WWF
SAVE THE ALPINE RIVERS!

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WWF EALP Freshwater
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1. INTRODUCTION

The Alps are Europe‘s freshwater reservoir. Cities near and far rely on Alpine water for their drinking needs and energy supply. But human interferences and global warming have put alpine freshwater at risk.

The river network of the Alps fulfills many functions related to the ecosystem for about 180 million people in the catchment area of Rhone, Rhine, Po and Danube. It shelters a unique diversity of fauna and flora and serves as important bio-corridor within the Alps as well as within their surrounding area.

For centuries, various human activities resulted in pressures on the aquatic environment affecting the physic-chemical conditions of running waters and strongly influencing and impacting the morphological character, the hydrological regime and, as a consequence, the unique aquatic biota.

As a result, almost all European river basins are heavily affected by human activities. In the Alpine region, hydromorphological alterations due to hydro power production and flood protection are identified as key pressures.

Hydropower plays an important role throughout the Alpine area, both on a small and large scale. Depending on landscape and needs, the hydroelectric use of rivers ranges from channeling small torrents via big barrages the dams and large reservoirs. The remaining hydroelectric potential depends on still unexploited river stretches, which are, often enough, in or close to a natural state and at the same time increasingly rare.

Due to the high hydroelectric potential in the Alps on one hand, and the importance, diversity and value of unique ecosystems and landscapes on the other hand, the construction of new hydro power plants often results in conflicting interests between the use of renewable energy and the protection of aquatic ecosystems.

Over the last years, major efforts have been made to improve the ecological status of Alpine rivers. However, most protection and restoration attempts are carried out on small scale and mainly focus on just one compartment of the river (e.g. species protection without large-scale restoration).

Especially availability of data regarding the Alpine Arc looks dire – there are huge information and knowledge gaps concerning the actual state and alteration of river systems throughout the Alps.

But only by help of explicit information, clear priorities for future restoration and protection measures can be developed. These processes of assessment and prioritization are essential and imperative for decisions regarding future use and development of rivers in the Alps, especially in the context of further development of hydropower.

Given the rarity of remaining unexploited, natural rivers, strategic reflection is of utmost importance to avoid irreversible damages to the entire Alpine Arc freshwater system.

Concluding, the need for a pan-Alpine overview regarding the status of Alpine rivers and streams as an essential basis for a pan-Alpine protection and restoration strategy is obvious.

That is why WWF assigned the Institute of Hydrobiology and Aquatic Ecosystem Management/BOKU - University of Natural Resources and Life Sciences in Vienna to conduct a study on “Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc”.

The overall aim of this study was to provide a comprehensive pan-Alpine overview for setting protection and restoration priorities for Alpine Rivers.

Its specific objectives are (1) the designation of river stretches with very high/high protection priority (“no-go/priority areas”) and river stretches with high restoration potential, (2) the identification and documentation of the main impacts/pressures and (3) the compilation of a consistent pan-Alpine database on information related to running waters and their ecosystems.

2. METHODOLOGY

2.1 INVESTIGATED AREA

Principally, the area of investigation covers the entire Alpine Arc according to the Alpine Convention perimeter. The borders depicted in the Alpine Convention were defined through geological criteria, vegetation zones, an altitude mainly above 700 meters, but also administrative borders. Its member countries are Austria, Liechtenstein, Germany, Slovenia, France, Monaco, Switzerland and Italy. The rivers of Liechtenstein and Monaco are not included in the analysis due to the negligible contribution to the Alpine river network (i.e. Rhine included in Swiss dataset, Monaco has no rivers). Therefore, this study covers the Alpine parts of Austria, Germany, France, Italy, Slovenia and Switzerland.

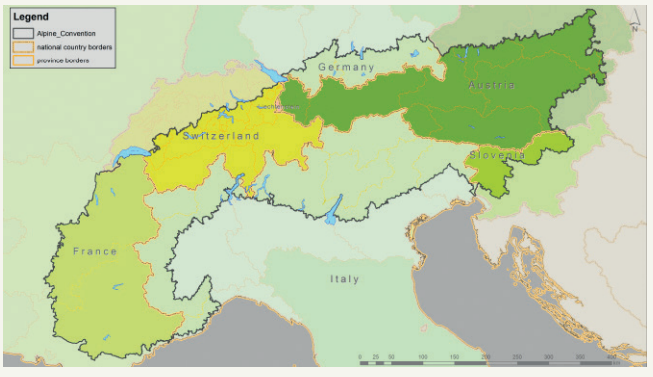


Figure 1: Overview of countries located in the Alpine Arc

2.2 EVALUATION SCHEME "PROTECTION PRIORITY"

The scheme is based on the Austrian WWF Eco Masterplan II, which was simplified due to data restrictions and consistency issues.

The rating of the "Protection Priority" can be described as follows:

Very High Protection Priority
All river units with a high ecological status or high ecological value (see "Surrogate Method Switzerland") or river units located within protected areas of IUCN category Ia, Ib or II, and natural river units (no AWB/HWMB) associated with Cat. A Wetland/Floodplains.

High Protection Priority
All river units with good ecological status and all river units associated with Cat. B Wetland/Floodplain. AWB/HMWB river units associated with Cat. A Wetlands/Floodplain.

Moderate Protection Priority
All river units with a moderate ecological status. If the ecological status is below moderate or if a river unit is AWB/HWMB, it can still have a moderate protection priority when associated with a Natura 2000 area or expert-recommended protected area. AWB/HWMB associated with Wetlands/Floodplains.

Low Protection Priority
All river units with poor or bad ecological status as well as AWB/HMWB not associated with Wetlands/Floodplains or protected areas.

Insufficient Data
Stretches with no information on the ecological status, Wetland/Floodplain and no association with protected areas. River units that fall within Natura 2000 or expert-recommended areas but are neither associated with Wetlands/Floodplains nor is there information on the ecological status available.

Switzerland: There exist no AWB/HMWB. River units with ecomorphological class 4 or 5 as well as river units affected by hydrological pressures were treated like AWB/HMWB.

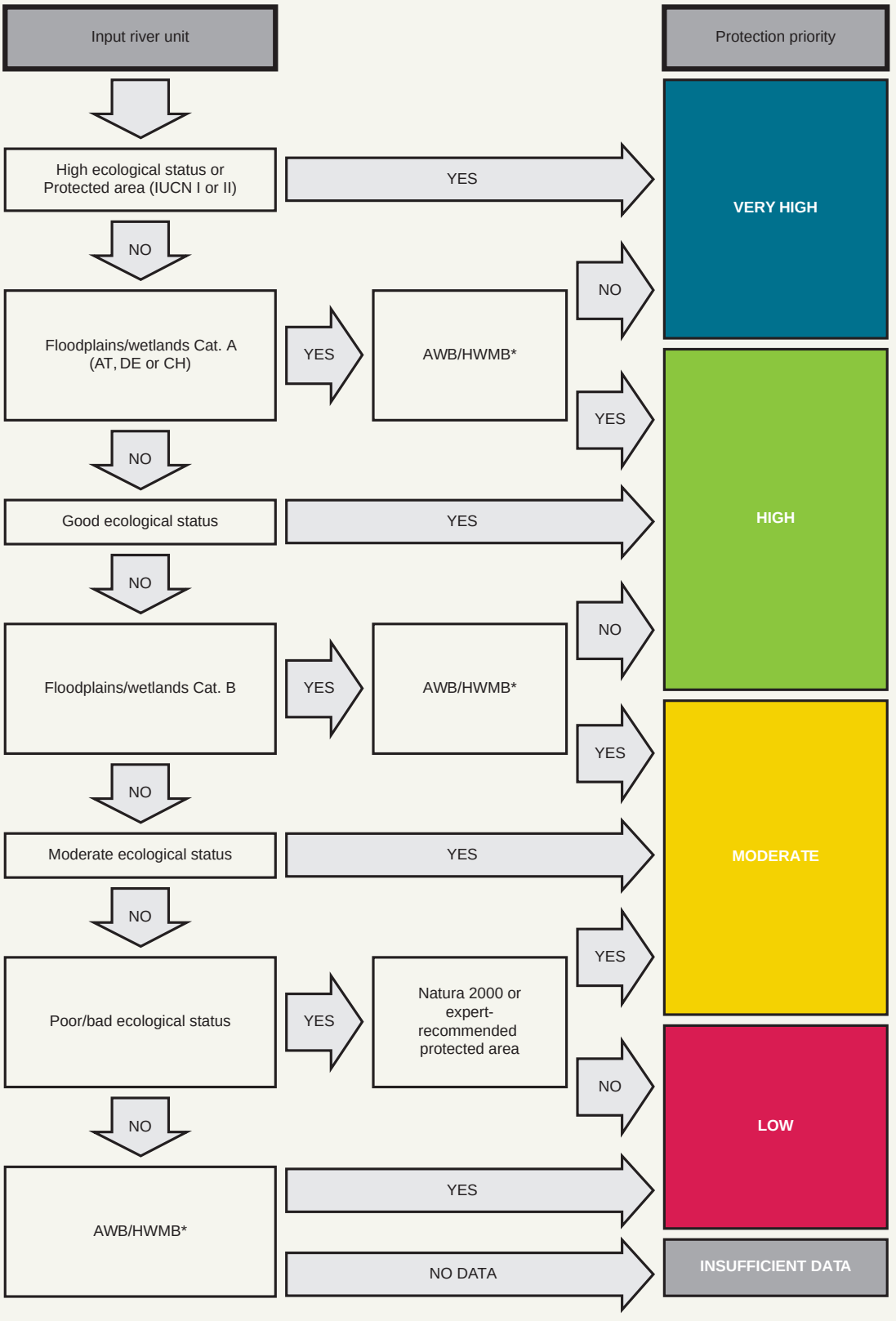


Figure 2: Protection priority rating scheme

2.3 DATA BASE AND DATA PROCESSING

2.3.1 RIVER NETWORK

One essential basic requirement for this study was a complete GIS data set containing all rivers in the Alpine Arc with a catchment area larger than 10 km². Upon closer investigation, it became clear that the accuracy and scale of the pan-European ECRINS data set differs too much from national data sets. This results in a difficult and inaccurate transfer of data regarding the national river network, especially for smaller rivers. Consequently, the next option was to merge the existing official national river networks of the Alpine countries provided by responsible national authorities. The advantage of this procedure is that the geometries of the national river networks are maintained. Only a minimal loss of accuracy occurred through re-projecting the national data sets to a common coordinate reference system (ETRS LAEA 1989).
For the combined pan-Alpine network, rivers were classified into different size classes, based on the total cumulative catchment size of the entire river.
For the analyses in this study, lakes were not considered as part of the river network whenever possible.

2.3.2 RIVER UNITS

Next, valuation units were defined in order to associate the final rating of protection priority with the according river stretches. Originally, WFD water bodies were designed to be those units; however, this proved to be impossible for two reasons: First, they were not available for all countries (e.g. Switzerland). Second, the definition of water bodies varied strongly among countries; e.g. water bodies in Germany (average length 28 km) and France (average length 15 km) are much longer than the ones in Austria (average 4 km). Therefore, “river units” were defined as the smallest valuation entity within the entire pan-Alpine river network (catchment area equal to or larger than 10 km²). A river unit was defined as the stretch of a river between two tributaries. Each river unit is assigned a unique iD.

2.3.3 FINAL PAN-ALPINE RIVER NETWORK DATA SET

The final pan-Alpine river network data set contains the most important information from source data sets, while still maintaining a manageable number of data fields. The following information was retained from national data sets (where available):

- **River ID:** ID that traces a stream from its source to its mouth.

- **Unique Feature Identifier:** OBJECTID, FID or similar of the original source data sets. This field corresponds to the smallest subdivision that is present in the source data set. In some countries, this corresponds to the water body (where classification of water bodies is available).

- **Water body code**

- **River name:** as in the original national data sets.

In addition, the following new fields were calculated:

- **River unit:** Unique code for each river unit as described above.

- **Catchment size:** Size of catchment area of the entire river as described above.

- **Reformatted river name:** Manually reformatted river name for mapping and other display purposes; only available for rivers with a catchment size > 100 km².

2.3.4 DATA DESCRIPTION AND DATA STATUS

In order to gain an overview about the availability of different data types in the countries of the Alpine Arc, four different "data availability categories" were defined (Table 1). Data availability was classified in all countries and regions according to these categories and mapped for each data type.

Class 1 (data is available) means that data were provided by national authorities or data were retrieved from official websites (i.e. mapping of restoration projects). This, however, does not imply data are consistently provided throughout the country., i.e. that they were available for the entire country/region or in the same quality.

Class 2 was assigned if responsible authorities communicated that relevant data are in preparation and will be available in the future.

Class 3 means that data does not exist officially, and is not in preparation.

Regions or countries are classified as class 4 if data could neither be obtained nor if there is any information about their existence.

Table 1: Data status categories

Class	Definition
1	Data officially exist (published online, or are available via request) and we received them.
2	Data are in preparation/update process and are therefore not available yet.
3	Data do not exist officially (communicated via authorities) and are therefore not available.
4	We do not know if data exist.

2.3.4.1 Ecological Status

Data on the ecological status of rivers were available for all EU countries (see Table 2), therefore, further harmonization was not necessary. For Slovenia, data on the ecological status were provided only for rivers with catchment sizes > 100 km². According to national authorities, a more detailed data set is in process and will be available in the near future.

Table 2: Final/original classification, spatial scale and source of ecological status data set

	Ecological status	AT	DE	FR	IT PO	IT AO	IT LIG	SI
Classes	High	1	Sehr gut	État trés bien	Elevato	Elevato	Elevato	Zelo dobro
	Good	2	Gut	État bien	Buono	Buono	Buono	Dobro
	Moderate	3	Mäßig	État moyen	Moderato	Suficiente	Moderato	Zmerno
	Poor	4	Unbefrie-digend	État médiocre	Scadente	Scarso	Scadente	Slabo
	Bad	5	Schlecht	État mauvais	Pessimo	Cattivio	Pessimo	Zelo slabo
Source		*UBA*	*LFU*	*Eau France*	*ADBPO*	*ADBVE*	*Regione Liguria*	*ARSO*

2.3.4.1.1 Surrogate Method Switzerland

As Switzerland is not a member of the EU and, therefore, is not applying the WFD, no comparable methodology is available. To compensate this lack of data, a surrogate method was developed based on available biological, hydromorphological and pressure data from numerous sources. In order to avoid confusion with the ecological status classification required by the

WFD, a Swiss surrogate parameter called „ecological value“ was developed. This parameter is limited by data coverage, quality and inhomogeneity. It does not constitute a direct replacement for the ecological status, but rather, it is an intermediate step to compare the situation in Switzerland to other Alpine countries.

Due to the use of proxy indicators (most importantly, fish spawning areas and ecomorphology classifications), the calculated „ecological values“ are presumably higher than what would result from an ecological status classification based on a sound data base.

2.3.4.2 Morphological Status

The hydromorphological status as demanded in the WFD was available only for Austria, Slovenia and a few larger tributaries of the Po river in Italy. For Germany, Switzerland, France and Trentino-Alto Adige, this data could be converted to a 5-tiered scale so it can be compared to the hydromorphological status as required by the WFD (Table 3).

For France, hydromorphological status data were only available on a very rough basis by help of a few classified sampling points and then only in two classes: “Très bon état” (corresponds to high hydromorphological status class) and “others”. In addition, hydromorphological pressure classifications can be found in the same data set with the classes: “No to low pressure”, “Medium pressure” and “High pressure”. Combining this information, we derived four classes and mapped each sampling point to the nearest river unit.

The German hydromorphological status is 7-tiered. Transformation into five EU-WFD compliant classes was carried out according to a proposal from local experts (LAWA).

In Trentino-Alto Adige, 20 different hydromorphological classes were transformed into five classes according to the proposal of the Federal Environmental Agency, who provided the data.

In Switzerland, a similar approach to the hydromorphological status, the “ecomorphology” data set (Ökomorphologie, BAFU, 2009), was available on a nationwide scale with varying degree of completeness regarding of coverage between cantons. This rating is also condensed into five classes, which were considered as analogous to the 5 classes of the hydromorphological status.

Table 3: Final/original classification and source of hydromorphological status data set

	Finale name	AT	DE	CH	FR	IT Po	IT TAA	SI
Classes	High	1	1 & 2	1	Trés bien	Elevato	20	Naravni vodotok
	Good	2	3	2	Faible	Buono	17 – 20	Zmerno spremenjen vodotok
	Moderate	3	4	3	Moyen	Moderato	13 – 16	Obèutno spremenjen vodotok
	Poor	4	5	4		Scadente	9 – 12	Moèno spremenjen vodotok
	Bad	5	6 & 7	5	Fort	Pessimo	5 – 8	Zelo moèno spremenjen vodotok
Source		*UBA*	*LFU*	*BAFU*	*Eau France*	*ADBPO*	*APPO Bozen*	*ARSO*

2.3.4.3 Protected Areas

Many different classifications of protected areas exist within the EU territory based on global, European and national approaches. Most data sets on protected areas are easily accessible for all countries within the Alpine Arc.

The two most important data sets are the “National Designated Areas (CDDA)” and the “Natura 2000” shapefiles, which are freely available at the EEA (2012b) website. While extensive information about Natura 2000 sites is available, little information is supplied for other sites. Alternative sources, e.g. RAMSAR wetlands and UNESCO World Natural Heritage sites, are available, though, this information is already included in the aforementioned EEA data sets. In many cases, also national data sets of protected areas could be obtained. In Switzerland, national data sets were used instead of EEA data to avoid loss of positional accuracy due to re-projecting the data. In Slovenia, the “Valuable Natural Features” data set was used to complement the EEA data sets. In the other countries, national data on protected areas was redundant with the EEA data sets, and were discarded, therefore.

The protected areas were classified into 2 categories:

- **Protected areas classified as Ia, Ib, or II** (Strict Nature Reserve, Wilderness Area, National Park) after the IUCN classification system.

- **Protected areas recommended by national experts** (only available for Slovenia, Switzerland, and Austria, see Table 4), and Natura 2000 areas.

Protected areas recommended by national experts are shown in tables 4-9. The remaining classes were considered of low importance and, therefore, were not included in this study.

For Switzerland, experts recommended a relatively wide range of protected areas to be considered for this evaluation (e.g. landscapes and monuments of national importance). Reasons for this are:

a) the absence of protected areas that specifically aim at protecting natural watercourses, with the exception of large floodplains, and

b) that the high pressure on river ecosystems in Switzerland has led to a dramatic decline in natural watercourses.

This led to the interpretation that different sorts of protected areas, from which a protection of a water body can be derived from, are to be considered of high importance.

Table 4: Types of protected areas inside the area of the Alpine Convention (international)

Protected area designation	IUCN rating	Expert recommended
International		
UNESCO World Natural Heritage		
Biosphere Reserve	VI	
RAMSAR Wetland		
EU/EC		
Natura 2000		

Table 5: Types of protected areas considered for Austria

Protected area designation	IUCN rating	Expert recommended
Austria		
National Park	II	x
Nature Reserve	Ia, IV	x
Landscape Protection Area	V	
Nature Park	V	

Protected area designation	IUCN rating	Expert recommended
Protected Landscape Section	III,IV,V	
Rest Area	IV	
Flora Protection Area	IV	
Special Conservation Areas	IV	
Townscape Protection Areas		

Table 6: Types of protected areas considered for Switzerland

Protected area designation	IUCN rating	Expert recommended
Switzerland		
Moor Landscapes of National Importance	V	x
Floodplains of National Importance	IV	x
Reserves for Waterbirds and Migrants of International and National Importance	IV	x
Amphibian Spawning Grounds		x
Dry Grasslands	IV	
Swiss National Park	Ia	x
Federal Hunting Reserves	IV	
Fenlands of National Importance	IV	x
Emerald Sites	IV	x
RAMSAR Sites	IV	x
Landscapes and Natural Monuments of National Importance	III,V	x
Sites for Compensation of Losses During the Use of Hydropower	IV	
UNESCO World Natural Heritage	V	x

Table 7: Types of protected areas considered for Germany

Protected area designation	IUCN rating	Expert recommended
Germany		
Nature Reserve	IV	
National Park	II	
Landscape Protection Area	V	

Table 8: Types of protected areas considered for France

Protected area designation	IUCN rating	Expert recommended
France		
National Park - Buffer Zone/Area of Adhesion	V	
National Park - Core Area	II	
Nature Reserve		
Regional Nature Park	V	
Marine Nature Park	V	
Forest Biological Reserve	Ia, IV, 0	
National Nature Reserve	III, IV	
Regional Nature Reserve	IV	
National Hunting and Wildlife Reserve	IV	
Biotope Protection Order	IV	
Land acquired by Conservatoire du Littoral (National Seaside and Lake-side Convention)	IV	

Table 9: Types of protected areas considered for Italy

Protected area designation	IUCN rating	Expert recommended
Italy		
Regional/Provincial Nature Reserve	Ia, IV, V	
National Parks	II	
Regional/Provincial Nature Park	IV, V	
Regional/Interregional Nature Parks		
State Nature Reserve	Ia, IV, V	
Nature Reserves		
Wetlands of International Importance		
Other Protected Natural Areas		
Land and Marine Potential Park Areas		
Other Protected Natural Regional Areas	III,IV,V	
Plant Protection Area		
Forest Reserve/Protected Forest	Ib/IV	
Protected Area	V	

2.3.4.4 Floodplains/Wetlands

German, Austrian and Swiss data sets were included into the pan-Alpine overview and in final analyses in their original format. In Germany and Austria, there exists a classification of a nature protection value of floodplains.
For Austria, data on floodplains/wetlands were available, which allowed for differentiation regarding the protection priority in further analyses. Floodplains/wetlands of the highest ratings were classified as “Cat. A”, all others were classified as “Cat. B”.
In Switzerland, a differentiation has been made between the general floodplain inventory and floodplains of national importance. Floodplains of national importance were designated as “Cat. A”. The other Swiss floodplains and floodplains/wetlands of the other countries, which were not rated according to their protection value, were classified as “Cat. B”.
The Slovenian wetland inventory is based on Ramsar habitat types (Ramsar, 2012). Only selected inland wetlands were used for the pan-Alpine overview of floodplains/wetlands and for the final analyses. Other wetlands, like artificial wetlands, permanent freshwater lakes (code: O) or marine wetlands were not included in order to maintain comparability to the inventories of the other countries.
In France, floodplain inventories were received through the French Water Agency. The classification was based on a national methodology. Relevant wetland types (marshes and heaths, floodplains, and local floodplains) were included while others (e.g. artificial wetlands) were excluded to maintain comparability to other data sets. However, information about wetland types was only included in the data set for Provence-Alps and not for Rhône-Alps. In order to avoid artificial and other non-relevant floodplain/wetland categories in the data set, a data set of Natura 2000 biotopes for the Rhône area was used instead. All floodplain forest biotopes were included in the pan-Alpine overview.
For Italy, no data on floodplains/wetlands were available. As a surrogate, Natura 2000 protected areas including floodplain/wetland habitats were used. In contrast to the Natura 2000 data set, which was used in Rhône-Alps, only the complete protected area could be integrated into further processing. Biotopes/habitats could not be filtered and mapped separately within one Natura 2000 area. For this reason, Natura 2000 areas were only included when the selected habitats sum up to an area of > 2 ha and when more than 15% of the entire Natura 2000 area was associated with the selected floodplain/wetland habitat types.

Impounded river stretches were excluded from all floodplain/wetland data sets. Table 10 represents a summary of available floodplain/wetland data sets.

Table 10: Overview of floodplain/wetland data sets and data sources, additionally including a description if all floodplain/wetland types were used for further processing or if data was filtered; detailed information about included floodplain types is presented in annex

Country	Dataset	Sources
AT	National floodplain inventory (all types included)	UBA
DE	National floodplain inventory (all types included)	LFU
CH	(1.) National floodplain vegetation inventory (2.) Floodplain forests of national importance (all types included)	BAFU
FR - Provence-Alps	National wetland inventory (selected freshwater floodplains/wetlands)	Eau France
FR - Rhône-Alps	CORINE biotopes (all floodplain forests)	Eau France
IT	Natura 2000 areas (selected floodplain/wetland types)	EEA
SI	RAMSAR classification (selected freshwater floodplains/wetlands)	ARSO

2.3.4.5 Pressures

Impoundment

GIS data on impounded stretches were received for Austria, Germany, France and the RBD Alpi Orientali, whereas in the rest of Italy and Slovenia, this pressure type was not assessed. Intensity of the impairment was not taken into account for mapping and analysis.

Water Abstraction

Data were available for France, Switzerland, Germany, Austria and the RBD Alpi Orientali. In France and Alpi Orientali, the information was available within the ecological status data set in cases where water abstraction was the reason for failing the good status. For France the information was available only sporadically and most likely, it is incomplete. In the Po basin as well as in Slovenia, these data sets are in process. The amount of abstracted water is not recorded and, therefore, was not taken into account and no further classification was developed.

Hydropeaking

Data on river stretches affected by hydropeaking were not available across the entire Alpine Arc. Nationwide data were only provided for Austria. For Italy, the data received consisted of some stretches for the RBD Alpi Orientali and additionally, a separate data set for Trentino-Alto Adige with more detailed information. In Switzerland, WWF CH provided a data set on

hydropeaking stretches. In the Po basin and in Slovenia, this type of data is not available. Again, no distinction of pressure intensity was made for mapping and analysis.

Hydro power plants and other barriers

Data sets on hydro power plants were obtained for the entire study area; however, they are very heterogeneous in terms of comprehensiveness and classifications of hydro power plants. In many cases, several conflicting data sets with overlapping content were available per country: five each for Italy and France, three for Austria and two for Slovenia. Additionally, an EU-wide data set of large hydro power plants is freely available from the European Environment Agency (EEA, 2012a).

Information about the size and capacity of hydro power plants was not available for all countries/regions, therefore, these parameters were not considered for further processing. However, an overview of hydro power plants and other barriers is presented in a map in the data annex ('Hydro power plants and other barriers'). GIS data sets on barriers other than hydro power plants were also quite heterogeneous. The barrier types included in the data sets differ as well as the completeness of the data of assessed barriers. E.g. height information was not available in German barrier data set.

Received barrier data sets of the different countries are very heterogeneous regarding types of barriers and number of recorded barriers. Due to the above described inhomogeneity, barriers were not included into protection priority rating but are instead visualized in the map 'Hydro power plants and other barriers' (see data annex).

Morphological Pressures

River units with a hydromorphological status/ecomorphology class of moderate or worse (i.e. status classes 3-5) were defined as being affected by morphological pressures.

Heavily Modified & Artificial Waterbodies

Information on heavily modified water bodies (HMWB) and artificial water bodies (AWB) is included in all national data sets related to ecological status, except for Switzerland. For the German data set, there was no distinction between artificial and heavily modified water bodies. For Switzerland, all rivers with an ecomorphological status of 4 (artificial) and 5 (culverted) were treated as category HMWB/AWB.

2.3.4.6 Restoration

A low and incomplete number of restoration projects data could be obtained through the EU-funded project REFORM (reformrivers.eu). Additionally, EU LIFE river restoration projects accessible via the LIFE project database were also included. For Switzerland, all projects presented on the Swiss website rivermanagement.ch as well as restoration projects described by Hostmann&Knutti (2009) were mapped.

2.3.4.7 Data Aggregation on River Units

Different methods had to be developed to aggregate different kinds of input parameters (see Table 11).

Table 11: Aggregation parameters

Parameter	Levels	Method
Ecological status/value	1-5, no data	Relative share over 50% (described below)
Hydromorphological status/ ecomorphology class	1-5, no data	Relative share over 50% (described below)
Protection status	1-3	Share over 20%
Floodplains/wetlands	1-2	Share over 20%
Water abstraction	yes/no	Share over 20%
Hydropeaking	yes/no	Share over 20%
Impoundment	yes/no	Share over 20%
AMWB/HWMB	1/0	Share over 50%

The rating for the entire river unit based on line data (ecomorphology class and biological deficit analysis in the canton Valais), is derived in the following way:

- 1 (Highest rating): More than 50% of the river unit are rated ”1”,
- 2: More than 50% of the river unit are rated either ”1” or ”2”,
- 3: More than 50% of the river unit are either rated ”1”, ”2”, or ”3”,
- 4 (worst rating): More than 50% of the river unit are rated ”4” or ”5”,
- For determining classes 1-4, unrated sections of the river unit are ignored.

A river unit was designated as containing a protected area if at least 20% of its length can be associated with a protected area. Depending on the type of protected area, the river unit was assigned with a value of either: 1 (IUCN cat. Ia, Ib or II), 2 (expert-recommended protected area) or 3 (Nautra 2000). This 3-tier system is only used internally, since for all analysis in this study expert-recommended and Natura 2000 areas are treated equally.
Floodplains/wetlands were aggregated in a similar way: If at least 20% of a river unit is associated with a Cat. A floodplain/wetland, it is rated 1, if at least 20% of a river unit is associated with a Cat. B floodplain/wetland, it is rated 2.
For hydrological pressures (water abstraction, hydropeaking, impoundment), it is only evaluated if more than 20% of the river unit is affected by one of these pressures. Information about severity of pressure was not available for distinguished rating.
Finally, it is evaluated if a river unit has a share of HMWB/AWB. If a water body designated as HMWB/AMB covers more than 50% of a river unit, the entire river unit is designated as HMWB/AWB.

3. RESULTS

3.1 INDIVIDUAL RESULTS

3.1.1 RIVER NETWORK

The pan-Alpine river network consists of 10 549 river units with a total length of roughly 57 000 km. More than 50% of the total river length has a catchment size between 10 and 100 km^2. About one quarter of the pan-Alpine river network consists of rivers with a catchment size of 100 to 500 km^2. The remaining quarters are large rivers that drain more then 500 km^2. The country with the biggest share of river kilometer in the Alpine Arc is Austria (32%), followed by Italy (25%) and France (19%).

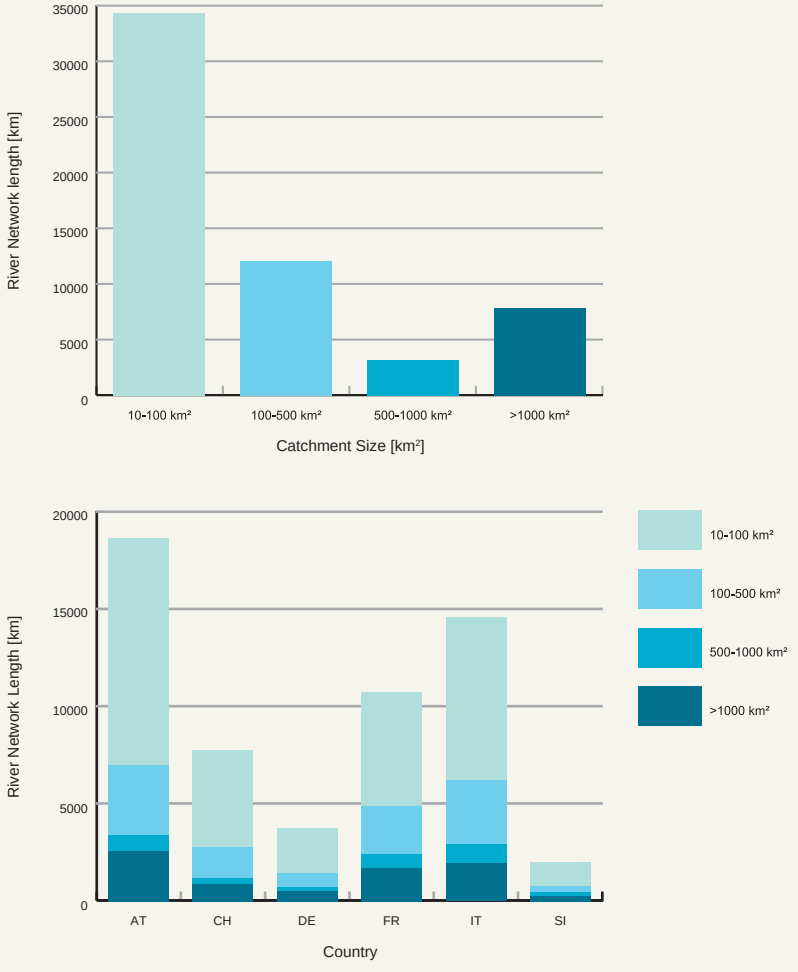


Figure 3 a, b: River network length (57 290 km in total) by catchment size (a) and country (b)

Table 12: River network length per catchment size class & country

Country	River network length in km and percent per catchment size class				
	Total	10-100 km²	100-500 km²	500-1000 km²	>1000 km²
AT	18 572.3	11 577.8	3 617.2	813.3	2 564
	32%	20%	6%	1%	4%
CH	7 729.8	4 957.5	1 587.5	309.1	875.6
	13%	9%	3%	1%	2%
DE	3 737.4	2 309.2	741.2	160.0	526.9
	7%	4%	1%	0%	1%
FR	10 709.2	5 859.3	2 463.9	683.8	1 702.2
	19%	10%	4%	1%	3%
IT	14 550.2	8 367	3 257	999.5	1 926.6
	25%	15%	6%	2%	3%
SI	1 991.8	1 195.3	353.4	171	272
	3%	2%	1%	0%	0%
Alps	57 290.7	34 266.1	12 020.2	3 136.7	7 867.3
	100%	60%	21%	5%	13%

3.1.2 ECOLOGICAL STATUS

Half of the Alpine rivers with a catchment size between 10 and 100 km² show a good or high ecological status (51%). About 30% of the rivers fail to attain the good status and for another 18% the ecological status was not yet assessed or is not available. For rivers with catchment sizes >10 km² only a small proportion of the river units is classified as heavily modified or artificial (4%). For the large rivers in the Alpine Arc, the picture is different: Around 30% of rivers with catchments >1000 km² are classified as heavily modified waterbody or artificial! Only a small proportion of 4% shows a high ecological status. A third of the large rivers is in a good ecological status, though.

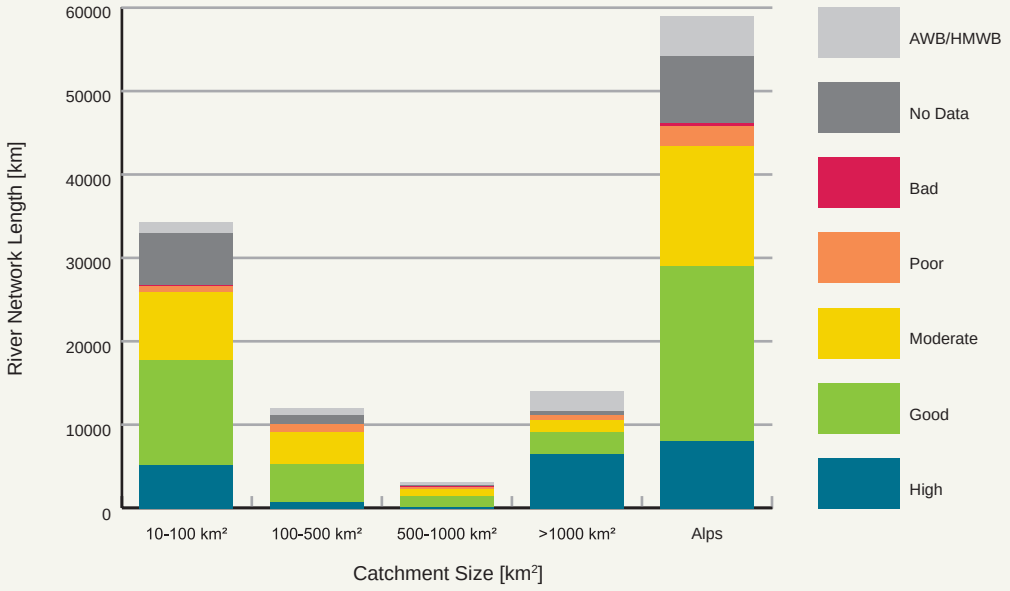


Figure 4: Ecological status/value per catchment size class;
*For Switzerland, the 4-tiered surrogate parameter ”ecological value” is displayed

Table 13: Ecological status/value class per catchment size class;
* For Switzerland, the 4-tier surrogate paramter ”ecological value” is considered

Ecological status/ value class	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
High	5 201.2 15%	789.9 7%	150.2 5%	338.3 4%	6 479.5 11%
Good	12 500.2 36%	4 525.8 38%	1 322 42%	2 642.2 34%	20 990.2 37%
Moderate	8 151.9 24%	3 843.4 32%	846.7 27%	1 465.7 19%	14 307.8 25%
Poor	773.2 2%	854 7%	272.7 9%	538.3 7%	2 438.6 4%
Bad	59.9 0%	101.7 1%	61.6 2%	90.9 1%	314.1 1%
No Data	6 250.8 18%	1 012.7 8%	183.6 6%	471.3 6%	8 025.0 14%
AWB/HMWB	1 332.0 4%	892.7 7%	326.1 10%	2 291.2 29%	4 735.4 8%

3.1.3 HYDROMORPHOLOGICAL STATUS

From the assessed rivers with a catchment area between 10-100 km^2, 29% are in a high or good hydromorphological status while 18% are either in a moderate, poor or bad state. The share of rivers failing the good status increases strongly with catchment size and culminates in nearly half (42%) of large rivers with a catchment size >1000 km^2 in a moderate to bad status. Overall, smaller rivers seem to be less impacted by morphological pressures than large rivers.

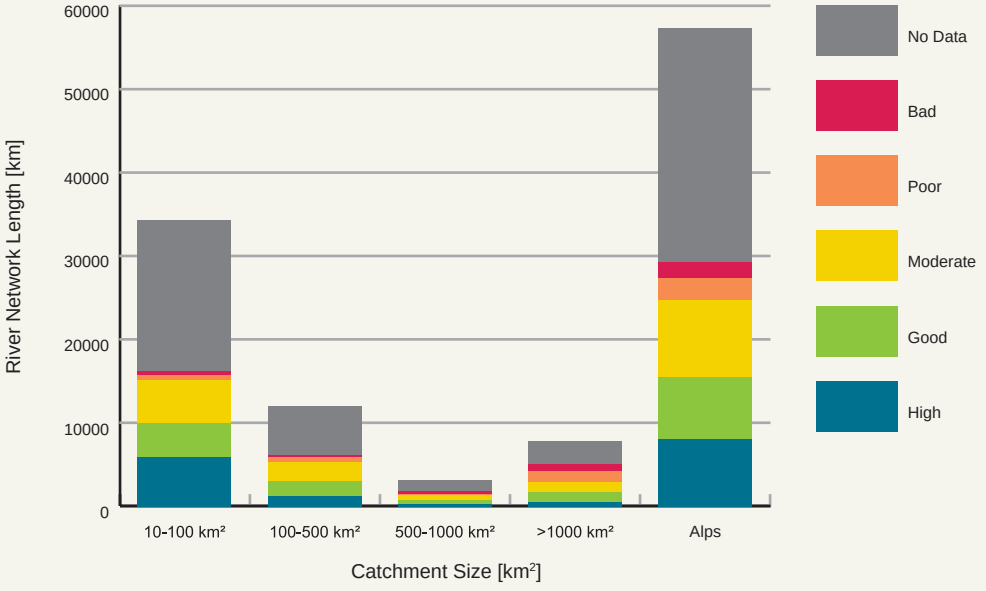


Figure 5: Hydromorphological status/ecomorphology class per catchment size class.

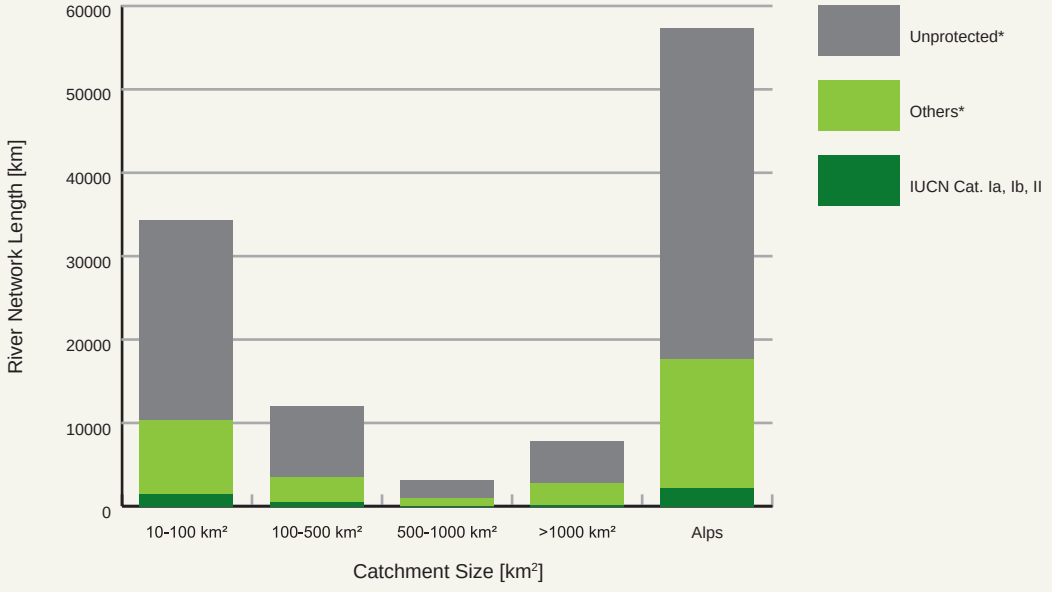
Table 14: Hydromorphological status per catchment size class; *For Switzerland, the ecomorphology class is displayed

Hydromorphological status	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
High	5 888.4	1 304.4	306.6	552.0	8 051.3
	17%	11%	10%	7%	14%
Good	4 127.2	1 693.4	479.2	1 184.5	7 484.3
	12%	14%	15%	15%	13%
Moderate	5 057.3	2 337.5	554.6	1 197.5	9 147.0
	15%	19%	18%	15%	16%
Poor	648.5	576.4	180.1	1 303.7	2 708.6
	2%	5%	6%	17%	5%

Hydromorphological status	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Bad	468.9	285.3	239.8	813.5	1 807.4
	1%	2%	8%	10%	3%
No Data	18 078.8	5 823.3	1 402.7	2 787.1	28 092.0
	53%	48%	44%	36%	49%

3.1.4 PROTECTED AREAS

For this study, protected areas where filtered according to their relevance for rivers and their legal value (see section 2.3.4.3). After merging the protected area network with the pan-Alpine river network, 31% of the rivers proved to be under some form of protection. However, the vast majority of these are outside of an IUCN Category I or II protection scheme, which offers less to no legal protection.



Figures 6: Protection status per catchment size class.
*Only Natura 2000 and protected areas recommended by national experts were considered.

Table 15: Protection status per catchment size class;
*Only Natura 2000 and protected areas recommended by national experts were considered

Protection status	River network length in km and percent per catchment size class				
	10-100 km²	**100-500 km²**	**500-1000 km²**	**>1000 km²**	**Alps**
IUCN Cat. Ia, Ib, II	1 539.4	479.7	72	131.4	2 222.6
	4%	4%	2%	2%	4%
Others*	8 816.8	3 028.7	965.2	2 687.8	15 498.5
	26%	25%	31%	34%	27%
Unprotected*	23 912.9	8 511.8	2 125.7	5 019.2	39 569.6
	70%	71%	67%	64%	69%

3.1.5 FLOODPLAINS/WETLAND

The available data shows that very few Alpine rivers are still associated with floodplains or wetlands. On one hand, this is due to the morphological characteristic of Alpine rivers lacking large floodplains on higher altitude. On the other hand, most former floodplains and wetlands have been eliminated due to river channelization. Only 2% of the assessed river units still contain natural floodplains and wetlands.

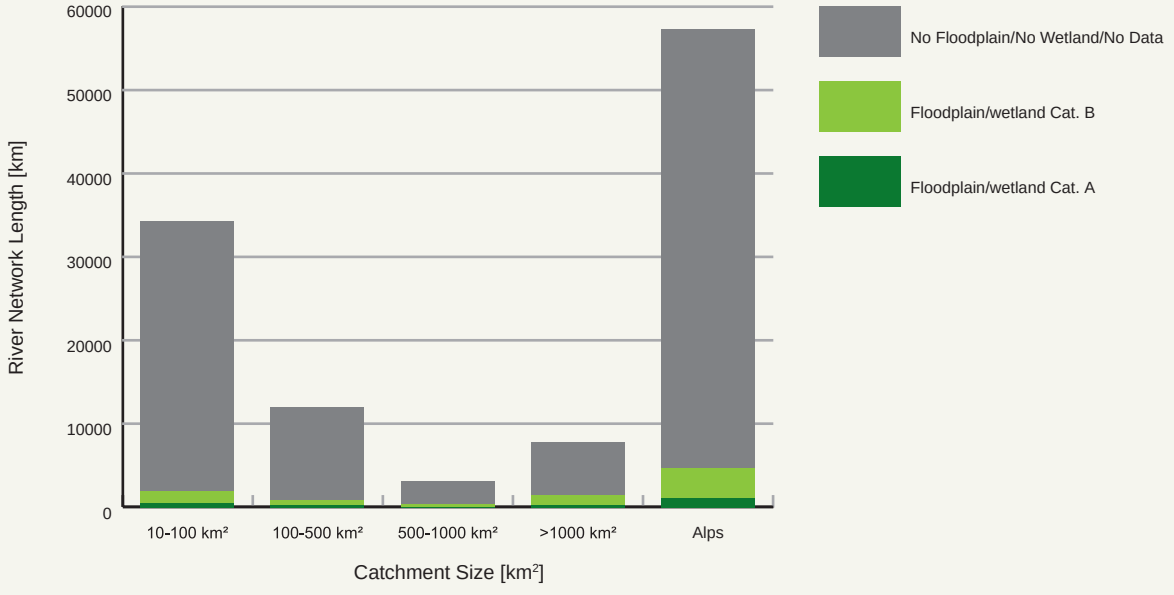


Figure 7: Length of river units associated with floodplains/wetlands per catchment size class.
*Floodplains/wetlands Cat. A: wetlands of high protection value defined by national authorities/experts;
Floodplains/wetlands Cat. B: all other floodplains/wetlands included in the analyses

Table 16: Floodplains/wetlands per catchment size class

Floodplain/ wetland category	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Floodplain/ wetland Cat. A	492 1%	303.2 3%	61.8 2%	299.9 4%	1 157 2%
Floodplain/ wetland Cat. B	1 513.2 4%	592.4 5%	303.6 10%	1 102.4 14%	3 511.7 6%
No floodplain/ wetland/ no data	32 263.9 94%	11 124.6 93%	2 797.5 88%	6 436 82%	52 622 92%

3.1.6 PRESSURES

3.1.6.1 Hydrological Pressures

Hydrological pressures, such as water abstraction, hydropeaking and impoundments, are the dominating cause of river deterioration in the Alpine Arc. And yet, the presence of hydrological pressures on many river units is not known as there are no official data.

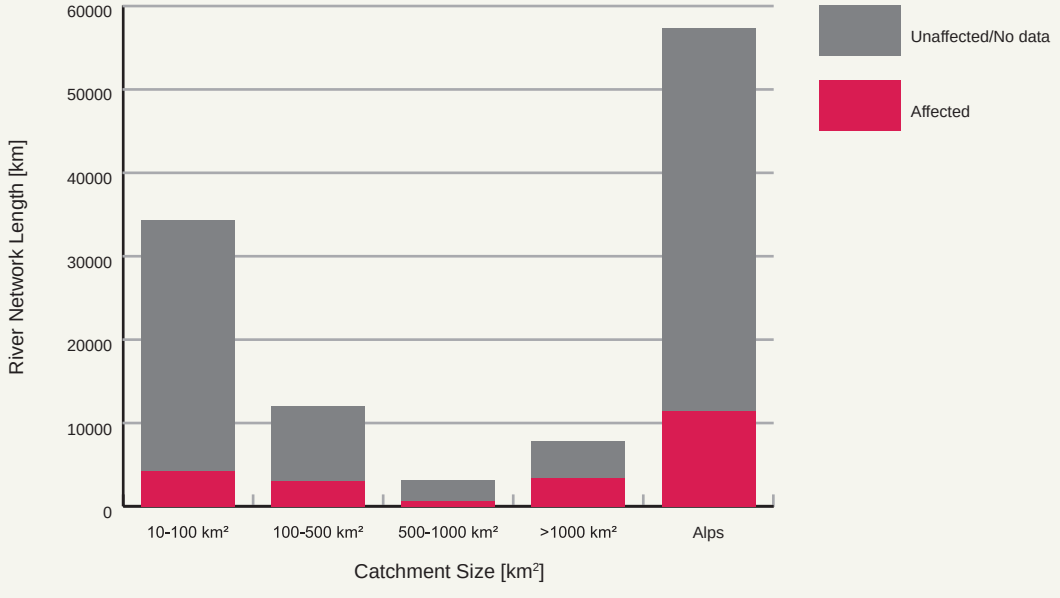


Figure 8: Hydrological pressures (water abstraction, hydropeaking and impoundment) per catchment size class.

Table 17: Hydrological pressures per catchment size class

Hydrological pressures	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Affected	4 255.1 12%	3 040.3 25%	635.1 20%	3 432.8 44%	11 363.2 20%
Unaffected / No data	30 014.1 88%	8 980 75%	2 527.9 80%	4 405.6 56%	45 927.4 80%

3.1.6.2 Morphological Pressures

According to data availability, all Alpine rivers could be classified in two categories, i.e. “affected” (classified as “moderate” to “bad”) and, in regions with comprehensive data cover, “unaffected” (river units with “high” or “good” hydromorphological status). The ratio of affected to unaffected river units corresponds to the river size with small rivers being less affected than large rivers.

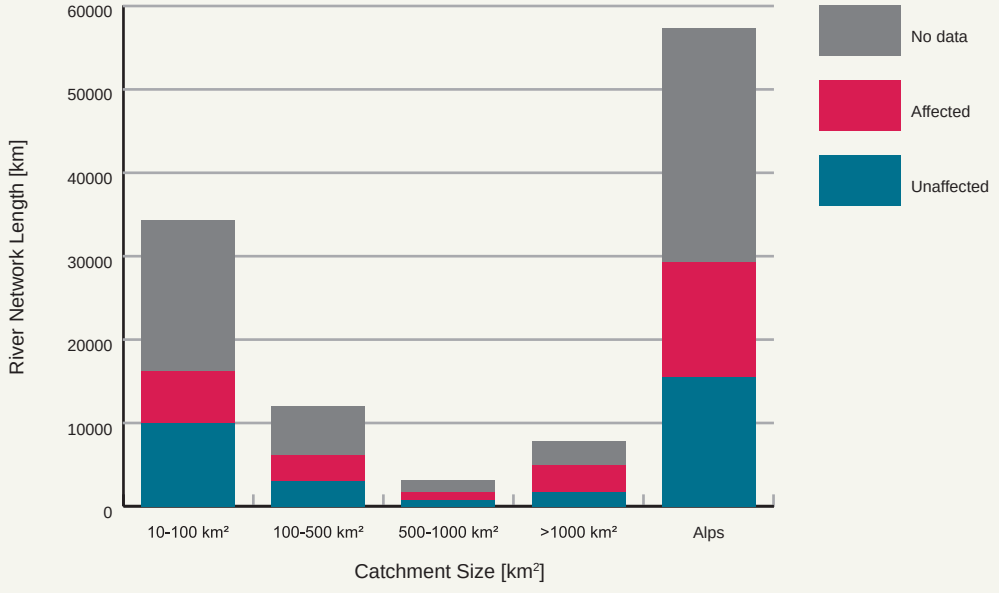


Figure 9: Morphological pressures per catchment size class; River units with a morphological status worse than ”good” were designated as ”affected”.

Table 18: Morphological pressures per catchment size class

Morphological pressures	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Unaffected	10 015.6	2 997.8	785.7	1 736.5	15 535.6
	29%	25%	25%	22%	27%
Affected	6 174.7	3 199.2	974.5	3 314.7	13 663.1
	18%	27%	31%	42%	24%
No Data	18 078.8	5 823.3	1 402.7	2 787.1	28 092.0
	53%	48%	44%	36%	49%

3.1.6.3 Hydro power plants and other barriers

The data quality of hydro power plants and barriers across the Alpine Arc varies widely. Especially the data on barriers are too inhomogeneous to be comparable on an Alpine scale. River units with one or more hydro power plants were designated as affected. Of all assessed river units, more than 16 000 km are affected by hydro power plants. The relative abundance of affected river stretches varies only slightly between catchment size classes.

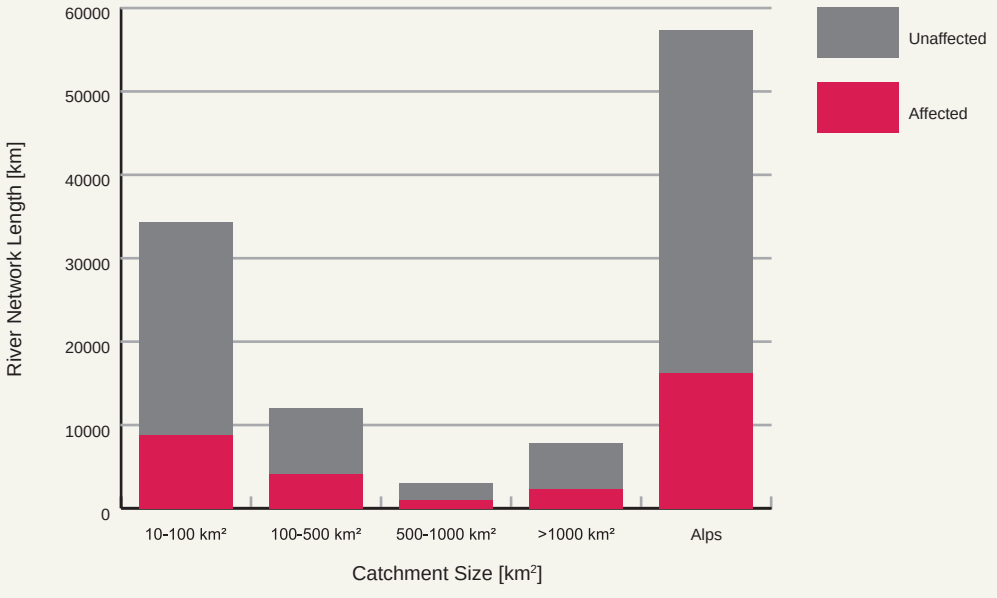


Figure 10: Hydro power plants per catchment size class; river units with one or more hydro power plants were designated as affected

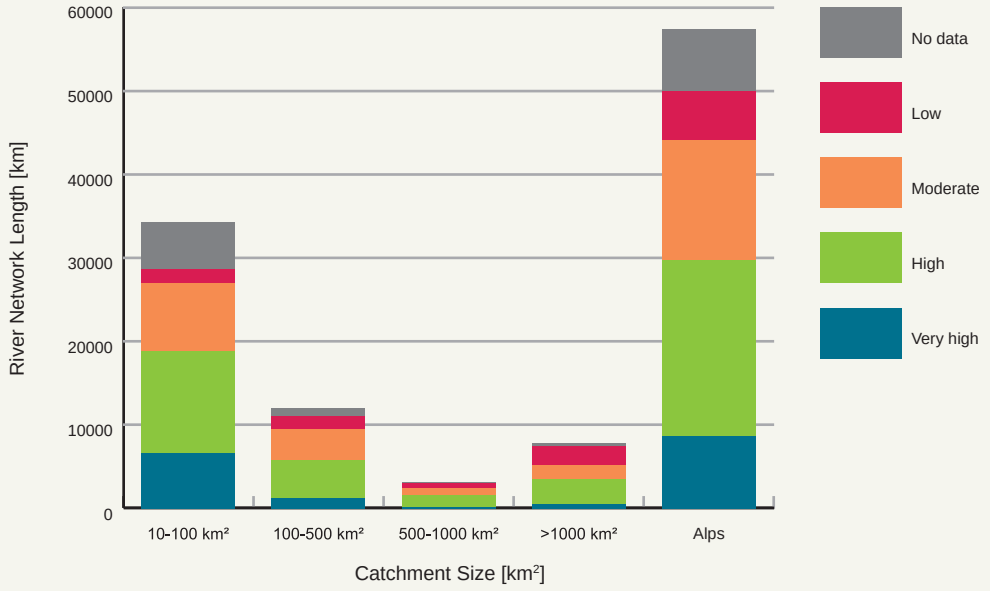
Table 19: Affected by hydro power plant per catchment size class

Affected by hydro power plant	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Affected	8 766.9	4 128.7	1 036.3	2 313.9	16 245.8
	26%	34%	33%	29%	72%
Not affected	25 499.3	7 891.5	2 100.7	5 553.5	41 044.9
	74%	66%	67%	71%	28%

3.2 AGGREGATED RESULTS

3.2.1 PROTECTION PRIORITY

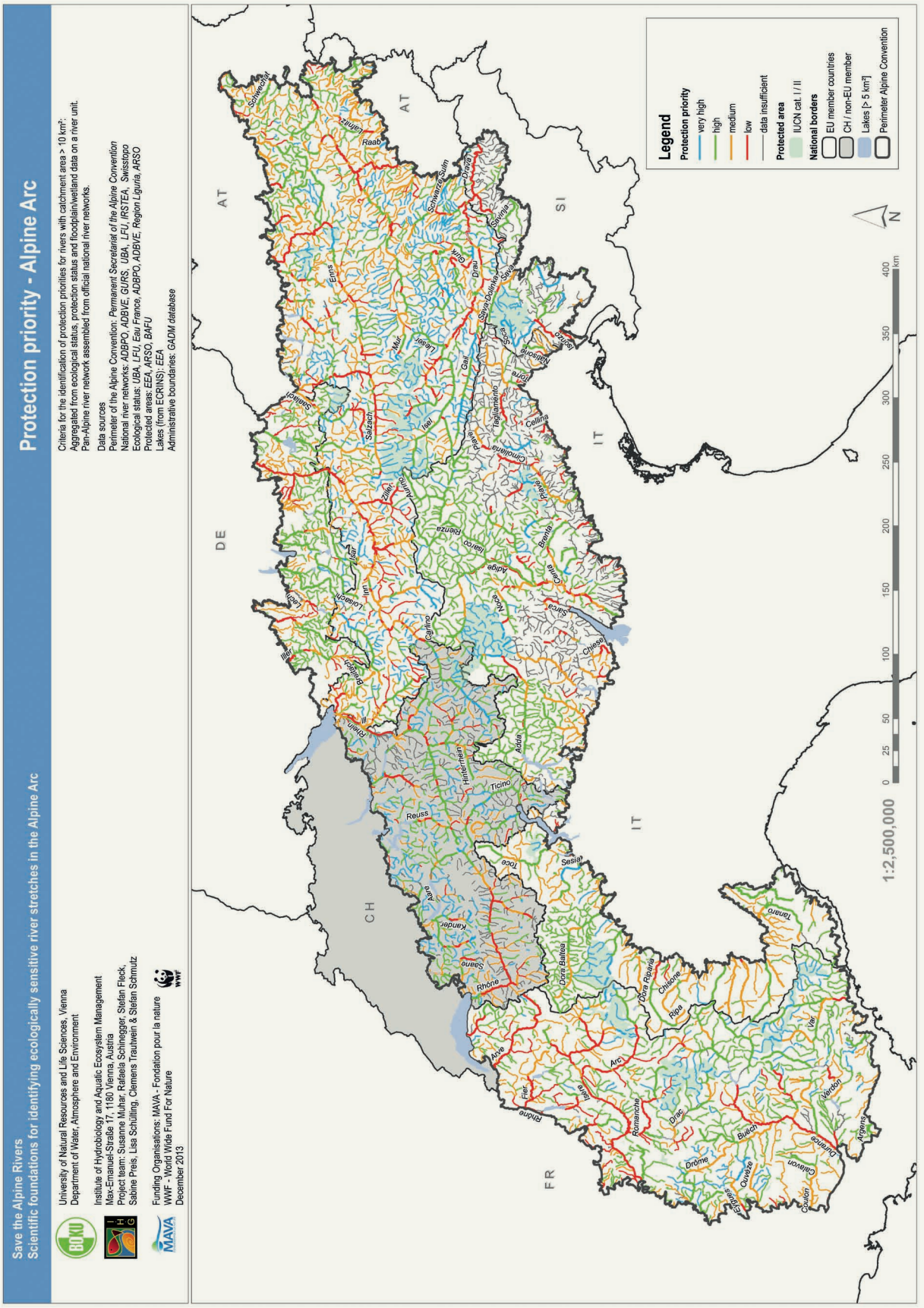
Emanating from previously discussed results, WWF defined the protection priority of Alpine rivers reflecting the ecological role of the river within the river network.
About 15% (8 674 km) of Alpine rivers are of very high protection priority. Another 37% (21 010 km) are classified as rivers with high protection priority.
Small rivers with catchment sizes between 10 and 100 km² represent a large part (19%) of rivers with very high protection priority. This class is also frequent in rivers with catchment sizes between 100 and 500 km². Only 5% of the smallest rivers have low protection priority. In contrast, 27% of rivers with a catchment size > 1 000 km² are classified as being of low protection priority, whereas only 7% (554 km) are of high protection priority.



Figures 11: Length of river units with different protection priority categories per catchment size.

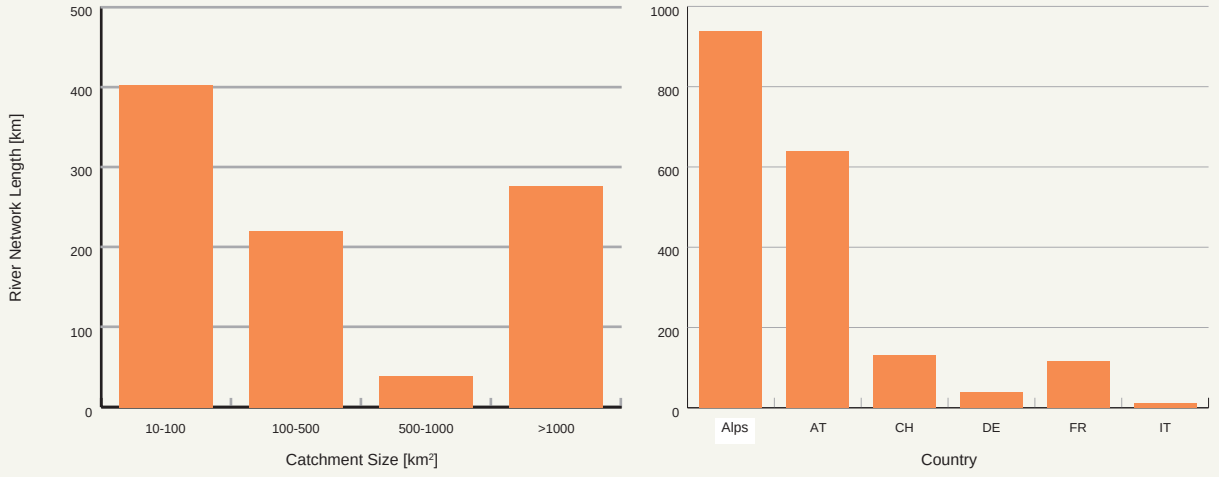
Table 20: Length of protection priority categories per catchment size class.

Protection priority category	River network length in km and percent per catchment size class				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Very high	6 598.5 19%	1 293.6 11%	227.5 7%	554.1 7%	8 673.8 15%
High	12 235.6 36%	4 461.1 37%	1 427.2 45%	2 882.4 37%	21 010.3 37%
Moderate	8 069.7 24%	3 750.6 31%	778.1 25%	1 761.6 22%	14 356.1 25%
Low	1 737 5%	1 554 13%	547.2 17%	2 208.7 28%	5 944.3 10%
No data	5 625.3 16%	960.8 8%	157 5%	460.4 6%	7 306.2 13%


Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Protection priority - Alpine Arc
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck,
Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Criteria for the identification of protection priorities for rivers with catchment area > 10 km²:
Aggregated from ecological status, protection status and floodplain/wetland data on a river unit.
Pan-Alpine river network assembled from official national river networks.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Ecological status: UBA, LFU, Eau France, ADBPO, ADBVE, Region Liguria, ARSO
Protected areas: EEA, ARSO, BAFU
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
Legend
Protection priority
very high
high
medium
low
data insufficient
Protected area
IUCN cat. I / II
National borders
EU member countries
CH / non-EU member
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N
AT
DE
CH
FR
IT
SI

3.2.2 PROTECTION NEED

All catchment sizes and countries taken together, there is a total of 937 km of river units, which have a high or good ecological status and are associated with floodplains or wetlands but have no protection status.



Figures 12: Length of river units with different protection need per catchment size; only river units classified as being in need of protection are shown. Data are not comparable between countries because of large differences in data availability.

3.2.3 RESTORATION

According to the Water Framework Directive, all surface water bodies of the EU member countries have to achieve an ecological status of "good" or better till 2015, with possible extensions up to 2021 or 2027. Artificial and heavily modified water bodies are exempted from this obligation, but have to achieve at least a "good ecological potential". Switzerland was excluded from this analysis as it is not member of the EU.

River units with an ecological status or an ecological potential of "moderate" or worse were defined as being in need of restoration.
About 24% of rivers with a catchment size between 10 and 100 km² were found to be natural rivers in need of restoration. Only 2% of the small rivers are designated as artificial or heavily modified water bodies and are in need of restoration. In contrast, 46% of rivers of a catchment size larger than 1 000 km² need restoration, and half of those are artificial or heavily modified water bodies.

As the Table 22 shows, the length of the river network with need for restoration is about 13 663 km in the Alps (24% of the total pan-Alpine river network). Here, especially rivers with a catchment size > 500 km² and > 1000 km² need restoration, more so considering the lower share of larger rivers in the Alpine river network.

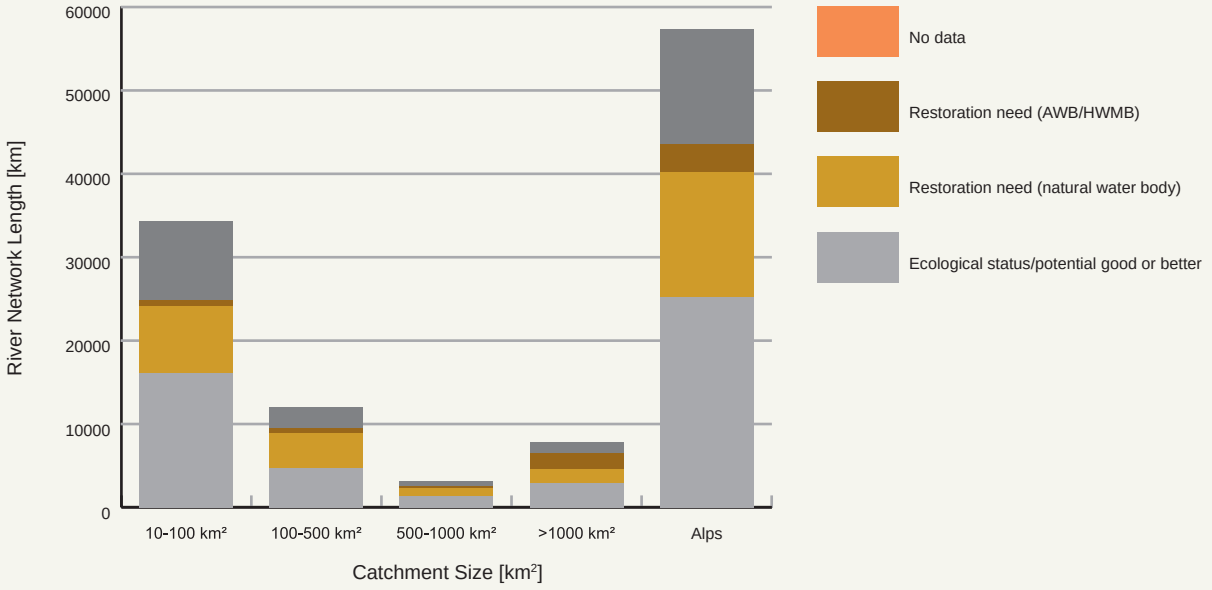


Figure 13: Length of river units with different need for restoration categories per catchment size.

Table 22: need for restoration per catchment size class

Restoration need	River network length in km and percent per country				
	10-100 km²	100-500 km²	500-1000 km²	>1000 km²	Alps
Ecol. status/potential good or better	16 092.6 47%	4 690.8 39%	1 400.1 45%	2 947.7 37%	25 131.1 44%
Restoration need (natural water body)	8 111.5 24%	4 190.6 35%	971.2 31%	1 693 22%	14 966.2 26%
Restoration need (AWB/HWMB)	684.6 2%	663.6 6%	268.3 9%	1 851.0 24%	3 467.6 6%
No data	9 377.4 27%	2 475.2 21%	497.4 16%	1 375.6 17%	13 725.7 24%

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

University of Natural Resources and Life Sciences, Vienna
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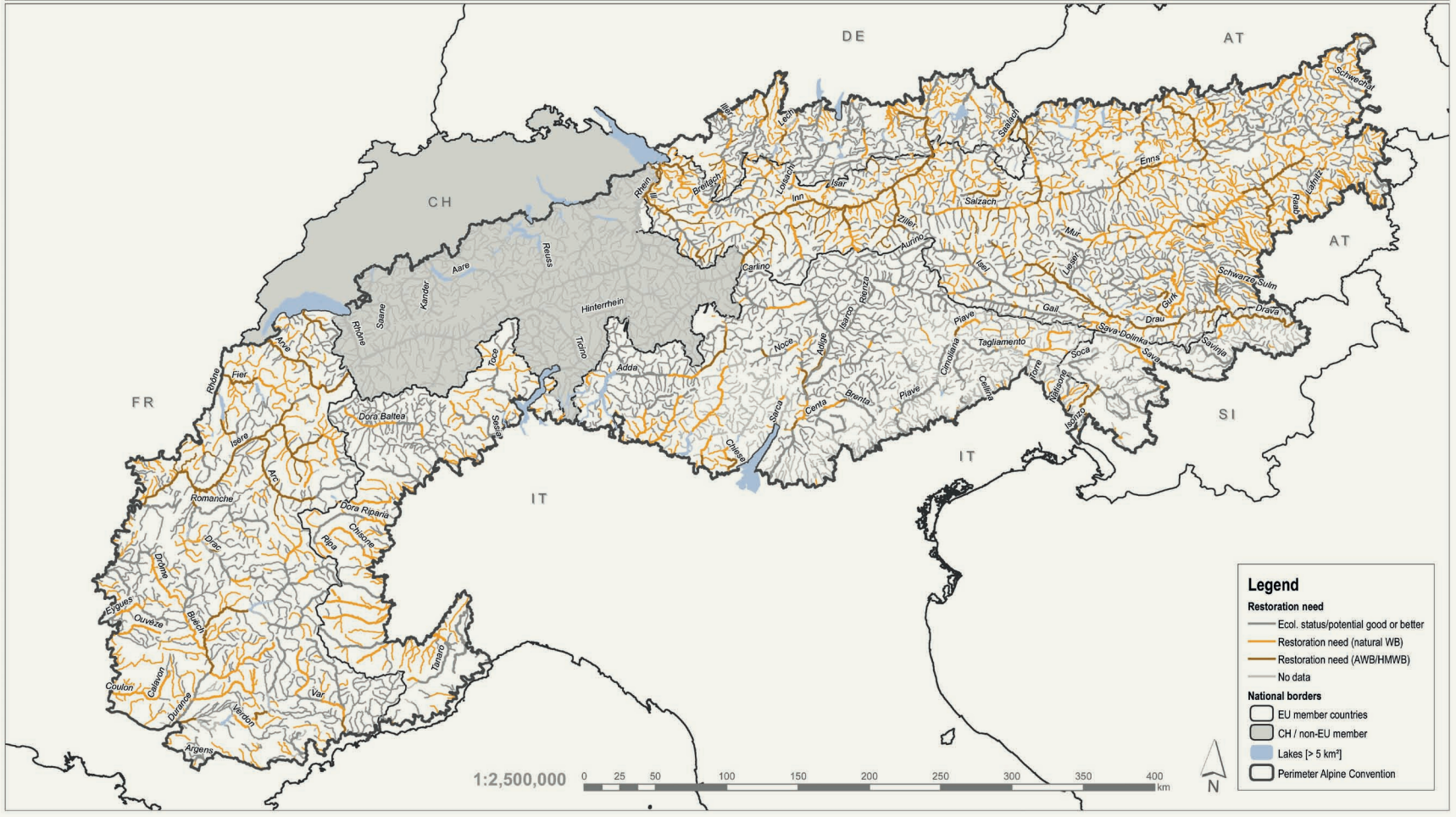
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz

Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

Restoration need - Alpine Arc

Restoration need based on ecological status and ecological potential. Data were aggregated to river units (= river stretch between two tributaries).
Pan-alpine river network assembled from official national river networks. Only rivers with a catchment size >10 km² are displayed.

Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO,ADBVE,AUS, GURS, UBA, LFU, CEMAGREF, Swisstopo*
Ecological status: *UBA, LFU, Eau France, ADBPO, ADBVE, Region Liguria, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*



4. WWF CONCLUSION & RECOMMENDATIONS

Based on the outcome of the study („Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc"), WWF was able to formulate conclusions and recommendations with a pan-alpine perspective. By using integrative criteria (see section Methodology), the outcome visualizes the pan-Alpine status of rivers, as well as the situation of the individual Alpine countries according to catchment size. Together, this database serves to address urgent needs of protection and indicates protection priorities with regard to the vulnerability of the river.

4.1 STATUS QUO OF PAN-ALPINE RIVER NETWORK

The results explicitly demonstrate that a high amount of Alpine rivers is affected by severe human pressures. Rivers with intact aquatic bioconeoses – expressed by their high ecological status – are restricted throughout the Alps to 11% of the river network. While 15% of the smaller rivers and streams (catchment size 10-100 km²) are still in a high ecological status, only 4% (91km) of the large rivers (catchment size > 1000 km²) remain in a high ecological status (see data annex).
About 28% of the large rivers, like the rivers Inn, Drau, Isère or Piave, have been designated as HMWB/AWB indicating the huge amount of human pressures on those river systems. This situation is exemplified in more detail by the share of hydrologically affected river units, whereby the pressure is increasing with the catchment size. Moreover, 44% of the large rivers (e.g. rivers Rhône, Rhine, Piave) show altered hydrological regimes due to water abstraction, hydropeaking and/or impoundments. In contrast, based on collected data, only 12% of the smaller rivers were classified as being affected.
Similarly, 42% of the large rivers fail the good morphological status (e.g. rivers Rhône, Inn, Traun, Isar). About 8% are in poor or bad status and 28% are even classified as being heavily modified or artificial.
The study was extended to the floodplain areas with the objective to give an additional overview of the river-floodplain systems of the Alps. Although detailed information on the specific functional and nature conservation value of some national floodplain inventories is missing, a rough pan-Alpine overview of the Alpine floodplains can be provided. According to numerous reports on the individual loss of former extended floodplain forests collected in this study, the decline of floodplain or wetland areas for the entire Alpine Arc can now be quantified. Only 8% (4 669 km) of the Alpine rivers still have floodplains or wetlands. Historically, most large Alpi-

ne rivers (catchment size > 1 000 km²) were associated with floodplains; however, nowadays only 18% retained some fragments of their former floodplain habitats (e.g. upper regions of the Rhine river, Gail and Calavon). The situation in medium-sized rivers (catchment sizes 500 – 1 000 km²) shows similar trends (12% of still existing floodplain or wetland areas). Additionally, remaining floodplain areas are impaired and dynamic processes have been strongly limited. Based on the comprehensive database developed in this project, the protection priority of rivers could be identified according to the (1) high ecological status, (2) protection status as Strict Nature Reserve, Wilderness Area or National Park and/or (3) floodplains/wetlands of high or national importance. Rivers of "very high protection priority" comprise 15% of the total Alpine river network. Interestingly, a significant proportion of rivers with very high protection priority (937 km) is still unprotected (e.g. Gail river, Roanne river). According to the evaluation scheme, another 37% are designated as rivers of high, 25% of moderate and 10% low protection priority.

4.2 DATA GAPS AND UNCERTAINTIES

During this study, it became apparent that there exist huge gaps for certain types of data. Especially regarding hydromorphological status and other pressure data, detailed information was missing. Due to this fact, it was not possible to include the hydromorphological status in the final protection priority scheme and to provide a complete overview on the pan-Alpine pressure situation. Moreover, the map on existing hydro power plants and other barriers shows an incomplete picture (see map "Hydro power plants and other barriers" in the data annex), which leads to the fact that connectivity of rivers (i.e. the length of free-flowing river sections) could not, despite its importance for river ecosystems, be considered in a pan-Alpine protection priority scheme. Especially for Italy and France, information on the indicated data does not exist for certain regions or was not provided by national/regional authorities. This corresponds to statements in the "Report from the Commission on the Implementation of the Water Framework Directive and River Basin Management Plan" (European Commission, 2012). This document sums up the first reported RBMPs and states that e.g. for Italy, the ecological status of about 50% of water bodies in the River Basin District Alpi Orientali is unknown. However, these and other data (e.g. hydromorphological status, information on barriers etc.) need to be prepared or are under preparation and can be expected in the 2nd RBMP, to be submitted in early 2015 providing a more complete data set for further studies.
Another relevant issue is that some Swiss data are hardly comparable to EU WFD data (i.e. ecomorphology class) or do not exist at all (i.e. ecological status data). The surrogate method developed for characterizing the "ecological value" (chapter 2) enabled a rough comparison with other countries, however, it can be assumed that the surrogate method results in a better classification, than in a classification according to the ecological status. Attempts by the Swiss national administration are required in the near future to make data sets comparable across the Alps.

4.3 CONCLUSIONS

Based on the aforementioned aspects, the following conclusions can be drawn:

- **Data availibility**
  During the course of the study it became clear, that part of the data, especially on hydromorphological pressures, is not available neither on an Alpine nor national scale. According to the water framework directive this data should be provided by the authorities within the RBMP. Nevertheless, the study has shown that some parts of the official WFD data are missing or are not officially available. This is specifically true for parts of Italy and France. Furthermore, the procedure of data collection and data allocation is not transparent, leading to additional problems in gathering the necessary data sets. And finally, there is no harmonization between member states in gathering data or exchange of know-how. This should be improved in the future.

- **Alpine rivers are threatened**
  As shown in the results (chapter 3), the ecological integrity of Alpine rivers is endangered by many threats such as morphological alterations and new hydro power plants. Especially large rivers with a river basin larger than 1000 km^2 are heavily degraded. Although small rivers are less affected by alterations, the expected trend in hydroelectic production with small scale hydro power plants, especially in headwaters, poses a real threat to the ecological integrity of small rivers in the Alps.

- **Alpine rivers already suffer from existing pressures**
  Given the poor data quality on hydromorphological pressures throughout the Alpine Arc and the non-existence of data on existing and planned hydro power plants, an assessment of the actual situation of pressures on a pan-Alpine scale proved to be difficult. Nevertheless, looking at the assessed river network, the scale and magnitude of pressures appeared to be immense. To give an example: In Austria, which has the largest part in the pan-Alpine river network, more than 5 000 hydro power plants are already found on rivers and streams of all catchment sizes. More than 100 new hydro power pants are planned to be build over the next few years, intensifying the already dire situation for the Austrian Alpine river system. The situation in Switzerland is similar and it is very likely that, given those 2 examples, resemblant conditions are found all across the Alpine Arc.

- **Alpine rivers face many new threats**
  Apart from the aforementioned threat of new hydro power plants, Alpine rivers face many new threats in their near future. One prominent example is climate change, which will negatively affect the Alpine environment. According to reports of the EEA, weather extremes such as droughts and floods will be more frequent in the Alpine Arc in future due to changes and shifts in the yearly precipitation regime. This affects not just riverine habitats such as floodplains, but is also important for the production of hydroelectric energy. With a more volatile water distribution, water withdrawal could take place nearer the spring, which has even more negative impacts for downstream habitats. However, some of this

negative effects arising from climate change on riverine habitats can be mitigated by the higher resilience of natural rivers compared to rivers affected by human pressure.

- **Alpine rivers lack sufficient protection**
  As shown in chapter 3, intact Alpine rivers often lack proper protection. This becomes even more important as one of the deciding factors in assessing the protection need of Alpine rivers is the existence of flood plains or wetlands. Given the rarity of those habitats it is of vital importance for the ecological integrity of the pan-Alpine river system that rivers in a natural state should be preserved. A second issue is that the protection status of rivers is often weak and no guarantee to exclude alterations or hydro power development within the protected area.

4.4 WWF RECOMMENDATIONS

The study's results indicate that Alpine rivers are under pressure from manifold threats and are largely degraded. This is especially true for large rivers.
Therefore, WWF recommends to take immediate action to counter those threats and preserve the unique habitats and ecosystems that rivers offer in the Alpine area.

1. **Improve data quality and availibility on the pan-Alpine river network**
   Apart from the process of data acquisition and availability, which should be more transparent and harmonized between member states through extended stakeholder processes and involvement of relevant parties early on in the operational procedure, the need for member states to provide accurate and comprehensive data sets should be reflected strongly in the River Basin Management Plans. The results of this study can guide research and administration in generating and collecting the most useful and relevant data. The impact of human pressures could not be included in the final protection priority scheme due to the limitations of available data. Hence, characterization and quantification of these impacts is needed, so that these issues can be addressed more comprehensively in future work. Quantitative information on existing hydro power plants and other barriers will be a prerequisite to assess the connectivity status of Alpine river stretches and should be included into the River Basin Management Plans.

2. **Define No-Go areas where hydrological and morphological alteration is forbidden**
   As stated by the EU Water Directors, No-Go areas should be implemented within the River Basin Management Plans. A first example on how that could be done was made by the ICPDR Guidelines. Within the Alpine Arc, protection strategies should be developed with focus on rivers with "very high" and "high" protection priority (see map „Protection Priority"). Particular attention should be given to those rare river stretches, which are characterized

by a high/good ecological status and associated floodplains/wetlands but which are, at the same time, unprotected. Due to data constrains, some river stretches could also be in the category of very high ecological status but the data is not available. Another important point is that rivers, which do not fall under the status of a very high protection priority, could still contain important or endemic species which are not mapped or represented in the available data sets. No-Go areas should act as a strategic management tool but do not replace a detailed local analysis (eg EIA).

3. **Restore floodplains, wetlands and large rivers to reverse degradation and provide ecological flood protection**
   This topic contains two important issues: The non-deterioration goal and the restoration principle of the Water Framework Directive. With floodplains, wetlands and large rivers being one of the most threatened ecosystem major effords should be made to reverse the heavy degradation of large rivers and to restore natural regimes wherever possible (see map „Restoration Need“). Special attention should be given to ecological flood protection and the role of a healthy river ecosystem therein. Additional degradation should be avoided where ever possible as anything else would contradict the goals of the WFD. Mapping and compilation of existing and planned infrastructure facilities (eg. hydro power plants) into a comprehensive database is urgently needed here. This is especially important for establishing continuity throughout the Alpine river network.

4. **Development of a Pan-Alpine River Management Plan to ensure the balance between nature protection and human needs**
   About 14 million people of 8 different countries live in the Alpine Arc. This huge human pressure is confronted with unique ecosystems that do not only provide important ecosystem services, but also, these are found nowhere else on earth. At the same time those ecosystems, with freshwater leading the way, are highly threatened. Therefore, it is imperative to develop strategies to balance the need of protecting those unique habitats with human needs.
   The WFD gives a good reference to implement regional programs for river management. But apart from direct influences on river systems, indirect influences need to be considered. Climate change, invasive and endemic species are just some examples of important factors that play a significant role in the development and management of regional river basin management programs.

5. REFERENCES

Abell, R., Thieme, M. L., Revenga, C., Bryer, M., Kottelat, M., Bogutskaya, N., & Petry, P. (2008). Freshwater ecoregions of the world: a new map of biogeographic units for freshwater biodiversity conservation. BioScience, 58(5), 403-414.

BAFU, B. für U. (2006): Erstaufnahme alpine Auen. Schlussbericht: Methoden und Indikatoren, Ergebnisse Schweiz, Umsetzungshilfen.

BAFU (2009): Datenbank Ökomorphologie Stufe F: Kurzdokumentation.

BAFU (2013): Einzugsgebietsgliederung Schweiz EZGG-CH.

Bissardon, M., Guibal, L., & Rameau, J. (n.d.): CORINE Biotopes. Version originale Types d'habitats Français.

BMLFUW (2012): Österreichischer Wasserkatalog – Wasser schützen – Wasser nutzen; Kriterien zur Beurteilung einer nachhaltigen Wasserkraftnutzung.

Bourdin, L. (2004): Les revieres en tresses sur le basin Rhone Méditerranée Corse. Bilan et perspectives de gestion. Mem. De fin d'etude. Master Gestion de l'Eau. ENGREF, CNRS., pp. 60.

Brunotte, E., Dister, E., Günther-Diringer, D., Koenzen, U., & Mehl, D. (2009): Flussauen in Deutschland: Erfassung und Bewertung des Auenzustandes. Bonn.

CIS Policy paper (2007): "Water Framework Directive & Hydropower". Recommendations for better policy integration.,Berlin, 4-5 June 2007.

EU Water Directors (2010): Hydropower Development under the Water Framework Directive: Statement of the Water Directors. Informal Meeting of Water and Marine Directors of the European Union, 2010.

European Commission (1992): Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

European Commission (2000): Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 Establishing A Framework for Community Action in the Field of Water Policy; pp. 1–73. OJEC, L 327.

European Commission (2009a): Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources.

European Commission (2009b): Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.

European Commission (2011): Biodiversity Strategy to 2020. Brussels, 3.5.2011. COM (2011) 244 final. 17S

European Commission (2012): Report from the commission to the European parliament and the council on the Implementation of the Water Framework Directive (2000/60/EC) river Basin Management Plans.
http://eurlex. europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52012DC0670:EN:NOT

Hostmann, M., Knutti, A. (2009): Befreite Wasser. Entdeckungsreisen in revitalisierte Flusslandschaften der Schweiz. Mit Fotos von Michel Roggo, WWF Schweiz, Rotpunktverlag. Zürich

ICPDR (2013): Sustainable Hydropower Development in the Danube Basin. Guiding Principles.

Lazowski, W., Schwarz, U., Essl, F., Götzl, M., Peterseil, J., Egger, G. (2011): Aueninventar Österreich: Bericht zur bundesweiten Übersicht der Auenobjekte. Vienna.

Martinet, F., Dubost, M. (1992): Die letzten naturnahen Alpenflüsse. Internationale Alpenschutzkommission.

Mader, H., Kraml, J., & Sattler, S. (2011): Abschätzung des energiewirtschaftlichen Potentials für Ökomasterplan-Flüsse, WWF Österreich. Vienna/Innsbruck.

Muhar, S., M. Schwarz, S. Schmutz, M. Jungwirth (2000): Identification of rivers with high and good habitat quality: methodological approach and applications in Austria. In M. Jungwirth, S. Muhar & S. Schmutz (eds). Assessing the Ecological Integrity of Running Waters, Hydrobiologia 422/423: 343 – 358.

Muhar, S., Poppe, M., Preis, S., Jungwirth, M., Schmutz, S. (2011): Schutz und Sicherung ökologisch sensibler Fließgewässerstrecken: Anforderungen, Kriterien, Implementierungsprozess. Österreichische Wasser- und Abfallwirtschaft, 9-10/2011, 196-204; ISSN 0945-358X.

Permanent Secretariat of the Alpine Convention (2009): Water and water management issues. Report on the state of the alps. Alpine convention Alpine Signals - Special Edition

Rast, G., & Tranter, C. (2011): WWF-Alpenflussstudie. München. Schinegger R., Trautwein C., Schmutz S., Melcher A. (2012): Multiple human pressures and their spatial patterns in European running waters. Water Environ. J. 2012;26:261–273.

Schmutz, S., Schinegger, R., Muhar, S., Preis, S., Jungwirth, M. (2010): Ökologischer Zustand der Fließgewässer Österreichs – Perspektiven bei unterschiedlichen Nutzungsszenarien der Wasserkraft. Österr. Wasser- und Abfallwirtschaft, 56.JG, 62, pp. 162-167;

ISSN 0945-358X bzw. 1613.

Schmutz, S., Wiesner, C., Preis, S., Muhar, S., Unfer, G., Jungwirth, M. (2011): Auswirkungen des Wasserkraftausbaues auf die Fischfauna der Steirischen Mur. Österreichische Wasser- und Abfallwirtschaft, 9-10/2011, pp. 190-195; ISSN 0945-358X.

WWF Österreich (2009): Ökomasterplan, Schutz für Österreichs Flussjuwele, WWF Österreich. Vienna/Innsbruck.

WWF Österreich (2010): Ökomasterplan II, Schutz für Österreichs Flussjuwele, Ch. Walder & Ch. Litschauer.

WWF European Alpine Programme, Lassen, B. & Savoia, S. (2005)

Websites

Bayerisches Staatsministerium für Wirtschaft und Medien, Energie und Technologie (n.d.): Energieatlas Bayern. Website: http://www.energieatlas.bayern.de/, checked on 13/12/19.

Eawag, WSL, ETHZ, EPFL (2005): Integrales Gewässermanagement - Erkenntnisse aus dem Rhone-Thur Projekt. Website: http://www.rivermanagement.ch, checked on 13/12/12.

EEA (2012a): EEA Catchment and Rivers Network System ECRINS v1.1. Copenhagen: European Environment Agency. Website: http://www.eea.europa.eu/data-andmaps/data/european-catchments-and-rivers-network, checked on 13/12/11.

EEA, (2012b): Protected areas in Europe — an overview. Website: http://www.eea.europa.eu/publications/protected-areas-in-europe-2012, checked on 13/12/12.

European Commission (2013): Environment LIFE Program – Database. Website: http://ec.europa.eu/environment/life/project/Projects/, checked on 13/12/12.

Ramsar (2012): Classification System for Wetland Type. URL: http://www.ramsar.org/cda/en/ramsar-documents-guidelines-classificationsystem/main/ramsar/1-31-105%5E21235_4000_0__, checked on 13/12/19.

REFORM (2012): REFORM wiki – Case studies. Website: http://wiki.reformrivers.eu/index.php/Category:Case_studies, checked on 13/12/12.

RESTORE (2013): RESTORE wiki – Case studies. Website: http://riverwiki.restorerivers.eu/wiki/index.php?title=Main_Page, checked on 13/12/12.

6. ANNEX

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Freshwater Ecoregions - Alpine Arc

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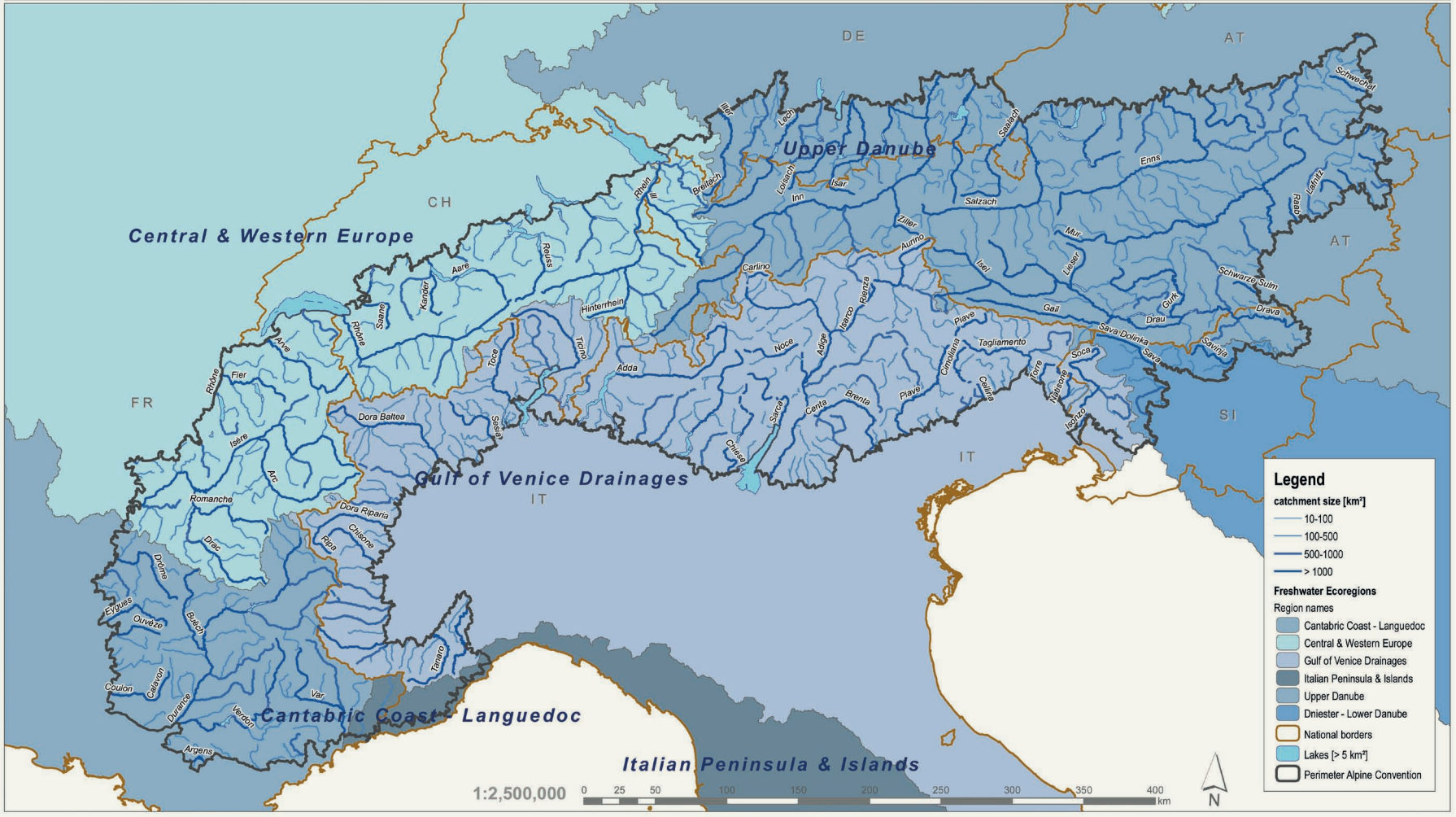
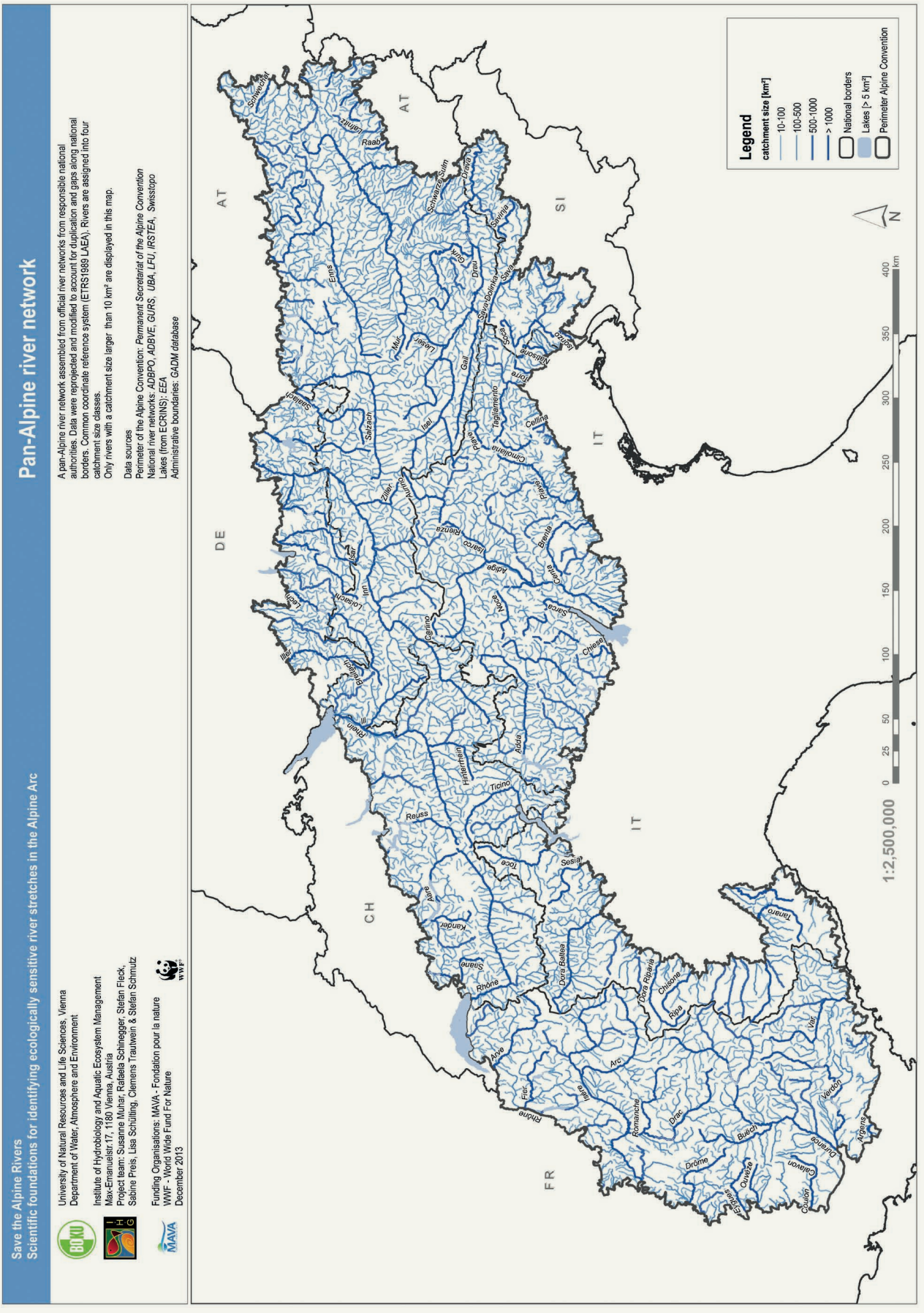
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

A pan-Alpine river network assembled from official river networks from responsible national authorities. Only rivers with a catchment size larger than 100 km² are displayed in this map.
A freshwater ecoregion is defined as a large area encompassing one or more freshwater systems that contains a distinct assemblage of natural freshwater communities and species.

Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo*
Freshwater Ecoregions: *Copyright 2008 by The Nature Conservancy and World Wildlife Fund, Inc*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Pan-Alpine river network
A pan-Alpine river network assembled from official river networks from responsible national authorities. Data were reprojected and modified to account for duplication and gaps along national borders. Common coordinate reference system (ETRS1989 LAEA). Rivers are assigned into four catchment size classes.
Only rivers with a catchment size larger than 10 km² are displayed in this map.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
University of Natural Resources and Life Sciences, Vienna
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Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Legend
catchment size [km²]
10-100
100-500
500-1000
> 1000
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
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FR
SI

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Pan-Alpine river network

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Only rivers with a catchment size larger than 100 km² are displayed in this map.

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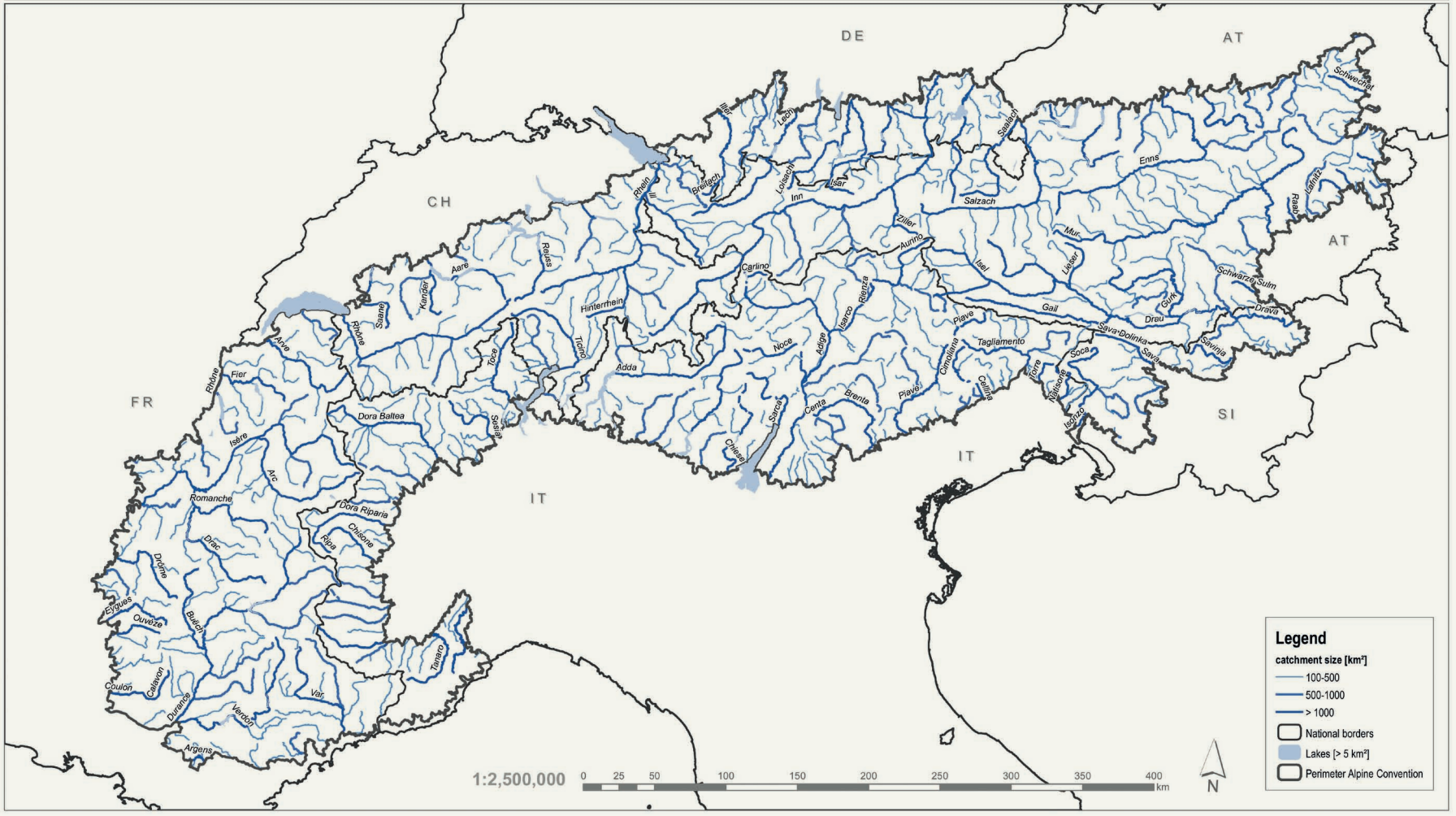
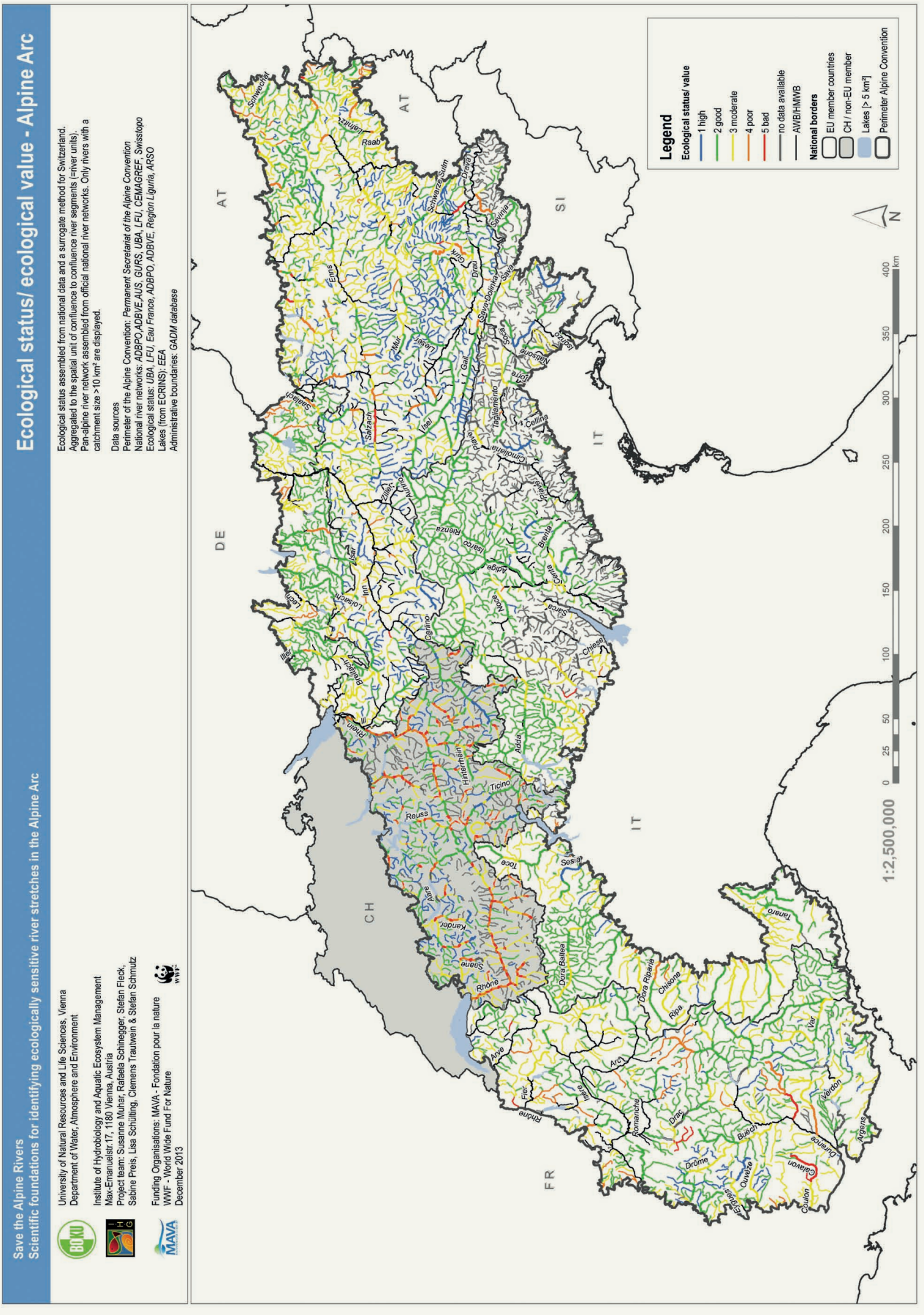
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Ecological status/ ecological value - Alpine Arc
University of Natural Resources and Life Sciences, Vienna
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Institute of Hydrobiology and Aquatic Ecosystem Management
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Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Ecological status assembled from national data and a surrogate method for Switzerland.
Aggregated to the spatial unit of confluence to confluence river segments (=river units).
Pan-alpine river network assembled from official national river networks. Only rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO,ADBVE,AUS, GURS, UBA, LFU, CEMAGREF, Swisstopo
Ecological status: UBA, LFU, Eau France, ADBPO, ADBVE, Region Liguria, ARSO
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
Legend
Ecological status/ value
1 high
2 good
3 moderate
4 poor
5 bad
no data available
AWB/HMWB
National borders
EU member countries
CH / non-EU member
Lakes [> 5 km²]
Perimeter Alpine Convention
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Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Ecological status/ ecological value - Alpine Arc

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Funding Organisations: MAVA - Fondation pour la nature
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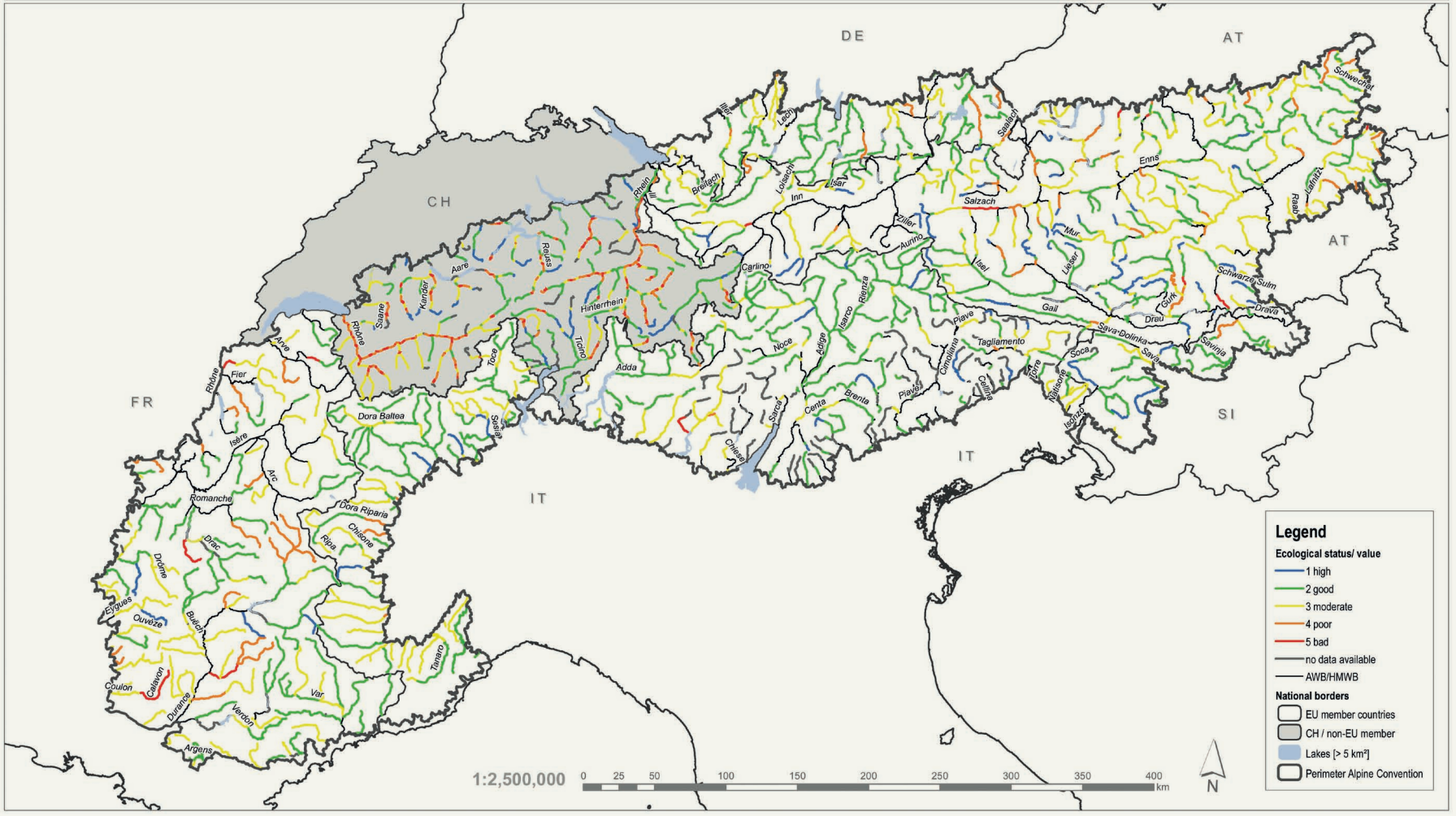
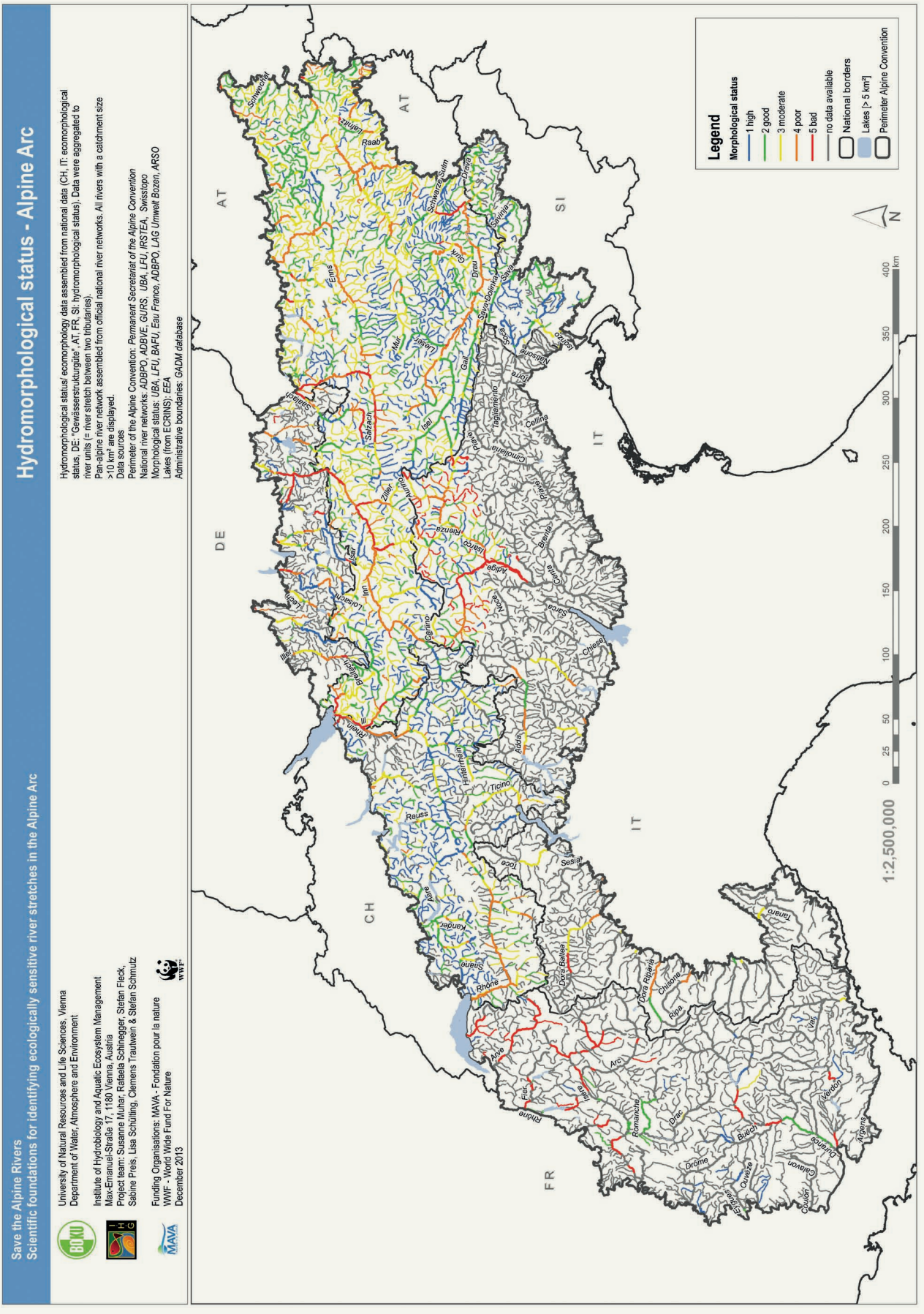
December 2013

Ecological status assembled from national data and a surrogate method for Switzerland. Data were aggregated to river units (= river stretch between two tributaries).
Pan-Alpine river network assembled from official national river networks. Only rivers with a catchment size >100 km² are displayed.

Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO,ADBVE,AUS, GURS, UBA, LFU, CEMAGREF, Swisstopo*
Ecological status: *UBA, LFU, Eau France, ADBPO, ADBVE, Region Liguria, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Hydromorphological status - Alpine Arc
University of Natural Resources and Life Sciences, Vienna
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Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Hydromorphological status/ ecomorphology data assembled from national data (CH, IT: ecomorphological status, DE: 'Gewässerstrukturgüte', AT, FR, SI: hydromorphological status). Data were aggregated to river units (= river stretch between two tributaries).
Pan-alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Morphological status: UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
Legend
Morphological status
1 high
2 good
3 moderate
4 poor
5 bad
no data available
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
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Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Hydromorphological status - Alpine Arc

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Hydromorphological status/ ecomorphology data assembled from national data (CH, IT: ecomorphological status, DE: "Gewässerstrukturgüte", AT, FR, SI: hydromorphological status). Data were aggregated to river units (= river stretch between two tributaries).
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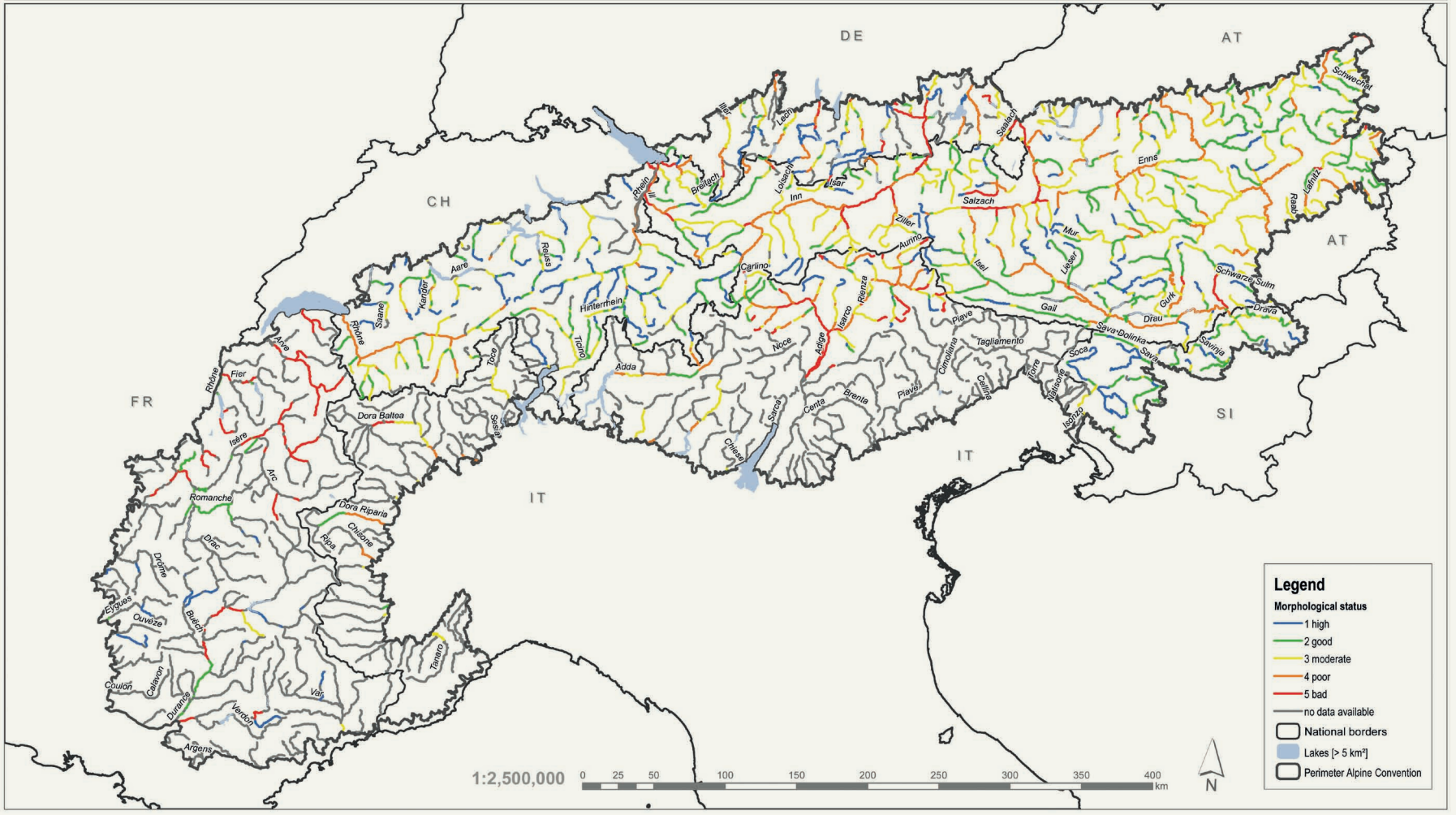
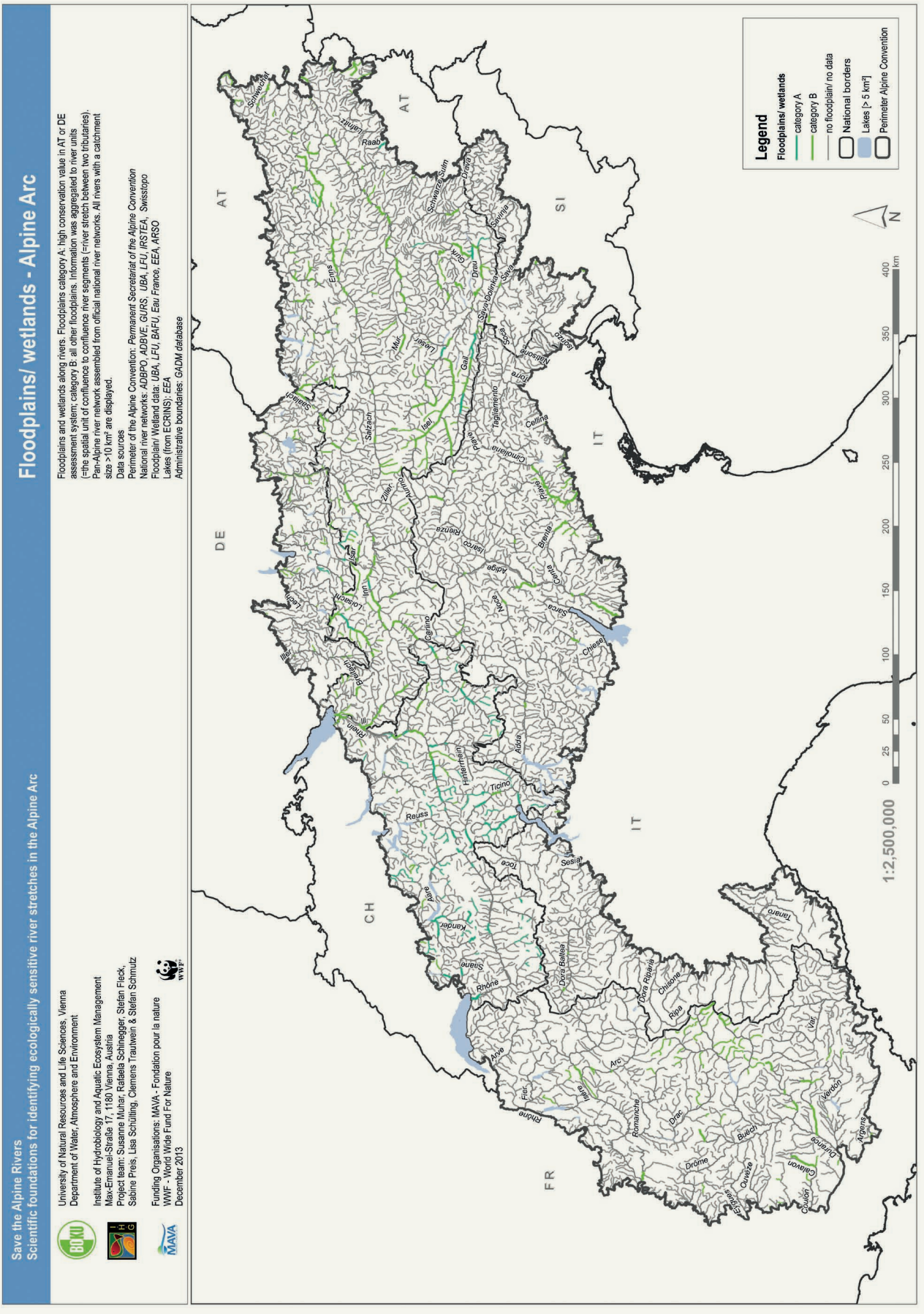
Morphological status: *UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Floodplains/ wetlands - Alpine Arc
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Funding Organisations: MAVA - Fondation pour la nature
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December 2013
Floodplains and wetlands along rivers. Floodplains category A: high conservation value in AT or DE assessment system; category B: all other floodplains. Information was aggregated to river units (=the spatial unit of confluence to confluence river segments (=river stretch between two tributaries). Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Floodplain/ Wetland data: UBA, LFU, BAFU, Eau France, EEA, ARSO
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
Legend
Floodplains/ wetlands
category A
category B
no floodplain/ no data
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
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Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Floodplains/ wetlands - Alpine Arc

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Funding Organisations: MAVA - Fondation pour la nature
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December 2013

Floodplains and wetlands along rivers. Floodplains category A: high conservation value in AT or DE assessment system; category B: all other floodplains. Information was aggregated to river units (=the spatial unit of confluence to confluence river segments (=river stretch between two tributaries). Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >100 km² are displayed.
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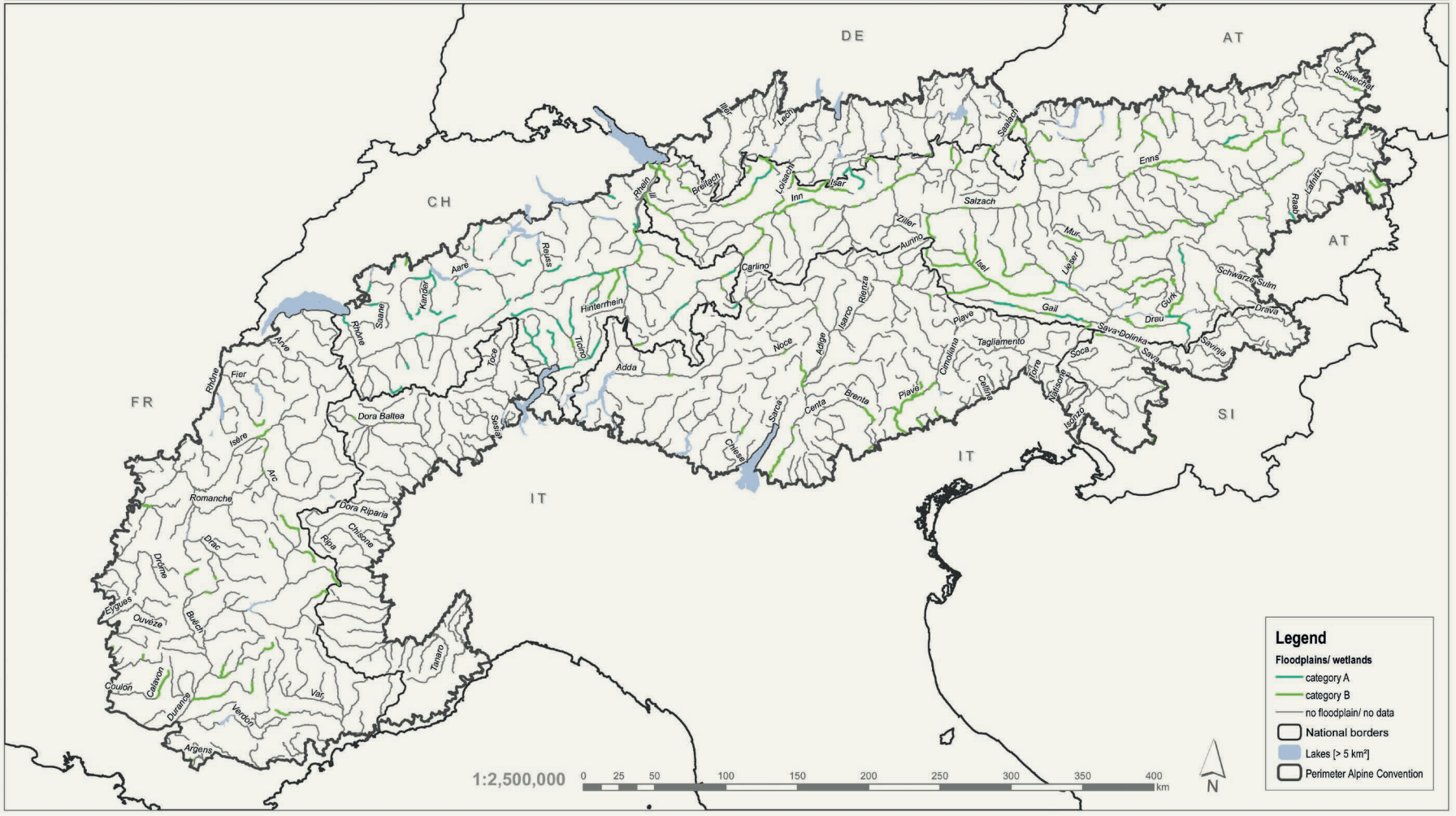
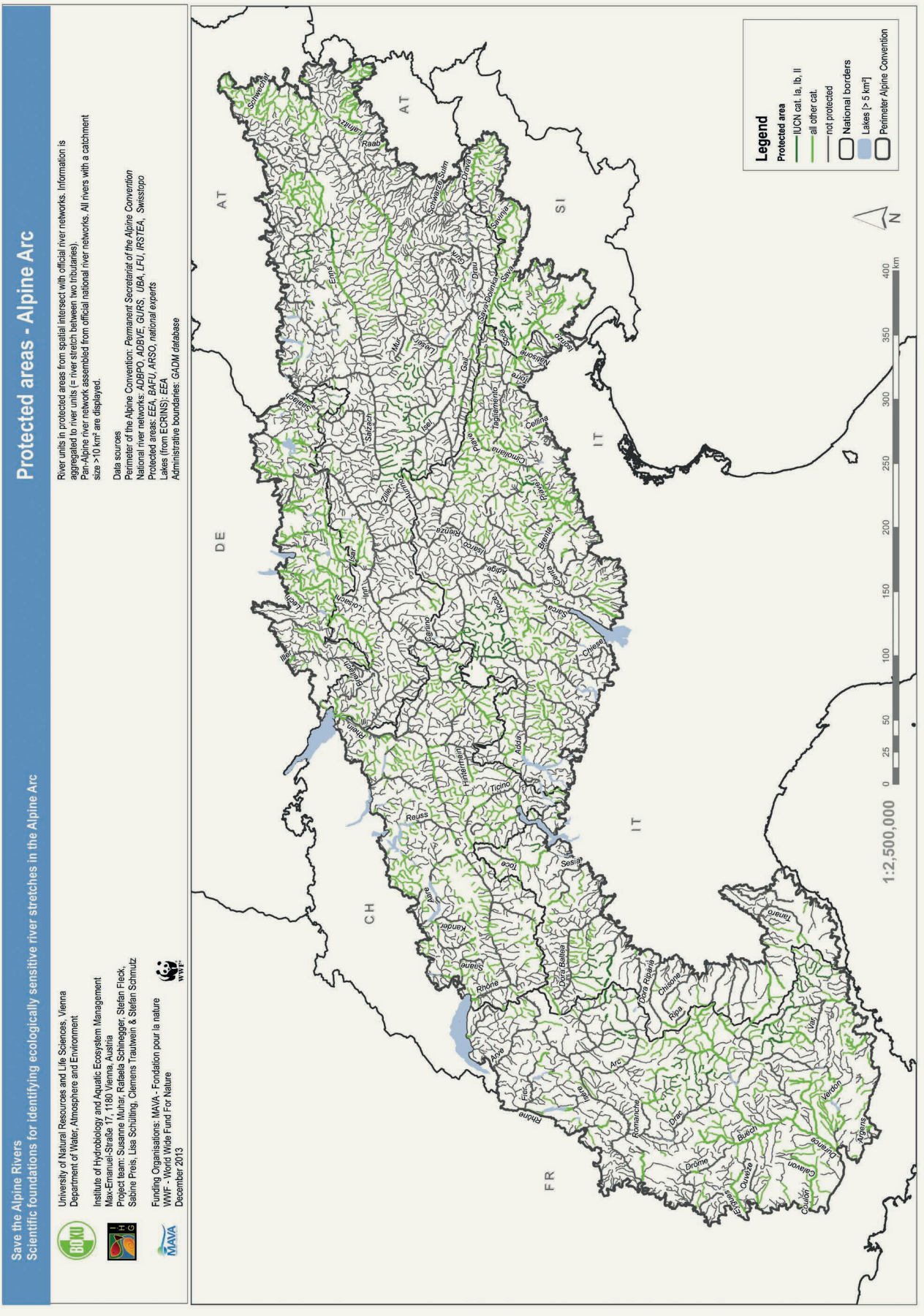
Floodplain/ Wetland data: *UBA, LFU, BAFU, Eau France, EEA, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Protected areas - Alpine Arc
River units in protected areas from spatial intersect with official river networks. Information is aggregated to river units (= river stretch between two tributaries).
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Protected areas: EEA, BAFU, ARSO, national experts
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Legend
Protected area
IUCN cat. Ia, Ib, II
all other cat.
not protected
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N
DE
AT
CH
IT
FR
SI

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Protected areas - Alpine Arc

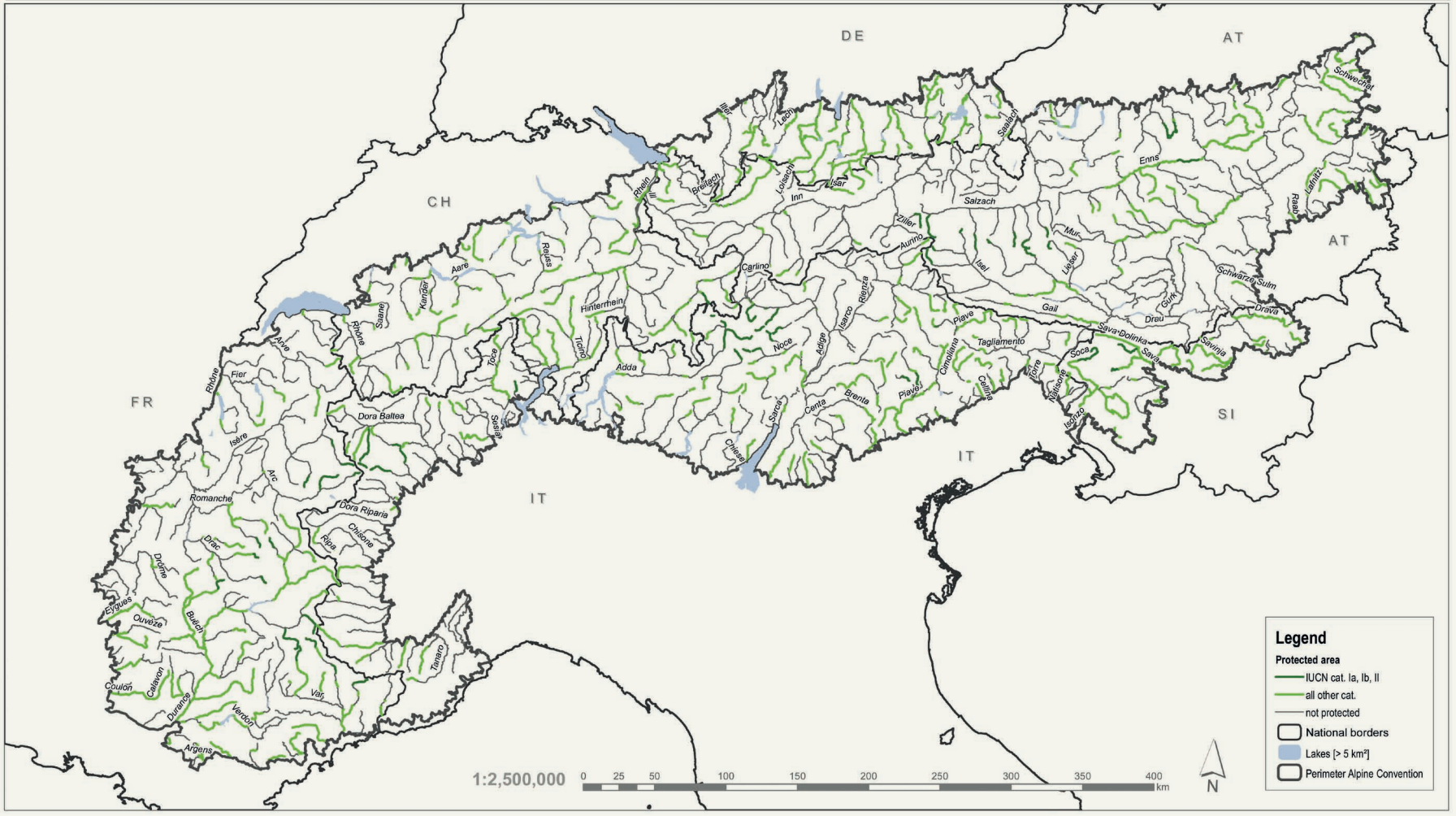
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

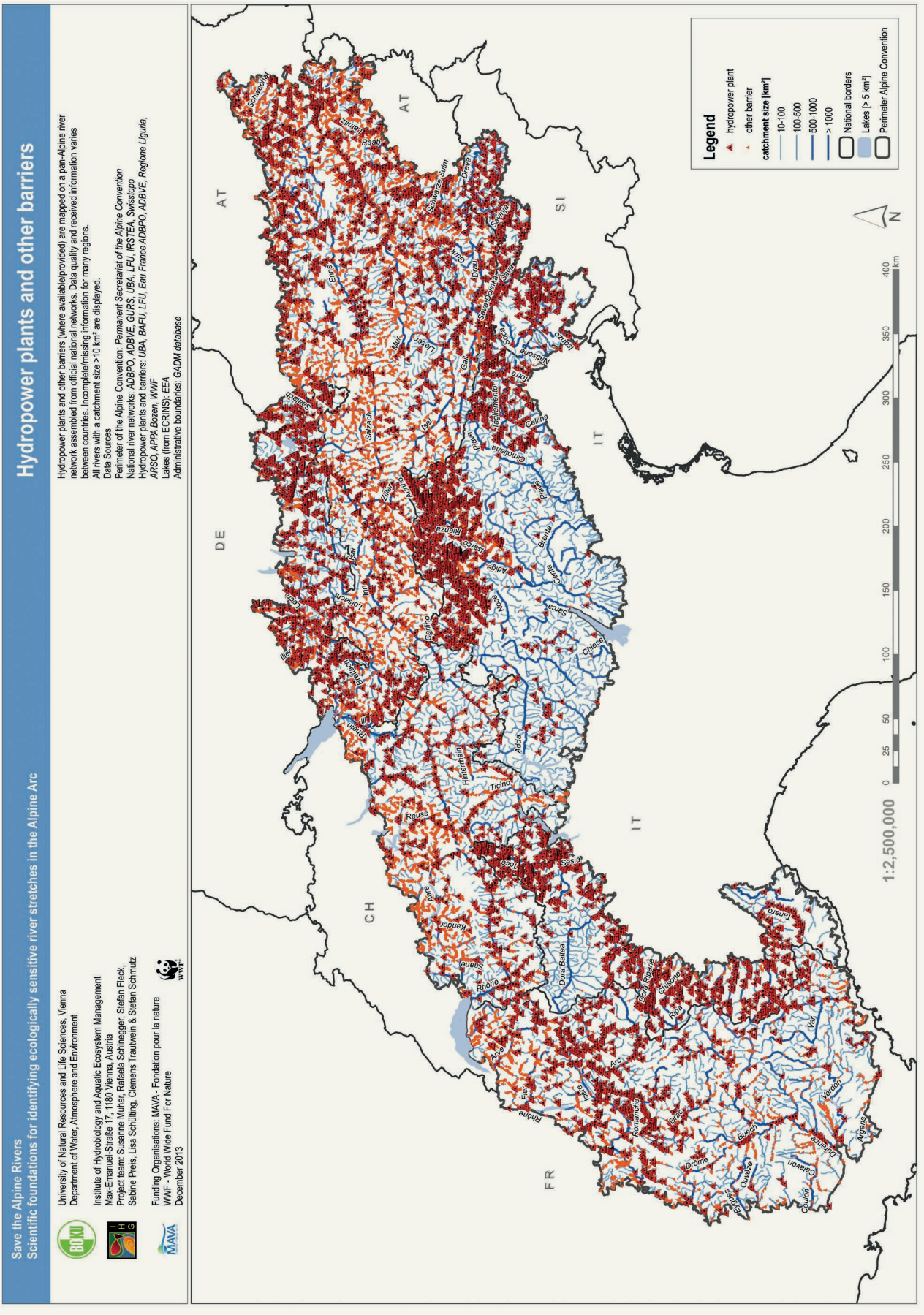
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz

Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

River units in protected areas from spatial intersect with official river networks. Information is aggregated to river units (= river stretch between two tributaries).
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >100 km² are displayed.

Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo*
Protected areas: *EEA, BAFU, ARSO, national experts*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Hydropower plants and other barriers
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Hydropower plants and other barriers (where available/provided) are mapped on a pan-Alpine river network assembled from official national networks. Data quality and received information varies between countries. Incomplete/missing information for many regions.
All rivers with a catchment size >10 km² are displayed.
Data Sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Hydropower plants and barriers: UBA, BAFU, LFU, Eau France ADBPO, ADBVE, Regione Liguria, ARSO, APPA Bozen, WWF
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
Legend
hydropower plant
other barrier
catchment size [km²]
10-100
100-500
500-1000
> 1000
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N
DE
AT
CH
IT
FR
SI

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

Hydrological pressures - Alpine Arc

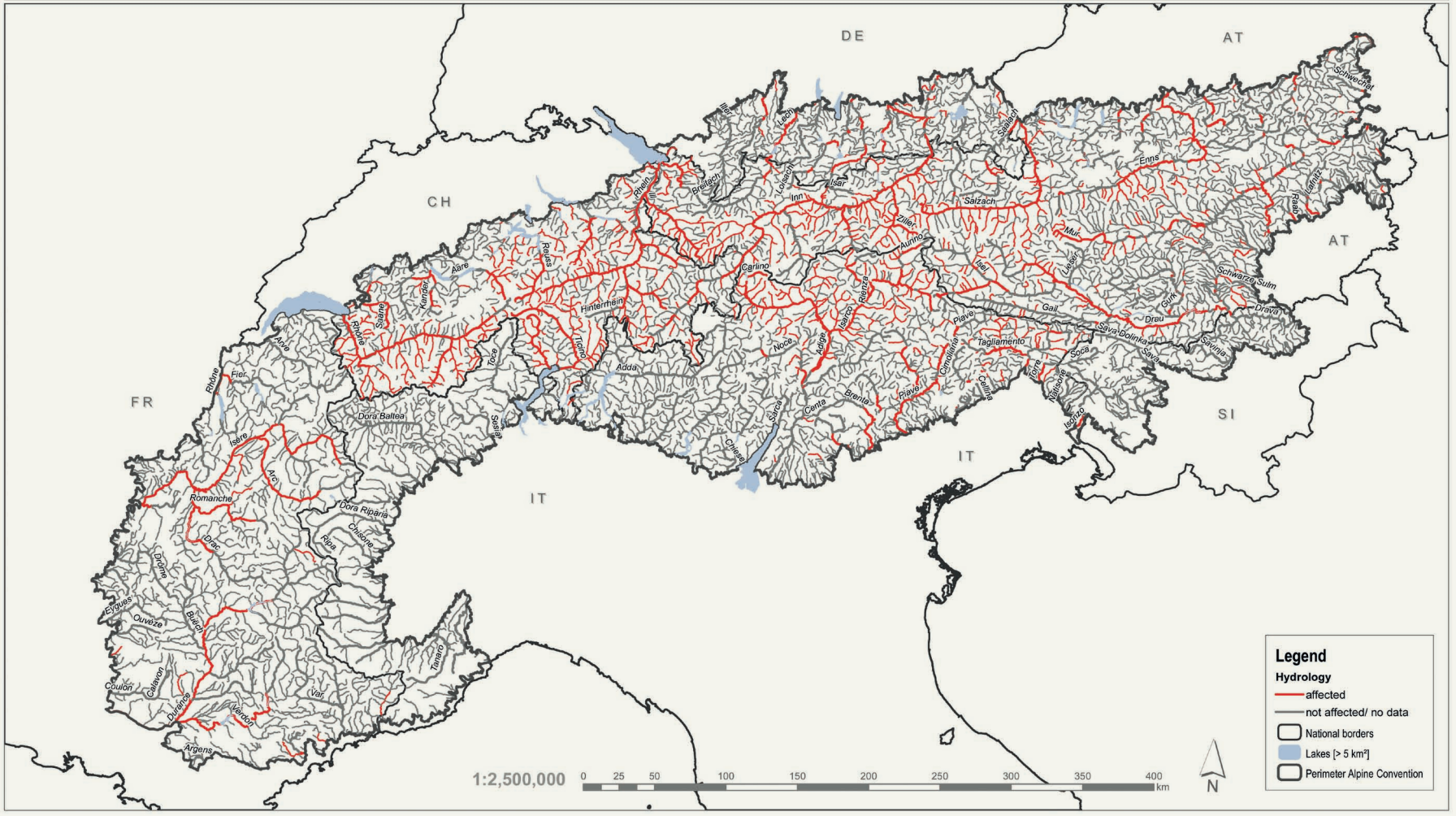
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

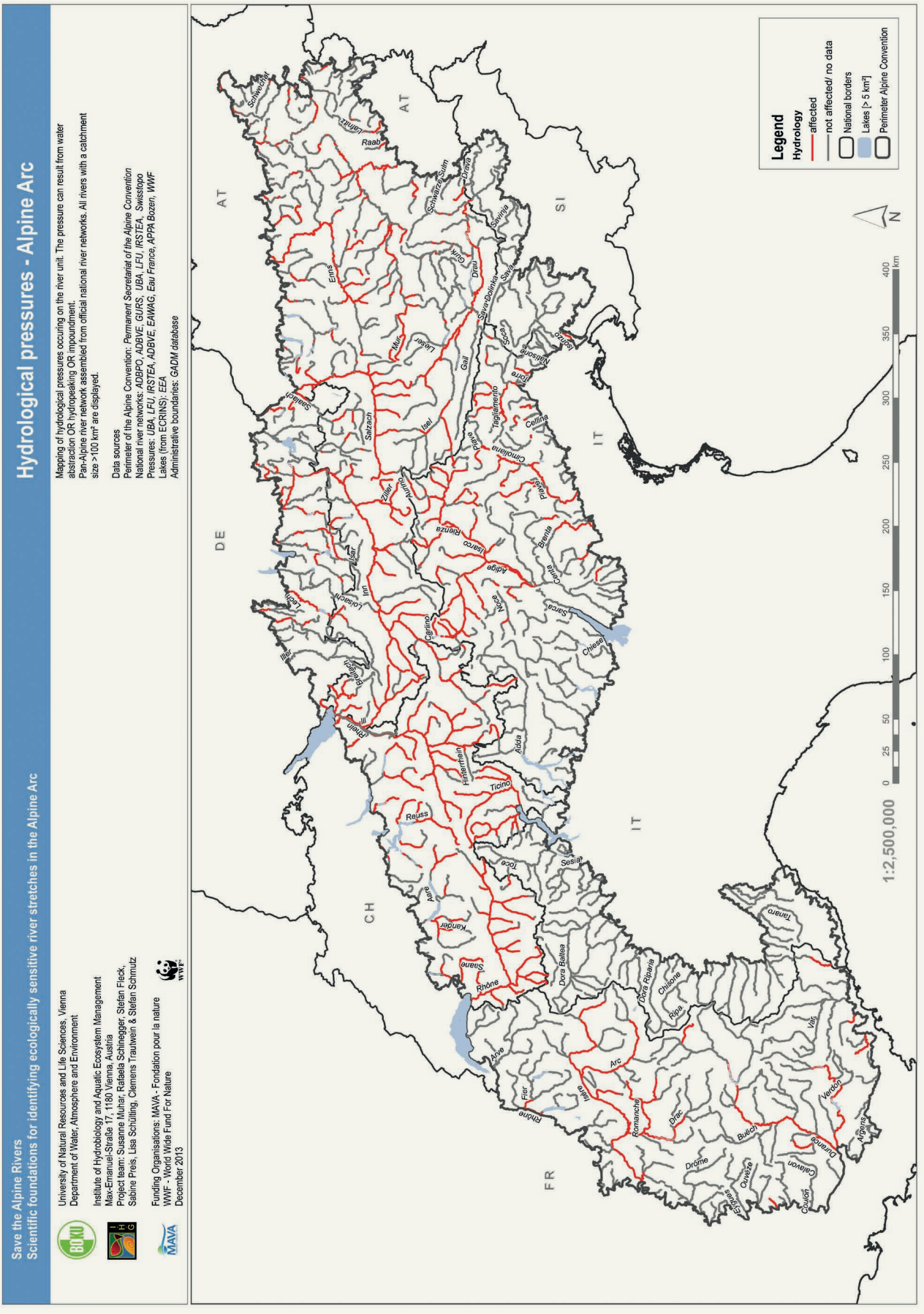
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz

Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

Mapping of hydrological pressures occuring on the river unit. The pressure can result from water abstraction OR hydropeaking OR impoundment.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.

Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo*
Pressures: *UBA, LFU, IRSTEA, ADBVE, EAWAG, Eau France, APPA Bozen, WWF*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Hydrological pressures - Alpine Arc
Mapping of hydrological pressures occuring on the river unit. The pressure can result from water abstraction OR hydropeaking OR impoundment.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >100 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Pressures: UBA, LFU, IRSTEA, ADBVE, EAWAG, Eau France, APPA Bozen, WWF
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Legend
Hydrology
affected
not affected/ no data
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N
AT
DE
CH
FR
IT
SI
Schwechat
Lafnitz
Raab
Schwarza
Sulm
Drava
Enns
Gurk
Drau
Savinja
Sava Dolinka
Sava
Mur
Lesach
Gail
Isonzo
Soca
Natisone
Torre
Salzach
Isel
Tagliamento
Cellina
Piave
Chiese
Zillertal Inn
Ziller
Rienza
Brenta
Adige
Isarco
Noce
Sarca
Lech
Inn
Bellinzona
Ticino
Adda
Hinterrhein
Reuss
Toce
Sesia
Aare
Kander
Saane
Rhône
Dora Baltea
Dora Riparia
Chisone
Ripa
Arve
Arc
Isère
Fier
Romanche
Drac
Buëch
Drôme
Ouvèze
Verdon
Durance
Argens
Calavon
Coulon
Tanaro
Vara

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

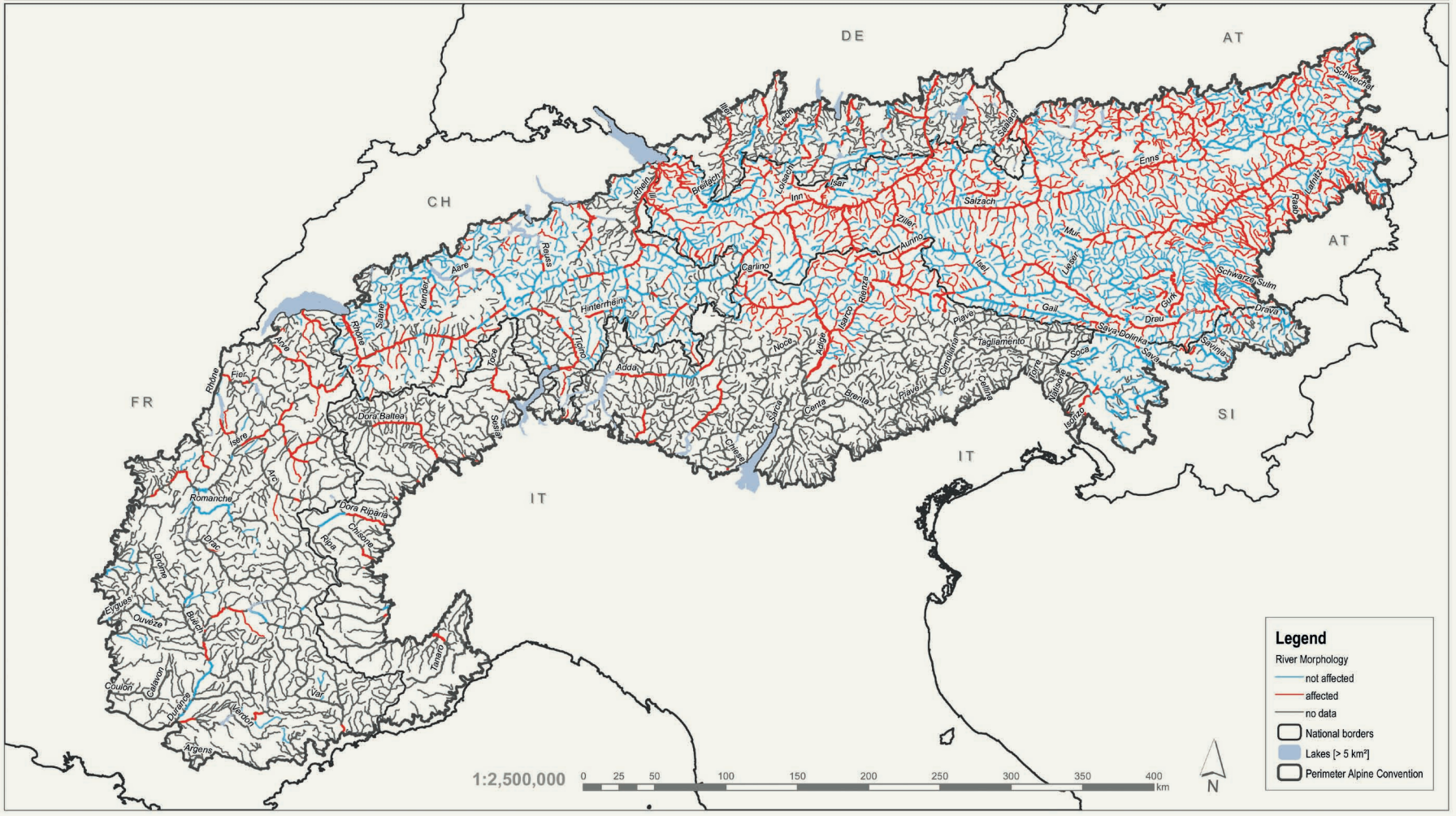
Morphological pressures - Alpine Arc

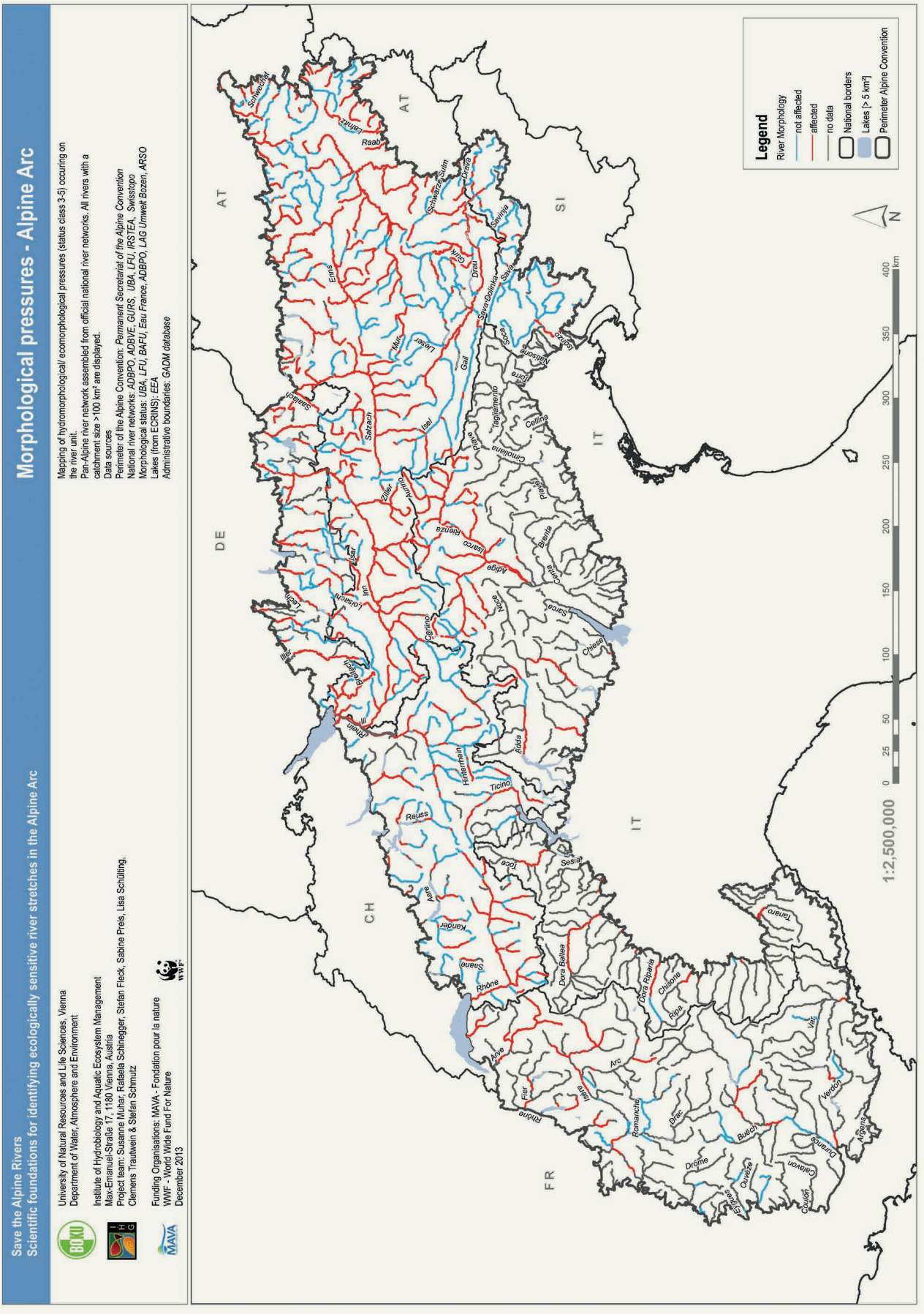
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz

Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

Mapping of hydromorphological/ ecomorphological pressures (status class 3-5) occuring on the river unit.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo*
Morphological status: *UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Morphological pressures - Alpine Arc
Mapping of hydromorphological/ ecomorphological pressures (status class 3-5) occuring on the river unit.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >100 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GUIRS, UBA, LFU, IRSTEA, Swisstopo
Morphological status: UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Legend
River Morphology
not affected
affected
no data
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N
AT
DE
CH
FR
IT
SI
Schwechat
Lafnitz
Raab
Enns
Schwarza
Salzach
Isel
Mur
Drau
Gail
Save
Sava Dolinka
Sava
Savinja
Inn
Ill
Reuss
Aare
Rhône
Saane
Kander
Hinterrhein
Ticino
Toce
Sesia
Adda
Oglio
Chiese
Mincio
Adige
Brenta
Piave
Tagliamento
Livenza
Meduna
Cellina
Cormor
Natisone
Torre
Isonzo
Soca
Idrija
Ljubljanica
Krka
Kolpa
Dora Baltea
Dora Riparia
Chisone
Pellice
Po
Varaita
Maira
Stura
Tanaro
Orba
Scrivia
Arve
Fier
Isère
Arc
Romanche
Drac
Bourne
Vercors
Drôme
Ouvèze
Eygues
Buëch
Durance
Calavon
Coulon
Argens

Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc

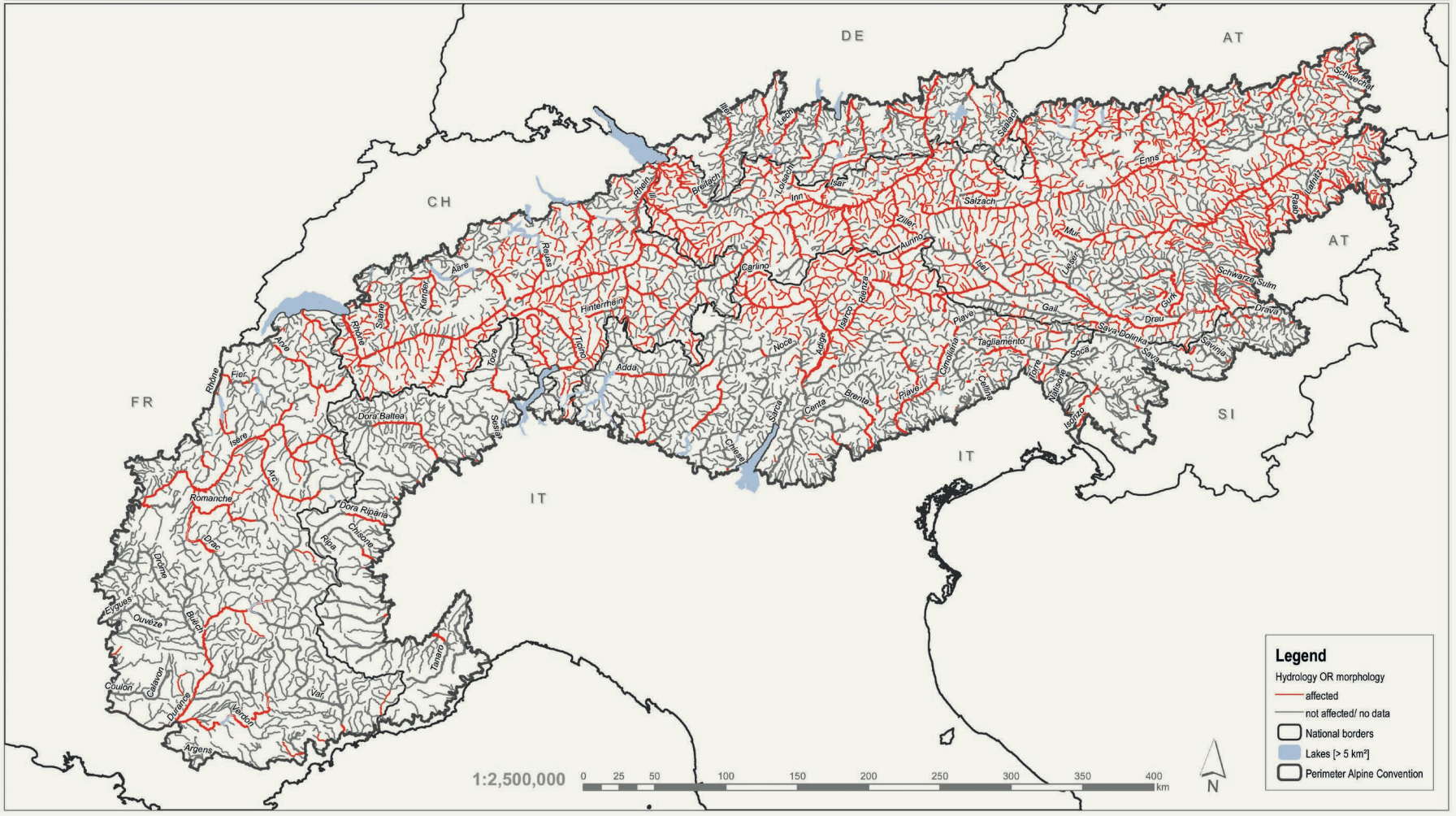
Combined pressures (hydrology or morphology) - Alpine Arc

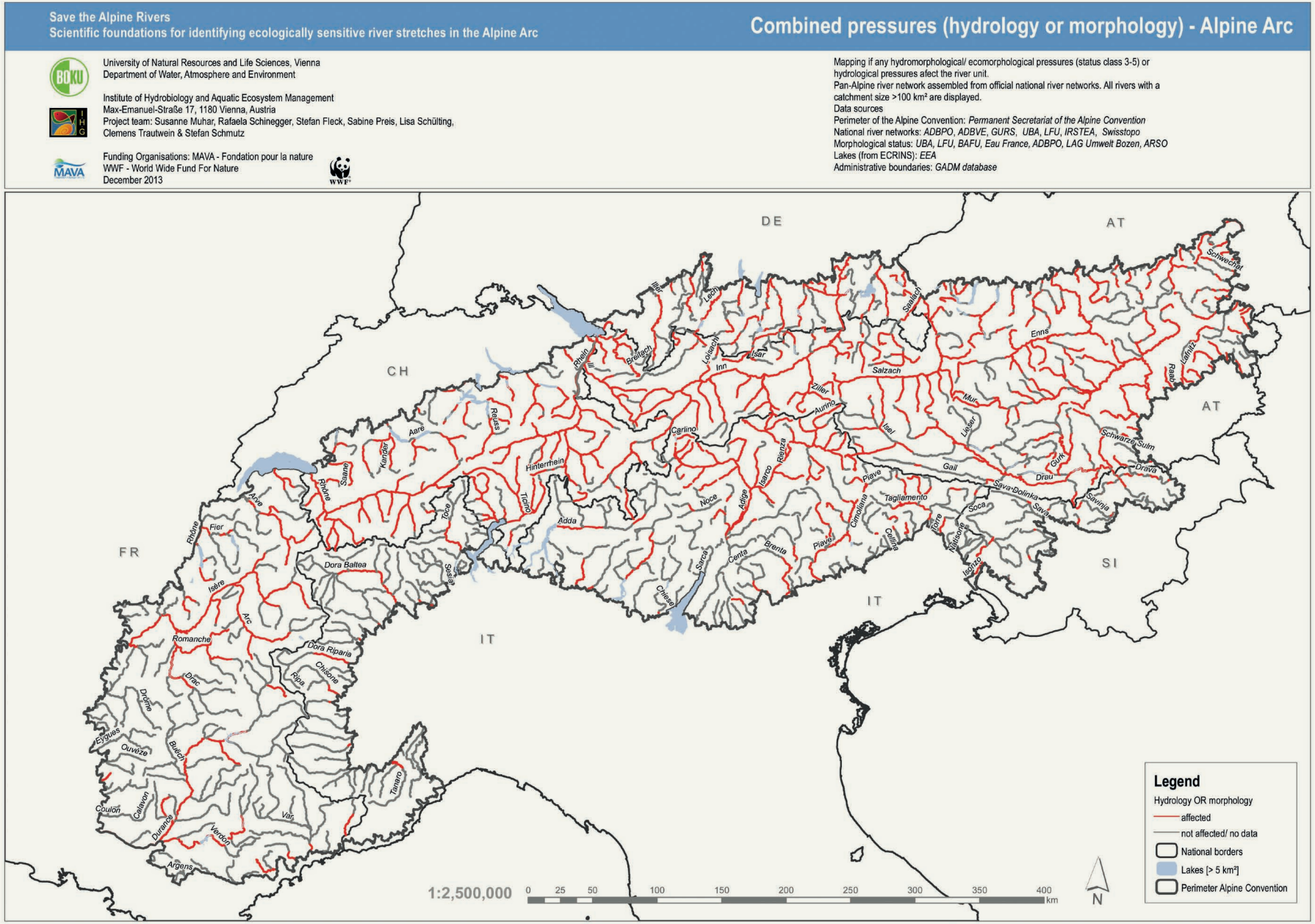
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz

Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013

Mapping if any hydromorphological/ ecomorphological pressures (status class 3-5) or hydrological pressures afect the river unit.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >10 km² are displayed.
Data sources
Perimeter of the Alpine Convention: *Permanent Secretariat of the Alpine Convention*
National river networks: *ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo*
Morphological status: *UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO*
Lakes (from ECRINS): *EEA*
Administrative boundaries: *GADM database*




Save the Alpine Rivers
Scientific foundations for identifying ecologically sensitive river stretches in the Alpine Arc
Combined pressures (hydrology or morphology) - Alpine Arc
University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment
Institute of Hydrobiology and Aquatic Ecosystem Management
Max-Emanuel-Straße 17, 1180 Vienna, Austria
Project team: Susanne Muhar, Rafaela Schinegger, Stefan Fleck, Sabine Preis, Lisa Schülting, Clemens Trautwein & Stefan Schmutz
Funding Organisations: MAVA - Fondation pour la nature
WWF - World Wide Fund For Nature
December 2013
Mapping if any hydromorphological/ ecomorphological pressures (status class 3-5) or hydrological pressures afect the river unit.
Pan-Alpine river network assembled from official national river networks. All rivers with a catchment size >100 km² are displayed.
Data sources
Perimeter of the Alpine Convention: Permanent Secretariat of the Alpine Convention
National river networks: ADBPO, ADBVE, GURS, UBA, LFU, IRSTEA, Swisstopo
Morphological status: UBA, LFU, BAFU, Eau France, ADBPO, LAG Umwelt Bozen, ARSO
Lakes (from ECRINS): EEA
Administrative boundaries: GADM database
DE
AT
CH
FR
IT
SI
Legend
Hydrology OR morphology
affected
not affected/ no data
National borders
Lakes [> 5 km²]
Perimeter Alpine Convention
1:2,500,000
0 25 50 100 150 200 250 300 350 400 km
N

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+ 100

WWF is in over 100 countries, on 5 continents

1961

WWF was founded in 1961

+ 5 M

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony and nature.

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