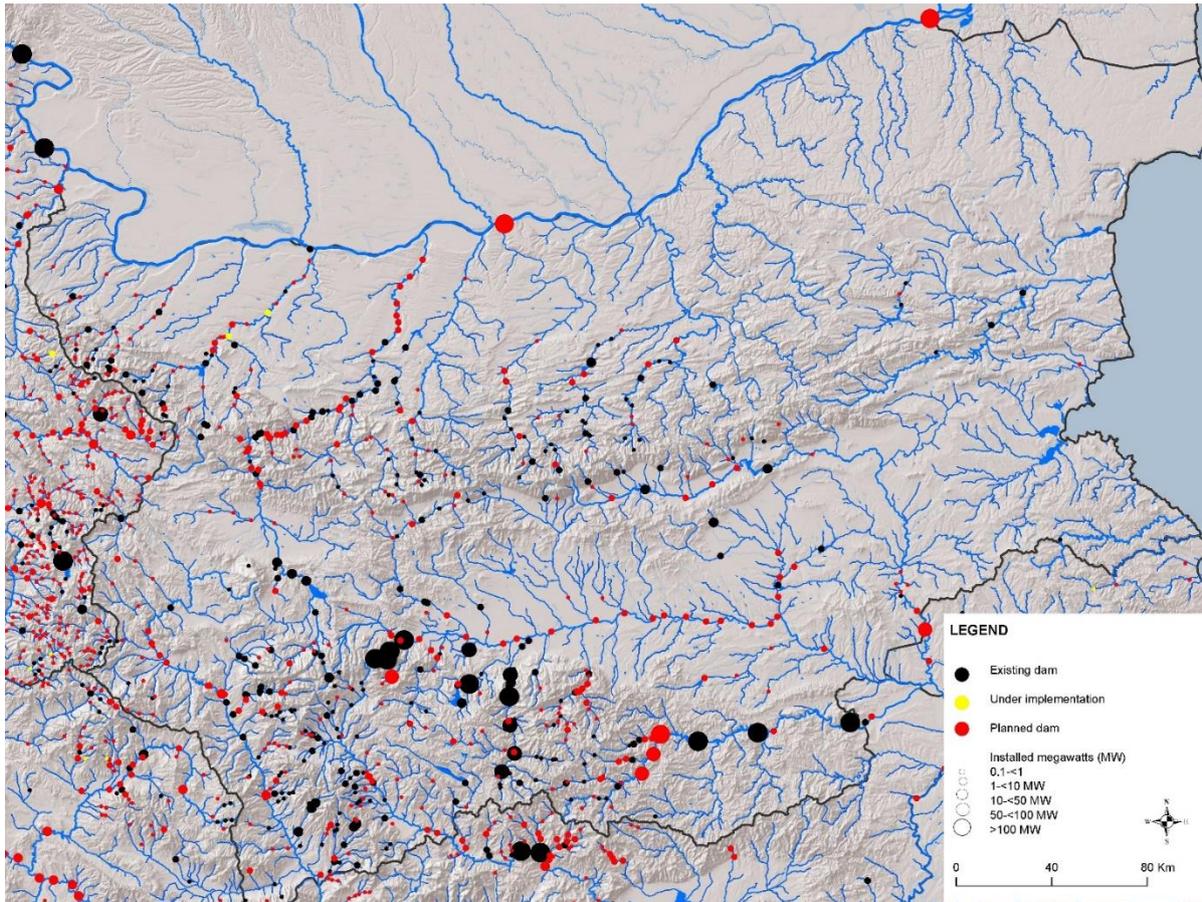


Figure 35: Distribution map of HPPs in Bulgaria.

#### 4.11 Distribution of HPPs in northern Greece

Some additional medium and small HPPs have been realized in recent years, but the large number of planned SHPs seems to remain fictive.

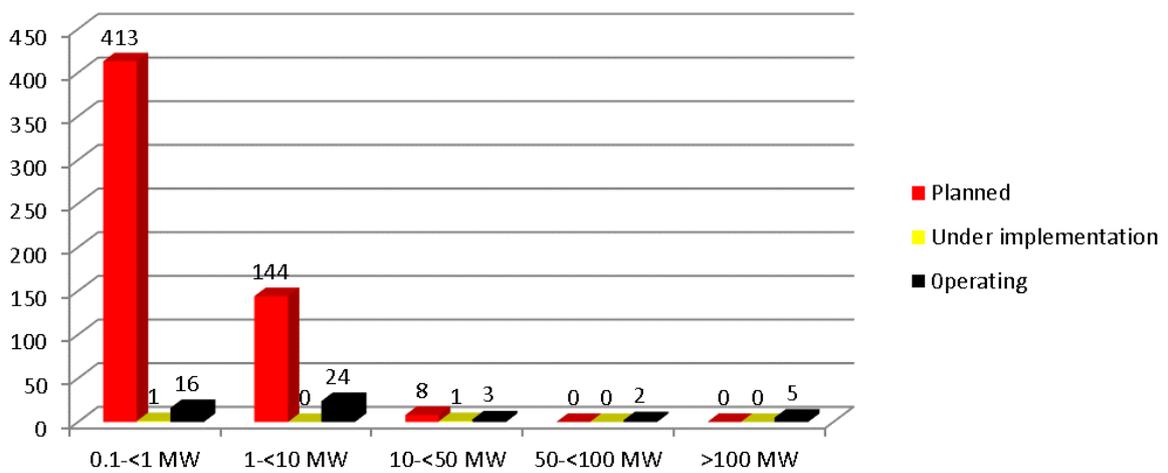
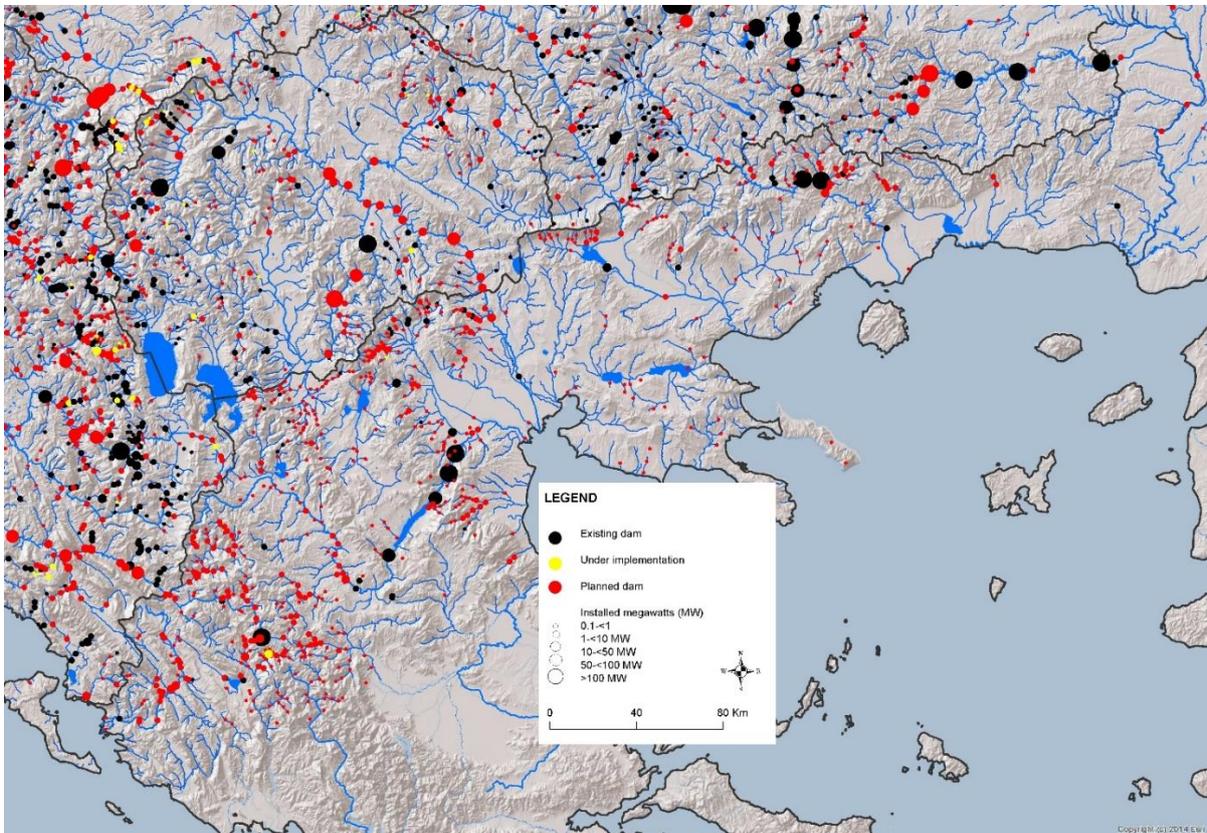


Figure 37: Distribution of HPPs for northern Greece.



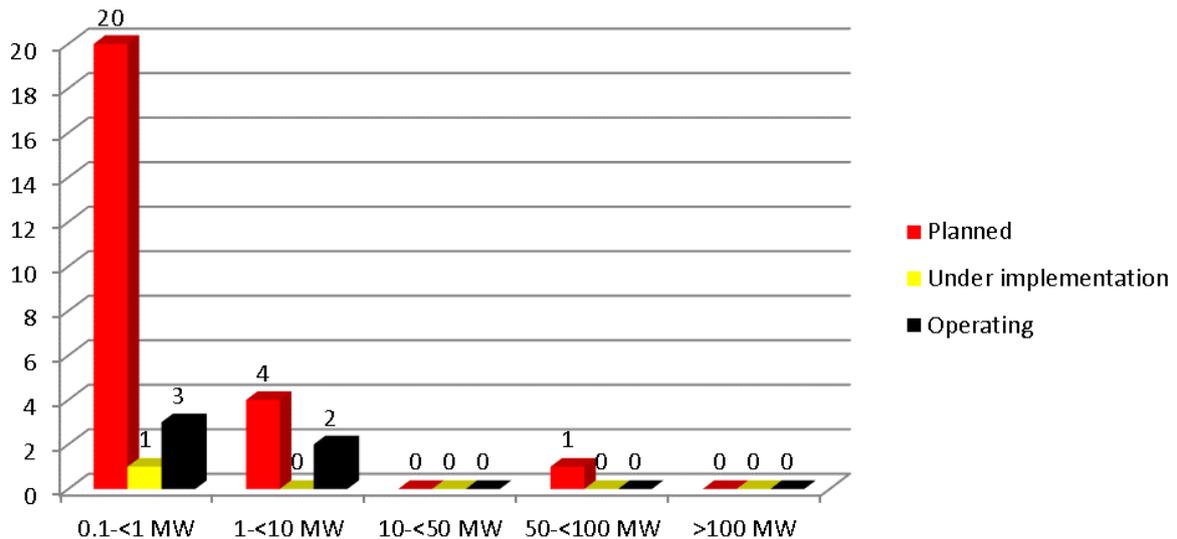
**Figure 38:** Not always do large dams and reservoirs destroy entire valleys. These two SHPs are located in the Eastern Rhodops and abstract the river water for a distance of at least 15 kilometers (GE 2020).



**Figure 39:** Distribution map of HPPs in Greece.

#### 4.12 Distribution of HPPs in the European part of Turkey

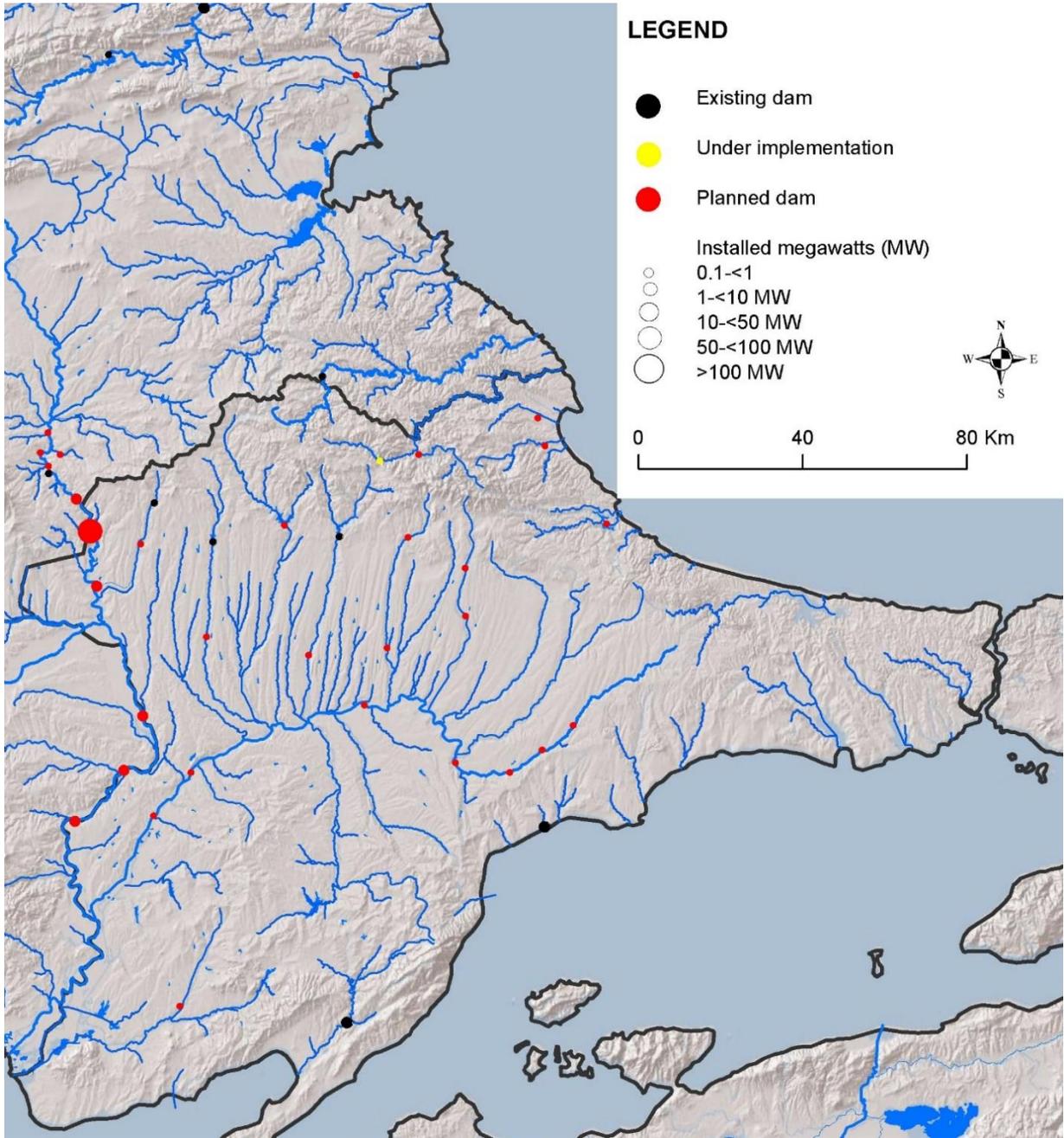
The European part of Turkey is not subject to the same aggressive hydropower development strategy that transforms the rest of Turkey. However, even though hydropower doesn't play a key role in this part of Turkey, many reservoirs are constructed and some of these also serve for hydropower production to a limited extent. Large projects along the two major border rivers (Evros and Tundsha), similar to those envisaged along the Greek and Bulgarian borders are politically problematic and planning is currently stalled.



**Figure 40:** Distribution of HPPs in the European part of Turkey.



**Figure 41:** Some recently constructed multipurpose reservoirs serve also as SHPs and interrupt the river continuum (GE 2020).



**Figure 42:** Distribution map of HPPs in the European part of Turkey.

## 5. Conclusions

Since 2012, a rapid development of hydropower plans across the Balkan Peninsula can be observed. Aside of booming countries like Albania (also for larger HPPs) and later Bosnia & Herzegovina (for small and medium-sized HPPs), Serbia, Kosovo, North Macedonia and Montenegro also stand out. In the EU countries (Slovenia, Croatia, Bulgaria and Greece) additional development is slow, but some larger projects such as those on Sava in Slovenia or Iskar in Bulgaria were realized in recent years.

Apart from traditional storage dams, the establishment of water abstraction HPPs is frequent and booming, especially on smaller rivers and even creeks. Considering the fact that in most cases almost all river water is abstracted over dozens, in total even hundreds of kilometres, the ecological damage is and will be extensive, while energy production is marginal.

The protected area network, and primarily the planned network in non-EU countries is impacted by numerous hydropower constructions and plans. The analysis – even at the European level – indicates a large number of HPPs in protected areas.

In many Balkan countries the booming hydropower sector defies the EU's political ambitions of improving the state of rivers in line with the Water Framework Directive and to reconnect 25,000 km of rivers by removing dams and water abstraction systems. On the other hand, the pressure of climate change argumentation and renewable energy policies encourage the ongoing development. Hydropower could fall under the "transition" energy forms, as discussed within the EU commission recently, meaning that in the long term hydropower development would not receive the same attention and subsidies as other renewables, like wind and solar. This could reduce the high pressure on the last remaining rivers in the Balkans. Also, a stringent protected area policy could slow further developments, as has been observed in Croatia. In Albania, hydropower development has been particularly accelerated, with several larger rivers such as Devoll, the main Mati tributaries and major rivers of the upper Drin catchment now being interrupted by huge and medium-sized dams. This makes it even more urgent to stop the projected hydropower development on Vjosa, and to create a national as well as an international coalition for the establishment of a "Wild River National Park" along its entire course, in order to protect this last free-flowing large river in continental Mediterranean Europe.

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