E.C.O. Institut für Ökologie

Ecological Connectivity in the Danube Region

Final Report

Interreg Danube Transnational Programme

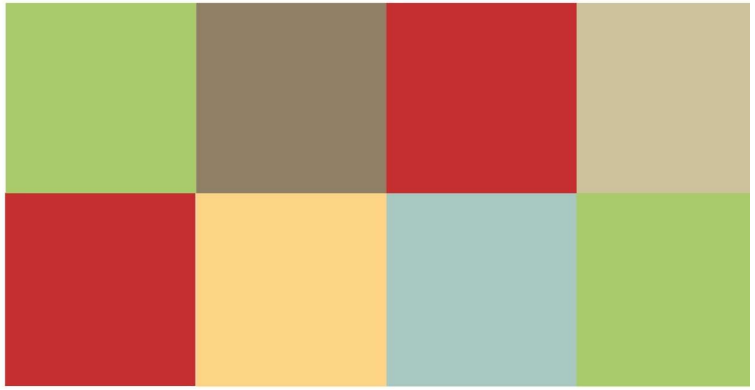
DANUBE REGION strategy Biodiversity

European Union

Client:

Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, (*Bavarian State Ministry of the Environment and Consumer Protection,* PA 6 Leader of EUSDR)

September 2018



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ECOLOGICAL CONNECTIVITY IN THE DANUBE REGION

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Abbreviations

AC	Alpine Convention
ACRC	Alpine-Carpathian-River Corridor
ADC	Alps – Danube – Carpathians (Corridor)AKK Alpen-Karpaten-Korridor (Alps-Carpathians-Corridor)
BISE	Biodiversity Information System for Europe
BMUB	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit
CBD	Convention on Biodiversity / Convention on Biological Diversity
CCIBIS	Carpathian Countries Integrated Biodiversity Information System
CIPRA	International Commission for the Protection of the Alps
CMS	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
CNPA	Carpathian Network of Protected Areas
DRB	Danube River Basin
DRBM	Danube River Basin Management Plan
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EFD	EU Flood Directive
EIA	Environmental Impact Assessment
ERDF	European Regional Development Fund
ESPON	European Spatial Planning Observation Network
EU	European Union
EUSALP	European Strategy for the Alpine Region
EUSDR	European Strategy for the Danube Region
GAP	Global Action Program
GI	Green Infrastructure
HNV	High natural Value

ICPDR	International Commission for Protection of the Danube River
ISCAR	International Scientific Committee for Alpine Research
IUCN	International Union for Conservation of Nature
IWT	Inland waterway transport
JECAMI	Joint Ecological Continuum Analysing and Mapping Initiative
GRETA	GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development).
NGO	Non-governmental organization
PA	Priority Area
PEEN	Pan European Ecological Network
SACA	Strategic Alpine Conservation Area
SCC	Secretariat of the Carpathian Convention
SEE	South-Eastern-Europe
TEN	Trans-European Network
TEN-E	Trans-European Energy Network
TEN-G	Trans-European Network for Green Infrastructures
TEN-T	Trans-European Transport Network
TSES	Territorial System of Ecological Stability
UNEP	United Nations Environment Programme
WDPA	World Database on Protected Areas
WFD	Water Framework Directive
ZGS	Slovenia Forest Service

1 INTRODUCTION

The improvement or rehabilitation of ecological connectivity is considered a fundamental aspect to reduce the loss of biodiversity and to preserve various ecosystem services for the benefit of humans on the long term. Sectoral policies and a dynamic economic development of the Danube river basin thus represent a major challenge for the remaining green spaces in the area. Ecological connectivity and joint transnational strategies addressing this topic are not yet fully on the agenda in political discussion.

Within the frame of the implementation of the European Strategy for the Danube Region (EUSDR) the discussion gains momentum. organizations or initiatives such as DANUBEPARKS, the Carpathian Network of Protected areas or the Green Belt Initiative are constantly working on the practical implementation of connectivity projects.

Bavaria and Croatia coordinate Priority Area 06 (Biodiversity) of the EUSDR and works, similarly as the EUSALP Action Group 7, towards a strategic strengthening of ecological networks at macroregional level. At medium term, the establishment of a TEN-G (Transnational Network for Green Infrastructures) is envisaged to provide a strategic instrument at European level.

However, it remains unclear which activities, programmes and projects are currently going on and how the European Green Infrastructure Strategy could be implemented in practice. Activities are numerous and spread all across the Danube River Basin and are often driven by local or national actors as well as by NGOs.

Definition of Green Infrastructure

Green Infrastructure refers to the concept as such, as well as to structures in the landscape. Thus, it is a strategically planned network of natural or semi-natural areas with different natural characteristics that provide a wide range of ecosystem service to a wide range of beneficiaries (European Commission 2013).

The EC defines four key elements of green infrastructures:

- Promoting Green Infrastructure in the main EU policy areas;
- Supporting EU-level GI projects;
- Improving access to finance for GI projects;
- Improving information and promoting innovation.

Summarizing, GI actually...

- …has a physical basis by means of a network of natural and semi-natural areas which supports natural processes and ecosystem functions;
- …promotes projects with the objective to maintain, preserve or restore ecosystem service functions;
- …seeks to integrate the protection, improvement or restoration of natural spaces and processes into spatial and territorial planning;
- …and seeks to develop methods and instruments which improve the understanding and awareness of green infrastructures and thus facilitate financial investments.

Table 1: Exemplary elements of GI

Local level	gardens, green roofs, ponds, hedges, urban parks, rivers,
Regional/National level	lakes, watersheds, extensive cultural landscapes, (semi-) natural forests
EU/Transnational level	international watersheds, large forest areas, mountain ranges

1_1 Objective and scope of the consultancy

The objective of this study is to implement the EU strategy on Green Infrastructure within the area of the EUDSR and thus to support the objective of a Transnational Network of Green Infrastructures (TEN-G).

Consequently, in a first step the current status of green infrastructures and ecological connectivity in the Danube River Basis needs to be analyzed. This explicitly includes the spheres of connectivity at land, water and air.

The study shall provide a sound foundation how the GI-strategy of the EU can be practically implemented in the Danube River Basin. In a subsequent step, this shall serve as a basis for the elaboration of

concrete project proposals for further implementation.

Key elements of the study include:

- Delineation of the project area (Danube Corridor, linkages to the Alps and Carpathians);
- Overview on the status quo regarding projects and national objectives in the individual states in the Danube River Basin;
- Overview on cooperation between the countries;
- Overview on basic information available on Green Infrastructures in the respective countries;
- Thematic and spatial gap analysis;
- Proposal of measures and projects to improve, restore or maintain ecological connectivity in the Danube River Basin;
- Definition of starting points for concrete measures and projects;
- Overview on similar experiences of other macro-regions to be transferred to the Danube River Basin;
- Outline of potential contributions of the EUSDR and PA06 to the implementation of the EU Green Infrastructure Strategy.

1_2 Area of investigation and delineation

The main scope of the study comprises the countries of the EUSDR, but also includes adjacent countries of the Dinaric Arc, the Alps and the Carpathians, where considered to be useful.

The area investigated comprises the Danube River Basin as also used by ICPDR:

The spatial analysis based on existing reveals specific fields as well as areas of actions within the weeks coming and propose sites where proposed measures could take place.

Figure 1: Overview of the Danube Region
Source: https://www.danube-region.eu/about/the-danube-region

With regard to the ecological connectivity the spatial scope is essential. In terms of the EUSDR space, an ecological, rather than a political delineation seems reasonable. This is also the reference area used by ICPDR (see Figure below). The delineation goes along with the catchment area of the Danube river and includes following countries or parts of it: Germany, Czech Republic, Austria, Slovakia, Hungary, Romania, Bulgaria, Ukraine, Moldova, Servia, Bosnia and Herzegovina, Montenegro, Croatia, Slovenia as well as a valley of Switzerland (Engadin) and a very small part of Italy (the source of the Drava river).

Referring to this area also allows for achieving overlaps with adjacent macro-regions and ecological spaces or corridors (Dinaric Arc, Alps, Carpathians and Green Belt).

This influences the selection of cooperating partners on projects:

- Green Belt Initiative
- ALPARC
- CNPA

This allows to gradually extend the experiences, e.g. from ALPARC towards the Danube River Basin core area.

The ecological connectivity of this area is provided by different parts of green infrastructure on land, river and air.

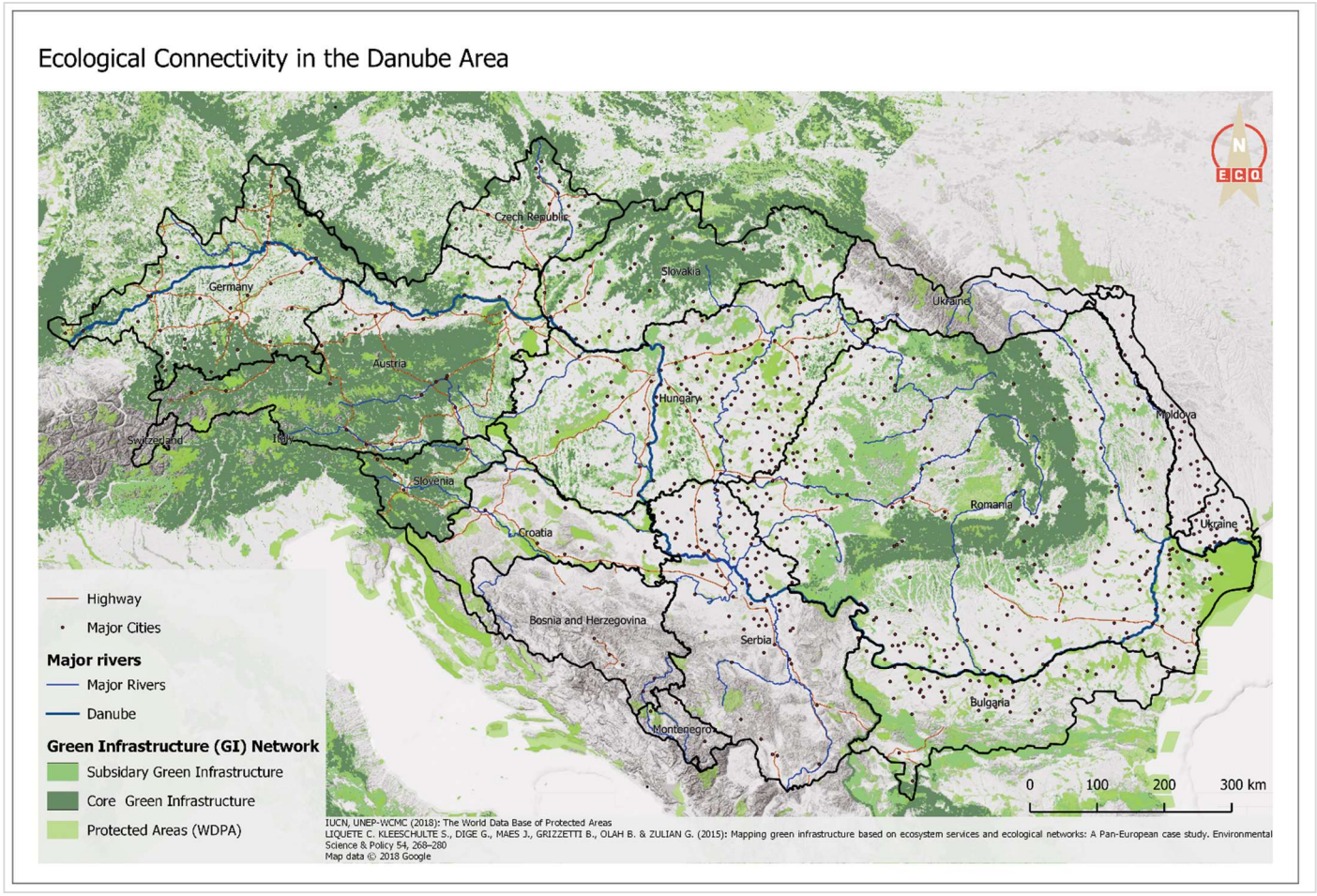


Figure 2: Investigation area with defined green infrastructure and protected area network. Based on the Green Infrastructure Modelling of Liquete et al. (2015) and existing protected areas (www.protectedplanet.net)

1_3 Work plan and time-schedule

The following table shows the proposed and agreed work plan and time schedule of the project.

For the development of project proposals, 7 project ideas were presented. Out of these PA06 selected 3 for further elaboration.

	Workstep	March	April	May	June	July	August
1.	Preparation and status quo						
1.1.	Kick-off meeting with client						
1.2.	Literature review						
1.3.	Interim report and literature overview						
2.	Conceptual phase: Definition of corridors						
2.1.	Identification of transnational GI-elements in the Danube River Basin						
2.2.	Phone interviews with key stakehlders						
2.3.	Gap analysis						
2.4.	Visualization of corridors						
2.5.	Description of GI Elements						
3.	Proposal development for pilot projects						
3.1.	Overview on project proposal ideas and discussion with client						
3.2.	Elaboration of 3-4 project proposal						
4	Finalization						
4.1.	Final recommendations						
4.2.	Final Report						
	Ongoing communication						
	submission of final report						

Figure 3: Overview of the project time schedule and work plan
Source: Author's draft

1_4 Definitions

Ecological connectivity, ecological networks, functional connectivity, ecologic corridors, green infrastructure and many more -all these terms are frequently mentioned in different types of publications, strategies and reports. However, they are not used consistently. Thus, this section gives a brief overview on the main definitions of the key terms used in the context of ecological connectivity and green infrastructure.

Ecological network

A widely accepted and quoted definition is proposed by Bennett (2006):

"Ecological network is regarded as a coherent system of natural and/or semi-natural landscape elements that is configured and managed with the objective of maintaining or restoring ecological functions as a means to conserve biodiversity while also providing appropriate opportunities for the sustainable use of natural resources".

This definition is widely used and even if slightly modified, all definitions emphasize the need for a "system", to have a "coherent" network and "maintenance of ecological functions" and an interaction or link between individual patches (Zhang 2012). These networks require structural models or concepts how to describe, analyze, plan or implement them including GI Models, ecological corridor concepts or green ways.

Ecological corridors

Ecological corridors can be considered a component of an ecological network model describing a functional zone connecting several natural zones for a group of species dependent on a single environment. This corridor therefore connects different populations and allows migration of species between them. These corridors are also sometimes named "ecocorridors", "landscape corridors" or "greenways". Ecological corridors mostly have a clear conservation and species focus and are the backbone of all ecological networks

Greenways

According to Zhang (2012) green ways are a specific form of an ecological corridor describing semi-natural structural and linear elements in landscapes.

Green infrastructure

Green Infrastructure refers to the concept as such as well as to structures in the landscape. Benedict and McMahon (2006) define green infrastructure as "*a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for […] people."*

Thus, it is a strategically planned network of natural or semi-natural areas with different natural characteristics that provide a wide range of ecosystem service to a wide range of beneficiaries (European Commission 2013). It explicitly integrates the ecological services provided to human population (ecosystem services) and emphasizes the multipurpose and sustainable use of green infrastructure (Zhang 2012).

Ecological connectivity

In general, connectivity refers to the spatial and temporal extent to which animals or plants and related ecosystem functions can move between different habitat patches. Ecological corridors, greenways or stepping stones facilitate connectivity (Chester and Hilty 2010). Thus, ecological connectivity describes how well an ecological network works. However, the concept is still discussed controversially as there is no consensus on a common definition reaching from enabling the movement of specific spies along linear elements to achieving large regional connections to facilitate ecological flows and species migration between different landscape parts (Walzer 2016).

Dobson et al. (1999) defined the following scales for connectivity:

- connectivity between habitat patches,
- connectivity at the landscape mosaic scale and
- connectivity at large or regional scale.

This study refers to the large (macro-regional) scale whenever possible, referring to connectivity at landscape mosaic scale.

2 ECOLOGICAL CONNECTIVITY IN THE DRB: STATUS QUO

Studies, initiatives, projects and programme documents regarding green infrastructures, ecological connectivity or ecological corridors are abundant. This section gives a general overview on Green Infrastructure and ecological connectivity within the Danube River Basin.

As the focus of the study is on the macro-region and beyond (connectivity between different macro-regions). Other key areas were investigated in general to reveal potential connections and synergies (Green Belt, Dinaric Arc, Carpathians, EUSALP region).The following sub-chapters provide a brief overview about:

- Relevant key strategies and policy instruments at macro-regional level (Chapters 2_1 and 2_2);
- Brief overview about main funding instruments (Chapter 2_3);
- Brief overview about the status of green infrastructure and ecological connectivity concepts and plans at macroregional level (Chapter 2_4);
- Brief overview about the status of green infrastructure and ecological connectivity concepts and plans in the individual countries (Chapter 2_6);
- Brief overview about projects and initiatives on ecological connectivity in the Danube River Basin (Chapter 2_7).

An overview on (physically) existing green infrastructure elements and barriers from a transnational perspective is provided in a separate chapter (Chapter 3).

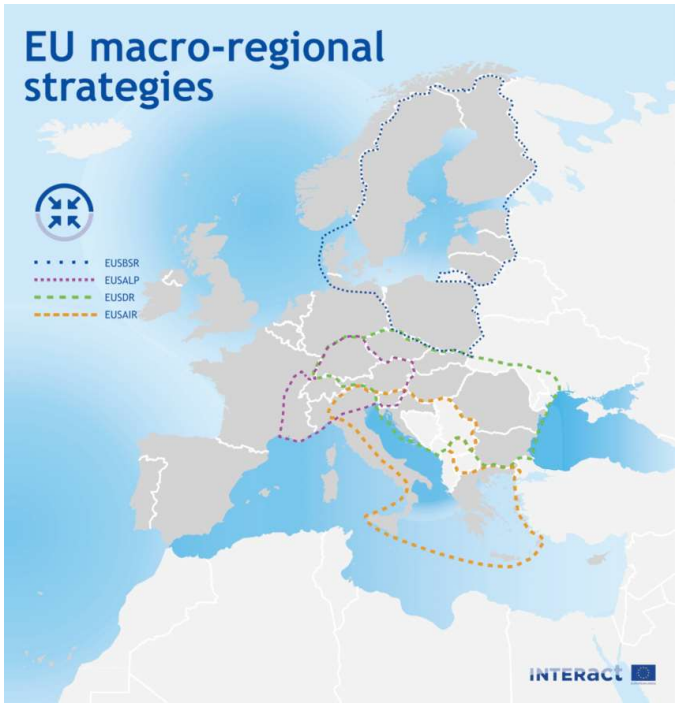


Figure 4: Macro-regional strategies in Europe
Source: Haarich (2016)

2_1 Relevant strategies and policies

At macro-regional and European level several strategies address the role of ecological networks. The following section lists the relevant core documents and gives a brief overview about their link to ecological connectivity.

EU Strategy on Green Infrastructure

Target 2 of the EU 2020 Biodiversity Strategy requires that by 2020 *"ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded*

ecosystems". In order to support this process, in 2013 the European Commission adopted the EU strategy to promote the deployment of green infrastructure across Europe as well as the development of TEN-G.

According to the strategy, GI solutions can make a significant contribution to:

- Regional policies (Green Infrastructure is recognized as contributing to regional policy and sustainable growth in Europe and facilitating smart and sustainable growth through smart specialization);
- Climate change and Disaster risk management (GI solutions can help in reducing the effects of climate change [e.g. Green Transport Corridors, GI initiatives in agriculture and forestry] and reducing the effects of natural disasters through implementing risk management approaches [e.g. functional flood plains, riparian woodland, barrier breaches]);
- Natural Capital (Green Infrastructure can play an important role in protecting, conserving and enhancing the EU's natural capital - land and soil, water and nature).

The **Trans-European Network Green Infrastructure (TEN-G)** initiative is considered an important contribution to the implementation of the EU GI Strategy, similar to that already in place for large-scale EU transport (TEN-T) and energy (TEN-E) networks. The overall objective of the EU's GI related policy ambition is to have an EU network of green infrastructure in optimal condition to deliver essential ecosystem services throughout Europe.

EU Strategy for the Danube Region – EUSDR

This macro-regional strategy aims at reinforcing EU-policies in the Danube macro-region. It presents challenges, opportunities and main issues regarding the Danube Region. The strategy addresses four main thematic pillars through which they address the main issues. These pillars are:

- Transport (Connecting the Danube Region);
- Environmental Protection (Protecting the Environment in the Danube Region);
- Prosperity (Building Prosperity in the Danube Region);
- Capacity Building (Strengthening the Danube Region).

Within the EUSDR, priority areas serve to implement and push forward the main pillars. **PA 6 of the EUSDR** – Priority area (PA) 6 "Preserving biodiversity and landscapes the air and soil quality" includes developing and implementing green infrastructure on the macro-regional level (e.g. Alpine-Carpathian Corridor). The targets of PA 6 are:

- By 2020 strengthen the work on halting the deterioration in the status of all species and habitat covered by EU nature legislation to achieve a significant and measurable improvement, adapted to the special needs of the respective species and habitats in the Danube Region;
- Enhance the work on establishing green infrastructure and the process of restoration of at least 15% of degraded ecosystems, including soil, to maintain and enhance ecosystems and their services by 2020 in the Danube Region and to improve air quality;
- Encourage achieving significant progress in identification and prioritization of invasive alien species and their pathways to control or eradicate priority species, to manage pathways and to prevent the introduction and establishment of new invasive alien species in the Danube Region by 2020;
- Continue the ongoing work and efforts to securing viable populations of Danube sturgeon species and other indigenous fish species by 2020.

EU Strategy for the Alpine Region – EUSALP

The macro-regional strategy of EUSALP presents challenges and opportunities of the Alpine Region. Strategy covers thematic policy areas of economic growth and innovation, mobility and connectivity and environment and energy. The EUSALP action plan presented in the strategy is structured around three interdependent thematic objectives for different policy areas and one cross-cutting objective. The objectives of strategy are:

- Fair access to job opportunities, building on the high

competitiveness of the Region;
- Sustainable internal and external accessibility;
- A more inclusive environmental framework and renewable and reliable energy solution for the future;
- A sound macro-regional governance model for the Region to improve cooperation and the coordination of action.

AG7 (Biodiversity) of EUSALP aims at setting up a comprehensive macro-regional scheme by applying the EU Strategy for Green Infrastructure (GI) to regional scales in the Alps.

Convention on Cooperation for the Protection and Sustainable Use of the Danube River (Danube River Protection Convention)

The Danube River Protection Convention forms the overall legal instrument for co-operation on transboundary water management in the Danube River Basin. The Convention was signed on June 29, 1994 in Sofia (Bulgaria) and came into force in 1998. The main objective of the Danube River Protection Convention (DRPC) is to ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably.

The ICPDR acts as a platform for its contracting parties to coordinate responses to various environmental threats, formalized in the Danube Protection Convention of 1994. Since 2009, the Danube River Management Plan (DRMP) provides a roadmap for this. It contains a Joint Programme of Measures and aims to fulfil the EU Water Framework Directive (WFD). The ICPDR also implements the EU Flood Directive (EFD).

Closely linked, the organization of DANUBEPARKS is explicitly dealing with improving the exchange between protected areas along the Danube with a clear focus on the ecological connectivity.

Carpathian Convention

The Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) was adopted in Kyiv in Ukraine in May 2003 during the “Environment for Europe” Ministerial Conference. To support the implementation process, in 2004 the Secretariat of the Carpathian Convention (SCC) was opened in the Vienna offices of UN Environment. As of 2018 the following protocols were included:

- Protocol on Sustainable Transport to the Framework Convention on the Protection and Sustainable Development of the Carpathians (2014)
- Protocol on Sustainable Forest Management to the Framework Convention on the Protection and Sustainable Development of the Carpathians (2011)
- Protocol on Sustainable Tourism to the Framework Convention on the Protection and Sustainable Development of the Carpathians (2011)
- Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity to the Framework Convention on the Protection and Sustainable Development of the Carpathians (2008)
- Framework Convention on the Protection and Sustainable Development of the Carpathians (2003)

European Landscape Convention of the Council of Europe

The first aim of the European Landscape Convention which was signed in Florence in 2000 is to encourage States to introduce a national landscape policy that is not restricted to the protection of exceptional landscapes but also takes everyday landscapes into consideration. It further aims, through transfrontier cooperation, to create a genuine impetus to reinforce the presence of the landscape as a value to be shared by different cultures. The intention is thus to promote the integration of the landscape dimension in international relations, at national, regional and local levels.

According to Article 5 of the Convention, signatory states aims *“to establish and implement landscape policies aimed at landscape protection, management and planning through the adoption of the specific measures”* and *“to integrate landscape into its regional and town planning policies and in its cultural, environmental, agricultural, social and economic policies, as well as in any other policies with possible direct or indirect impact on landscape.”*

According to Article 9, signatory states encourage *“transfrontier co-operation on local and regional level and, wherever necessary, prepare*

and implement joint landscape programmes."

Consequently, the landscape convention contains numerous elements which directly link to the implementation of GI.

Habitats, birds and water framework Directives

The Habitats and Birds Directives and their implementation through the Natura 2000 network are key instruments for the implementation of ecological connectivity at European level. These directives put emphasis on the coherence and connectivity of the network and require member states to fulfil the requirements. Thus, the Natura 2000 network is also considered the backbone for a European Green Infrastructure network.

White Paper on Integrated Sustainable Development of the Danube River Basin

The White Paper (Winiwarter & Haidvogel, 2015) identifies important knowledge gaps, principles and topics of inter- and transdisciplinary long-term research for the sustainable development of the Danube River Basin. It includes recommendations for policy makers on important pre-requisites and organizational measures on national and European level. The opportunities for targeted research, which are presented in the literature, including:

- Implementation of the Global Action Program (GAP) initiative for sustainability education;
- Use of sustainability issues to build cultural bridges and foster post-conflict cooperation;
- Research on protecting ecosystem services and biodiversity, under conditions of global change;
- Protected areas as real-laboratories and core of an international conservation research network.

2_2 Strategies of the major protected area networks

The protected area networks of ALPARC, DANUBEPARKS and Carpathian Network of Protected Areas (CNPA) are amongst the key actors regarding the implementation of green infrastructure and ecological connectivity projects. Thus, their strategies are briefly reflected in this section.

Strategy of ADC (Alps-Danube-Carpathians)

In 2016, the protected area networks ALPARC, DANUBEPARKS and CNPA signed a memorandum of cooperation and agreed on working on common goals and objectives regarding the conservation of biodiversity, through activities with primary aim in the creation and realization of ecological corridors. Their main common objectives are:

- Respond to the loss of biodiversity, especially in times of climate change, by ensuring the migration of species;
- contribute to article 12 of the Alpine Convention protocol about "Nature Protection and Landscape Conservation" and of relevant protocols to the Convention;
- contribute to the goals of the DANUBEPARKS network for ecological connectivity in the Danube region;
- contribute to the implementation of Article 4.5 of the Carpathian Convention about the "Conservation and sustainable use of biological and landscape diversity" and of relevant protocols to the Convention;
- contribute to the creation of a European and worldwide ecological network, one of the most ambitious objectives of the Convention of Biological Diversity (CBD);
- contribute to the cooperation of the both Alps and Danube Macro regions in the field of biodiversity conservation; a close cooperation with the both EU macro-regional strategies (Danube, Alps) is part of the cooperation;
- develop a joint voice towards habitat connectivity on a political level and EU policies (e.g. GI) including all concerned countries of the regions;
- raise awareness of the public for the importance of large non-fragmented areas and permeable landscapes.

Strategy of ALPARC 2016-2021

ALPARC is the Alpine Network of Protected Areas, which brings together hundreds of protected areas of all kinds that are in the Alps, from France to Slovenia. The association is supposed to support the implementation

of the Nature Conservation Protocol of the Alpine Convention including the promotion of ecological connectivity in the Alps. ALPARC supports numerous activities and projects that can be relevant and useful for the Danube Region as well.

ALPARC aims to preserve the natural space in the Alps. The field of action is divided into five different working fields. Their main purpose is to ensure better work efficiency in protected areas, through integrating thematic and spatial connectivity. All working fields provide equal continuity and openness to new themes, which allows further strengthening of international cooperation in the Alpine region. According to strategy 2016-2021 the working fields of ALPARC are:

- Services and network management (network animation, networking, project preparation and implementation assistance, provision of data and map materials, internal and external communication);
- Thematic and methodical projects on all levels (ecological connectivity, sustainable regional development, environmental education, management approach)
- Exchanges, events and research (establishment and animation of working groups, public events, cooperation with the field of research, Danilo Re Memorial);
- Cooperation with the Alpine Convention and Alpine macro-region;
- Regional territorial management (establishment of network of regional managers, who work as decentralized platforms for exchange between Alpine municipalities and other local communities, providing access to all available alpine communication and information tools, with participation with other networks in the Alpine space).

Apparently, ALPARC has key experiences regarding the implementation of ecological connectivity projects within a larger territory. These activities include for instance, the “Ecological continuum initiative”: aimed to create or restore ecological connectivity between important areas for nature conservation (PAs and non-PAs). Launched by ALPARC, it is developed in partnership with the International Commission for the Protection of the Alps (CIPRA) and the International Scientific Committee for Alpine Research (ISCAR). Territorial evidence delivered include the following main achievements:

- Support to the establishment of the Ecological Network Platform of the Alpine Convention (AC);
- Support to the establishment of the Working Group Large Carnivores of the AC;
- Development of E-CONNECT project under Alpine Space Programme (ASP);
- Think Tank on ecological networks in/to the Alps (workshops);
- Catalogue of measures to improve ecological connectivity in the Alps, thematic projects and experts.

The Alpine Convention Ecological Network Platform (Econet) (2007) set up by AC aims to create an Alpine cross-boundary spatial network of PAs and connecting elements with the support of experts, policy makers and stakeholders. Territorial and policy evidence delivered by Econet. It includes the following achievements:

- Designation of 10 Pilot Regions of the AC for Ecological Connectivity / Econet;
- Participation in the Working Group “Green Infrastructure and Restoration” of the European Commission (EC).

ALPARC provides its long-term experience on ecological connectivity by actively participating in AG7 of EUSALP and lobbying for a recognition of the thematic results achieved in the Alpine region and AC. ALPARC representatives took part in the four AG7 meetings organized so far and other major EUSALP events.

Strategy of conservation and navigation of DANUBEPARKS

The strategy of DANUBEPARKS has defined a number of objectives:

- Assess and communicate the overall situation of Danube waterway development and nature conservation, providing concrete and tangible information on navigation projects and conservation issues with a focus on the DANUBEPARKS areas;
- define concrete nature conservation demands and requirements in the context of current inland waterway transport (IWT) development planning;
- strengthen the capacity and commitment of protected area managers to properly fulfil their stakeholder role in the planning and decision-making process of IWT development projects;

- gives guidance to protected area and waterway managers on available tools and opportunities to integrate conservation and navigation;
- present common positions and actions to involve DANUBEPARKS as a distinct interest group and relevant stakeholder in river development;
- assist the implementation of the EU Danube Region Strategy and illustrate the position of DANUBEPARKS to stakeholders.

Strategy of CNPA

The strategy of the Carpathian Network of Protected Areas has several objectives related to ecological connectivity and conservation:

- Promotion of cooperation on protection, restoration of nature and sustainable use of natural resources, preservation and promotion of the cultural heritage of the Carpathians;
- Promotion of sustainable livelihoods and sustainable development of the Carpathians;
- Implementation of the relevant provisions of the Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity;
- Implementation of decisions and recommendations undertaken by the bodies established under the Carpathian Convention as well as of other applicable relevant international legal instruments.

2_3 Relevant financial instruments

The following financial instruments are generally available for projects related to ecological connectivity and green infrastructures. They vary in their focus and scope and are used to different extents.

Cohesion Fund

This fund aims at Member States whose Gross National Income (GNI) per inhabitant is less than 90 % of the EU average. The Cohesion Fund partly allocates his funds to environments where it can support projects related to energy or transport, as long as they clearly benefit the environment in terms of energy efficiency and/or use of renewable energy.

LIFE Programme (Programme for the Environment and Climate Action)

This is the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU. This instrument mostly funds projects regarding Natura 2000 areas and large-scale restoration projects.

European Regional Development Fund (ERDF)

The ERDF aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. Its investments are on several key priority areas (http://ec.europa.eu/regional_policy/en/funding/erdf/). Based on the project overview this fund mainly funds the INTERREG programmes like The Danube Transnational Programme and The Alpine Space Programme. According to the initial review, most transnational projects make use of INTERREG funding programmes making it the most important source of funding for ecological connectivity at present.

Within ERDF there is also located the ESPON programme (European Observation Network for Territorial Development and Cohesion or European Spatial Planning Observation Network). The programme aims at promoting and fostering a European territorial dimension in development and cooperation by providing evidence, knowledge transfer and policy learning to public authorities and other policy actors at all levels. In the current programming period the implementation of green infrastructures is amongst the priorities of ESPON (e.g. Project GRETA: GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development).

HORIZON 2020

This is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. This instrument mainly focuses on research, academic

research and innovation.

European Agricultural Fund for Rural Development (EAFRD)

This Fund finances rural development programmes across the Member States and the regions of the Union. For the 2014-20 programming period the Fund also focuses on ensuring the sustainable management of natural resources and climate action.

Agri-environmental schemes

Agri-environment measures provide payments to farmers who subscribe, on a voluntary basis, to environmental commitments related to the preservation of the environment and maintaining the countryside. Thus, these measures are considered a key element for integrating environmental aspects into the Common Agricultural Policy. Agri-environmental measures account for more than 20% of the EU expenditures for rural development. Usually, the implementation of the schemes and related criteria is specified by the agricultural policies of the individual members states (e.g. agricultural or environmental ministries). At local level these measures are highly efficient to improve ecological conditions in certain agricultural landscapes (e.g. ÖPUL Programme in Austria).

2_4 Transnational ecological corridor systems and maps

Considering an ecological network or a network of Green Infrastructure Elements at macro-regional region, the size of network components serves as a criterion of the network hierarchy (Mander et al. 2003).

This can comprise mega-scale ecological networks such as the Atlantic flyways (Boere et al. 2006), macro-regional level plans such as PEEN (Bouwma et al. 2002, Jongman et al. 2006), national level projects such as TSES in Slovakia or Czech Republic. However, ecological networks were planned at a mesoscale or micro scale.

2_4_1 Ecological corridors and networks of ICPDR

The Danube itself apparently is a key green infrastructure of the EUSDR Macro region. It is the ecological backbone. Thus, the International Commission for Protection of the Danube River (ICPDR) carried out a thorough analysis of the ecological continuum status of the Danube river system with the long-term objective to reach longitudinal connectivity (Danube River Basin Management Plan 2009-2015 including an update in 2015).

The DRB Management Plan includes a set of detailed maps on existing barriers and restoration priorities at a macroregional level.

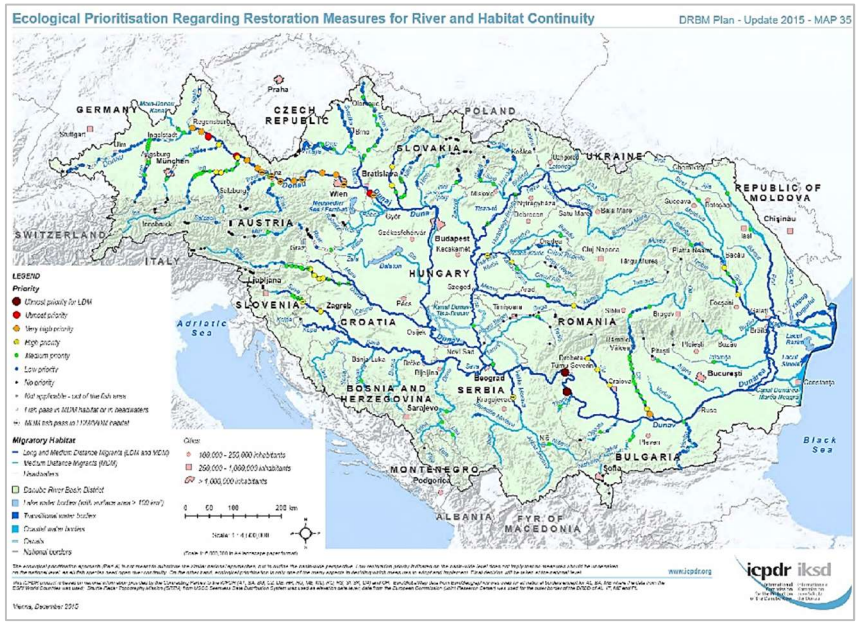


Figure 5: Ecological river corridors in the Danube River Basin
Source: DRBM Plan, Update 2015, Map 35

As a consequence, due to the work of ICPDR and DANUBEPARKS a complete overview on restoration priorities, barriers and longitudinal connectivity is available. More than 40 thematic maps form a sound basis for any connectivity or GI implementation measures referring to aquatic connectivity (http://www.icpdr.org/main/publications/maps).

2_4_2 Danube Wild Island Habitat Corridor

Within the frame of the ongoing INTERREG project DanubeparksConnected, a corridor network of 912 islands covering an area of 138 415 ha which include wetland and dryland habitats is being established. This substantially supplements the aquatic Danube Habitat Corridor and provides important stepping stones. Further information is available at http://wildisland.danubeparks.org/.

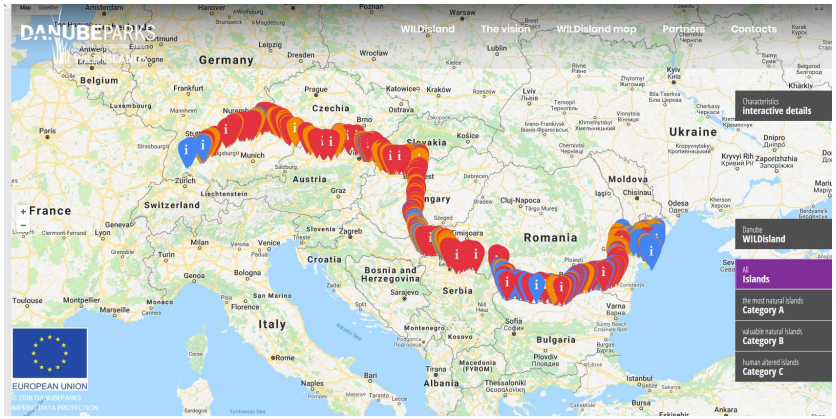


Figure 6: Overview of "Wild islands" stepping stones along the Danube
Source: http://wildisland.danubeparks.org/

2_4_3 Pan European Ecological Network (PEEN)

The Pan European Ecological Network (PEEN) developed a guiding vision for the effective implementation of the Convention on Biological Diversity (CBD) at European level. It is considered a key element of the pan European biological and landscape diversity strategy (PEBDLS) under the auspices of the Council of Europe. PEEN was developed in three subprojects between 2002 and 2006 resulting in three maps which give a spatial overview on ecological coherence and macro-regional corridors (Jongman et al. 2011). All maps were developed at a scale of 1:3.000.000 and have a comparable legend showing the three categories for habitat size needed for population survival (marginal, 100%, greater than five times population size).

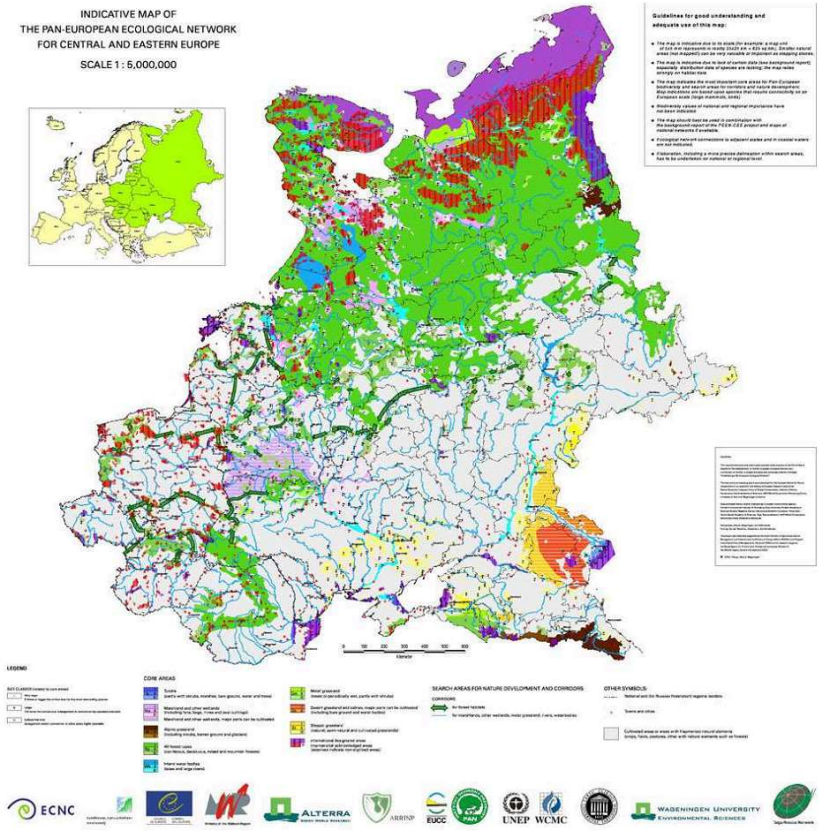


Figure 7: PEEN Map for Central and Eastern Europe
Source: Bouwma et al. (2002)

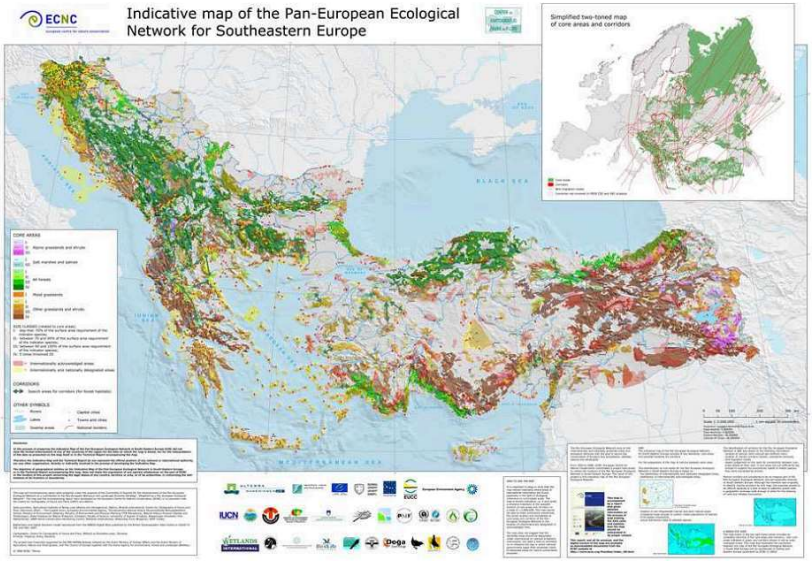


Figure 8: PEEN Map for South-Eastern Europe
Source: Biró et al. (2006)

PEEN maps mostly refer to two types of corridors namely forest corridors as well as River-Wetland corridors.

In general, the PEEN Maps provide a good overview on corridors and ecological networks from a European perspective. However, no or very limited conclusions can be drawn for national or local scales as the data was generally very coarse to remain comparable across Europe (Jongman et al. 2006).

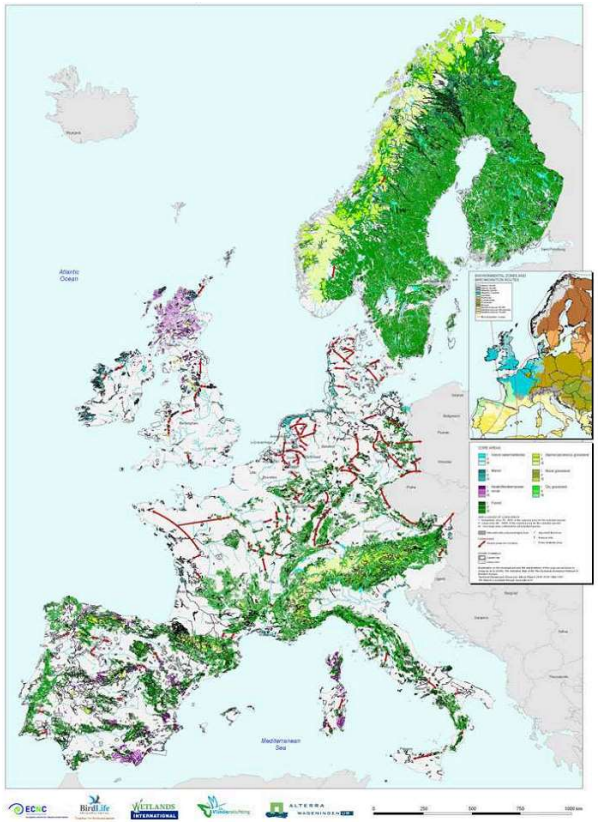


Figure 9: PEEN Map for Western Europe
Source: Jongman et al. (2006)

2_4_4 European Green Belt

Apart from geographic features and legal protected areas, transnational key infrastructure exists with ecological corridor function.

One of it is the European green belt, a transcontinental axis of the European ecological network along the former 'Iron Curtain'. In total it has a length of over 12.500 km, crosses the Danube catchment area. Along the Green Belt a lot of ecological valuable landscapes can be found, and many protected areas have been realized since 2002.

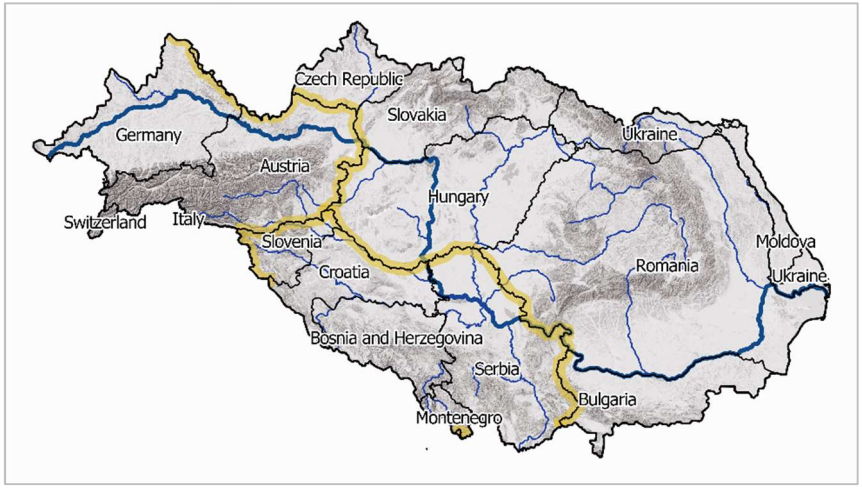


Figure 10: European Green Belt
Source: Author's draft

2_4_5 European Green Infrastructures

Liquete et al. (2015) developed a methodology to analyze and categorize Green Infrastructures at a European level. The methodology and the model derived from it separates between core green infrastructure and supporting green infrastructure. The model is based on the provision of ecosystem services and the requirements of large mammal populations. The resulting map indicates also the core and supporting green infrastructure elements in the EUSDR area.

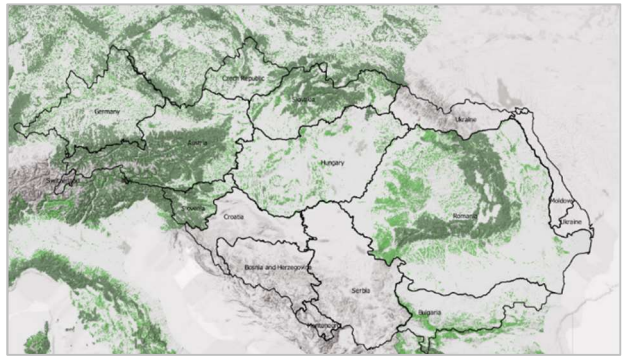


Figure 11: Green infrastructure of the Danube River Basin.
Source: Liquete et al. (2015). Analysis excluding Croatia, Bosnia and Herzegovina, Serbia, Ukraine and Moldova.

2_5 Corridors and ecological connectivity initiatives from projects

2_5_1 Danube-Carpathian Programme of WWF

The WWF in cooperation with UNEP Vienna and the related Danube-Carpathian Programme collected valuable baseline information about key migratory species and connectivity in the Danube River Basin (EU SEE Transnational Cooperation Programme BioRegio Carpathians, 2011 -2013). As a result, an interactive WebGis map was developed indicating the habitat suitability and corridors for bear and lynx in the DRB (http://webgis.eurac.edu/bioregio/)

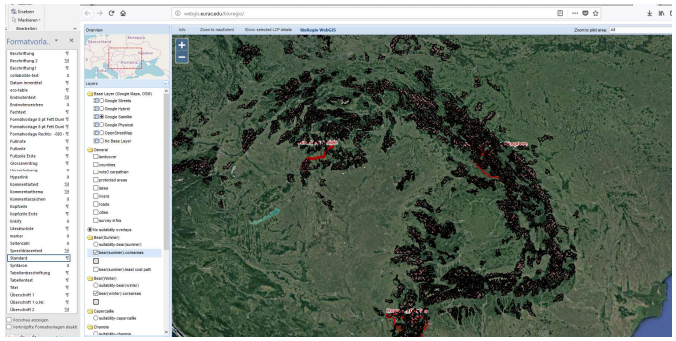


Figure 12: Exemplary screenshot from the WebGis Platform of the BioRegio project
Source: http://webgis.eurac.edu/bioregio/

2_5_2 Carpathian Countries Integrated Biodiversity Information System

Within the INTERREG Project TransGreen (2017-2019), the CCIBIS Geoportal (http://geoportal.ccibis.org/) was developed integrating various items of biological (e.g. endangered species, habitats) and environmental (protected areas, Natura 2000 sites, old-growth forests) information about the Carpathian Ecoregion. It furthermore provides valuable information about the existing road network (barriers).

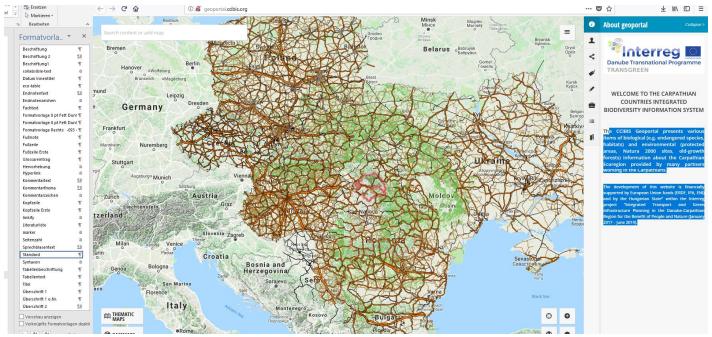


Figure 13: Screenshot from the CCBIS geoportal
Source: http://geoportal.ccibis.org/

2_5_3 Joint Ecological Continuum Analyzing and Mapping Initiative (JECAMI) on ecological connectivity

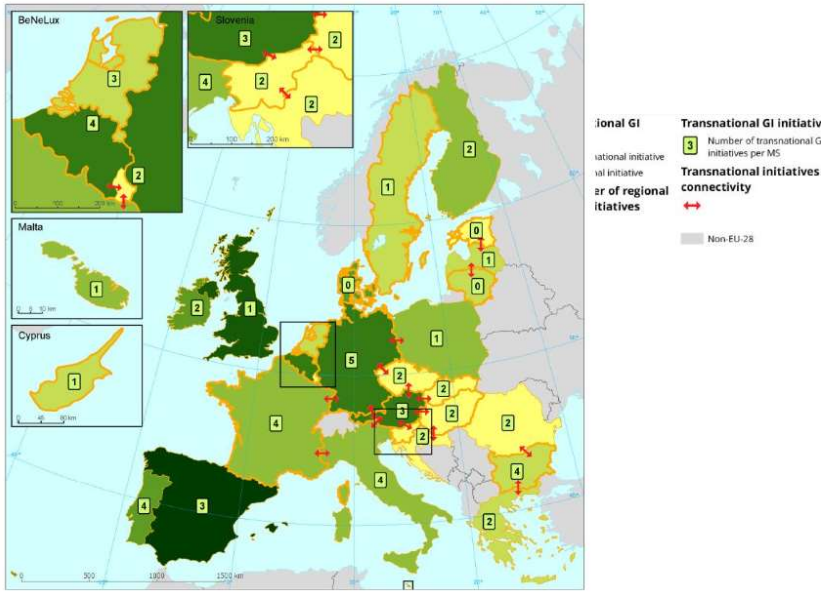
JECAMI is an online application (www.jecami.eu) that facilitates the analysis of ecological connectivity in the European alpine region. It was developed within the ECONNECT project and is operated by ALPARC. At the moment it is the most advanced WebGis solution for spatial information on ecological connectivity. It allows for uploading own layers and carrying out connectivity analyses (Continuum Suitability index as a combination of structural landscape connectivity and landscape permeability). Furthermore, it allows to analyze habitat suitability for species and calculation of optimal paths (corridors) and related barriers.

Currently, the tool is being updated. Furthermore, there are considerations to extend the tool towards the DRB (Interview Kohler 2018;and ADC Action Plan 2016).

2_6 National ecological corridor systems and policies

A study of the European Commission (EC 2016) analyzed the number and type of GI initiatives in individual countries pointing out also the transboundary initiatives. This indicates a strong commitment of Austria and its neighboring countries.

Figure 15 provides an overview of GI related projects in the EU (EC 2016) and links them to the different objectives. As GI is multidimensional and interpreted in many ways by individual actors, this figure is particularly helpful to understand what is actually being implemented under the broad topic of GI.

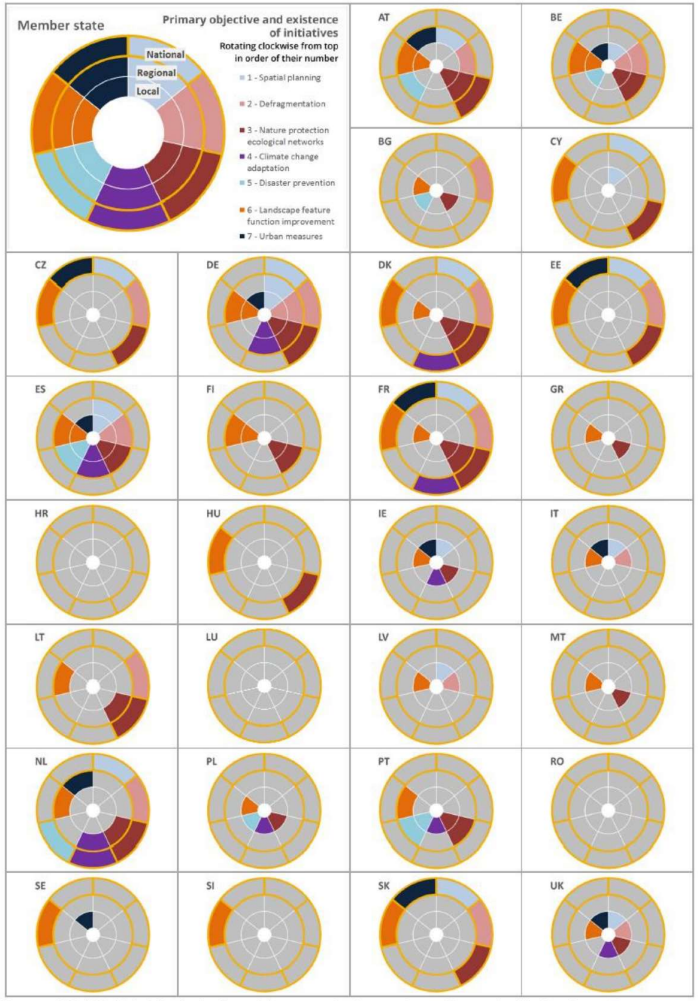


[Sources: EEA/ETC-ULS, 2015 for the Green Infrastructure Implementation and Restoration Working Group, European Commission, 2015]

Figure 14: Report GI initiatives and transboundary efforts across Europe as of 2015
Source: EC (2016)

As of 2016, 20 out of 28 countries implemented GI-related projects with a focus on nature conservation, whereas projects on disaster prevention (7 countries) or urban measures remain isolated topics for individua countries (13 countries) in relation to GI. Half of the countries (14) link GI to spatial planning, mostly at national level. Apparently, many of the least active countries are located in the DRB (Bulgaria, Croatia, Hungary, Romania, Serbia, Slovenia).

The type and level of initiatives gives also valuable information about the priorities, topics and stakeholders active in implementation of GI. As national level might indicate state stakeholders and only local implementation referring to individual initiatives in many cases.



[Sources: EEA/ETC-ULS, 2015 for the Green Infrastructure Implementation and Restoration Working Group, European Commission, 2015]

Figure 15: Analysis of reported GI initiatives and spatial scope 2016
Source: EC (2016): Supporting the Implementation of Green Infrastructure. Final Report. Rotterdam. P.159

Key data source: Biodiversity Information system for Europe (BISE)

The Biodiversity Information System for Europe gives a comprehensive overview about the current status on Green Infrastructures in the individual EU member countries. This includes a summary of the policy setting as well as information about the implementation of Green Infrastructure, efforts towards mainstreaming green infrastructure, financing and challenges regarding the implementation at national level (https://biodiversity.europa.eu/countries/gi). It offers an excellent knowledge base for further work. The following summaries are widely based on information from this website as well as from Alberton (2013).

Czech Republic

The Czech Republic has adopted active approaches in utilizing methods of ecological restoration. They currently have several on-going national and international projects which are directly (TRANSGREEN) or indirectly linked (UNaLab) to green infrastructure. They have successfully implemented LIFE Nature projects and projects regarding ecological connectivity and migration corridors for large mammals on national level (Complex Approach to the Protection of Fauna of Terrestrial Ecosystems from Landscape Fragmentation in the Czech Republic 2015-2017 https://eeagrants.org/project-portal/project/CZ02-0017). In terms of legal framework, they have an obligatory legal tool (Territorial System of Ecological Stability – TSES) for planning ecological networks and green infrastructure at national level (https://biodiversity.europa.eu/countries/gi/czech-republic).

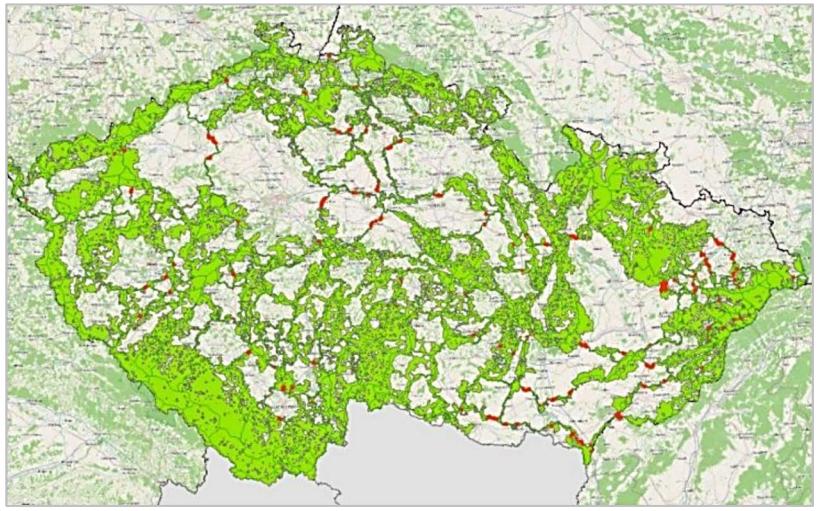


Figure 16: Czech ecological corridor system
Source: http://www.lebensraumvernetzung.at/

Germany

Germany has successfully finished projects on ecological networks and corridors (e.g. Network Green Borders – nature without borders between Nordrhein-Westfalen and the Netherlands, BUND Wildkatzenprojekt – Wildcat Rescue Project) Germany currently runs several projects regarding green infrastructure (URBAN GreenUP, Living Lahn, EnRoute). They have several key policies regarding ecological connectivity and green infrastructure for example The National Green Infrastructure Concept and The Federal Nature Conservation Act (https://biodiversity.europa.eu/countries/gi/germany)

Figure 17: German ecological network
Source: BfN (2013)

Austria

Austria has many completed and ongoing projects which aim at improving connectivity and green infrastructure status, such as LIFE+ Traisen Project (2009-2016), ConNat and the Alpine-Carpathian-River Corridor (ACRC). In terms of legal framework, strategies and concepts play an important role in strengthening and implementing green infrastructure on national and regional level (e.g. Austrian Biodiversity Strategy 2020+, Lower Austrian Nature Protection Concept). Most activities are executed at the local or federal province level (https://biodiversity.europa.eu/countries/gi/austria).

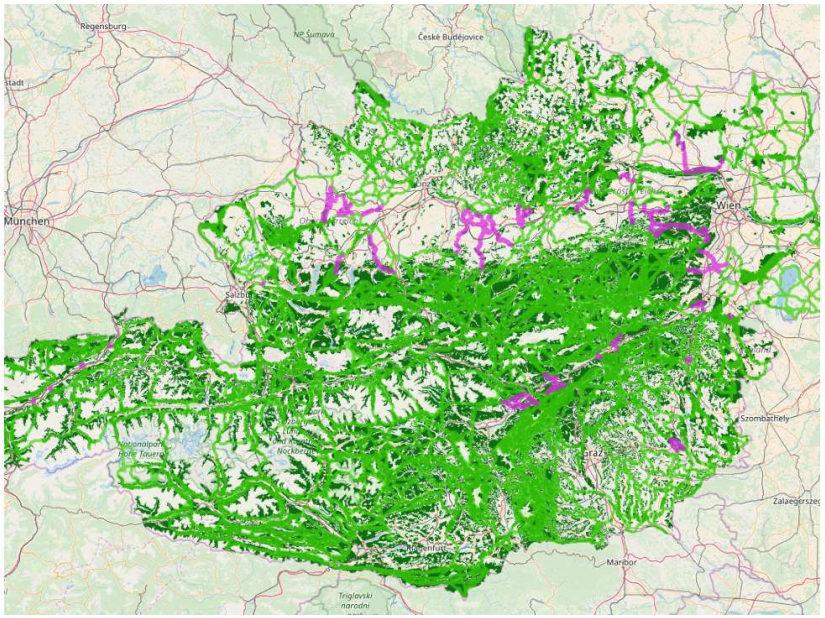


Figure 18: Important habitat corridors in Austria
Source: http://www.lebensraumvernetzung.at/

Hungary

In Hungary the National Ecological Network represents the main policy on green infrastructure. The zone of the National Ecological Network is incorporated into the spatial planning regulation on local level

(municipalities). The implementation of green infrastructure in Hungary on local level is mostly related to urban green infrastructure (i.e. Development concept for green spatial system of Budapest), while on regional level LIFE projects are presented (e.g. ongoing projects LIFE Old-Drava, KASZO LIFE). There are a few cross-border projects regarding green infrastructure, which are also active at the moment (e.g. TRANSGREEN, Danubian Green Belt, COOP MDD) (https://biodiversity.europa.eu/countries/gi/hungary).

Slovakia

Like the Czech Republic, Slovakia also has a Territorial System of Ecological Stability (TSES), which represents a type of ecological network and one of the approaches to building green infrastructure. Besides the TSES several measures in water management, that are linked to ecological connectivity, such as restoration of water courses and migration routes, are also being implemented. Some ongoing LIFE and INTERREG projects are linked to green infrastructure such as LIFE IPORSEN project, LIFE Danube floodplains project and INTERREG TRANSGREEN (https://biodiversity.europa.eu/countries/gi/slovakia).

According to Deodatus et al. (2013) Slovakia is amongst the few Eastern European Countries with a functional system of ecological corridors.

Slovenia

Several projects on transitional (e.g. Commitment towards the development of Blue-Green corridors along the Adriatic-Ionian region, INTERREG project Alpine Space) and regional (LIFE Kočevsko) level are currently active in Slovenia but are not directly linked to green infrastructure. Successful projects like WETMAN and Sečovlje Salina prove that Slovenia successfully implemented green infrastructure practices. The Slovenia's Development Strategy 2014–2020 is a policy directed towards investments in green infrastructure. There are several polices which aim to improve ecological connectivity such as *Decree on ecologically important areas (Uradni list RS, št. 48/04, 33/13 in 99/13)* and The Natura 2000 Management programme for Slovenia for 2015-2020 (https://biodiversity.europa.eu/countries/gi/slovenia).

Croatia

Direct and indirect link to implementation of green infrastructure in Croatia can be observed in several projects like DRAVA LIFE - Integrated River Management, Green Bridges, COOP MDD, GrowGreen. In terms of the legal framework in Croatia, the Nature Protection Act only recognizes green infrastructure as a term but does not give any more explanation than that. The Strategy and Action Plan for the Protection of Biological and Landscape diversity of the Republic of Croatia as well as The Nature Protection Act indirectly addresses ecological connectivity through objectives and guidelines for the conservation of biological and landscape diversity (https://biodiversity.europa.eu/countries/gi/croatia).

Bulgaria

The strategic planning document, the National Prioritized Action Framework for NATURA 2000, prioritizes the development of green infrastructure, green business and green tourism in the Natura 2000 network in Bulgaria. Regarding projects on green infrastructure Bulgaria is collaborating in transnational projects (e.g. GREEN: Growth, Responsibility, partnErship, Ecology, Nature, EnRoute).

Romania

In Romania, the Law on Environmental Protection directly defines connectivity. Indirect reference to ecological connectivity and protection measures may be found in sectoral legislation (EURAC 2013). Projects on green infrastructure in Romania can be found on transnational (e.g. “Open Borders for Bears between Romanian and Ukrainian Carpathians”, “SURF-Nature project”, and “Lower Danube Green Corridor”) and national (e.g. “Implementation of adequate management systems for nature protection”) level. LIFE projects on green infrastructure (e.g. LIFE project Connect Carpathians) are not recurring in Romania (https://biodiversity.europa.eu/countries/gi/romania).

Serbia

Ecological connectivity is a relatively new concept in Serbian legislation. Serbian constitution does not explicitly mention ecological networks or

connectivity but there is a Regulation on Ecological Network and Rulebooks that addresses ecological connectivity (i.e. Rulebook on special technical-technological solutions for enabling smooth and safe communication of wild animals, Official Gazette of the Republic of Serbia No.72/2010). Ecological connectivity is also specified as a separate objective of Spatial Planning.

Ukraine

The environmental legislation of Ukraine provides extensive provisions on regulating the preservation of ecological networks. The key legislative document in terms of ecological connectivity is the Law on the Ecological Network of Ukraine. The provisions of this Law are hardly ever implemented in practice. Projects on green infrastructure include a transnational project with Romania ("Open borders for bears between Romanian and Ukrainian Carpathians"). According to Deodatus et al. (2013) who carried out a pilot study for the creation of functional ecological corridors for the Carpathians in Ukraine, identified key trends affecting connectivity in the Carpathians since 1990. These are strongly linked to privatization and fragmentation of land, farmland abandonment, encroachment of farmland and pastures by forests, road infrastructure development and unsustainable development of tourism facilities. Deodatus et al. (2013) provides a very comprehensive overview on the implementation and planning of ecological corridors in Ukraine, which is particularly valuable as the Ukraine is usually not covered by EU-wide data collection efforts.

Moldova

In the Environment Protection paragraph of the Action Programme of the Government of Republic of Moldova for 2016-2018 green infrastructure is indirectly mentioned as to integrate principles on environment preservation, protection and recovery, green economic development and adaption to climate changes in all sectors of national economy. Ongoing projects on ecological connectivity include "Mainstreaming biodiversity conservation into Moldova's territorial planning policies and land use practices".

In 2002 a pilot project was carried out with support of IUCN to identify key ecological corridors in Moldova (Cazantev et al. 2003).

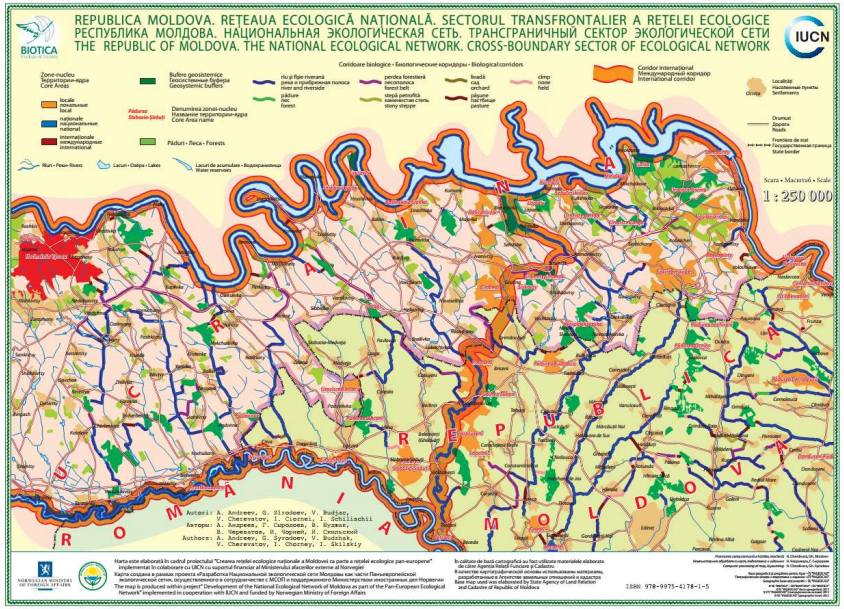


Figure 19: Moldova ecological corridors
Source: Cazantev et al. (2003)

2_7 Relevant (transboundary) projects and initiatives

In the course of the literature review, a comprehensive overview about ongoing or completed projects at macro-regional level in the Danube River Basin was done. This list gives a comprehensive overview at transnational level and indicates some projects at national level. The projects serve to identify key topics and actors addressed. A more detailed overview, which is periodically updated is available at https://biodiversity.europa.eu/countries.

INTERREG MaGICLandscapes

This project promotes sustainable land-use by providing land managers, policy makers and communities with tools and knowledge.

Link to green infrastructure: increase in the capacities of institutions to get to know the Green Infrastructure concept and to elaborate strategies and tools for protecting and further developing the existing Green Infrastructure in Central European regions.

Period: 2014-2020

Lead partner: Technische Universität Dresden - Faculty of Environmental Sciences/Fakultät Umweltwissenschaften

Participating countries of the DANUBE region: Slovenia, Hungary, Italy, Poland, Croatia, Czech Republic, Austria

Web access:

http://www.interreg-central.eu/Content.Node/MaGICLandscapes.html

INTERREG DANUBEparksCONNECTED

This project has initiated the Danube Habitat Corridor campaign to improve ecological connectivity on water, air and terrestrial habitats in the Danube Region. This includes the development of a Danube Dry Habitat Corridor Strategy, gap analyses for bottlenecks in Danube riparian forests, the establishment of a Danube Wild Island Habitat Corridor and the development of a Danube Free Sky strategy.

Link to green infrastructure: Develop Danube wide strategies and pilot actions to strengthen ecological corridors to counteract fragmentation.

Period: 2017-2019

Lead partner: Donau-Auen National Park, Austria

Participating countries of the DANUBE region: Austria, Germany, Slovakia, Hungary, Croatia, Bulgaria, Romania, Serbia, Moldova

Web access:

www.interreg-danube.eu/danubeparksconnected

INTERREG Danube coop MDD

This project fosters the restoration and management of ecological corridors in Mura-Drava-Danube through protection of core and buffer zones in five countries in existing nature parks, national parks and Natura 2000 sites.

Link to green infrastructure: promoting green infrastructure through restoration and management of important river corridors of Mura, Drava and Danube rivers

Period: 2017-2019

Lead partner: WWF Austria

Participating countries of the DANUBE region: Austria, Slovenia, Croatia, Serbia, Hungary

Web access:

http://www.interreg-danube.eu/approved-projects/coop-mdd

LIFE DINALP BEAR

The main project goal is to establish a transboundary, population level coordination in management and conservation of brown bears in northern Dinaric Mountains and the Alps which includes protection of migratory corridors.

Link to green infrastructure: promoting green infrastructure through ecological connectivity - restoration of land ecological corridors for targeted species.

Period: 2014-2019

Lead partner: Slovenia Forest Service (ZGS)

Participating countries of the DANUBE region: Slovenia, Croatia, Italy and Austria

Web access:

http://dinalpbear.eu/en/

INTERREG Alpine Space ALPBIONET2030

The project aims to implement a coherent and complementary Alps-wide system of Strategic Alpine Conservation Areas (SACA), reflecting the valuable and potential areas for ecological connectivity.

Link to green infrastructure: promoting green infrastructure through establishing ecological connectivity on macro-regional level (Alpine space)

Period: 2016-2019

Lead partner: ALPARC

Participating countries of the DANUBE region: Austria, Germany, Slovenia

Web access:

http://www.alpine-space.eu/projects/alpbionet2030/en/home

ETC Alpine Space Programme ECONNECT

The project was implemented to stimulate significant interest for the protection, improvement and development of ecological connectivity throughout the Alpine range.

Link to green infrastructure: promoting green infrastructure through ecological connectivity on macro-regional level (Alpine space)

Period: 2008-2011

Lead partner: University of Veterinary Medicine Vienna (Research Institute of Wildlife Ecology)

Participating countries of the DANUBE region: Austria, Germany, Slovenia

Web access:

http://www.econnectproject.eu/cms/?q=homepage/en

INTERREG Slovakia-Austria Alpine Carpathian River Corridor (AKK River)

The project goals are strengthening the habitat network of the Alpine-Carpathian Corridor and enhancement of rivers as ecological corridors through the implementation of revitalization and other habitat improving measures.

Link to green infrastructure: promoting green infrastructure through strengthening and enhancement of ecological land and river corridors on trans-national level.

Period: 2017-2020

Lead partner: Donau-Auen National Park, AT

Participating countries of the DANUBE region: Austria, Slovak Republic

Web access:

http://www.viadonau.org/en/company/project-database/aktiv/alpine-carpathian-river-corridor/?backurl=32

INTERREG Danube TRANSGREEN project

The project aims to contribute to safer and environmentally-friendly road and rail networks in mountainous regions of the Danube Basin with a special focus on the Carpathian Mountains.

Link to green infrastructure: developing concrete environmentally-friendly and safe road and rail transport solutions, considering elements of Green Infrastructure in particular ecological corridors.

Period: 2017-2019

Lead partner: WWF International Danube-Carpathian Programme

Participating countries of the DANUBE region: Czech Republic, Hungary, Slovakia, Romania

Web access:

http://www.interreg-danube.eu/approved-projects/transgreen

The European Green Belt as part of Green Infrastructure

This project strives to strengthen the governance structure of the European Green Belt Initiative, and to initiate a common strategical process for the European Green Belt, and to elaborate a concept for the representation in order to develop the Green Belt as part and model for Green Infrastructure.

Link to green infrastructure: representation and development of the Green Belt as part and model of Green Infrastructure.

Period: 2015-2018

Lead partner: European Green Belt Association e.V.

Participating countries of the DANUBE region: European Green Belt territory

Web access:

http://www.europeangreenbelt.org/projects/pan-european/the-european-green-belt-as-part-of-green-infrastructure.html

INTERREG IVC Green Infrastructure Network (GreenInfraNet)

The main goal of the project was to strengthen the development and implementation of green infrastructure in EU regions in close cooperation with other policy measures related to, for example, agriculture, urban development, transport, recreation and climate change adaptation.

Link to green infrastructure: developing innovative methods and tools based on green infrastructure

Period: 2011-2014

Lead partner: Flevoland Province Council (Netherlands)

Participating countries of the DANUBE region: Bulgaria, Hungary

Web access:

http://www.greeninfranet.org/

INTERREG Central Europe LUMAT

The implementation of sustainable land use and integrated environmental management of pilot projects in 7 Central European Functional Urban Areas (FUAs) is the main objective of this project.

Link to green infrastructure: Topics addressed in the FAMS include green infrastructure

Period: 2016-2019

Lead partner: IETU Institute for Ecology of Industrial Areas (Poland)

Participating countries of the DANUBE region: Austria, Czech Republic, Slovenia

Web access:

http://www.interreg-central.eu/Content.Node/LUMAT.html

INTERREG Central Europe Urban Green Belts (UGB)

The project aims to develop innovative methods and tools, leading to integrated models for managing urban green spaces smartly.

Link to green infrastructure: developing innovative methods and tools that are also based on green infrastructure

Period: 2016-2019

Lead partner: Municipality of 12th District of Budapest (Hegyvidék)

Participating countries of the DANUBE region: Slovenia, Hungary, Croatia, Czech Republic, Austria

Web access:

http://www.interreg-central.eu/Content.Node/UGB.html

Evaluation of Migration Permeability of the Landscape for Large Mammals and Proposal of Protection and Optimization Measures

The project goal was to improve the protection of landscape permeability for migration of large mammals with an aim of delimitation of migration corridors, representing an ecological network connecting areas of existing or potential presence of focal species (Eurasian lynx, Grey wolf, Brown bear, Muse and Eurasian Elk).

Link to green infrastructure: promoting green infrastructure through improvement of ecological land corridors for targeted species on national level

Period: 2008-

Lead partner: Ministry of the Environment of the Czech Republic

Participating countries of the DANUBE region: Czech Republic

Web access to the publication (English version): http://www.carnivores.cz/publications/protection-of-landscape-connectivity-for-large-mammals/

INTERREG IPA CBC Bulgaria-Turkey GREEN: Growth, Responsibility, partnErship, Ecology, Nature

The project aims to contribute to enhancing the cooperation in environmentally sustainable development in the cross-border area of Pinarhisar (Turkey) - Sredets (Bulgaria) through execution of small-scale investment activities in green infrastructure from both sides of the border.

Link to green infrastructure: promoting green infrastructure through small-scale investment activities in green infrastructure.

Period: 2017-2019

Lead partner: Municipality of Pinarhisar (Bulgaria)

Participating countries of the DANUBE region: Bulgaria

Web access:

http://www.ipacbc-bgtr.eu/projects-funded/green-growth-responsibility-partnership-ecology-nature

Enhancing Resilience of Urban Ecosystems through Green Infrastructure (EnRoute)

The project aims at enhancing knowledge of structure and functions of urban Green Infrastructure (uGI) and how it can be used in policy, to promote the application of urban green infrastructure at local level and delivering guidance on the creation, management and governance of urban green infrastructure.

Link to green infrastructure: promoting green infrastructure through small-scale investment activities in green infrastructure

Period: 2016-2018

Lead partner: Joint Research Centre of the European Commission (DE – Helmholz Centre for Environmental Research- Department of Urban and Environmental Sociology; Karlovo Municipality- BG)

Participating countries of the DANUBE region: Bulgaria, Germany

Web access to the inception report: https://ec.europa.eu/jrc/en/publication/enhancing-resilience-urban-ecosystems-through-green-infrastructure-enroute-inception-report

3 EXISTING ECOLOGICAL CORRIDORS AND CONNECTIVITY ELEMENTS IN THE DRB

3_1 Key elements of green infrastructures in the DRB

Green infrastructures are defined as a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation. This network of green (land) and blue (water) spaces can improve environmental conditions and therefore citizens' health and quality of life. These features vary for different types of habitats (air land, water). Connectivity can have several forms. It can be flyways as for migratory birds including steppingstones, but also terrestrial or river corridors (Jongman et al. 2011). The most obvious terrestrial corridors are forest corridors, but they can also exist as wetland/river related corridors or mountain corridors. According to Mazza et al. (2011) and Van der Sluis et al. (2004) the following features are considered Green Infrastructure Elements:

- **Protected areas** indicate already a certain existing value of national or international importance and are thus usually considered core areas for GI.
- **Restoration zones** are usually assigned to areas where important corridors are unprotected or fragmented, but still have a potential for restoration.

Individual GI elements can be either connected by natural connectivity features (e.g. existing corridors and natural areas), by artificial connectivity features (e.g. green bridges, built structures, green roofs), or by sustainable use/ecosystem service areas (areas where land use ensures permeability of the landscape such as extensive agricultural areas with lots of structures or mountain pastures).

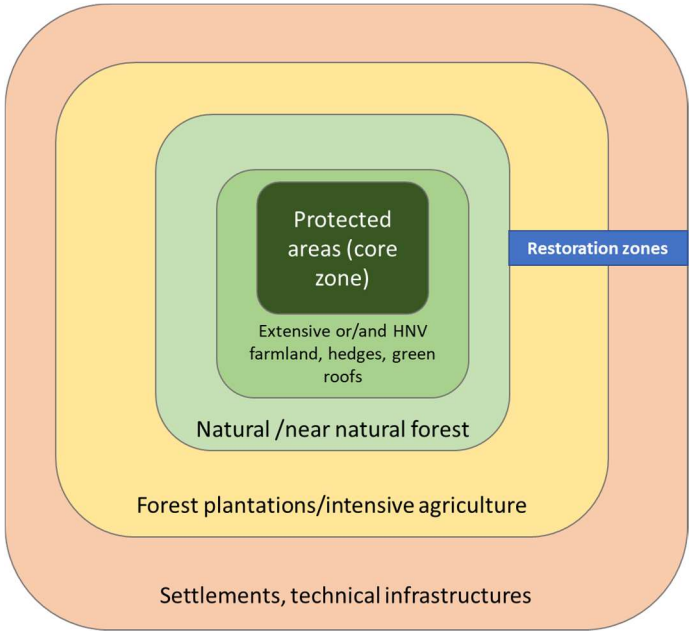


Figure 20: Elements of Green Infrastructures: Highest value inside (core), least value outside (barrier)
Source: Author's draft

Whereas protected areas, extensive or HNV farmland as well as (near) natural forest already represent important elements of green infrastructure; settlements, technical infrastructures, intensive agricultural areas or forest plantations are considered barriers between different green infrastructure elements. Thus, measures or projects can have the following foci:

- Maintenance/preservation of existing green infrastructure elements
- Improvement/restoration of areas that are considered as barriers for ecological connectivity through political or technical measures

Local importance	gardens, Green roofs, ponds, hedges, urban parks, rivers,
Regional/national importance	lakes, watersheds, extensive cultural landscapes, (semi-) natural forests
EU/transnational importance	international watersheds, large forest areas, mountain ranges

Table 2: Key GI elements and their spatial relevance

3_1_1 Main corridors and elements: Land

Protected area network

The backbone of Green Infrastructure on land is the protected area network within the Danube River Basin. If properly managed and maintained it secures the habitats also for those species with higher demand on their environment on a long-term perspective. According to the world database on protected areas an incredible number of more than 12 395 protected areas exist within the investigation area. Most of the protected areas especially the bigger ones are on higher mountains like those within the Alps, the Dinaric Alps, the Carpathians and the Balkan Mountains. In lower elevations, forest areas like the Bavarian forest and Sumava represent huge protected areas. In Hungary some large protected areas also cover the central part of the country. Apart from that the Danube River Delta covers a large area; most of them IUCN category V. Additionally, a variety of Natura 2000 sites were established along the major rivers like the Danube itself, the Drava and others.

However, protected areas are often not sufficient to fully cover all relevant ecosystems and habitat types required for connectivity as protected areas apart from Natura 2000 are often not selected regarding ecological representativeness but for other (e.g. political) reasons (Broggi et al. 2017). Nonetheless, this network provides the core of any GI-network.

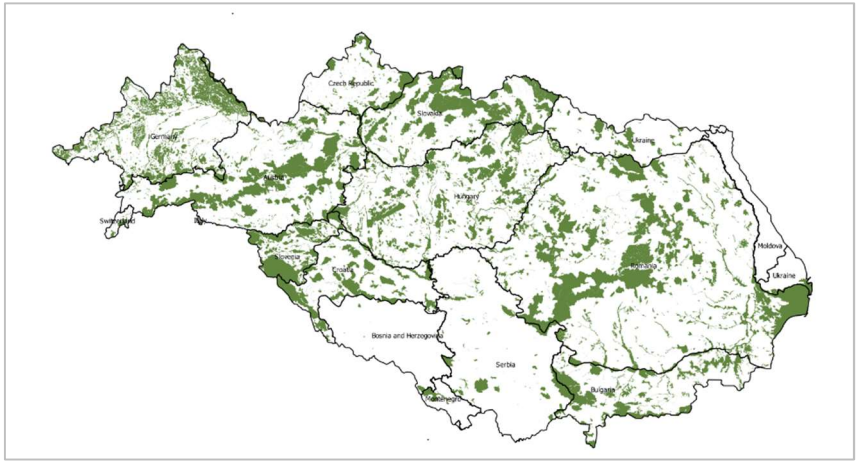


Figure 21: Protected area network of Danube River Basin. Source: WDPA 2018

All the countries contribute to the protected area network. Compared to the member states of the European Union with their Natura 2000 network, Bosnia and Herzegovina, Moldovia and Serbia did not establish larger protected areas apart from some national parks. On the other hand, those countries still maintain large natural areas within the investigation area.

Large Forest areas

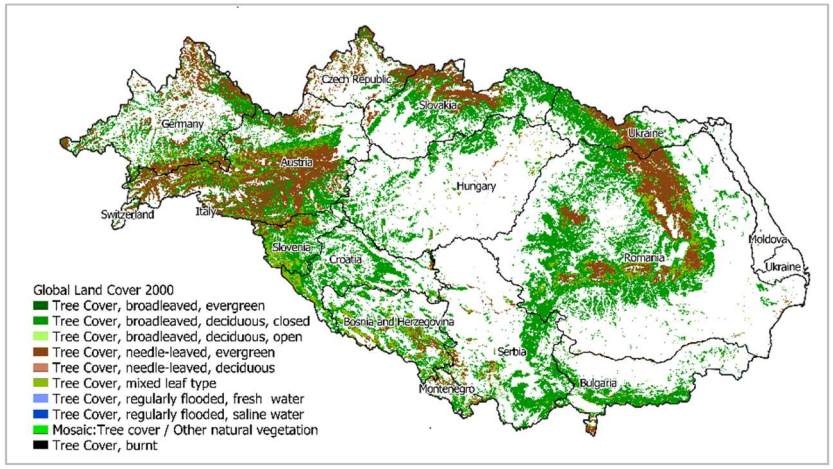


Figure 22: Large forest areas of Danube River Basin.
Source: JRC (2015)

Outside of protected areas, large forest areas play an important role as green infrastructure, if the forestry use is not too intensive. Areas with spruce monoculture or intensive logging with clear cuts are considered ecological barriers.

Areas characterized by traditional extensive agriculture

Apart from large forest areas – some of them adjacent alluvial forest to the Danube and the side rivers – areas with a rather extensive agriculture, characterized by small patches of meadows, fields and hedges, play a big role. There are some major key infrastructures or ecological corridors of transnational importance on land.

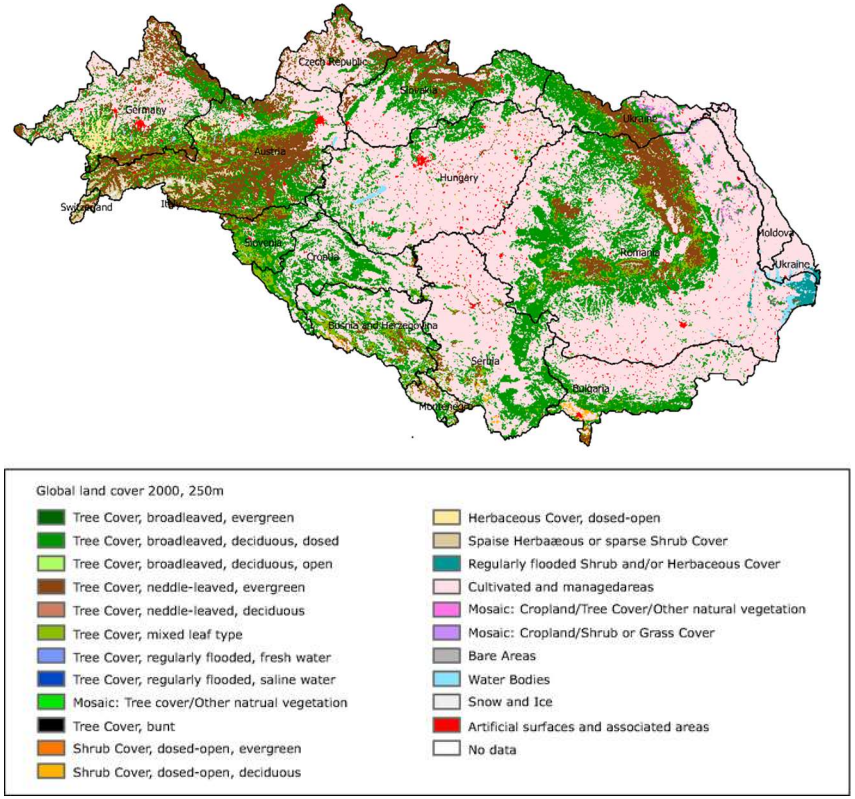


Figure 23: Land cover in the Danube River Basin; intensive agriculture in light red
Source: Global Land Cover (EEA, 2018)

The global land cover analysis shows rather few extensively cultivated areas, which are located particularly in mountain areas. This reflects good agricultural production capacities in lowlands stretching from East of Vienna till the Carpathians. Intensive agricultural areas are considered as barriers.

Main corridor 1: Alps-Carpathians corridor

Another transnational key infrastructure and important ecological network is defined as Alps-Carpathians corridor. It follows the Alps and the Carpathian Mountains, and many species of higher elevations occur in both mountainous areas. The Alps and the Carpathians shelter a large variety of large wild animals such as deer, lynx, wolf or bear – species that nowadays strongly depend on humans for the conservation of their natural habitat. The corridor between the Alps and the Carpathians is a traditional migration route for wildlife. This corridor does not only connect the Eastern border of the Alps with the Little Carpathians in Slovakia but also crosses a highly dynamic European region located between the cities of Bratislava, Sopron and Vienna. As a consequence, there is a good knowledge basis available for ecological connectivity in the Carpathians (e.g. Kutal, 2013; Maanen et al. 2006, CEEB 2011; Deodatus et al. 2013; Andel et al. 2010).

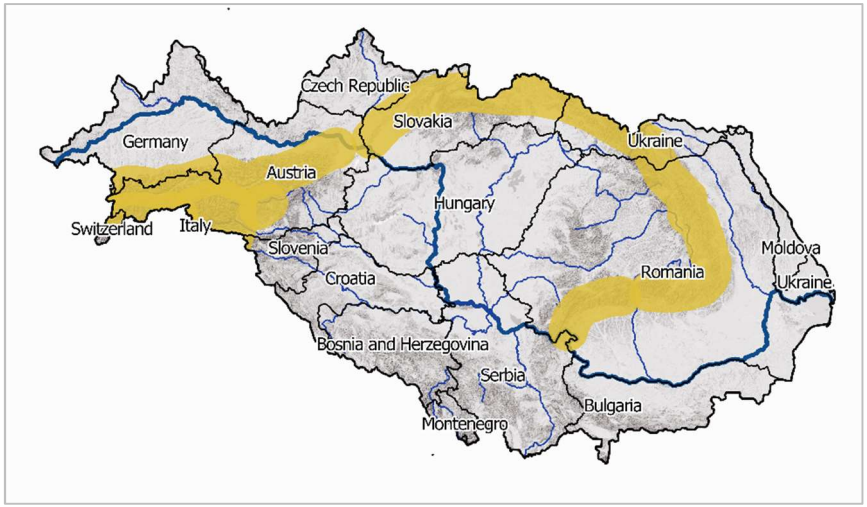


Figure 24: Alps - Carpathians Corridor.
Source: Author's draft

The connection of this areas and the improvement of the ecological situation is of transnational importance and the WWF together with Alp Parc has taken up a project to improve the habitat conditions for migrating wildlife together with the University of Agricultural Science of Vienna.

Also, the European Beech Forrest Network, recently founded as result of the approval an international world heritage side, broaches the need of ensuring the permeability and improving the corridors for typical and rare beech forest species with high demand on ecological quality habitats. Examples of significant species for central Europe are barbastelle bat, Alpine longicorn and white back Woodpecker which occur in the wilderness areas of Dürrnstein and the Nationalpark Kalkalpen in Austria (Kirchmeir & Kovarovics, 2016).

Main corridor 2: Alps-Dinaric Arc Corridor

Additional to those mentioned above, the Alps – Dinarics – Corridor is an important North-South connection for large mammals like (Proschek, 2005). This corridor at the southern end of the investigation area must be also considered as part of the green infrastructure of the Danube River Basin. It is reflected in the protected area network of Slovenia and Croatia, but not yet in Bosnia Herzegovina and Serbia and is an important North-South connection.

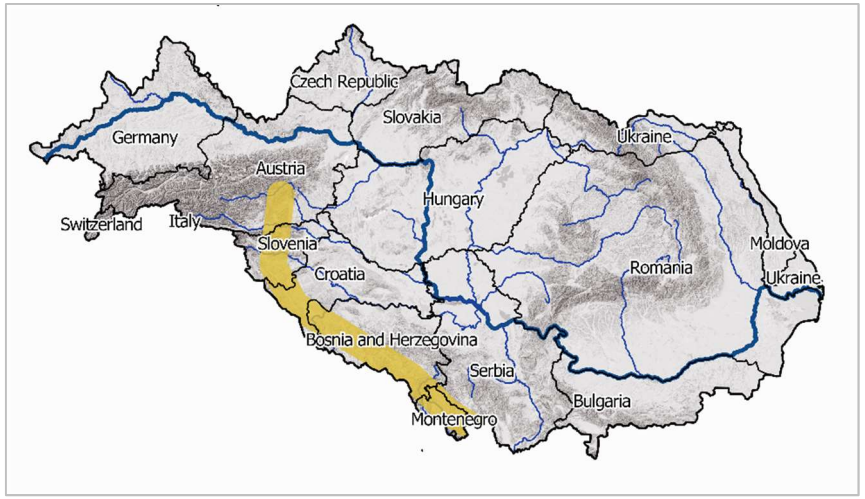


Figure 25: Alps – Dinaric Corridor
Source: Author's draft

WWF Adria plays a key role in protecting the biodiversity of the Dinaric Arc region, part of the larger Mediterranean and Danube-Carpathian ecoregion and is the main driver for pushing conservation in the Dinaric Arc. Currently, many Balkan countries (Montenegro, Macedonia, Croatia, Serbia) are focusing on the extension and consolidation of the protected area network (Natura 2000 and Emerald sites).

The area is an important refuge for large carnivores (lynx, bear, wolf) and other migratory species. Through the Alps and the Danube with its tributaries, the Dinaric Arc Ecoregion has many connection points to other European Macro Regions.

Main corridor 3: Danube Corridor

The corridor along the Danube is amongst the most valuable aquatic and terrestrial corridors in the DRB as it is the lifeline of the DRB passing by through the center of the microregion and crosses also rather developed and industrialized parts.

Currently, DANUBEPARKS is working on strengthening the corridor by establishing a network of wild islands and a dry habitat corridor. Considerable efforts regarding aquatic connectivity have already been made, whereas efforts to strengthen terrestrial corridors is rather new. However, riparian forests, (semi-wild) islands, dry habitats and wetlands comprise valuable green infrastructure elements along the Danube fulfilling not only ecological functions but also providing several ecosystem services such as flood retention or recreation. Particularly, in the lower flowing sections, urbanization and economic development are posing the main challenges (Filipovic & Petrovic, 2015).

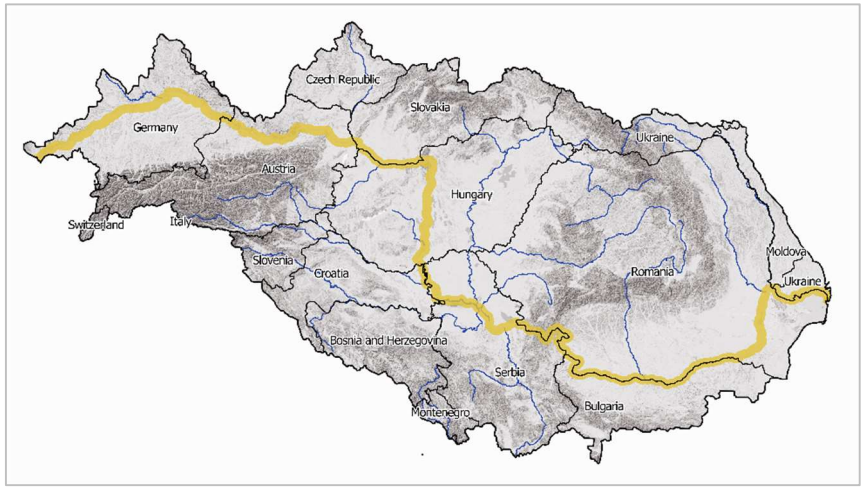


Figure 26: Danube Corridor
Source: Author's draft

3_1_2 Main corridors and elements: Water

Regarding aquatic connectivity, the Danube itself and its main tributaries are considered key elements of GI. Additionally, larger lakes supplement the Blue infrastructure of the Danube. Given the detailed and extensive mapping and activities of ICPDR, this section only indicates the main river system as well as the main lakes in the area.

In many cases (e.g. DANUBEPARKS Network, riparian forests and wetlands) this blue infrastructure is a core green infrastructure as well.

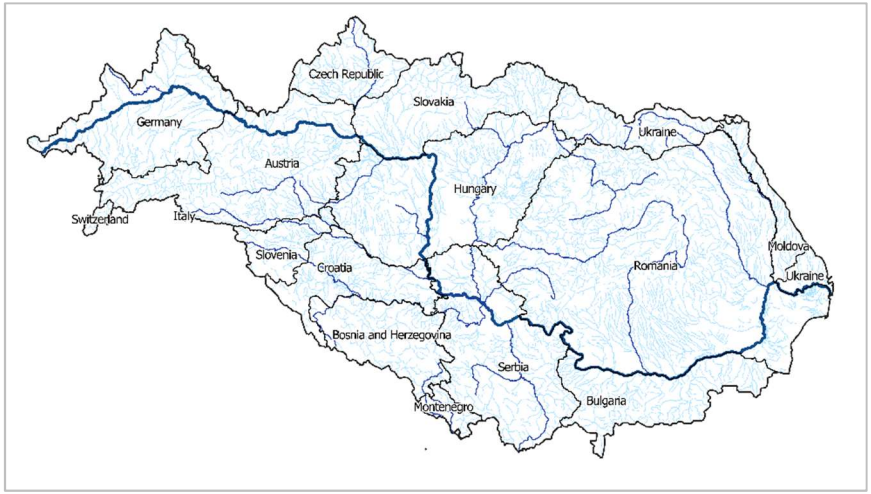


Figure 27: River system of Danube River Basin (Danube and main tributaries) Source: Author's draft based on data retrieved from https://www.danubegis.org/

The main lakes (surface area > 100 km²) in the Danube River Basin are Lake Neusiedl, Lake Balaton, Lake Sinoe, Lake Golovita, Lake Zemeica, Lake Razelm, and Ozero Ialpug. Out of these lakes Lake Balaton with an average depth of 3,60 m, is the deepest one.

Table 3: Danube and major rivers in the Danube river basin

	Mouth at Danube	Length	Size of catchment	Average discharge
river	[rkm]	[km]	[km^2]	[m^3/s]
Danube	0	2,78	801,463	6,46
Lech	2,497	254	4,125	115
Naab	2,385	191	5,53	49
Isar	2,282	283	8,964	174
Inn	2,225	515	26,13	735
Traun	2,125	153	4,257	150
Enns	2,112	254	6,185	200
Morava/March	1,88	329	26,658	119
Raab/Rába	–	311	10,113	88
Vah	1,766	398	18,296	161
Hron	1,716	278	5,463	55
Ipel/Ipoly	1,708	197	5,108	22
Sió	1,498	121	9,216	39
Drau/Drava	1,382	893	41,238	577
Tysa/Tisza/Tisa	1,214	966	157,186	794
Sava	1,17	861	95,719	1,564
Tamis/Timis	1,154	359	10,147	47
Morava (CS)	1,103	430	37,444	232
Timok	846	180	4,63	31
Jiu	694	339	10,08	86
Iskar	636	368	8,684	54
Olt	604	615	24,05	174
Yantra	537	285	7,879	47
Arges	432	350	12,55	71
Ialomita	244	417	10,35	45
Siret	155	559	47,61	240
Prut	132	950	27,54	110

Furthermore, the Danube Delta represents the key blue-green infrastructure of this system. Its main river is the most important corridor passing several otherwise disconnected areas. It is influenced by the whole river basin through its tributaries.

Due to the fact that rivers often also form transnational borders, these blue infrastructures, these systems are often of transnational importance. Management issues cannot be addressed at national level only. This has already led to the formation of interesting initiatives (Green Belt, Duna-Mura-Drava- area, March-Thaya riparian wetlands).

3_1_3 Main corridors and elements: Air

Ecological connectivity from an aerial point of view is a challenging question to address. Key elements for ecological connectivity in the air are migratory routes of birds and the linked main resting places of migratory birds, which are mostly wetlands.

Figure 28 provides a rough overview of main migratory routes of selected birds. Additionally, the Danube River itself is also considered a major flyway for certain species (FreeSky Initiative of DANUBEPARKS).

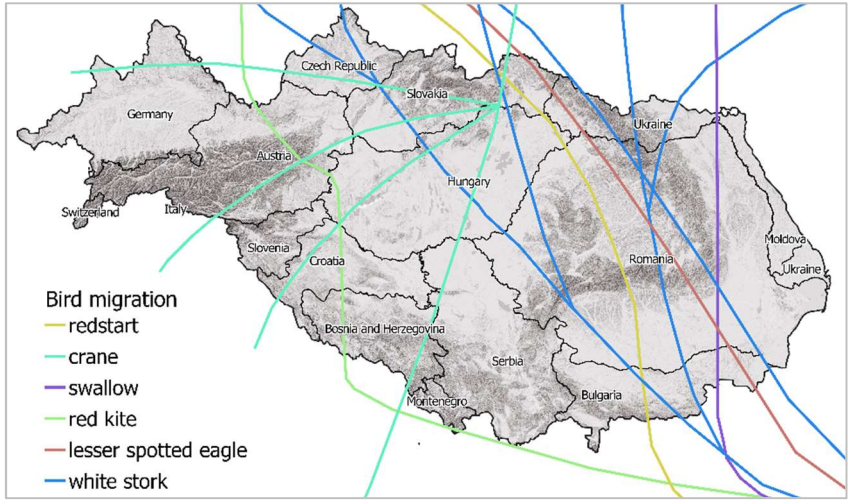


Figure 28: Bird migration – selected species (redstart, crane, swallow, red kite, lesser spotted eagle and white stork)
Source: NABU Crane Centre (2018)

The main routes of bird migration are shown for selected species in the Danube region in Figure 28. Hortobagy in Hungary is an important stopover site for crane. Other important sites are the Danube delta, Lake Balaton and Lake Neusiedl.

Even though these corridors are rather flexible and may shift due to habitat changes, climatic or wind direction changes, further investigation of these routes seem essential. The Convention on Migratory Species (CMS) aims to protect migratory species throughout their range, which particularly crucial for birds and is a key question of transboundary or international cooperation (e.g. Agreement of CMS on "African-Eurasian Migrant Waterbirds" linking Siberian, European and African Wetlands) (Jongman et al. 2011). Flyways of birds include the routes (and its barriers such as power lines), intermediate resting and feeding places as well as the respective final destinations (Boere et al. 2006). The Danube River Basin occupies an important role as it has core resting and feeding places.

However, the state of knowledge is still rather limited and the question of flyways in the discussion about green infrastructures and ecological connectivity has been widely neglected.

3_2 Relevant anthropogenic barriers

The natural relief of a landscape can act as a barrier for many species. Especially the mountain areas act as a barrier. The key mountain ranges in the DRB area are the Alps, the Tatra, the Dinaric Alps, the Balkan Mountains and the Carpathians. However, apart from the tops of these mountains ranges, these are mostly core areas for GI and are the backbone of GI next to the Danube and the protected area network.

Beside the natural barriers, there are several anthropogenic barriers such as airports, highways, hydropower plants and populated areas (Figure 29, Figure 30, Figure 31). Favilli et al. (2014) provide a good analysis of barriers for ecological connectivity in the Carpathians and Marschall et al. (2012) of barriers and gaps of the Green Belt.

Barriers on land

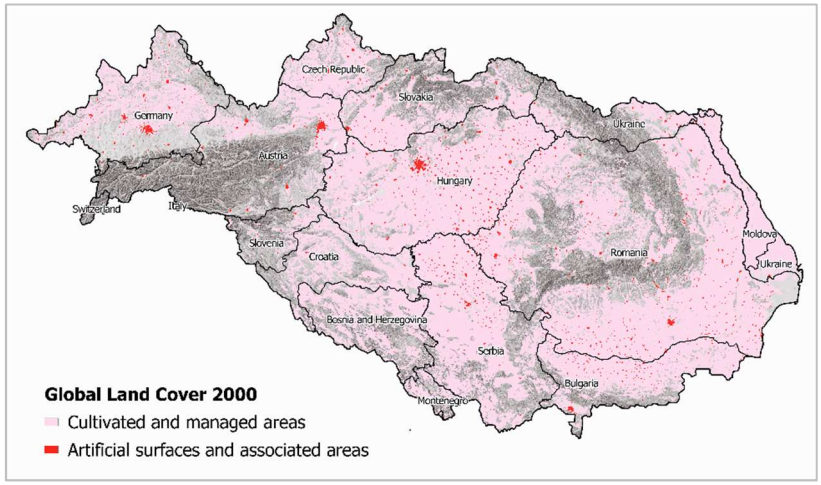


Figure 29: Cities and densely populated areas as barriers for terrestrial connectivity.
Source: Author's draft based on GLC 2000 map (JRC 2015)

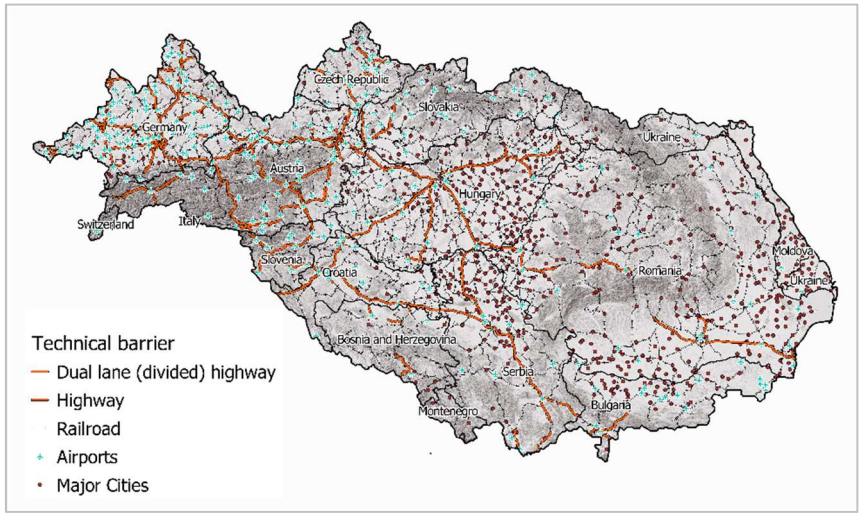


Figure 30: Linear transportation infrastructures, airports and major settlements as crucial terrestrial barriers.
Source: Author's draft based on Google Maps and Open Street map

Barriers on water

The river system is beside of hydropower plants additionally negative influenced by artificial in-channel structures and anthropogenic negative influence on hydraulic characteristics. In the Danube River Basin there are over 700 dams and weirs only at the main tributaries.

The ICPDR in general and DANUBEPARKS in specific have been continuously working on aquatic connectivity for many years. Thus, restoration potential and status are well known at macroregional level. However, the main focus so far was the main river, whereas tributaries only gradually receive increased attention.

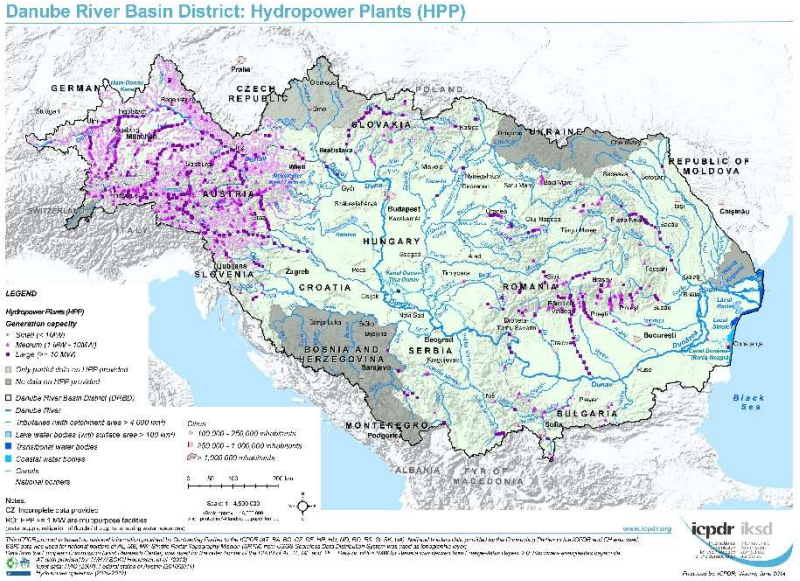


Figure 31: Existing hydropower plants as main barriers for an ecological continuum in river ecosystems
Source: ICPDR (2015)

Barriers in the air

In the air, the main barriers are related to high voltage powerlines and wind parks resulting in considerable mortality of migrating birds. However, no comprehensive map for high voltage powerlines and wind parks could be retrieved in reasonable resolution.

Planned barriers

The DRB is a very dynamically developing and in many parts not yet developed region. Areas that still have high ecological integrity and low fragmentation – particularly in the Carpathians – are facing increasing development pressures (logging and transportation infrastructure development).

This particularly includes the implementation of the strategic energy (TEN-E) and transportation (TEN-T) networks.

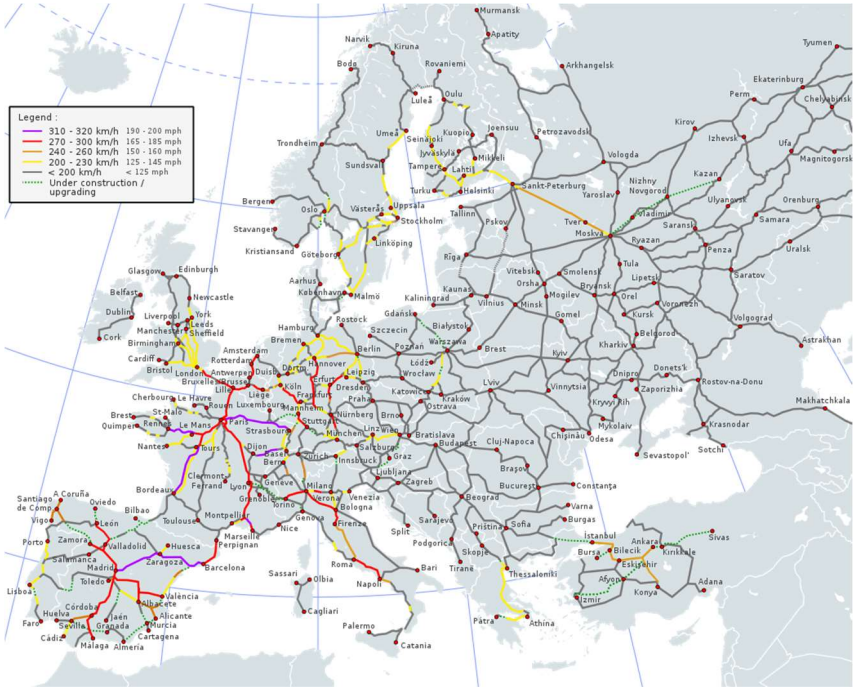


Figure 32: TEN-T: Railway network overview
Source: Bernese media, User:BIL2011 SVG version: User:Akwa and others derived from High Speed Railroad Map of Europe 2015.svg

The consideration of the TENs in planning ecological connectivity is essential as these corridors are likely to become the main barriers in future unless connectivity questions are already integrated into planning and implementation of TEN projects (e.g. EIA, spatial planning, compensation measures, obligatory green bridges).

Regarding TEN-E particularly new high voltage powerlines and wind parks are potential barriers for migrating birds and bird flyway corridors.

Figure 33: TEN-T: Core network corridors in the DRB
Rhine-Danube Corridor (blue), Mediterranean (green), Orient/East-Mediterranean (brown).
Source: http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html?corridor=9

A burning topic furthermore is the comeback of border fences due to the ongoing migration crisis in Europe. Since 2012 hundreds of kilometers of permeable or impermeable fences were constructed across Europe. These fences may cause direct mortality for wildlife but represent also barriers for wildlife or migrating animals if these barriers persist for a long time. These can go as far as starting genetic differences caused by permanent fences (Trouwborst 2016).

3_3 Corridors of transnational importance in the DRB

Summarizing the specific corridors, the outline of an ecological network in the DRB shows four main corridors regarding macroregional ecological connectivity on land: The Green Belt, the Danube, the Alps-Carpathians corridor as well as the Alps-Dinaric Arc Corridor.

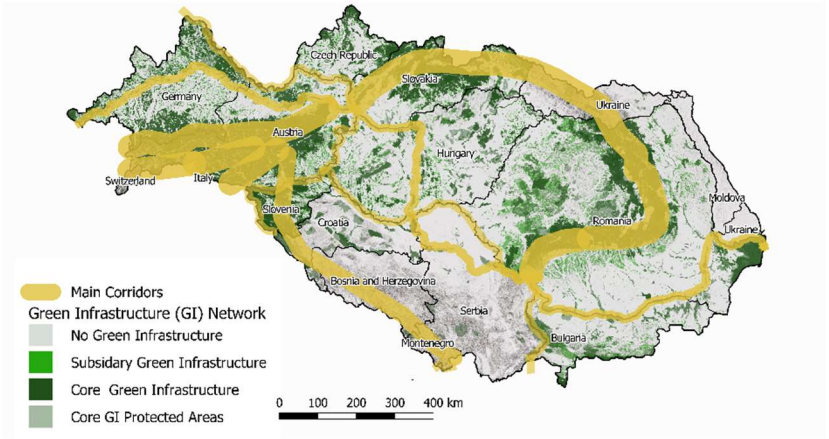


Figure 34: Main corridors of transnational importance in the DRB
Source: Author's draft based on green infrastructure data from Liquete et al. (2015)

Additionally, the Balkan Corridor is connecting the Alps-Dinaric Arc Corridor with the Black Sea and is located at the Southern boundary of the Danube River Basin.

3_3_1 Connectivity of main corridors in the DRB

In order to have a general overview of the degree of fragmentation and the spatial distribution of individual steps stones was elaborated via ArcGis. This analysis serves to identify major gaps at macro-regional level and supports the interpretation of the general status quo.

Methods

The spatial analyses were implemented with ESRI ArcMap (with Spatial Analyst Extension) and QGIS version 3.2.0-Bonn. As the underlying data for the cost distance analysis the protected areas in the DRB (IUCN, UNEP-WCMC, 2018) and the Global Land Cover 2000 (Global Land

Cover 2000 database. European Commission, Joint Research Centre, 2003) were used. The Global Land Cover 2000 were classified in three categories natural (extensively used and natural vegetation), intensive (cultivated and managed areas) and anthropogenic (Artificial surface and associated areas) areas. Natural areas and the protected areas where combined as core areas (green). Hence, the least accumulative cost distance for each core area over the classified Global Land Cover 2000 was calculated. The least accumulative cost distance is represented in light green. The changing color gradient from light green until dark violet shows an increasing effort to get to the next core area.

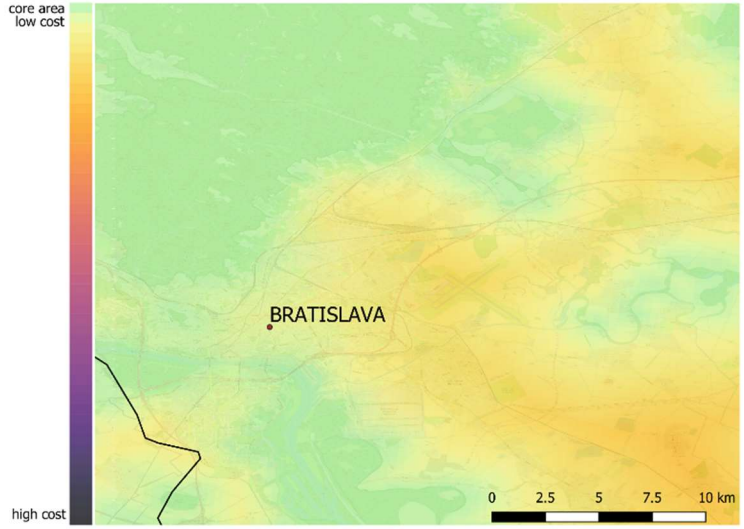


Figure 35: Example of the results of the cost-distance analysis at the Slovak-Austrian border
Less isolated areas (green) and stronger isolated areas (yellow/orange)
Source: Own analysis carried out with QGIS 2.8.

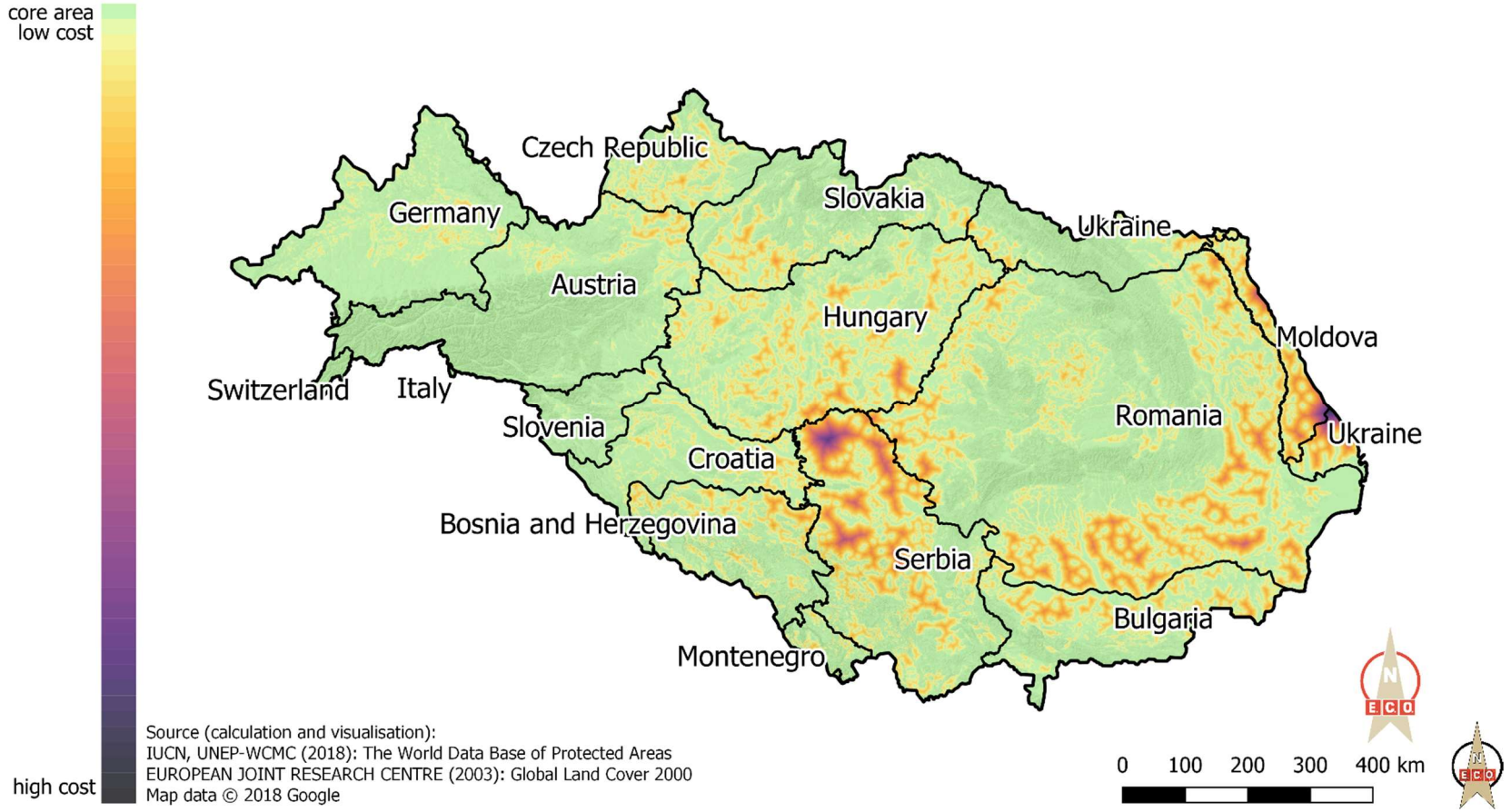


Figure 36: Cost-Distance Analysis of the DRB: Status of Macroregional ecological connectivity
Source: Own analysis carried out with QGIS 2.8.; Basic data: Global Land Cover 2000 (JRC/EC 2003) and UNEP-WCMC (2018)

Results of the cost-distance analysis

Figure 36 shows the results of a cost-distance analysis of the whole Danube River Basin. Whereas greenish areas have low distances between them, yellowish to violet areas indicate areas where no or only very isolated patches of (semi-)natural areas can be found. Given the scope of work and time given, no linear barriers (roads, railroads) were

considered in the analysis.

The results show only a broad overview at macroregional level. It is important to note that this analysis does not replace a concrete local assessment and modelling for targeted species and local barriers. However, the results can be used at a very strategic level when it comes to decisions about the selection of pilot regions, the allocation of budgets for connectivity projects or the determination of transnational corridor systems.

Furthermore, isolated areas in more intensive/fragmented areas most probably have a higher importance with regards to loss of the area. Whereas areas with cost values (green) allow for many different options for wildlife to migrate (alternative routes), a loss of natural elements in isolated (yellow-violet) can trigger complete isolation.

Nonetheless, the analysis shows clearly where existing main corridors are located and gives a broad indication of areas with low general connectivity, this particularly applies for:

- The Pannonian Lowlands in the border region of Croatia, Serbia and Hungary. These are areas that are dominated by large intensive agricultural areas. The Green Belt and the Danube are amongst the few key green infrastructures in the area.
- The lowland areas between the Danube and the Carpathians in Romania. These areas are also dominated by important agricultural areas. Tributaries to the Danube main river represent important, local elements for connectivity between the Danube and the Carpathians.
- The area where Ukraine, Romania and Moldova share the boundary shows some major barriers and is located along the main Alps-Carpathians Corridor.
- The boundary area between Slovakia and Austria is a major barrier for the connection of the Alps with the Carpathians. Thus, it has received considerable attention by numerous stakeholders and NGOs in the past and at present.
- The boundary area between Slovakia, Ukraine, Hungary and Romania shows some major barriers which are located right along the main corridor within the Carpathians. Thus, this area was also already targeted in some projects on ecological connectivity.

These areas were also selected to be priority areas for ecological connectivity related pilot projects. For the selection of these areas the following criteria were considered:

- Degree of isolation
- Transboundary aspects (at least 2 countries)
- Location along one of the identified main corridors
- Areas with a certain amount of existing knowledge (e.g. through previous or ongoing projects) to further develop and implement approaches and to avoid starting from scratch.

Figure 37 shows five selected priority areas for consideration of the implementation of pilot projects as proposed in chapter 5

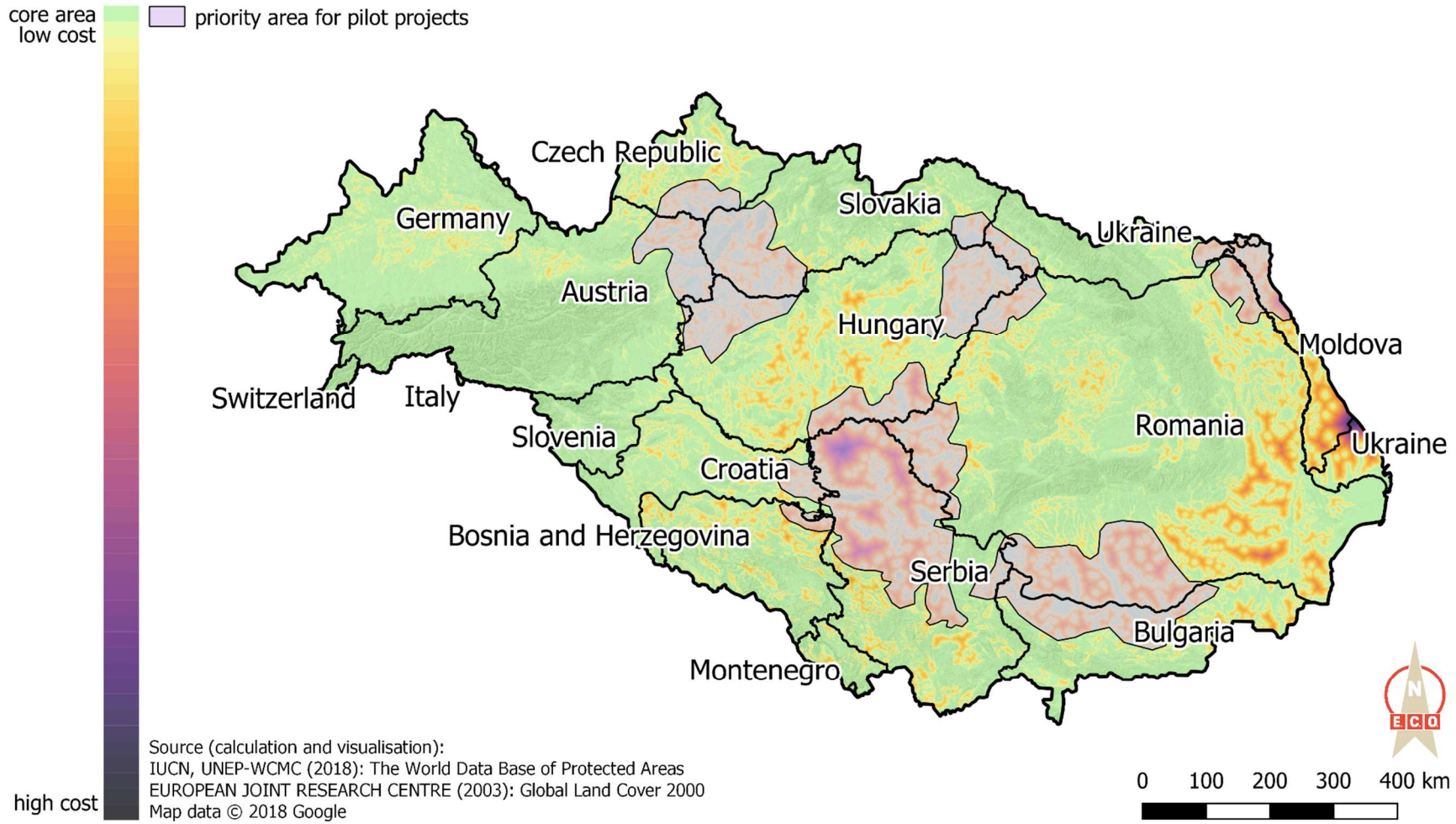


Figure 37: Priority areas proposed for the implementation of pilot projects on ecological connectivity

4 EXISTING GAPS AND CHALLENGES

The analysis of the current state of knowledge, available studies and selected interviews with representatives of ALPARC and DANUBEPARKS shows a number of different gaps to be addressed in the future.

The different gaps refer to:

- Research and knowledge gaps
- Cooperation gaps
- Institutional gaps
- Communication gaps
- Spatial gaps

Research/knowledge gap: Selective connectivity topics

Most attention so far has been paid to the longitudinal connectivity of the Danube main river, the ecological connection between the Alps and the Carpathians (Alps-Carpathians Corridor) and species-related connectivity in the Carpathians (particularly for bear, lynx, wolf and capercaillie). DANUBEPARKS recently extended the scope towards…

- …the dimension of connectivity in the air for birds including a mapping and flagging of powerlines and wind parks to ensure bird connectivity;
- …terrestrial connectivity along the Danube (Danube Dry Habitat Corridor, Wild Island Initiative).

However, generally there has been paid low attention to flyways of birds in the whole DRB, the tributaries of the Danube and the connectivity of patches in the DRB outside the Carpathians.

Research gap: Lack of a common model

Corridor construction is the backbone of any attempt to develop a green corridor, a green belt and ecological networks. Making linkages and providing for connectivity within the larger network structure is of great importance for the functioning of the system. Hence, corridor planning has become the determining factor of any reasonable network scheme. (Zhang 2012).

A variety of models have been proposed in theoretical studies, including dispersal models, least-cost modelling, cost-distance models, sources-sink models, geographic surface models or movement models of individuals. All of these models primarily apply to specific landscape scales. Recently, the topological analysis based on graph theoretical methods and artificial neural networks have been discussed. However, there still is no satisfactory and comprehensive theoretical framework to support the concept of landscape connectivity in developing multi-scale ecological networks.

Research gap: Interface science – policy making

Abundant literature is available from a scientific point of view, but this is often constrained to the local level or the scientific world whereas research seldomly is appropriately being communicated to the decision-making level.

In recent years there was a boost in available literature regarding green infrastructures at different levels. As of now, bringing together the rather policy focused green infrastructure results with ecological studies focusing on the concrete ecological connectivity seems to be the major challenge for the near future.

Research gap: Complex large ecological processes

Knowledge transfer is needed as well as new knowledge especially in relation to the impact of changing environmental and land use conditions on species and habitats in the wider countryside. Climate and global change will affect the patterns of many ecological and other relationships in the landscape, potentially leading to a level of complexity that may prove intractable and difficult to resolve. Research on changing population patterns in relation to landscape permeability should be directed towards the provision of essential knowledge needed for the limitation and prevention of irreversible damage, adaptation and mitigation measures (Jongman et al. 2011).

Knowledge gap: Macro-regional overview

The information about the current status on ecological connectivity is very dispersed and varies a lot between the different countries of the Danube River Basin (Kostyanzski 2013). Similar challenges have been reported also from the EUSALP area (Plassmann et al 2016) and other studies which tried to provide an overview on ecological connectivity or green infrastructure (Sinnett et al. 2016).

Table 4 provides an overview about the information available about ecological connectivity in the individual countries of the DRB and about the degree of integration into national planning.

Austria and Germany have carried out numerous studies and projects regarding the identification of corridors and barriers for different habitats and species. A broad overview on corridors and related qualitative information is available. In certain sectors, the results are integrated into specific spatial plans (e.g. Waldfachplan (Forest Management Plan) in Austria or the consideration of wildlife corridors in transportation infrastructure planning in Germany (Rudolph et al. 2010).

Furthermore, the Czech Republic, Slovakia and Hungary have rather good concepts for national ecological corridors systems (TSES), which need to be considered in spatial planning. Thus, there is also a national legal basis for ecological corridors. However, during the research no in-depth information about the quality of these corridors or the final degree of implementation could be derived.

Most countries at least dispose of an overview about their main ecological corridors at national level and detailed studies for specific areas (e.g. locally relevant corridors) or specific species (e.g. regional lynx corridors). However, ecological connectivity and ecological corridors are seldomly legally implemented or integrated into spatial planning. In most cases, ecological connectivity is considered a cross-cutting topic only. The quality of corridors in many countries remains unclear which can be related to publications only in national languages, no public availability of data or the fact that this information is not available.

This underpins the necessity to identify common standards and methods if the issue of connectivity is to be tackled at transnational or macroregional level.

Table 4: Available information and activities regarding ecological connectivity in individual countries of the DRB
green: good information/frequent activities, yellow: medium information level/some activities, orange: no information available/no activities)
Author's assessment based on literature review

	Transboundary activity	Corridors known	Quality of corridors known	Barriers mapped	Legally integrated	Integration into spatial planning
Austria						
Bulgaria						
Croatia						
Czech Republic						
Germany						
Hungary						
Moldova						
Serbia						
Slovakia						
Slovenia						
Romania						
Ukraine						

As a consequence of this heterogeneity, hardly any transnational information is available and can be only created by using global datasets and probably missing much locally or nationally available information. Information about the TSES in Slovakia and Czech Republic could potentially be highly relevant also for other countries.

When it comes to the topics addressed it is very clear that water-related connectivity issues are mostly addressed at transnational level providing comprehensive information about connectivity and barriers. Regarding land, the information mostly remains at national level with corridors sometimes even ending at the countries boundary. Most connectivity projects, laws or acts strongly refer to terrestrial connectivity, whereas aerial connectivity is an issue not yet mentioned anywhere.

Knowledge gap: Detailed information about priority corridors

Table 5: Overview on knowledge gaps for priority corridors
Available information about key corridors of transnational importance; Estimation of study team based on literature review

	(Transboundary) project activity	Corridors known	Quality of corridors known	Barriers and gaps mapped	Main actors	Remarks
Alps-Carpathians Corridor	Abundant, but dispersed	Various mappings and model results	Widely yes	Partly, ADC-corridor as priority area	CNPA, DANUBEPARKS, ALPARC	Large area with dispersed initiatives and punctual projects
Dinaric Arc Corridor	Isolated	Partly	Partly	Not available	WWF Adria	Wide area of the Balkan serving as corridor
Danube	Abundant	Well known through DANUBEPARKS and ICPDR	Detailed knowledge for aquatic space, mixed information for land, no information for air	For aquatic connectivity	DANUBEPARKS, ICPDR	
Green Belt	Isolated	Completely know and mapped	Mostly mapped	Detailed gap analysis available	Green Belt Initiative; no institutional framework	Based on the Green Belt Initiative

Cooperation gap: Heterogeneity of basic data

Given the fact that the DRB comprises “old” and “new” EU states as well as non-EU members, the heterogeneity of data is very high, even though there have been several efforts to collect harmonized datasets (e.g. http://www.ccibis.org/). However, connectivity models such as JECAMI require a certain amount of harmonized data. These models also work with generally available data (e.g. Global Land Cover or CORINE Land Cover) but this serves to create a general picture rather than being a tool for regional gap analyses or concrete corridor development.

Even though advanced geospatial technologies have been applied in some counties, the qualities of their application are not harmonized with others. These techniques might, in the future, have the potential to be effectively applied. However, the validation of large-scale modelling approaches relies on sufficient and reliable data. This is a minimum requirement to use these connectivity data for ecological network planning.

Cooperation gap: Knowledge exchange and institutional cooperation

A key challenge in the field of ecological connectivity is the discrepancy between theoretical research and practical application in practice in the different countries (Zhang 2012). The harmonization of data, databases, geospatial information and the development of a common approach is indispensable for a transboundary strategy (Zhang 2012, Interview Kohler 2018). As within each country several subnational and national agencies, universities, NGOs or transboundary bodies such as DANUBEPARKS work on ecological connectivity, a comprehensive overview is challenging (Zhang 2012). Given the broad scope and heterogeneity of actors, there is a general lack of common maps and a common understanding of ecological connectivity (Interview Kohler 2018).

Institutional gap: Coverage of the DRB

In terms of structures, the most relevant framework for the implementation of GI seems to be the system of macroregional strategies linked with specific conventions and their implementing bodies (Figure 38). These are often main drivers to bring forward ecological connectivity at a transboundary level.

The analysis indicates that an institutional framework that supplements a macro-regional strategy with a legal basis, a funding instrument and an implementing body is most promising (Ionita et al. 2013). Thus, ALPARC

(EUSALP) and DANUBEPARKS (EUSDR) strongly pushed ecological connectivity within their scope of influence. Whereas the purpose of DANUBEPARKS is to explicitly focus on the Danube River as such, ALPARC has a broader mission and explicitly works in the whole area of the Alpine Convention. CNPA theoretically has the same institutional basis but is currently lacking human and financial resources to push forward.

Ecological connectivity measures – particularly transboundary ones – are to a large extent pushed by these implementing bodies. However, following this logic, there is neither a legal basis (explicit convention) nor a corresponding implementing body available for:

- Areas which are not in the immediate proximity of the Danube
- Areas that are outside the sphere of work of ALPARC

CNPA and the Carpathian Convention theoretically have the explicit objective push ecological connectivity (Art. 4 (1.) of the Convention, which states that parties should "…*take appropriate measures to ensure a high level of protection and sustainable use of natural and semi-natural habitats, their continuity and connectivity, and species of flora and fauna being characteristic to the Carpathians*…" and Art. 4 (5.) which states that the parties should *"…cooperate in developing an ecological network in the Carpathians, as a constituent part of the Pan-European Ecological Network, in establishing and supporting a Carpathian Network of Protected Areas, as well as enhance conservation and sustainable management in the areas outside of protected areas*."

However, there is a gap for areas in the DRB that are neither addressed by DANUBEPARKS (Danube Corridor) nor ALPARC (Alpine areas) or CNPA (Carpathians). Furthermore, CNPA currently has insufficient capacity to increasingly work on connectivity topics as there is currently only one part-time responsible person.

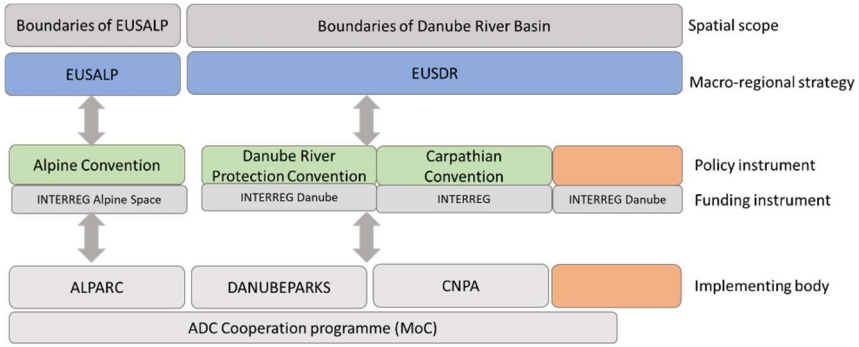


Figure 38:Key framework for the implementation of ecological corridors at transboundary or macroregional level
Source: Author's draft

Institutional gap: Limited access to funding/inappropriate knowledge or availability for funding mechanisms

Resources for the communication, planning and implementation of ecological connectivity projects are rather limited mostly to INTERREG and LIFE projects. During the interviews carried out (Interview Kohler 2018 and Frank 2018), it was mentioned that there are only limited funding opportunities for concrete – non-innovative implementation projects. This can be either due to the lack of a concrete, transboundary funding instrument or a lack of information about existing funding opportunities.

On the long-term ecological connectivity measure it could be useful to consider them in agro-environmental schemes with the EU CAP or in the LEADER programme development.

Institutional gap: Lack of a transboundary body/platform

The Ecological Continuum Initiative and the multi-stakeholder platforms established by ALPARC seem to be viable option to ensure a continuous intersectoral and international exchange. However, no such platform or forum specifically addressing connectivity questions is available in the DRB.

Cooperation gap: Disconnection between ecology and policy/other sectors

Most projects, initiatives and studies were initiated by stakeholders from the ecological sector (either public or private). Intersectoral approaches are most promising (e.g. approach by ALPARC), however interest and involvement of other sectors remains low (BROSCHÜRE CONNECTIVITY ALPS) or limited to specific cases (cooperation with energy sector for flyways within INTERREG DANUBE or with transportation sector within INTERREG TransGreen).

Cooperation gap: Connecting national and local network initiatives

Based on observations of the implementation of the Natura 2000 network Zhang (2012) identifies the spatial scope and their hierarchic relationship as a key challenge: Ecological plans, management plans or strategies are linked to different scales (national-regional-local). Often it remains unclear how they are connected. He identified 3 key questions that are also essential in the context of implementation of ecological connectivity projects:

- How to achieve reasonable transitions from a national protection strategy to concrete local projects; what are the main principles and what is the theoretical model?
- How to achieve negotiations and mediations when dealing with local stakeholders, especially when aiming at financial compensations for individual land owners
- How to optimally explore community contributions, particularly through involvement social learning and other processes by which the maximum protective effects might be achieved?

This challenge is also closely linked with the implementation of GI (Interview Kohler 2018) and has been partly solved by the pilot region approach of ALPARC. However, still the challenge of local implementation of (inter)national strategies by local stakeholders remains a challenge. Kohler (2018) thus pleads for a stronger involvement and ownership of local stakeholders, even though it is often not realized due to low interest of respective stakeholders (Plassmann et al. 2016).

Cooperation gap: National focus vs. transnational network

The PEEN project was successful in reaching its goal to promote the idea of a pan-European vision of biodiversity conservation through a European ecological network. However, yet there is still no coherent ecological network in place (Jongman et al. 2011).

A major problem is that European ecological corridors are not being developed as there is no responsible institution or coordination mechanism in place. That means that coherence between countries and regions is hard to realize in practice. Developing connectivity is one of the recommendations of the CBD Conference of Parties in Nagoya (Japan) in October 2010. Ecological networks need to be developed at the field and regional scales, and at the national and transnational scales (Jongman et al. 2011).

Apparently, most countries have completed quite a lot of work regarding ecological corridors at national level which require to be interlinked amongst each other.

Cooperation gap: Lacking main vision and understanding of GI and connectivity

Currently, there is no common understanding of GI and connectivity leading to a large diversity of efforts, regulations and activities that are not compatible (Interview Kohler 2018). There are countries that have a comprehensive system of national ecological networks which are integrated into spatial planning and reflect the national level perspective (Hungary, Slovakia, Czech Republic, Germany), countries that focus on isolated efforts at regional scale (Austria, Romania, Ukraine), countries where ecological connectivity is a rather new topic (e.g. Serbia) and countries that focus on selected implementation projects only (e.g. Bulgaria). Hardly any information is available for non-EU states such as Moldova, Bosnia & Herzegovina or Ukraine. Even though more detailed information is available for selected countries (e.g. Romania (Cazan 2013) or Serbia (Kujundžić 2013)). Furthermore, projects are often focused on specific species (e.g. lynx, bear, capercaillie, sturgeon) and not on strengthening a general ecological network.

This also refers to the cultural heterogeneity as many data is available only in national languages and different structure.

Habitats and corridors from an ecological point of view mostly refer to species and species migration patterns (traditional understanding of corridors). This requires a modelling of specific distribution and movement patterns of species. However, more recent concepts of ecological connectivity and green infrastructure increasingly refer to a multifunctional – and process-oriented understanding of connectivity (e.g. functioning of ecological processes, ecosystem services, human benefits), not referring to individual species anymore. This shift in understanding challenges also a clear communication between stakeholders.

Communication gap: Benefits of ecological networks and Green Infrastructures – concrete effects such as ecosystem services

Awareness amongst stakeholders is rather low (Frank 2018), you need to see connectivity before you can integrate it into spatial planning (Interview Kohler 2018), strong demonstration projects are crucial as a first step.

Quantifying the economic benefits of ecological networks and making them explicit through interdisciplinary research and integrated long-term research on the social, economic and ecological mechanisms that maintain biodiversity and its ecological services is a clear necessity. (Jongman et al. 2011), also to raise awareness amongst stakeholders. Currently, many institutions are working on quantifying and communicating the benefits of ecosystem services (e.g. TEEB 2010; Getzner et al. 2015; Maes et al. 2018). An increasing focus still needs to be paid to how to use these results to communicate the benefits of GI, which explicitly include the maintenance and provision of ecosystem services as a main benefit.

Almost all who are actively involved advocate that tremendous positive effects are achieved by establishing ecological networks. These advocates are active in the fields of nature conservation and ecological and sustainable development. Much money has been invested into network construction. On the other hand, there is a considerable shortcoming of confirmation, through quantitative assessment, on the degree that ecological networks really work. There is a great need to answer the question: to what degree has any ecological network achieved its objective? (Zhang 2012).

Spatial gap: Detailed corridors and barriers mapped for priority corridors

Connectivity gaps are described at local level in various reports. One of it describes gaps in the central European Green belt (Schlumprecht et al, 2008). Gaps are mainly described as either areas which are not legally protected areas and areas with intensive land use. Additionally, artificial surfaces (roads, railways, urban areas, fabrics and settlements) were counted as connectivity gaps.

A general cost-distance analysis carried out with existing datasets by the authors reveals some key gaps at macroregional level particularly for the main corridors. These gaps include particularly:

- Connection Alps-Carpathians
- Connection Carpathians-Black Sea
- Connection of the Pannonian Flatlands
- Connection within selected areas of the Carpathians
- Connection of tributaries with Danube Main River

Particularly, the implementation of TEN E and T in the Carpathians are likely to cause major fragmentation of this corridor in future.

5 PROJECT OUTLINE FOR ENHANCING ECOLOGICAL CONNECTIVITY

Based on the literature review, the spatial analysis and the derived gaps, several project ideas were extracted. The purpose of this study is not only to give an overview on ecological connectivity in the DRB but also to identify gaps and project opportunities to close them.

In order to develop targeted pilot project proposals to enhance ecological connectivity in the EUSDR area, different types of projects need to be applied (Figure 39).

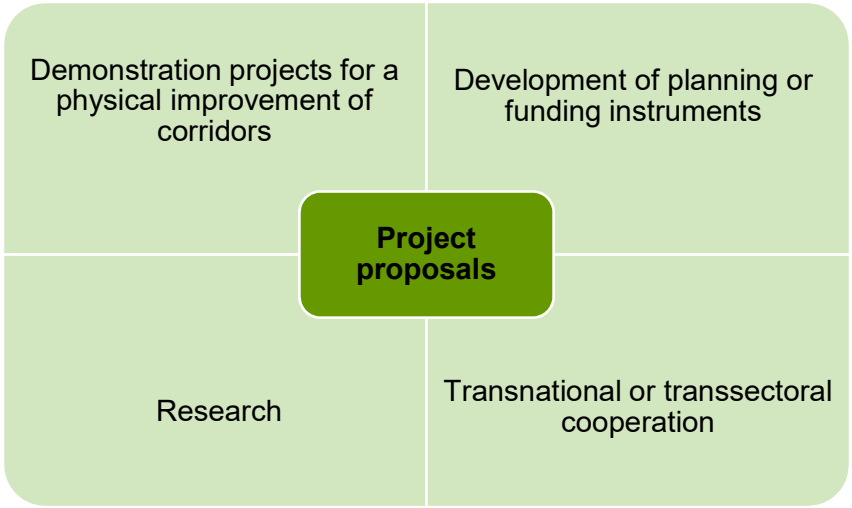


Figure 39: Type of pilot project proposals
Source: Author's draft

Demonstration projects for physical improvement of corridors

Demonstration projects serve both to increase awareness amongst stakeholders and the broad population and to physically improve connectivity in priority areas. This is a main instrument of LIFE and some INTERREG projects. In order to make political strategies, theoretical concepts or in this case ecological connectivity tangible, it is necessary to show hard facts to stakeholders. Concrete projects thus help to increase awareness and prepare the ground for the development and implementation of instruments, to integrate connectivity into spatial planning at different levels and to develop tools to be upscaled.

Research projects to enhance knowledge

Connectivity is a highly complex topic. The establishment of corridors, regulations or spatial planning tools requires a profound scientific basis regarding underlying causes and linkages. This includes the modelling of ecosystem services benefits, to present reliable facts for communication. It also includes in-depth research regarding the selection of appropriate sites for stepping stones for specific species to avoid inappropriate implementation. Knowledge about large-scale ecological processes is still limited. Thus, research projects are amongst the key elements when aiming to promote ecological connectivity.

Cooperation projects to strengthen transnational collaboration and tackle transboundary topics

Ecological connectivity does not stop at the border. It requires mechanisms for cooperation and exchange of knowledge. In order to implement transboundary measures and concepts appropriate stakeholder platforms or institutional and legal arrangements need to be established.

Planning instruments to institutionalize connectivity by integrating them into policy instruments

At the end of all pilot and research projects, the results should be considered in regulations, mechanisms or instruments to institutionalize the results if they proved to make a relevant contribution to the objective. Otherwise, results will remain isolated cases with isolated impacts.

List of proposed project ideas

Based on the analysis of the current state on ecological connectivity, ongoing activities and various existing project documents and strategies (e.g. the ADC Action Plan) in the DRB, several project ideas were

proposed and discussed within EUSDR and PA06.

Given the scope of work of EUSDR, particularly transboundary, intersectoral and strategic projects are of particular interest. After presentation of 7 project proposals derived from the analysis (

Table 6), the representatives of PA06 (Bavarian State Ministry of the Environment and Consumer Protection, PA 6 Leader of EUSDR) selected three of the most relevant and important ones for further elaboration. Proposals 1, 5 and 7 were selected, 2, 3, 4 were not selected and 6 was split and integrated into the other proposals.

Proposal Nr. 1strives to develop harmonized approaches and tools for macroregional planning of corridors and the prepare the ground for transboundary implementation of GI- or corridors based on sound data and information.

Project proposal Nr. 5 is considered crucial for the long-term work on ecological connectivity as connectivity topics need to be dealt with in an intersectoral environmental. Thus, a platform which includes all relevant stakeholders is the basis.

The abundant, but dispersed information about ecological connectivity solutions, leads to project proposal Nr. 7. “ConnectivitySolutions” which aim to promote particularly successful solutions that yet exist but that most decision-makers and planners are not aware of. These results and a related methodological toolbox should enable decision-makers in the future to easily implement connectivity measures.

The communication of ecological connectivity is a cross-sectoral subject which is considered an essential part of all projects. It is a key challenge for most projects to prepare and communicate information in a relevant, appropriate and tailored way so that the target group can make use of the results and that they have sound basis for making respective decisions.

The following chapters provide more detailed information about the project proposals selected for further elaboration. The other project proposals were not subject to further work.

Table 6: Summary of project outlines to enhance ecological connectivity in the DRB

List presented to PA06 for selection of 3 proposals for further elaboration (1, 5 and 7 were selected. Elements of 6 were extracted for further elaboration in the proposals 1, 5 and 7).

Nr.	Title	Key objective	Type
1	**Connecting corridors: Development of a common approach to define and determine ecological corridors for key target species on land**	Harmonized approaches and tools for macroregional planning; Creation of basis for implementation	Research, transnational cooperation
2	ConnectTHEdisconnected: Ecological corridors and connectivity: Detailed analysis of barriers and priority corridors	Improvement of terrestrial connectivity; intersectoral cooperation between transportation and environment sector	Research, transnational cooperation; identification of demonstration projects
3	ConnectAir: Protection of migratory bird corridors and establishment of air corridors and related step stones	Improvement of sky corridors; intersectoral link between ecology, & energy sector	Research, (demonstration project)
4	ConnectForest: Increasing beech forest connectivity in the Danube River Basin	Improve forest connectivity, thematic network building	Transnational cooperation, demonstration projects, research
5	**ConnectionBeyond: Establish a network of**	System of blue and green	Policy development

	linked protected areas and policy stakeholders to enhance ecological connectivity outside protected areas: Pilot project on green and blue corridors	corridors: Options for integration into spatial planning	
6	Communicating ecological connectivity: Establishment of a transnational communication and knowledge sharing platform	Improvement of awareness; knowledge sharing amongst policy, science, practitioners	Transnational cooperation
7	**ConnectivitySolutions: Pilot actions towards closing gaps of ecological corridors**	Physical improvement of corridors; Demonstration sites for communication and awareness raising	Demonstration/Implementation

5_1 Proposal 1: Connecting corridors: Development of a common approach to determine ecological corridors for key target species on land

Type

Research; Transnational Cooperation

Gap addressed

Currently, almost all countries have to some extent ecological connectivity strategies, maps or have existing corridors. However, in some cases no information about the status/quality of these corridors is available, often the target species or targeted habitats are not the same. Furthermore, most corridors end at the national borders with no obvious connection to the adjacent country. The only exception is the ecological connectivity of the Danube River System itself where main barriers and restoration potential was identified and is available at macroregional level. For land and air, no harmonized approach or comparable information is available.

A harmonized knowledge basis is amongst the largest challenges and one of the most crucial elements for the establishment of a common network.

Background

There has been made already considerable – mostly isolated – efforts to work towards a common approach for defining ecological corridors in the area mostly focusing on the Carpathians supported by ALPARC. Within the efforts to enhance ecological connectivity, ALPARC priority areas for ecological connectivity in the Alps (Strategic Alpine Connectivity Area – SACA) (Plassman et al. 2016a):

- SACA Category 1: Areas with a very high degree of fragmentation (Ecological intervention areas)
- SACA Category 2: Areas with persistently functional connectivity and with non-fragmented patches (Ecological conservation areas)
- SACA Category 3: Areas with a high potential for connectivity with larger, more or less natural non-fragmented patches (Ecological potential areas)

A similar approach could be very helpful for the determination of priority intervention areas in the DRB. Furthermore, the corresponding methodology has already been developed (Plassmann et al. (2016) and an application in the EUSDR area will also allow to coordinate efforts with the Alpine Macro Region and will create easy linkages for trans-macro-regional connectivity.

With JECAMI the Alpine area also disposes of a transnationally applicable tool to model ecological connectivity and initial efforts have already been made to adapt the tool for the Carpathians (Interview Kohler 2018). Next to this, the Carpathians already dispose of a common basis with the WebGis Platform developed within the ConnectGreen INTERREG project.

The implementation and adaptation could be considered an action under the ADC Action Plan and thus has a legally agreed basis for cooperation.

When defining corridors, different scopes for defining need to be considered. Thus, it seems to be useful to refer to the different levels as were used for the preparation of the PEEN maps (Jongman 2011):

- *mega-scale:* very large natural core areas (>10000 km^2);
- *macro-scale:* large natural core areas (>1000 km^2) connected with wide corridors or stepping stone elements (width >10 km);
- *meso-scale:* medium size core areas (10-1000 km^2) and connecting corridors between these areas (width 0,1-10 km);
- *micro-scale:* habitats, woodlots, wetlands, grassland patches, ponds (<10 km2) and connecting corridors (width <0,1 km).

The focus of this project should be at mega and macro scale, eventually meso-scale. Micro-scale should be applied in selected pilot regions also to calibrate the other scales and form the basis for the implementation of practical measures.

Project objective

Development of a common, standardized approach and tool giving EUSDR, governments and other stakeholders the ability to analyze connectivity, plan transboundary measures and localize spatial gaps in the network at a transboundary level. A standardized tool will allow for the identification of key ecological corridors for specific habitats or species based on a through spatial analysis.

Work package

WP 1: Transnational working group and communication platform

Establishment of a transnational working group comparing the national approaches and agreeing on common features and standards. It is particularly important to form an interdisciplinary multinational working group to agree on a joint definition of ecological connectivity, standards and tools.

This platform furthermore should serve as multiplier for the results.

Results:

- Periodically meeting working group in place
- Joint position paper on ecological connectivity in the DRB

WP 2: Elaboration of common tools and standards

After agreement on standards and tools, these tools need to be adapted or developed. This particularly includes the definition of targeted umbrella species (e.g. Lynx, Wildcat, Brown Bear), the methods to identify corridors, the spatial scope of corridors as well as the adaptation of the tools to be used. It is recommended to use JECAMI as a well-tested tool and adapt it to the specific characteristics of the EUSDR region.

Results:

- Adapted toolbox for identification of corridors
- Adapted WebGis tool for future use
- Technical handbook on ecological connectivity in the DRB

WP 3: Establishment of macro-regional corridors

This work package comprises the application of the tools at macro-regional level and the determination of a final corridor network in the DRB. This includes the compilation and harmonization of national and globally available data as well as the creation of an ecological network map for the DRB. Particular attention needs to be paid to transboundary connection of individual corridors.

Results:

- Harmonized dataset for the macro-region available through WebGis Platform
- Ecological connectivity map for the EUSDR Macro-Region

WP 4: Establishment of pilot regions

A crucial element of the definition of ecological connectivity map and the future implementation of pilot measures is the identification of Connectivity Pilot Regions. For the selection of pilot regions, it is highly recommended to follow the approach of ALPARC in the Alpine areas and make use of their experiences. This can be considered an action within the implementation of the ADC Action Plan. This serves to link the macro-regional corridors with local implementation, to validate the results and to test the SACA approach. Many countries have national systems and these need to be integrated into the macro-regional perspective. It is

recommended to select transboundary pilot regions in order to have the opportunity to directly compare results and methodologies as the transnational connection points are a key question when different national ecological corridor systems meet. Amongst the pilot regions the following could be contacted:

- Slovakia-Austria at the March-Thaya-Auen,
- Austria-Slovenia-Hungary at the Mura-Drava Biosphere Reserve
- Croatia-Serbia at the Gorne Podulnavlje Nature Reserve
- Slovakia-Ukraine-Poland around Uzhanskyi and Poloniny National Park
- Germany-Czech Republic at Sumava NP/Bayrischer Wald
- Romania-Serbia at the Iron Gate area

In subsequent projects and work steps these regions can also serve as pilot regions for the implementation of connectivity measures.

Results:

- Local stakeholder platform established
- Delineation of pilot regions
- Map with validated SACAs

WP 5: Communication and knowledge management

- Create a common spatial tool (e.g. Webgis) for the EUSDR area indicating the main corridors
- Set-up of a training format to disseminate the methods, tools and standards to the target audience needed.

A key element is related to the communication and dissemination of the results. It specifically refers to the processing of the results in a way that it meets the needs of the respective target group. This includes particularly the following activities:

Table 7: Proposal for the focus of a dissemination strategy

Element to be disseminated	Target Group	Emphasis on
Ecological connectivity analysis tool	National nature conservation and spatial planning authorities, NGOs,	dissemination of the common tool to be used for national or supra-regional planning
Ecological connectivity map at macro regional level	National decision-makers, EUSDR Priority Area Coordinators, Pole meetings (INTERREG)	Awareness raising about ecological connectivity
Position paper on joint definition and standards	National nature conservation and spatial planning authorities, NGOs,	Awareness raising about ecological connectivity
Map of SACAs in pilot regions	Regional decision-makers, interested public, local NGOs, Spatial Planning authorities	Awareness raising about ecological connectivity, implications for regional planning

Involved partners/institutions

ALPARC has develop the JECAMI tool for the analysis of ecological connectivity in the Alpine area and has defined SACAs for the Alpine Area. This tool can be adapted to the specific requirements of the EUSDR area. According to the ADC Action plan this is an activity also proposed within the ADC cooperation and could be carried out in cooperation of ALPARC, DANUBEPARKS and CNPA.

Furthermore, nature conservation ministries of involved countries should be consulted and involved where appropriate, particularly with regards to data collection and harmonization.

A key question will be the hosting of the WebGis platform. These platforms are often set-up within the frame of specific projects and never fully come to life. Thus, joined forces with ALPARC and the JECAMI tool should be envisaged.

The European Parks Academy in Klagenfurt which is supported by IUCN provides short practice-oriented trainings to specific topics for very

specific target audiences. A cooperation with this academy could lead to the elaboration and testing of specific training contents and be used to disseminate the newly agreed standards amongst all countries of the DRB.

Furthermore, representatives at district level of the finally selected pilot regions should be involved and include stakeholders from different sectors.

The European Beech Forest Network (within the frame of the UNESCO Natural World Heritage Site of Primeval Beech Forests of the Carpathians and Other Regions of Europe) could be an appropriate partner for defining pilot regions outside the already known protected area networks.

Countries

For the determination of macroregional corridors, the mega and macro-scale level requires the involvement of all DRB countries. The calibration of the corridors should take place in specific pilot regions, which are in the ideal case transboundary. This could comprise either sites in Romania/Ukraine, Slovakia/Austria and Austria-Slovenia-Hungary (Duna-Mura-Drava BR)(Meso-and Micro scale) or areas of the UNESCO World Heritage sites (Austria, Germany, Slovenia, Croatia, Romania, Bulgaria, Slovakia, Ukraine) (Pilot regions).

Funding options

Given the nature of the project and the required transnational cooperation objective, INTERREG DANUBE seems to be an appropriate funding source (Priority 2: Environment and culture responsible Danube region – Foster the restoration and the management of ecological corridors).

Regarding the set-up of pilot regions and knowledge exchange group in a transnational context, selected parts could also fit into INTERREG Europe Priority Axis 4 Environment and Resource Efficiency.

In the case of a stronger research focus and a focus on ecosystem services provided by the GI elements identified, the axis “societal challenges” of the Horizon 2020 programme could be a further option. However, given the more practical needs as a basis for spatial or territorial planning, the project seems to fit better within the INTERREG programmes.

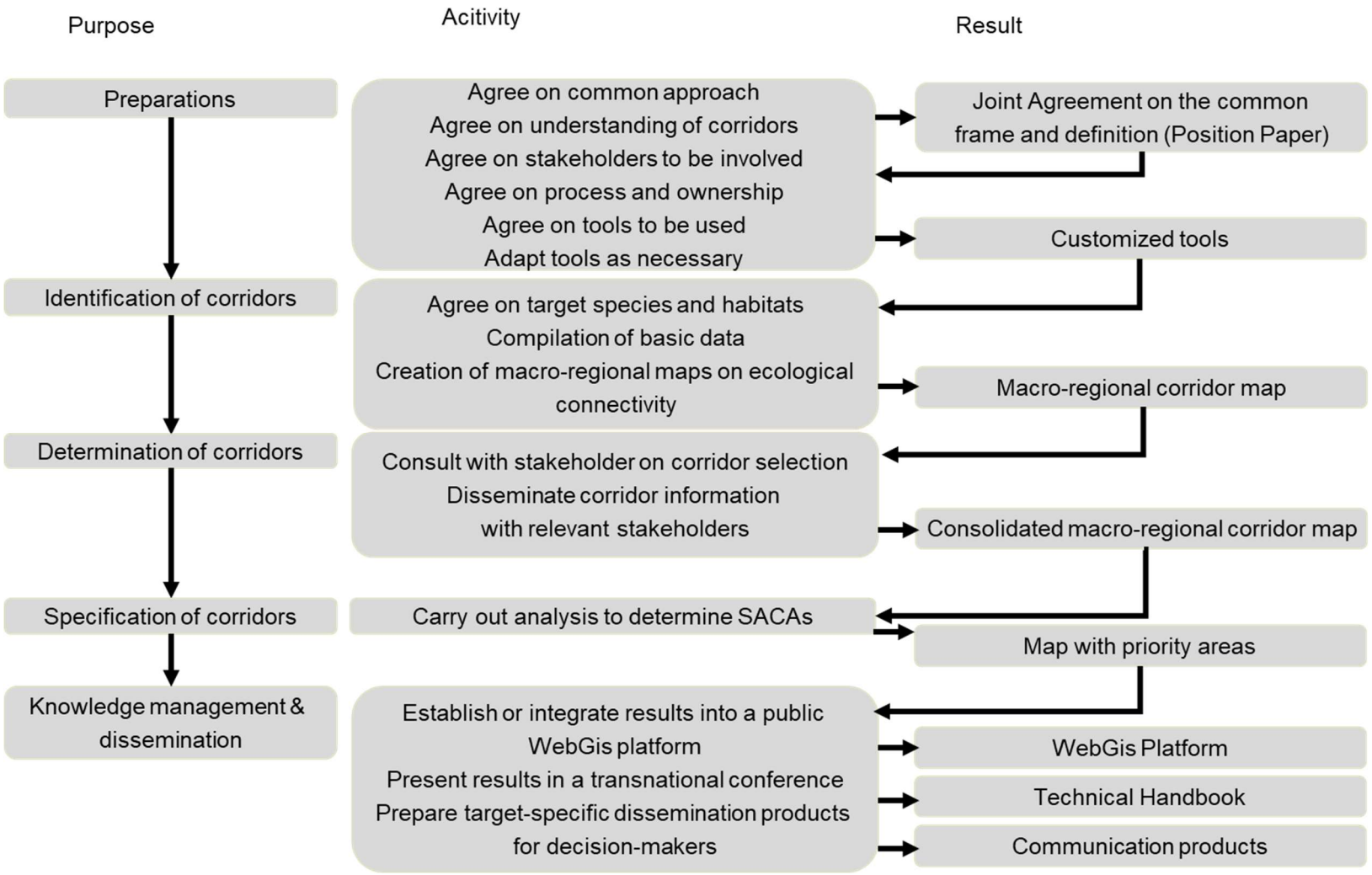


Figure 40: Outline of a potential workplan towards macro-regional ecological corridors:

5_2 Proposal 5: ConnectionBeyond: Establishing a network of protected areas and policy stakeholders to enhance GI outside protected areas (Pilot project on green and blue corridors)

Type

Development of policy and planning instruments

Gap addressed

One of the main challenges for ecological connectivity is the fact that migration of particularly larger mammals or birds occurs outside of protected areas. However, these are usually areas that are not under the management of protected areas and that are usually managed or used by a big variety of different stakeholders. Whereas France has taken quite ambitious steps with the 'trame verte et bleue' (Green and Blue Network, GBN), the Danube region currently lacks a similar approach which goes beyond the protected areas. However, countries like Czech Republic or Slovakia have already integrated to a certain level ecological corridors into spatial planning (TSES).

Background

Ecological connectivity is inevitably interwoven with land-use and territorial planning as connectivity mostly deals with the connection between protected areas or (semi-)natural areas. Whereas economically relevant land use can rely on specific areas, nature and landscape are to be considered trans-sectoral and often overlap with human land use. Thus, the successful introduction of ecological connectivity issues into spatial planning requires clear argumentation and a verification of social or societal benefits (ecosystem services) (Scheurer 2016).

Thus, this leads to the necessity to develop solutions that involve land-users and spatial planning authorities and communicate benefits accordingly. Many countries have developed national ecological networks which are integrated into territorial planning to different extents. In the DRB Slovakia and the Czech Republic have the most advanced systems with the TSES (Territorial System of Ecological Stability) which comprises of a national network of core areas and connections. The main principle of their design is to create an ecological network in intensively utilized landscapes through revitalization of the existing natural habitats and creation of new ones along with the proposal of their protection and management along predefined corridors (Moyzeova & Kenderessy 2015). The TSES corridors are the ecological basis for the preparation of territorial plans of communes, settlements zones and restoration projects. Whereas this is a national system, it is implemented locally and thus an interesting case for replication.

Amongst the most advanced approaches at the moment is the French "trame verte et bleue" (Green and Blue Network, GBN), which is a spatial planning tool covering the entire national territory, with a core objective of stopping the decline of biodiversity by conserving and restoring ecological continuities to ensure provision of ecosystem services (https://biodiversity.europa.eu/countries/gi/france). This corridor system was officially created in 2010. It is implemented at different levels from national to local. It sets the framework and ensures consistency to support the region in the development of "regional ecological coherence schemes". These are also subject to public consultation and follows subsidiary policy principles. Main implementation or restoration measures are implemented by departmental authorities whereas local authorities take into account the scheme in spatial and urban planning.

There are several studies at European level that increasingly focus on the macro-regional perspective and the governance of natural resources such as Zollner et al. (2018) who carried out a macroregional analysis of the governance mechanisms of soil at Alpine level. The fact that protected areas could be main drivers for territorial development is clear, but it is not yet fully understood how this can be achieved. Thus, ESPON carried out a very relevant study on the contribution and potential of protected area networks to territorial development (LinkPA Project 2018: Prezioso et al. 2018). The results indicate a strong role of protected area networks such as ALPARC or DANUBEPARKS.

This approach ensures that ecological connectivity and biodiversity objectives are considered in all territorial planning processes.

Furthermore, the Alpine areas of ALPARC have established mechanisms to integrate ecological connectivity into territorial planning

in the predefined ecological connectivity pilot regions. The long-standing experience of Alpine Ecological connectivity is particularly valuable given the similar mountainous character of the Carpathians.

Egner et al. (2017) show an interesting approach for intersectoral stakeholder platforms and describe how the interface university and protected areas and regions can implemented on a specific topic. Valuable experiences can be derived from this experience, which gained strong attention for the UNESCO Man and the Biosphere Network.

Project objective

Develop a system of blue and green corridors in selected pilot regions, which are of significant importance for transnational ecological corridors. The project should specifically focus on the development of viable approaches to integrate green and blue infrastructure into spatial planning. The project should raise awareness amongst political stakeholders.

Work packages

WP 1: Establishment of pilot regions and regional stakeholder platforms

Pilot regions in at least 4 countries should be set-up for the establishment of a Green and Blue Corridor Network. Preferably the pilot regions already have a corridor network in place (e.g. TSES in Slovakia) or have ongoing connectivity or corridor projects. Thus, a focus towards the integration into spatial planning can justified and less resources need to be spent for defining corridors. Optimal pilot regions already work on ecological corridors and experience challenges in the final implementation on the ground.

Given the intersectoral nature of the objective, a discussion platform at regional level involving territorial stakeholders is indispensable. These platforms increasingly gain importance at a later stage of the project, when options for integrating the corridor networks into spatial planning should be discussed.

Results:

- Pilot regions established (agreement)
- Stakeholder platforms functional

WP 2: Establishment of a network of green and blue corridors in pilot regions

This work package focuses on the mapping of green and blue corridors based on existing networks and previous projects. The project team needs to prepare a concrete methodology possibly following the approach of TSES or the French GBN. Priority can be given to areas that have already predefined corridors from previous projects (such as the WWF Transboundary Bear Corridor UA-RO or Drava-Mura Transboundary Biosphere Reserve.

The establishment of corridors thus includes:

- Definition of methodology and corridor identification
- Mapping of green and blue corridors
- Consolidation of corridors with regional stakeholders
- Description of corridors and potential benefits and spatial planning challenges

Results:

- Map of green and blue corridors consolidated with stakeholders
- Technical manual on determination of green and blue corridor identification methodology
- Technical report describing the corridors

WP 3: Integration of corridors into spatial planning

After the identification of the corridors, several options for integrating them in spatial planning should be developed and tested. This particularly includes:

- Comparative analysis of how ecological corridors can be integrated in spatial and territorial planning (Good Practices)
- Legal analysis of how corridors can be integrated in territorial planning or how effective the current system is if a system is already in place
- Identification of planning processes where the corridors should be considered
- Identification of needs and constraints from local stakeholders and planning authorities
- Elaboration of a catalogue of incentives, policy actions and instruments how to implement and manage green and blue corridors.

Results:

- Technical reports on corridors and spatial planning implications
- Catalogue of incentives, instruments and measures to implement green and blue corridors

WP 4: Implementation of pilot actions

Next to the identification of policy recommendations and options for formal integration, selected pilot incentives and instruments should be tested in the individual pilot regions (e.g. agro-environmental scheme to reduce pressure from land use, introduction/adaptation of a spatial planning category). A crucial part is the evaluation of the effectiveness of these tools.

Results:

- 1-2 pilot measures implemented in pilot regions
- Report on effectiveness of pilot measures

WP 5: Dissemination and communication

The main results of the pilot actions and the pilot implementation of corridors are of transnational interest as the challenge of reconciling ecological network planning and spatial planning has not yet been fully resolved. New solutions for overcoming segregative spatial planning and new instruments for a more transectoral, dynamic and integrative practice in spatial planning are highly needed and required for the implementation of ecological networks (Scheurer 2016).

Thus, the main dissemination products/results are as follows:

- Scientific report on green and blue corridors as element of spatial planning in a Central-Eastern European context
- Policy recommendations for DRB member countries
- Interactive exhibition at local level to increase awareness at local level

At local level the implementation of pilot measures and corridor planning should be communicated to relevant local stakeholders and shared amongst all pilot regions in at least 2-3 small pilot region conferences which include also partners from Alpine Ecological Connectivity regions and French communities which work on the GBN implementation.

Involved partners/Institution

This complex and intersectoral project requires a capable, policy-oriented lead partner to coordinate the pilot regions and facilitate the exchange. A university partner could be beneficial. This is a proposal also expressed by the ADC Action Plan (WP 3) and would thus include ALPARC, CNPA and DANUBEPARKS. ALPARC with its experience from the Alps can play an important role in the process.

In the pilot regions, spatial planning authorities as well as nature conservation authorities need to be involved. In order to implement pilot measures the respective land-user stakeholder groups should be considered.

Countries

Pilot regions in at least 4-5 countries of the DRB should be established. It would be crucial to involve Slovakia to consider their experiences with TSES.

Funding options

Given the nature of the project and the required transnational cooperation objective, INTERREG DANUBE seems to be an appropriate funding source (Priority 2: Environment and culture responsible Danube region – Foster the restoration and the management of ecological corridors).

With regard to the set-up of pilot regions and knowledge exchange group in a transnational context, selected parts could also fit into INTERREG Europe Priority Axis 4 Environment and Resource Efficiency. With the strong policy focus, INTERREG Europe could be an optimal funding source particularly as it would also allow to involve a French partner to include experiences of the Green and Blue Network (GBN).

5_3 Proposal 7: ConnectivitySolutions: Pilot actions towards closing gaps of ecological corridors

Type

Implementation/Demonstration

Gap addressed

Within the study area several key barriers were identified which affect a functional exchange between corridors. This includes powerlines, highways, large intensive agricultural areas or urban settlements. Selected projects are being implemented in different countries, addressing specific challenges (e.g. INTERREG TransGreen in the Carpathians addressing the infrastructure development challenge, DanubeparksConnected addressing free sky corridors, INTERREG coopMD working on cooperation and connectivity in Mura-Drava River Corridor). In order to strengthen a macro-regional perspective on connectivity and to increase public awareness a series of different solutions for different challenges in ecological connectivity, a common communication frame is necessary. This includes also the fact that promising isolated solutions at technical level have no format to reach political decision makers.

In general, this would follow similar objectives as the DanubeparksConnected project, but leaving the close focus on the river only.

Background

Even though the topic of ecological connectivity and green infrastructure has entered the general awareness and even though a large number of related projects is going on in the macro-region the interviews and desktop study revealed that:

- There is a lot of parallel activity going on in various European and national projects addressing the topic with limited exchange about results and tools;
- There is a missing link between researchers, NGOs and organizations working on concrete ecological connectivity topics and responsible policy stakeholders and there are limited options to communicate results of studies to relevant policy stakeholders;
- There is limited awareness about ecological connectivity at local level and in public discussion.

There are relevant EU programmes such as ESPON, which could facilitate a science-policy dialogue as well as specific working groups in the Alpine Region within the Alpine Convention and ALPARC. The thematic pole meetings, where INTERREG project managers of the EUSDR region meet periodically is a step towards this.

The results of this study underpin that a comprehensive inventory of ecological connectivity measures is lacking. ALPARC has developed a similar toolkit for Alpine regions. Furthermore, innumerous studies and projects developed, collected and tested different methods to enhance connecitivity on the ground without being accessible to a broader public.

Furthermore, previous studies as well as the interviews carried out during the study (Kohler 2018, Frank 2018) underpin that it is crucial to “show connectivity” in order to create awareness and subsequently get attention of relevant decision-makers. Egner et al. (2017) discusses the impacts of the project “ScienceLink” which links academic institutions with regional actors by means of a knowledge sharing platform. This outlines possible approaches how to set up such platforms.

The River School Project which is currently being implemented in the Duna-Mura-Drava Biosphere Reserve shows high potential to link specific topics across a transboundary corridor (Kovarovics & Schmied 2018). This could be a good option to increase awareness and communicate solutions and the general topic ecological connectivity through educational facilities.

It proved to be the most effective way to implement pilot actions in selected pilot regions and subsequently communicate the results in a way to link it to the living circumstances of the target group. The pilot region network of ALPARC consists of intersectoral regional platforms and closely links decision-makers and stakeholders from different sectors. Furthermore, these platforms allow a vertical communication between CIPRA and pilot regions.

This project can be closely linked with DANUBEPARKS and could be considered a follow up to the DanubeparksConnected INTERREG

project which will end in 2019.

Project objective

In order to push forward ecological connectivity in the DRB, the establishment of pilot regions, the establishment of an appropriate communication platform as well as clearly visible demonstration sites, which illustrate positive developments on the ground are indispensable. As a consequence, this project has two main objectives:

1. The implementation of concrete pilot measures for improving connectivity (ConnectivitySolutions) and for:
   - Achieving connectivity on land
     - Solutions for intensive agricultural areas (hedges, step stones)
     - Solutions of for extensive agricultural areas (agro-environmental schemes, long-term preservation of existing step stones)
     - Solutions for linear infrastructure barriers (e.g. green bridges)
     - Solutions for urban areas (green belts)
   - Achieving connectivity on water
     - Solutions for fish migration (fish ladders)
     - Solutions for reconnection of wetland-river systems
   - Achieving connectivity in the sky
     - Solutions for improving air connectivity (wind parks, power lines)
2. Increase awareness about solutions for achieving ecological connectivity under different political and environmental conditions by
   - The establishment of a transnational communication and exchange platform to disseminate ecological connectivity topics to selected stakeholder and the broad public.
   - Targeted interactive formats such as migratory exhibitions or specific school programmes.

Numerous activities already exist, but a comprehensive set to GI-measures adapted to the EUSDR context can increase awareness amongst stakeholders, explicitly improve connectivity on the ground and represent a network of demonstration sites for the future.

Work packages

WP 1: Inventory of existing solutions

This work package aims to compile a comprehensive set of existing solutions which are already in place. This particularly includes isolated solutions developed within the frame of INTERREG or LIFE projects as well as local solutions developed by NGOs or solutions presented and tested from science. An initial overview is available for the Alpine Region (http://www.alpine-ecological-network.org/information-services/measure-catalogue/measure-database). All methods should be applicable for the Danube River Basin, be well tested and proven. It is important that these solutions contribute to improve ecological connectivity. This catalogue of measures should finally serve for the selection of pilot implementation measures and the further development or adaptation within the pilot regions.

Results

- Catalogue of connectivity solutions applicable for the Danube River Basin including land, water and air solutions

WP 2: Establishment of pilot regions

In order to implement individual solutions, the identification of Connectivity Pilot Regions is recommended. For the selection of pilot regions, it is highly recommended to follow the approach of ALPARC and the specification as outlined in Proposal 1.

Apparently, the pilot regions should be located along the main ecological corridors or already be pilot regions if this project is implemented subsequently to Project Proposal Nr. 1. Depending on the final commitment of partners, it is advisable to cooperate with regions with existing connectivity projects or working groups. These can both support the identification of solutions they might have already developed or benefit from the support to test and apply additional connectivity measures.

The establishment “connectivity” demonstration sites where stakeholders and citizens can experience and learn about connectivity

should also consider a transnational demonstration effect (outstanding features or importance). Rivers are excellent demonstration objects as connectivity is an obvious topic. Similarly, main bird migration stop-over sites such as Hortobagy in Hungary have excellent awareness raising potential as well as the vast primeval forests of the Carpathians.

Results:

- Pilot regions established
- Delineation of connectivity demonstration sites

WP 3: Implementation of pilot measures in pilot regions

The pilot regions will be supported to select pilot measures appropriate for their region. Through the implementation of individual measures their applicability in the DRB will be illustrated and contribute to a physical improvement of ecological connectivity at local or regional level. Appropriate scope of measures is either Federal Provinces or District Administrations. Pilot measures should involve at least 2-3 different pilot measures (for air, land and water) and deliberately involve an evaluation component to finally assess the success and impacts of the individual measures from an ecological, economic and social point of view.

Results:

- 3 pilot measures per pilot region implemented and evaluated

WP 3: SolutionsPlatform – Success stories

In order to communicate positive stories about ecological connectivity and the visible improvement or benefits derived from specific measures, a SolutionsPlatform should be set up to share positive experiences. Similarly, to the IUCN supported Panorama Platform (https://panorama.solutions/en). This includes the elaboration of success stories in a way suitable for the broad public (*Virtual Solutions Platform).*

Next to the success stories for a broader public, specific solutions should be elaborated for planners and specific stakeholders (e.g. measures for bird-friendly powerline planning) *(target-group oriented solutions platform).*

Results

- Solutions platform in place
- Leaflets/Manuals for target groups published

WP 4: Establishment and coordination of a macro-regional stakeholder platform as a periodic communication format similarly to the formats developed in the Alps and within the Alpine Convention

Finally, a specific macro-regional stakeholder platform on ecological connectivity will be set-up representing a policy-science interface. It should be considered to set-up this format also at different hierarchic levels (e.g. macro-regional, national, regional) or deliberately combine them.

This discussion forum can take place within the frame of EUSDR working group meetings. This working group serves to share success stories and proven solutions with the respective decision-makers. It should be considered as a permanent format of periodic meetings (e.g. once a year) to share knowledge about current and new solutions *(policy-oriented solutions platform).* This platform should serve to:

- Disseminate relevant study results to push forward GI-development, new methods and approaches to other stakeholders, policy and the public
- Promote promising initiatives relevant for upscaling to macro-regional level
- Promote studies and results at policy level
- Illustrate Green Infrastructure and ecological connectivity by concrete “connectivity demonstration sites”

Results:

- Macro-regional stakeholder platform institutionalized and functional

Involved partners/Institutions

Key partners for this project could be any transnationally active institution such as WWF, DANUBEPARKS or interested universities. It is recommended to give the responsibility for the discussion forum to either a university or an organization with constant funding in order to ensure long-term sustainability of the platform.

Project managers of different INTERREG or LIFE projects already working on the topics or parts of it. It is recommended to involve them at

least to invite them for knowledge exchange events.

The European Beech Forest Network and the related World Heritage Coordination Office within the frame of the UNESCO World Heritage Site "Primeval and Ancient Beech Forests of the Carpathians and other regions of Europe" is currently facing similar challenges and is in the process of building up institutional structures for a transnational exchange and management. A cooperation would be highly beneficial as it also operates at the interface between practical implementation and policy makers.

For the implementation of measures, specialized SMEs or NGOs should be involved.

For the evaluation of connectivity solutions, a partner from a university is recommended. It proved also to be very efficient to build concrete intersectoral partnerships between universities, private partners and protected areas for knowledge sharing (Egner et al. 2017).

ALPARC and stakeholders from Alpine Connectivity Pilot Regions should be strongly involved in order to avoid duplicating effort, to maximize synergies and to use their experience of setting-up transnational communication platforms. Thus, formal cooperation or partnership under the ADC Memorandum of Understanding is recommended.

Thus, the main actors involved would comprise CNPA, the Carpathian Convention, DANUBEPARKS and ALPARC. EUDSR could represent a main function in linking the protected area network actors with policy stakeholders.

The set-up of pilot regions should widely follow the process as ALPARC carried it out in the Alpine Region. Consequently, relevant regional stakeholders which are involved in territorial or land-use planning and conservation, forestry, agriculture or tourism should be involved. Connectivity demonstration sites could also serve as local tourism attractions (e.g. restored riverine landscapes with gravel as recreation areas).

Countries

In general, all countries of the DRB are eligible. Priority could be given to areas that have a high demonstrating potential (exceptional challenges, large public audience due to proximity to cities, particularly innovative solutions).

Funding options

Given the nature of the project and the required transnational cooperation objective, INTERREG DANUBE can be an appropriate funding source (Priority 2: Environment and culture responsible Danube region – Foster the restoration and the management of ecological corridors).

Regarding the set-up of pilot regions and knowledge exchange group in a transnational context, selected parts could also fit into INTERREG Europe Priority Axis 4 Environment and Resource Efficiency.

As this project has a strong implementation and communication focus LIFE can be a promising funding source for this project, particularly referring to LIFE Environment & Resource Efficiency (for pilot and demonstration projects to develop, test and demonstrate policy or management approaches) as well as LIFE Environmental Governance & Information (for information, awareness and dissemination projects to promote awareness raising on environmental matters).

6 CONCLUDING RECOMMENDATIONS

The project has started with a thorough literature review, which covers a dynamic topic with numerous projects and initiatives continuously going on and gaining momentum with the EU GI Strategy, EU Biodiversity Strategy and increasing attention towards climate change and adaptation.

It is important for EUSDR to push forward and use the opportunity of public awareness and the numerous existing starting points to enhance ecological connectivity in the Danube River Basin. Given the dynamic development of Eastern European Countries and continuous soil sealing in Europe, the continuing work on ecological corridors in the DRB seems reasonable.

Concluding, some general recommendations were derived for further consideration:

Find common approach and definition

The lack of a common definition, common standards and even a common language in this field is a major challenge. For the EUSDR area an agreement on a joint and common picture is indispensable for future work.

One of the effects of this unclear definition is the fact that many projects or initiatives related to ecological connectivity or green infrastructure are unknown as they might use the wrong terms. In any case green infrastructure related projects are often not using the term “green infrastructure” but terms like “Preservation of cultural landscape elements referring to hedges” or “Improvement of habitat for a certain species”. Set-up of platform for the DRB.

Thus, developing a joint position paper for the DRB is considered the most basic step for transnational cooperation on the topic.

Put together existing results

Many, if not most approaches, methods and processes have already been developed, tested and evaluated somewhere. However, most of them disappear over time. The project websites of several potentially relevant INTERREG projects went offline after some years. GIS Layer get lost. There are several WebGis Platforms containing selected project-related information, but information remains dispersed and often incompatible in terms of data standards.

It is highly recommended to develop a kind of common database for ecological connectivity and related spatial information for the DRB (similarly to the DanubeGIS). Efforts to harmonize it with JECAMI of ALPARC could be useful.

Set-up an efficient CNPA secretariat similarly to the ALPARC association or DANUBEPARKS office.

A constant basic funding and an efficient organizational set-up is indispensable for the implementation of projects. Whereas DANUBEPARKS and ALPARC are rather well-equipped organizations capable to continuously step forward, CNPA lacks an own implementation body. It is recommended to strengthen the CNPA in order to increase the capacity to implement projects in a comparatively large area.

Create a common map for the DRB

The large number and high heterogeneity of the countries of the DRB are a major restriction for a macro-regional perspective on ecological connectivity. It is highly recommended to work towards a macro-regional map on strategically important ecological corridors and stepping stones presented in a single map as already available for the Danube Main River.

Implement ADC Action Programme

With the ADC cooperation programme a major step has been taken, but not yet shown results as the related action plans is not yet implemented. However, the action plan entails numerous highly relevant actions and project ideas which should be followed and further elaborated.

Use of this study for project proposal development

The results of this study serve as a valuable basis for the development

of concrete projects. They outline the draft contents and provide ideas for the structuring of work packages. However, the concrete and content of a specific project can only be fixed as soon as:

- The specific funding instrument is selected (e.g. LIFE, LEADER)
- The required partners have been identified and confirmed their commitment
- The concrete project objectives are discussed and agreed on with the project partners.

A more detailed project development should follow the selection of partners as they might request major changes or adaptations to the local context. Nonetheless, the information provided in this study will allow for a quick and targeted project proposal development as it is also a compendium on existing related projects and on current gaps on ecological connectivity in the DRB.

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