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Sava TIES

OIKON

Risk assessment study for key invasive species in the Sava River Basin in Slovenia, Croatia, Bosnia and Herzegovina and Serbia

Zagreb, April 2020.

Project co-funded by European Union funds (ERDF, IPA)

Project name	**Services for the preparation of a risk assessment study for invasive species in the Sava River Basin area, which includes countries Slovenia, Croatia, Bosnia and Herzegovina, Serbia**
Documentation type	Risk assessment study
Client	Public institution „Lonjsko polje Nature Park“
Contract number	1327-19
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1 Introduction

The Contracting Authority - Client (Public Institution "Lonjsko Polje Nature Park") concluded on July 22nd 2019. a contract with the Service Provider (Oikon Ltd.) with the subject public service contract **Services for the preparation of a risk assessment study for invasive species in the Sava River Basin** open tender procedure of small value, procurement number: 12/19, publication number of the invitation to tender in the Electronic Public Procurement Announcement of the Republic of Croatia 2019 / S 0F2-0012482 of 1 April 2019 and pursuant to the Class Selection Decision: 406-01 / 19-01 / 04, REGULATION: 2176-144-05 / 01-19-37 of July 17, 2019.

Project is co-funded by European Union funds (ERDF - European Regional Development Fund, IPA - Instrument for Pre-Accession Assistance).

2 Assignment

The following are the assignments according to the technical specifications:

1.1. Preparation of a risk assessment studie for invasive alien species in the Sava River Basin area, which includes the Republic of Slovenia, Republic of Croatia, Bosnia and Herzegovina, Republic of Serbia:

- False-indigo bush (*Amorpha fruticosa* L.),
- Japanese knotweed (*Reynoutria japonica* Houtt), giant knotweed (*Reynoutria sachalinensis* (F. S. Petrop.) Nakai in T. Mori), bohemian knotweed (*Reynoutria × bohemica* Chrtek et Chrtková esis),
- Canadian goldenrod (*Solidago canadensis* L.), giant goldenrod (*Solidago gigantea* Aiton).

1.2. Risk assessment audit for all invasive species listed by two independent experts.

2.1. Preparation of a risk assessment study for invasive alien species in the territory of the Republic of Croatia:

- False-indigo bush (*Amorpha fruticosa* L.),
- Japanese knotweed (*Reynoutria japonica* Houtt), giant knotweed (*Reynoutria sachalinensis* (F. S. Petrop.) Nakai in T. Mori), bohemian knotweed (*Reynoutria x bohemica* Chrtek et Chrtková esis),
- Canadian goldenrod (*Solidago canadensis* L.), giant goldenrod (*Solidago gigantea* Aiton).

2.2. Risk assessment audit for all invasive species listed by two independent experts.

The objective of the risk assessment is to define alien invasive species for a regional and / or Union black / white list or an alien invasive species list requiring enhanced regional cooperation.

The service includes the following activities:

- Collection of existing data (published scientific papers, Habitat Map, project reports, e-mail correspondence);

- Completion of the forms set out in the Annex to Commission Delegated Regulation (EU) 2018/968 of 30 April 2018 supplementing Regulation (EU) No 1095/2010 1143/2014 Questionnaire Regulations;

- Revision of the risk assessment study for all of the invasive sites listed by two independent experts.

The design methodology shall be in accordance with Article 2 and Annex (Detailed description of common elements) of Commission Delegated Regulation (EU) 2018/968 of 30 April 2018 supplementing Regulation (EU) No 1095/2010, 1143/2014 of the European Parliament and of the Council with regard to risk assessments in relation to invasive alien species.

The study should be delivered in Croatian and English.

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3 Invasive alien species

According to Nikolić et al. (2014), invasive alien species (IAS) are naturalized species that have a high rate and extent of propagation and a marked breeding capacity due to the successful production of large numbers of seeds at significant distances from parent plants. These are species that have a pronounced potential of spread to large areas outside their natural range. The species introduced, in order to adversely affect and threaten biodiversity, human health or create economic damage, must overcome certain barriers, and depending on how many barriers they overcome, the intensity of its impact will be lower or higher.

Each introduced species will not necessarily become invasive, nor will any population of the invasive alien species exhibit an invasive character. There are a number of factors that affect the success of establishing and expanding a population, such as: death of individuals, inability to create seeds, inadequate habitat or climatic conditions, presence of natural enemies, etc. (Blackburn et al. 2011).

According to European Union data (EU Regulation No 1143/2014, of 22 October 2014), approximately 12000 alien species are currently present in the environment in Europe, with an estimated 10 to 15% being invasive.

Invasive alien species potentially have numerous negative impacts on native species and ecosystems, since they cause changes in habitat structure and quality, and by competitiveness, disease transmission and hybridization, are displacing native species from their natural range. With the development of global trade, transport, tourism and climate change, the risk of the uncontrolled spread of invasive alien species is expected to increase, which requires timely response.

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4 Risk assessment

It is recommended to use the Weed Risk Assessment Form (WRA) to perform a good risk assessment of the introduction, settlement and spread of alien invasive species.

Risk assessment is the process of identifying the possible risks of introducing and spreading invasive alien species and determining mitigation measures to prevent or at least reduce these risks. The primary purpose of risk assessment is to identify species for which there is a high likelihood of showing an invasive character in a particular area outside their natural range (Roy et al. 2014). The risk assessment shall take into account the risks solely due to the invasive character of the alien species and not the method of introduction (or breeding). Furthermore, only negative impacts are taken into account and the result of the risk assessment is a recommendation and not a final decision. Accordingly, the risk assessment is subject to change if new findings related to a particular invasive alien species occur.

In Europe, there are a number of methods for assessing the risk of different focus, depending on the purpose (quick check or complete assessment) or the taxonomic group under analysis (fish, pathogens, plant species, etc.). However, a unique Europe-wide template is still not available to comprehensively analyze the risk of introduction and spread of alien species (Roy et al. 2014). The only form covering the entire region is the EPPO Priority Process for Invasive Alien Plants, designed by the European and Mediterranean Plant Protection Organization (EPPO). However, the main focus of this form is defining the list of the most invasive alien species and identifying the species for which it is necessary to carry out Pest risk analysis (PRA). Based on this form, EPPO lists of invasive species have been compiled (EPPO 2016a). Furthermore, Krivánek and Pyšek (2006) state that the EPPO PRA form is intended primarily for plant species and insects considered to be pests in agricultural habitats and is not adequate for assessing invasiveness in natural habitats.

4.1 Methodology

Non-native Risk Assessment (NNRA) methodology (Baker et al. 2008; Mumford et al. 2010) was selected for performing the risk assessment in consultation with the Ministry of Environmental Protection and Energy of the Republic of Croatia. The aforementioned methodology is a precise tool for assessing the entry, establishment and spread of invasive alien species in the form of providing an effective basis for decision-making that would bring and / or prevent the entry / further spread of invasive alien species. The methodology answers all the questions set out in the Annex to Commission Delegated Regulation (EU) 2018/968 of 30 April 2018 amending Regulation (EU) No 1095/2010. 1143/2014. The assessment involves completing a NNRA detailed risk assessment template, which includes the following components:

- **EU CHAPTER** – takes into account the current distribution of the species within EU Member States, within biogeographical regions, and a rough assessment of the potential establishment and spread of the species in the territory of EU countries within which the species has not been recorded so far;

- **SECTION A – ORGANISM INFORMATION AND SCREENING** – takes into account the description of the species, its taxonomic affiliation, history, natural and potential range, current risk assessments and known socio-economic benefits of the species in the area of the risk assessment;

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- **SECTION B – DETAILED ASSESSMENT** – take into account the likelihood and descriptions of possible intentional and / or unintentional routes of entry and spread in the risk assessment area, including, where appropriate, products with which the species is normally associated;

- **PROBABILITY OF ESTABLISHMENT** – takes into account the distribution of habitats suitable for the survival, development and reproduction of the species and the assessment of the possible survival of the species by attempting to eradicate it;

- **PROBABILITY OF SPREAD** – takes into account a detailed assessment of the likelihood of natural and anthropogenically conditioned species spread and an assessment of the potential restriction of species spread in the risk assessment area, assessment of the settlement of endangered habitats and protected areas, and a forecast of its likely future distribution in the threatened habitats / protected areas, as well as an assessment of the overall invasive potential of the species in the area of risk assessment;

- **PROBABILITY OF IMPACT** – takes into account the assessment of current and / or potential economic losses and costs of damage caused by the invasion of the species and the costs associated with managing the species in the area of risk assessment, a description of the adverse effects on biodiversity and related ecosystem services, native species as well as human health, safety and economy, including an assessment of possible future impact, taking into account available scientific data;

- **RISK SUMMARY** – includes an overview of input, establishment, spread, and existing and future impacts in the risk assessment area and conclusion of species risk assessment;

- **ADDITIONAL QUESTIONS - CLIMATE CHANGE** – takes into account a detailed assessment of the risks of introduction, settlement and spread in the relevant biogeographic regions in predictable climate change;

- **ADDITIONAL QUESTIONS - RESEARCH** – takes into account existing relevant scientific studies of the species that may advance the development of risk assessment.

If the above components and their answers are included, the assessment is considered reliable.

In addition to the components listed, the form contains a scale for the likelihood of an invasive alien species in the area of risk assessment. The probability values are logarithmic and are rated on a scale of 1 to 5 (Table 7-2). This scaling is based on the Australian and New Zealand Risk Management Standard (AS / NZS 4360 Risk Management) with additional modifications to the content of the description and frequency ranges (according to the UK Non-native Organism Risk Assessment Scheme User Manual, Version 3.3). According to the aforementioned scale, the assessment of the range of impacts of the invasive alien species on individual environmental components (impact on biodiversity, ecosystem, economy, economy and human health) is carried out (Annex 7-4). Also, the risk assessment involves scoring the confidence level of the assessment (Bacher et al. 2017), whereby the confidence level can be rated as low, moderate or high (Annex 7-3). The conduct of the risk assessment shall be based on the most reliable scientific publications and research available, on the basis of which systematic reliable answers and descriptions of the questions within the form provided by the constituents shall be taken, which entail a scientific approach to the taxonomic, biological, ecological characteristics of the invasive alien species and its known negative impact on the species. economy, human health and the ecosystem as a whole.

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Objectivity in risk assessment is ensured by the quality control of the content of the assessment and its review by two independent evaluators / experts. This audit ensures the strict quality and reliability of the risk assessment.

The structure of the risk assessment, as part of the project in question, is in line with Article 5 (1) (a) to (h) of the Annex to Commission Delegated Regulation (EU) 2018/968 supplementing Regulation (EU) No 1095/2010. 1143/2014 of the European Parliament and of the Council. The NNRA methodology identifies common components that need to be considered in the risk assessment of an invasive alien species project.

An NNRA methodology template was completed for each key species from the project, and the forms were submitted separately as appendices (Appendix 1 - *Amorpha fruticosa*, Appendix 2 - *Reynoutria japonica*, Appendix 3 - *Reynoutria sachalinensis*, Appendix 4 - *Reynoutria* x *bohemica*, Appendix 5 - *Solidago canadensis*, Appendix 6 - *Solidago gigantea*).

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5 Risk assessment area

Risk assessment area covers the entire Sava River Basin area (includes countries Republic of Slovenia, Republic of Croatia, Bosnia and Herzegovina, Republic of Serbia).

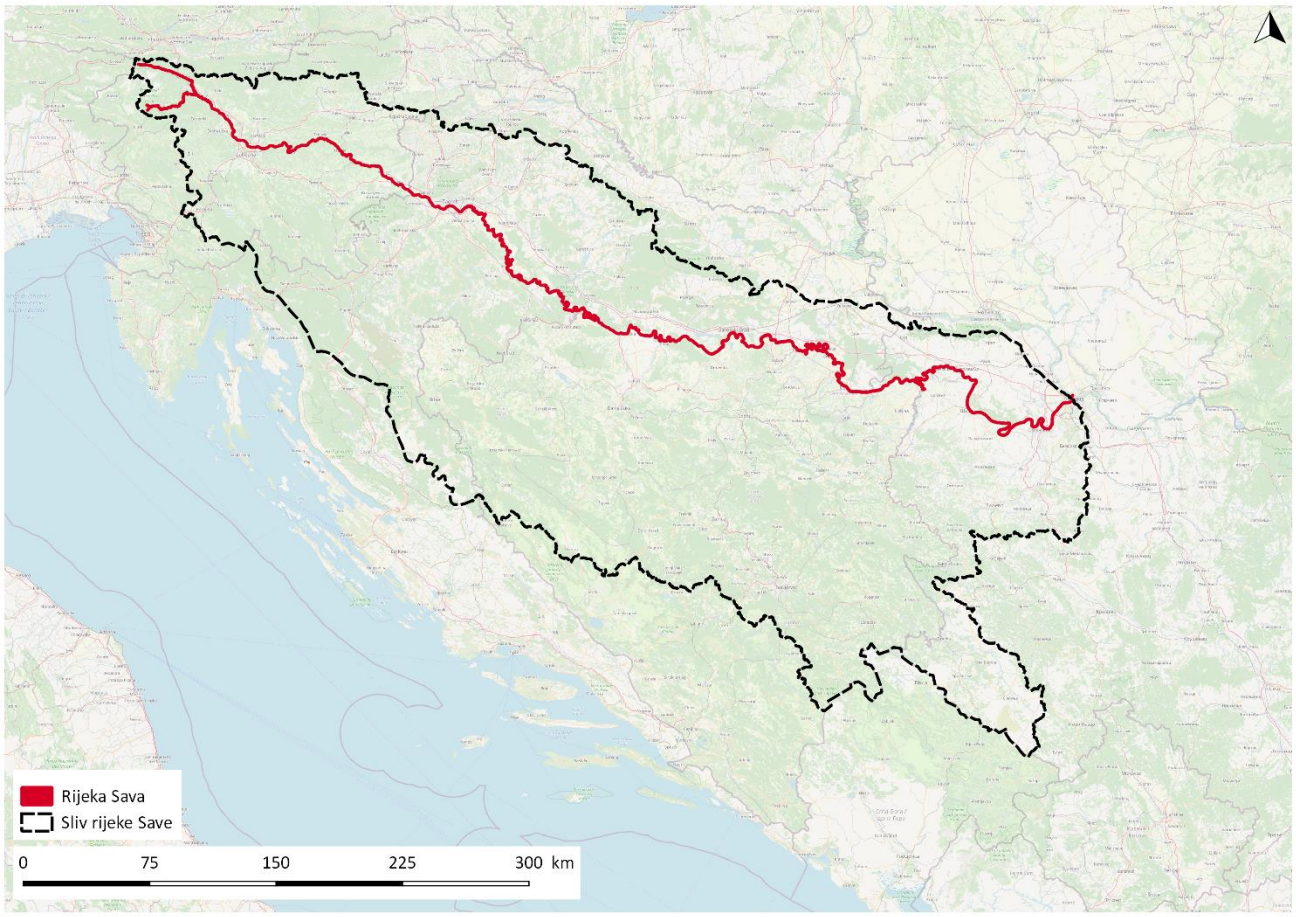

Figure 5-1 Sava River Basin Area in Slovenia, Croatia, Bosnia and Herzegovina and Slovenia (Source: Sava GIS Geoportal)

5.1 Climate

The Sava River Basin is characterized by a temperate climate with a clear difference between the cold and warm parts of the year. There are two general types of climate conditions in the Sava River Basin area:

- Alpine or mountain climate, which prevails in the upper part of the Sava River Basin in Slovenia and in the Dinaric Alps,
- temperate continental climate, which prevails at lower elevations of the basin.

The average annual air temperature for the whole area is about 9.5 ° C. Winter temperatures are low (average January temperature is -1.5 ° C) and summer temperatures are high (average for all three summer months is 20 ° C). According to the Köppen climate classification, the following climate types are identified in the risk assessment area:

- Slovenia - Cf (in the Sva River Basin area),

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- Croatia - Cf (in the Sva River Basin area),

- Bosnia and Herzegovina – Cf (in the Sva River Basin area),

- Serbia – Cf i Df (in the Sva River Basin area).

For the Sava River Basin area 2 climate scenarios have been created - RPC4.5 and RPC8.5. According to the climate scenario RPC4.5 (milder version), in the period 2011-2041, the average annual air temperature is expected to change from 1.2 -1.4 ° C, and in the period 2041-2070 from 1.9 to 2.0 ° C . Similar changes are expected for the mean annual minimum and maximum air temperatures. The RCP8.5 scenario gives much larger changes than the RCP4.5, at least 1.4 ° C in 2011-2041, while the situation is much more serious in the period 2041-2070, expected to increase up to 2.6 ° C. The same applies to minimum and maximum temperatures. In absolute terms, according to climate models, in the next 70 years there will be more and more summer days where the maximum daily temperature will exceed 40 ° C.

Precipitation changes in both scenarios will be insignificant, mostly with a positive sign. Changes in mean annual maximum wind speed will also be negligible, also with a positive sign. The increase in temperature also reduces the amount of snowfall and its retention on the ground. In both scenarios and in both observed periods, the snow equivalent of water is expected to be reduced by 5-7 mm, which, converted to inches of snow, is approximately 8-10 cm. The biggest changes are expected in the so-called extreme phenomena directly related to temperature. The number of ice days will decrease, by an average of 3 to 4 in 2011-2040 and 4-7 in the coming period, depending on the model. What is worrying is the increase in the number of hot days, by RPC4.5 by 10, and by RCP8.5 by 12-14 in the first 30 and by 16 and 20 respectively in the other 30 years. Similar changes are expected for the number of days with warm nights. With regard to extreme events, the smallest changes are expected in the number of rainy periods, which will be reduced by two, and the dry periods, whose number will change only slightly, but with a positive sign.

5.2 Flood regime in Sava River Basin

The Sava River Basin, as the main basin in Southeastern Europe, covers an area of approximately 97700 km2 and occupies 12% of the Danube basin. There are numerous, important tributaries on the main course of the Sava River, of which the right tributaries in the middle and lower reaches of the Sava have a pronounced torrential character and the river beds deeply cut into solid rocks. The left tributaries of the middle and lower reaches are drained by the plains and lowlands, which make the slopes and flow velocities smaller and the watercourses meander.

The regime of floods in the Sava River Basin is mainly influenced by the terrain and the shape of the basin, geographical and seasonal distribution of precipitation, groundwater levels, water spills into natural inundations and the functioning of the flood protection system.

Looking at the configuration of the terrain, heavy rainfall and snowmelt in the upper parts of the basin (in Slovenia) cause localized floods and have an impact on the downstream portions of the midstream of the Sava River. Major floods with a significant impact on the greater part of the basin occur in the middle and lower reaches of the Sava River, and are caused by runoff caused by heavy rainfall and / or sudden melting of snow. They occur most often in the fall and spring, with autumn large water waves being the result of intense short-lived rains, while the ones in springtime are the result of snow melting. Occasionally, the occurrence of spring flood waves is caused by the same as

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in the autumn, by intense rainfall of short duration. Floods are further compounded by torrential flows that carry large amounts of inorganic and organic material during runoff of the high waters, whose deposition in the trough prevents normal flow and runoff.

The first recorded flood in the Sava River Basin dates from 1550, from the territory of Slovenia. In the following years, the number of floods increased, with major floods, from 1994 to 2004, recorded each year. Based on the available data and the analyzes performed within the framework of the Sava Flood Risk Management Plan, 251 potential floodplains of significance for flood protection in the Sava River Basin have been identified. Therefore, the Sava basin is certainly susceptible to flooding, mainly in lowland areas along the river and at the mouth of larger tributaries, but also in the upper parts of the basin where floods are characterized by torrential character.

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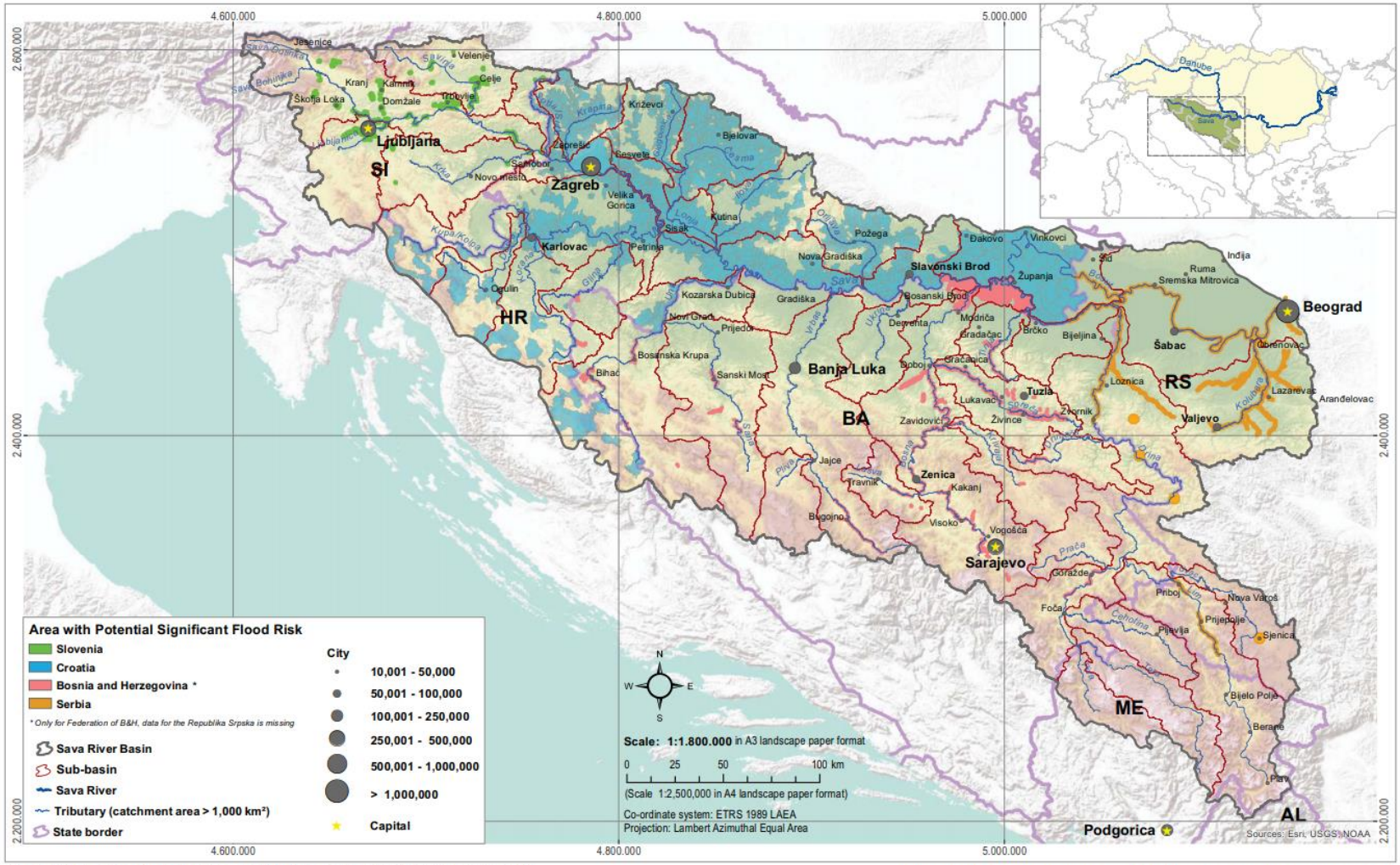

This product is based on national information provided by the Parties to the FASRB (SI, HR, BA, RS) and ME.
Shuttle Radar Topography Mission (SRTM-3) from USGS Seamless Data Distribution System was used as topographic layer.
The boundaries and names shown and designations used on this map do not imply official endorsment or acceptance by the ISRBC.

PRELIMINARY FLOOD RISK ASSESSMENT IN THE SAVA RIVER BASIN
ISRBC Secretariat, 2014

Figure 5.2-1 Flood risk map for a wider risk assessment area (Data source: https://www.savacommission.org)

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5.3 CORINE Land cover

Based on data for Europe produced by the European Environment Agency (EEA) on the status and changes of the CORINE Land Cover (CLC) in the period 2000-2006. In the area of risk assessment, which includes the Sava River Basin (Slovenia, Croatia, Bosnia and Herzegovina, Serbia), the most common forms of land cover relate to forest vegetation (mixed forest) (313), forest succession (324) and natural grasslands (321). In the area of major cities and settlements, dominant land covers are a complex of cultivated area (311), ex. agricultural land with a significant proportion of natural vegetation (243), pastures (231) and areas with scarce vegetation (333) (Figure 5.3-1). In view of the above, it can be concluded from the observed area that humid, forest and natural habitats and artificial lands are on a slight increase, while agricultural and inland waters - water areas are declining (Table 3-1).

Table 5.3-1 Distribution and area (km2) of land cover by CORINE land cover base by years of measurement (Data source: https: // www.savacommission.org)

Category name	Corine 2000		Corine 2006		Corine 2012	
	Area (km^2)	Percentage (%)	Area (km^2)	Percentage (%)	Area (km^2)	Percentage (%)
Artificial surfaces	2179	223	2415	248	2451	252
Cultivated area	41381	4236	40215	4126	40178	4122
Forest and suburban areas	53458	5471	54111	5552	54117	5553
Wet areas	78	0,08	90	0,09	91	0,09
Inland water - Water surfaces	616	0,63	632	0,65	625	0,64

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This product is based on national information provided by the Parties to the FASRB (SI, HR, BA, RS) and ME.
The borders between the countries cooperating in preparation of the Sava River Basin Analysis have not been finally determined.
The content and maps of this report do not prejudice the determination or demarcation of the borders in any way.

2ND SAVA RIVER BASIN ANALYSIS
Processed and compiled by the Secretariat of the ISRBC, December 2016

Figure 5.3-1 Land use map in the wider risk assessment area (Data source: https://www.savacommission.org)

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5.4 Protected areas in Sava River Basin

There are a number of protected areas in the area of risk assessment, which includes the Sava River Basin (Slovenia, Croatia, Bosnia and Herzegovina, Serbia). The conservation objectives of these areas are most commonly aquatic habitats, wetlands, wet meadows, flood forests, and the flora and fauna associated with such areas. These areas are protected by different levels of protection, and their numbers are categorized by category below:

- National Park (EU Member States only) - 1 area;
- Ramsar Area / Biosphere Reserve - 4 areas;
- Natura 2000 area (EU Member States only) - 20 areas,
- National Protected Areas (Bosnia and Herzegovina and Serbia) - 11 areas,
- Other protected areas (lower protection categories) - 41 areas.

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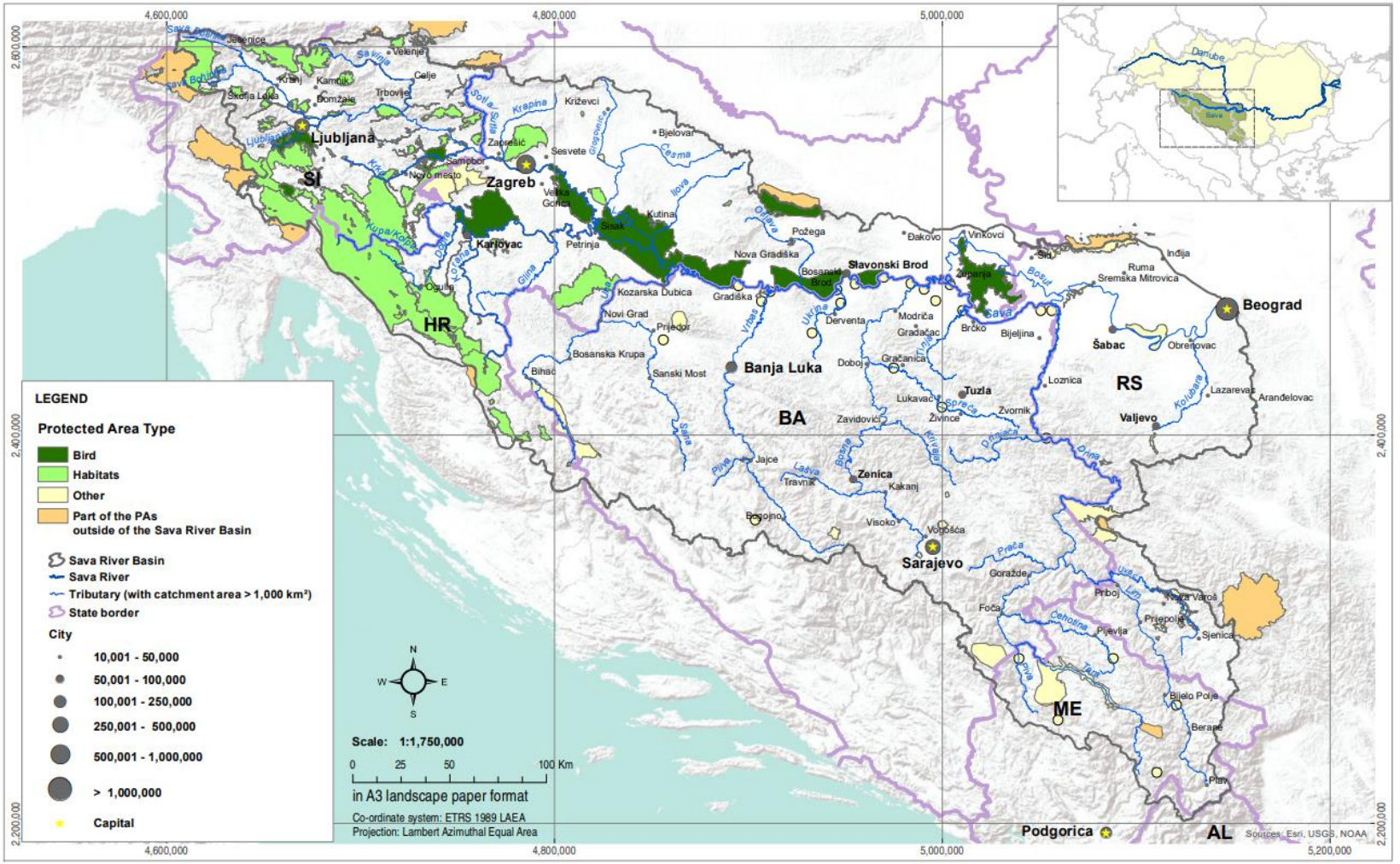

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2ND SAVA RIVER BASIN ANALYSIS
Processed and compiled by the Secretariat of the ISRBC, December 2016

Figure 5.4-1 Map of protected areas in a wider risk assessment area (Data source: https://www.savacommission.org)

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6 Risk assessment study summary

Risk assessment study for 6 key invasive species in the Sava River Basin yielded the results presented in the tables (Table 6-1 and 6-2).

Table 6-1 Risk assessment study results for species Amorpha fruticosa, Solidago gigantea and Solidago canadensis

Summary	***Amorpha fruticosa***		***Solidago gigantea***		***Solidago canadensis***	
	Response	Confidence	Response	Confidence	Response	Confidence
Entry	Likely	High	Likely	High	Likely	High
Establishment	Very likely	High	Very likely	High	Very likely	High
Spread	Rapidly	Moderate	Rapidly	Moderate	Rapidly	Moderate
Impact	Major	Moderate	Major	Moderate	Major	Moderate
Conclusion	High	High	High	High	High	High

Table 6-2 Risk assessment study results for species Reynoutria japonica, Reynoutria x bohemica and Reynoutria sachalinensis

Sažetak	***Reynoutria japonica***		***Reynoutria x bohemica***		***Reynoutria sahalinensis***	
	Response	Confidence	Response	Confidence	Response	Confidence
Entry	Likely	High	Likely	High	Moderately likely	Moderate
Establishment	Very likely	Moderate	Likely	Moderate	Moderately likely	Moderate
Spread	Rapidly	Moderate	Rapidly	Moderate	Moderately	High
Impact	Major	High	Major	High	Moderate	High
Conclusion	High	High	High	Moderate	Moderate	Moderate

The study concluded that the species *Amorpha fruticosa*, *Reynoutria japonica*, *Reynoutria* x *bohemica*, *Solidago canadensis* and *Solidago gigantea* are highly invasive species in the Sava River Basin. It is estimated that there is a high likelihood of introduction of these species, the species have a high spread potential and their impact is estimated to be high. The species *Reynoutria sachalinensis* is moderately invasive in the Sava River Basin, there is a moderate likelihood of introduction of this species and its establishment in the risk assessment area, the species has a moderate spread potential, and its impact is estimated to be moderate. The species is more significantly spread only in Slovenia, which is why it was estimated that the species is less invasive than other key species from the study.

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7 Annex

Table 7-1 Guidance for interpretation of CBD categories on introduction pathways (Harrower et al. 2018)

Category	Subcategory	Subcategory - explanation
1. RELEASE	1.1 Biological control	
	1.2 Stabilisation & Barriers	Erosion control / dune stabilization (wind breaks, hedges, ...)
	1.3 Fishery in wild	
	1.4 Hunting	
	1.5 Aesthetic release	Landscape / flora / fauna "improvement" in the wild
	1.6 Conservation in wild	Introduction for conservation purposes or wildlife management
	1.7 Release in nature for use (other than above, e.g. fur, transport, medical use)	
	1.8 Other intentional release	
2. ESCAPE	2.1 Agriculture	Including Biofuel feedstocks
	2.2 Aquaculture	Aquaculture / mariculture
	2.3 Botanical gardens & Zoos	Botanical garden / zoo / aquaria (excluding domestic aquaria)
	2.4 Pet	Pet / aquarium / terrarium species (including live food for such species)
	2.5 Farmed animals	Farmed animals (including animals left under limited control)
	2.6 Forestry	Including reforestation)
	2.7 Fur farms	
	2.8 Horticulture	
	2.9 Ornamental uses	Ornamental purpose other than horticulture
	2.10 Research	Research and ex-situ breeding (in facilities)
	2.11 Live food & live bait	
	2.12 Other escape	
3. CONTAMINANT	3.1 Nursery material contaminant	
	3.2 Bait contaminant	
	3.3 Food contaminant	Including of live food
	3.4 Contaminant of animals	Contaminant on animals (except parasites, species transported by host/vector)
	3.5 Parasite of animals	Parasites on animals (including species transported by host and vector)
	3.6 Contaminant on plants	Contaminant on plants (except parasites, species transported by host/vector)
	3.7 Parasite of plants	Parasites on plants (including species transported by host and vector)
	3.8 Seed contaminant	
	3.9 Timber trade contaminant	
	3.10 Contaminated habitat material (soil, vegetation, …)	
4. STOWAWAY	4.1 Fishing equipment	
	4.2 Container & bulk cargo	
	4.3 Airplane	Hitchhikers in or on airplane

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	4.4 Ship excluding ballast water or hull fouling	Hitchhikers on ship / boat (excluding ballast water and hull fouling)
	4.5 Machinery/equipment	
	4.6 People & luggage	People and their luggage/equipment (in particular tourism)
	4.7 Packing material	Organic packing material, in particular wood packaging
	4.8 Ballast water	
	4.9 Hull fouling	
	4.10 Land vehicles	Car, train …
	4.11 Other stowaway	
5. CORRIDOR	5.1 Canals and artificial waterways	Interconnected waterways / seas
	5.2 Tunnels and bridges	
6. SPONTANEOUS	6.1 Spontaneously	Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5

Table 7-2 Impact likelihoods of invasive alien species with description (adapted according to UK Non-native Organism Risk Assessment Scheme User Manual, Version 3.3)

Score	Likelihood	Definition	Frequency
1	Very unlikely	This sort of event is theoretically possible, but is never known to have occurred and is not expected to occur	1 in 10 000 years
2	Unlikely	This sort of event has not occurred anywhere in living memory	1 in 1000 years
3	Moderately likely	This sort of event has occurred somewhere at least once in recent years, but not locally	1 in 100 years
4	Likely	This sort of event has happened on several occasions elsewhere, or on at least one occasion locally in recent years	1 in 10 years
5	Very likely	This sort of event happens continually and would be expected to occur	Once a year

Table 7-3 Scoring the level of assessment security (adapted according to Bacher et al. 2017)

Security level	Description
Low	There is no direct evidence of the impact of the invasive alien species to support the assessment, eg only derived assessment data were used as evidence of impacts and / or impacts were recorded within a specific spatial range not relevant in the area of risk assessment and / or recorded impacts in the local the scale is not relevant in the area of risk assessment and / or evidence of impact is of poor quality and very difficult to interpret, for example extremely vague data and / or data sources used in the assessment are of poor quality and contain unreliable data.
Moderate	There is some direct evidence of the impact of the invasive alien species to support the assessment, however, certain information is solely derived and / or impacts are reported only at the local scale, but re-routing to the relevant risk assessment area is considered reliable or involves little uncertainty and / or the interpretation of the data to some extent is unclear or contradictory.

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High	There is direct relevant evidence of the impact of the invasive alien species supporting the assessment (including causality) and impacts have been reported on a comparable scale and / or there is reliable / qualitative information on the invasive alien species impacts and interpretation of the data is simple and / or the data is not controversial or contradictory.

Table 7-4 Scoring the range of impact of the invasive alien species (adapted according to UK Non-native Organism Risk Assessment Scheme User Manual, Version 3.3)

Description	Impact on biodiversity and ecosystem	Impact on ecosystem services	Monetary loss and response costs	Health impact
Minimal	Localized, short-term population loss without significant impacts on the ecosystem.	No ecosystem services are affected.	Up to 10 000 euros/year	No social disorder. Localized, mild, short-term feedback effects on individuals.
Minor	Several localized impacts on the ecosystem with backward changes.	Local and temporary feedback on one or more ecosystem services.	10 000-100 000 euros/year	Significant impact at local level. Localized, mild, short-term feedback on identifiable groups
Moderate	A measurable long-term negative impact on populations and ecosystems, but with a small range of spread without extinction.	Measurable, temporary, local, and feedback impacts on one or more ecosystem services.	100 000-1 000 000 euros/year	Temporary changes in normal activities at the local level. Low irreversible impacts and / or localized recurrent impacts on more people.
Major	Long-term irreversible alteration of the ecosystem with the present spread beyond the local range of the invasive alien species.	Local and irreversible or widespread and feedback on one or more ecosystem services.	1 000 000-10 000 000 euros/year	Few lasting changes locally with wide impact. Localized significant irreversible impacts or feedback over a larger area.
Massive	Widespread, long-term loss of populations and / or the occurrence of extinction, which affects many different species with serious consequences for the ecosystem as a whole.	Widespread and irreversible impacts on one or more ecosystem services.	Over 10 000 000 euros/year	Long-term social change with a significant decline in employment, migration from affected areas. Widespread, severe, long-term, irreversible impacts on human health.

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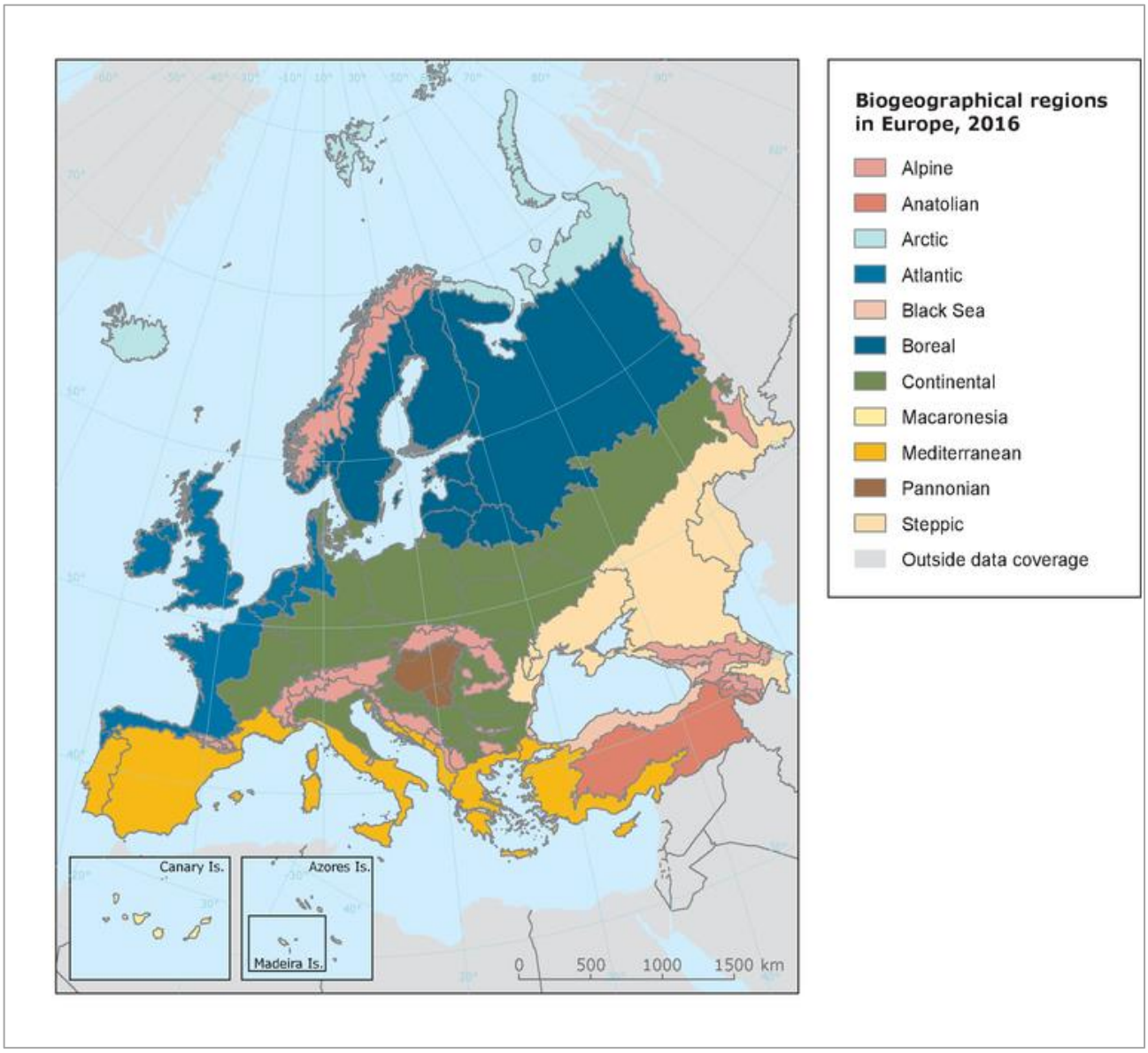

Figure 7-1 Biogeographical regions of Europe (Data source: EEA 2016, downloaded from: https://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-in-europe-2)

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