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Review and synthesis of best practices in governance and land-use policies to implement TEN-N

Joana Bores, Hildegard Meyer, Evelyn Underwood, Mila Sirychenko, Wouter Langhout, Peer von Döhren, Daniel Veríssimo, Balázs Horváth, Kenny Meganck, Alina Blaga, Måns Ingvarsson, Gabrielle Aubert, Barbara Herrero, Matea Osti, Anouk Puymartin

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NATURA CONNECT

Review and synthesis of best practices in governance and land-use policies to implement TEN-N

Deliverable 2.1

Funded by the European Union

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Author(s)	Joana Bores[1], Hildegard Meyer[2], Evelyn Underwood[3], Mila Sirychenko[2], Wouter Langhout[1], Peer von Döhren[4], Daniel Veríssimo[5], Balázs Horváth[2], Kenny Meganck[3], Alina Blaga[2], Måns Ingvarsson[3], Gabrielle Aubert[3], Barbara Herrero[1], Matea Osti[6], Anouk Puymartin[1]. 1. Stichting BirdLife Europe (SBE) 2. WWF Central and Eastern Europe (WWF-CEE) 3. Institute for European Environmental Policy (IEEP) 4. Humboldt-Universität zu Berlin (HU) 5. Rewilding Europe (RE) 6. International Institute for Applied Systems Analysis (IIASA)
Deliverable reviewers	Henrique Pereira (MLU), Nestor Fernandez (MLU), Piero Visconti (IIASA), Martin Jung (IIASA), Heini Kujala (UH), Maria Hällfors (SYKE), Zulima Tablado Almela (CSIC), Virgilio Hermoso (CSIC), Bárbara Pais (UE), Marie-Caroline Prima (CNRS), Marianne Tzivanopoulos (CNRS).
EC project officer	Christophe Coudun

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Deliverable description	We will review and synthesize information on existing land-use planning and land management policy and guidance for GI management across countries and administrative levels. We will then compile best practices which will be made available as a report in English and a selected number of languages for the 6 case studies.
Keywords	EU Biodiversity Strategy for 2030, Green Infrastructure, ecological connectivity, TEN-N, Political Economy Analysis, spatial planning, biodiversity law and policy, collaborative learning

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This report, titled ‘Review and Synthesis of Best Practices in Governance and Land-Use Policies to Implement TEN-N,’ represents the collective effort of many contributors across various fields and sectors.

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Special recognition is also due to the teams leading the NaturaConnect case studies that provided critical, real-world insights into the application of governance and land-use policies across different contexts. Their detailed analyses and on-the-ground experiences have been crucial in understanding the challenges and opportunities associated with the implementation of TEN-N.

This project has been made possible through the funding and support of the European Union's Horizon Europe research and innovation program. We are grateful for this opportunity to contribute to the broader understanding and development of sustainable governance and land-use policies.

Finally, we extend our appreciation to all collaborators and partners involved in this project. Their commitment and dedication have been key to the successful completion of this report.

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Abbreviations

CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CC	Carpathian Convention
CBF	Carpathian Biodiversity Framework
CCDR	Coordination and Development Commission (Portugal)
CoP	Conference of the Parties
DCR	Danube-Carpathian region
ERDF	European Regional Development Fund
EAFRD	European Agricultural Fund for Rural Development
EAGF	European agricultural guarantee fund
EC	European Commission
ES	Ecosystem Services
EU	European Union
EUROPARC	The Federation of Nature and National Parks of Europe
EUSDR	European Union Strategy for the Danube River
GAEC	Good agricultural and environmental conditions
GBF	Kunming-Montreal Global Biodiversity Framework
GDP	Gross Domestic Product
GEF	Global Environment Facility
GI/GBI	Green Infrastructure / Green-Blue Infrastructure
ICPDR	International Commission for the Protection of the Danube River
Interreg	Interregional Instruments
IUCN	International Union for Conservation of Nature
ICNF	Institute for Nature Conservation and Forests
LIFE	*L'Instrument Financier pour l'Environnement*
LULUCF	Land Use, Land Use Change and Forestry
n.d.	No date
NGO	Non-governmental organisations
OECM	Other effective area-based conservation measures
PA	Protected area
PAF	Prioritised Action Framework
PEA	Political Economy Analysis
PEEN	Pan-European Ecological Network

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SAC	Special Areas of Conservation
SCI	Site of Community Importance
SPA	Special Protection Area
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Transport Network
TEN-N	Trans-European Nature Network
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	Water Framework Directive
WFD CIS	Water Framework Directive Common Integration Strategy
WG	Working Group
WP	Work Package

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Glossary

Additional conservation area (ACA), Other effective area-based conservation measure (OECM), conserved area	A geographically defined area other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in situ* conservation of biodiversity values, with associated ecosystem functions and services and, where applicable cultural, spiritual, socioeconomic, and other locally relevant values (this is the definition of OECM per (CBD, 2018)).
Ecological connectivity	The movement of organisms, nutrients and ecological processes through a landscape (Crooks et al., 2011; Crooks and Sanjayan, 2006; Hilty et al., 2020).
Ecological corridor, connectivity conservation area	A defined geographical space that is governed and managed over the long term to conserve or restore the effective flow of natural processes between species, habitats, ecosystems, or protected areas (Hilty et al., 2020).
Governance	The individuals, groups, and institutions ultimately responsible for decision-making for an area or network of areas. Governance can also include the process of how decisions are influenced and made (Salafsky et al., 2024).
Green and Blue Infrastructure	An interconnected network of natural and semi-natural areas, including green terrestrial features such as green roofs, retention and detention ponds, re-naturalised and de-culverted rivers, swales, and rain gardens, as well as blue marine features, designed and managed to deliver a wide range of services (e.g., improvement in air and water quality, space for recreation, climate mitigation and adaptation) (Abbott et al., 2013) (Ghofrani et al., 2017) ('Green infrastructure - European Commission,' n.d.).
Natura 2000 site	Network of core breeding and resting sites for rare and threatened species, and for some rare natural habitat types, which aims to protect Europe's most valuable and threatened species and habitats, listed under both the EU Birds Directive and the Habitats Directive (EC, 2008).
Protected area	A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Protected Areas include nationally designated sites and Natura 2000 sites (Dudley, 2013) ('Effective protected areas | IUCN,' n.d.)
Political Economy Analysis (PEA)	Applied political economy analysis (PEA) is a set of concepts, questions and tools that can help diplomats, development professionals and local reformers better understand the contexts in which they operate, and to engage effectively in supporting change. Applied PEA is concerned with the interaction of political, economic, social and cultural processes and how these generate particular outcomes. This can help explain how change processes happen and

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	why they can become blocked (Australian Government - Department of Foreign Affairs and Trade, 2022).
Protected area network	A set of protected areas that are designed or grouped to collectively achieve long-term conservation of biodiversity and other values. Can include ecological networks and jurisdictional networks. Typically, this term refers only to the spatial sites and not the entities governing and managing them. A network can be formally designated, or it can be a grouping of existing areas with or across jurisdictional boundaries. Areas in an ecological network are ideally connected through ecological corridors to meet design criteria. (Salafsky et al., 2024)
Trans-European Nature Network (TEN-N)	The Trans-European Nature Network is a strategically planned network of protected areas and corridors, building on the existing Natura 2000 network and other protected areas, as well as natural and semi-natural areas that build on other Green Infrastructure. (European Commission, 2020)

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Executive summary

The **EU Biodiversity Strategy for 2030** aims to put Europe's biodiversity on the path to recovery by 2030. A key component of the Strategy is the development of a **Trans-European Nature Network (TEN-N),** through which EU Member States will designate additional protected areas to reach 30% protection of EU land by 2030, helping to address gaps in the coverage of Europe's priority habitats and species. The TEN-N will involve the design of a connected system of protected areas, which will include Green and Blue Infrastructure and ecological corridors (interconnected networks of terrestrial and freshwater natural and semi-natural areas). TEN-N has a dual mission: to enhance biodiversity conservation and nature's contributions to people.

To ensure that protection and management of conservation areas is adequate and effective, the TEN-N needs to be supported by appropriate governance mechanisms, policies and financing instruments. Key questions for consideration include:

- What are the governance, land-use policy elements and financing mechanisms that support ecological connectivity at both national and sub-national levels?
- What are the primary governance, policy, and financial barriers to and enablers for designing and implementing a well-connected TEN-N?
- Which models or frameworks have been successful, and what can be learned from them?

NaturaConnect, a Horizon Europe research project funded by the European Commission, aims to support EU countries in addressing these and other key issues concerning the design of the TEN-N. In this report, we present an assessment of European strategies, policies and legislation that can contribute to optimal governance and policy implementations for Green Infrastructure and ecological connectivity.

We conducted an in-depth review of current policies and governance frameworks across Europe using a Political Economy Analysis (PEA) framework. The PEA framework considers the following elements in its assessment of the economic, political, and social processes 'that drive or block policy reform' (Copestake and Williams, 2014): foundational factors, rules of the game, and people and organisations (Figure 1).

The PEA addressed foundational factors, rules of the game, and people and organisations, as well as their relationships and dynamics as a basis for determining potential pathways of change and interventions. Data was collected through an extensive literature review of over 400 sources, 50+ semi-structured interviews, 97 survey responses, and five workshops with key stakeholders at various governance levels. In addition to the European and national levels, we placed a special emphasis on the six case studies that are part of the NaturaConnect project: the transboundary Danube-Carpathian region; national-level case studies from Finland, France and Portugal; and sub-national level case studies from the Doñana region in Spain and the Leipzig-Halle periurban region in Germany.

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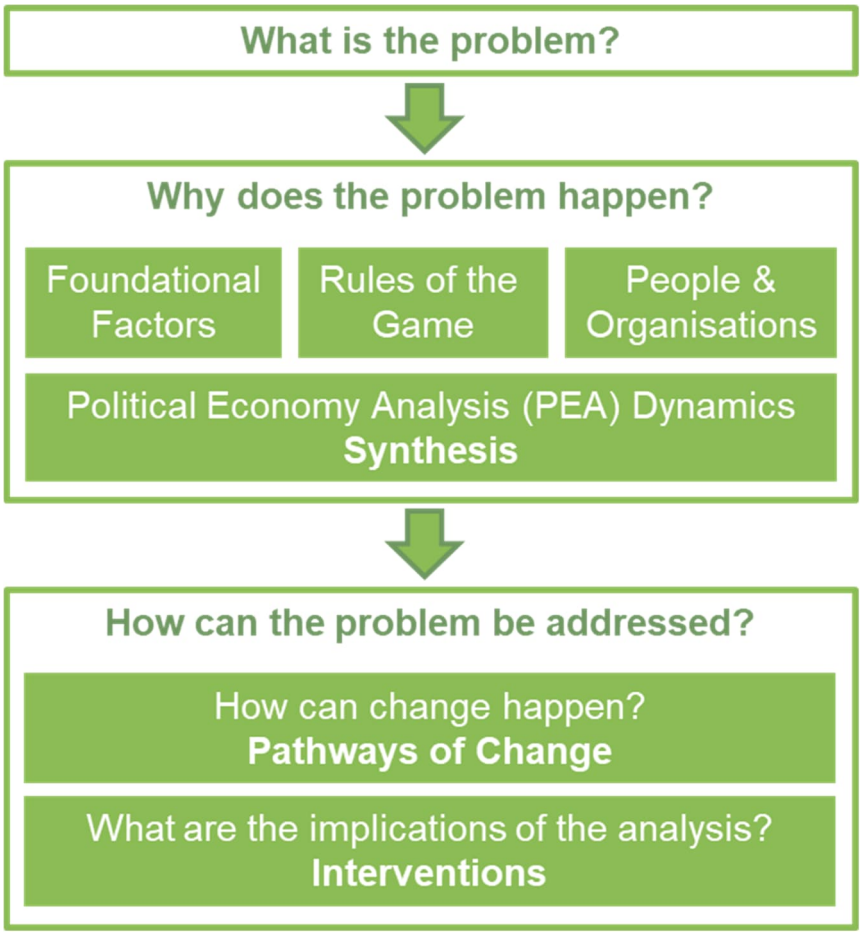

Figure 1. The three main steps of the Political Economy Analysis framework (WWF-CEE adapted from Copestake and Williams, 2014)

Step 1: What is the problem?

Many European countries face common governance implementation challenges despite having ecological connectivity frameworks or strategies in place. The main problem was formulated as 'Weak and ongoing loss of ecological connectivity of protected and conserved areas'. Key categories of challenges (Figure 2) include:

- Weak regulations and limited implementation
- Poor conflict management
- Unsustainable land use and infrastructure development
- Technical capabilities and knowledge gaps

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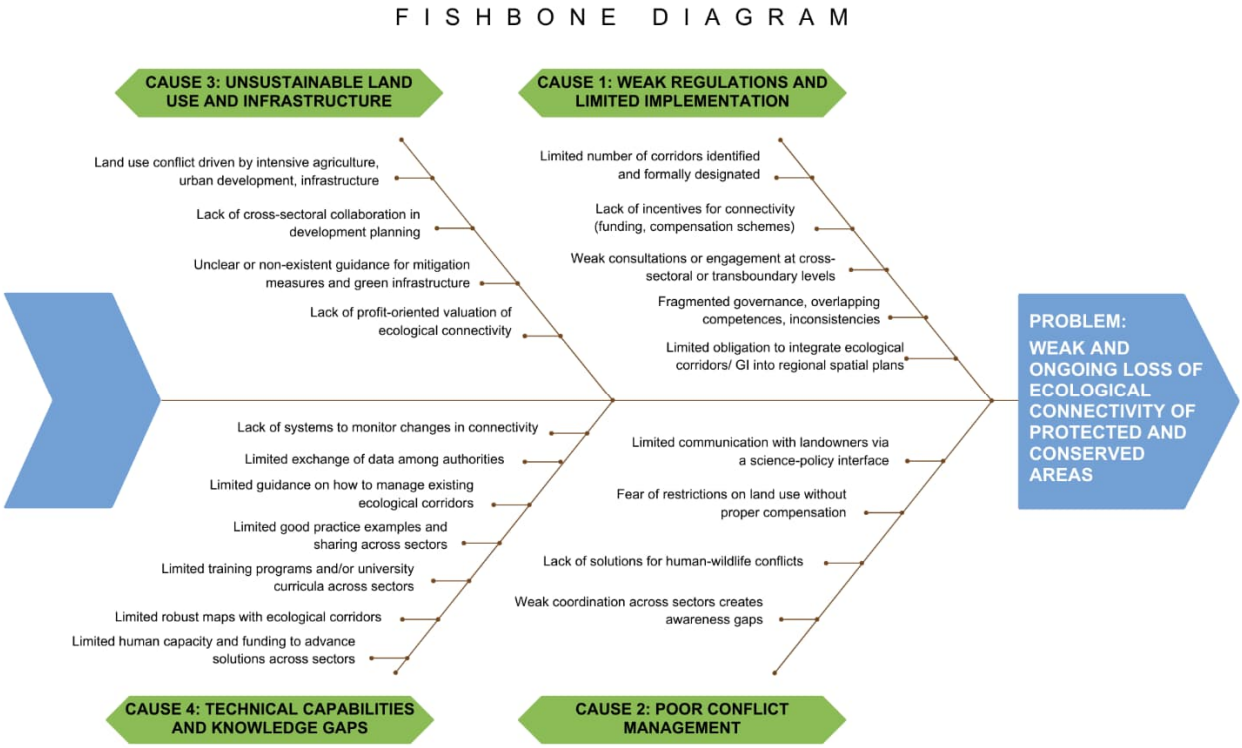

Figure 2. Fishbone diagram. To distil the problem's root causes, the team organised a Political Economy Analysis workshop in Bucharest. One of the outcomes was a visual of the problem and its causes, in the form of a cause-and-effect diagram.

Step 2: Why does the problem happen?

We analysed the three different building blocks (foundational factors, rules of the game, actors) at the European level and in the specific case studies. The results of our analysis highlight several critical findings and insights:

1. Guiding conservation frameworks at the European level have been established

At the **European level**, several strategies exist to facilitate ecological connectivity and biodiversity conservation. These include the EU Biodiversity Strategy for 2030 and the Green Infrastructure Strategy. These frameworks aim to establish a coherent and resilient network of conserved areas across Europe, ensuring that at least 30% of land is protected and connected to support biodiversity and ecosystem services towards the establishment of a coherent and resilient Trans-European Nature Network (TEN-N). The EU's legal instruments, such as the Habitats and Birds Directives, the Nature Restoration Law, Environmental Impact Assessment Directive, and Water Framework Directive, provide a comprehensive regulatory framework that unites Member States in addressing environmental challenges.

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2. Ecological connectivity frameworks and strategies already exist or are being developed in several EU countries, which can contribute to a well-connected TEN-N

Altogether, of the 19 countries included in the analysis, 15 (79%) had a strategy or legal framework for ecological connectivity at one or more levels (national, and/or in one or more regions and/or municipalities; Table 1).

*Table 1. Overview of ecological connectivity strategies and/or legal frameworks across various administrative levels of governance in NaturaConnect case study countries. All are government strategies, but they vary in their legal provisions and enforcement. *For detailed information see Table 3 in Section 3.1.3 and Appendix 1*

ECOLOGICAL CONNECTIVITY STRATEGY AND/OR LEGAL FRAMEWORK				
Country	National level	One or more regions	One or more municipalities	Other relevant strategies-frameworks
Austria	No	Yes	No	Yes
Bosnia and Herzegovina	No	No	No	Yes
Bulgaria	Yes	No	No	Yes
Croatia	No	No	No	Yes
Czech Republic	Yes	Yes	Yes	No
Finland	No	Yes	Yes	No
France	Yes	Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes
Hungary	Yes	Yes	Yes	Yes
Moldova	Yes	No	No	No
Montenegro	No	No	No	Yes
Poland	Yes	Yes	Yes	Yes
Portugal	Yes	Yes	Yes	Yes
Romania	No	No	No	Yes
Serbia	Yes	Yes	No	Yes
Slovakia	Yes	Yes	Yes	Yes
Slovenia	Yes	Yes	Yes	Yes
Spain	Yes	Yes	Yes	Yes
Ukraine	Yes	No	No	Yes

3. However, countries are experiencing challenges with implementation, and legal gaps

The challenges with policies and laws on ecological connectivity are manifold. Starting with **the choice of instrument**, it is common that the policies and legislation do not have an effect on spatial planning at the relevant level for implementation, be it the national, regional or municipal level. It is crucial, however, that the permeability of ecological corridors is protected, for example against land use change and new infrastructure developments.

We found **legal gaps** in several countries. **Some of these leave the legislation unimplemented** at the local level or result in a purely voluntary policy approach. This means that ecological connectivity is not considered formally in the decision-making and there is no

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legal protection of ecological corridors. Further legal gaps were identified in four countries in the Danube-Carpathian region. The Ukrainian **legislation lacked monitoring provisions**, which makes it hard to assess the effectiveness of the implementation. The Hungarian legislation was weakened through a recent bill that gives the government the right to rule by decree and had a general exemption for open cast mining and other infrastructure. In Romania, an officially adopted methodology for the identification and designation of corridors is missing, making it challenging to legally protect them. Another type of problem arose in Slovakia where information on the locations of the corridors was not easily accessible to the public because the plans have not all been digitized.

The implementation of the policies and legislation suffers from a **lack of political incentives** in some countries. There appears to be little appetite for enforcement in the Czech Republic, in spite of its comprehensive and binding legislation because the administrative procedures are a burden. In France, when weighing the interests of conservation against the interests of local stakeholders as required under the trame verte et bleue, local authorities usually favour the latter. In such cases ecological corridors may only exist on paper.

The designation of responsible authorities is a crucial choice in implementing any conservation planning. Ecological connectivity for the TEN-N is a large-scale challenge, but the designation of responsible authorities follows spatial planning competences, meaning that regions or municipalities are often responsible. Therefore, a **mismatch exists between the scale of implementation and the scale of action needed**, as exemplified in the Portugal case study or in Poland, where the municipalities are responsible. This problem is then compounded by **a lack of staffing and ecological expertise** at the lower administrative levels.

The **lack of formal rules for specific economic sectors** has a severe effect on connectivity. In particular, the lack of strategic planning which takes into account ecological connectivity in transport infrastructure (such as in Romania), and the lack of strategic planning and transboundary coordination of hydropower projects in the Balkan region are major problems. Strategic planning should in particular address choice of location or route and design, construction and maintenance, to maintain existing ecological connectivity or to create new ecological corridors.

There can be synergies between maintaining ecological connectivity and existing spatial planning rules, such as the protection of ecosystem types in Sardinia (Italy) and the zonation of forestry in Lithuania. Several innovative land use policy instruments are also proving to be successful. Conservation easements for protection are being used by forest owners in Finland and landowners in Spain, while in France a scheme similar to conservation easements exists for landowners. These schemes can be readily used for ecological connectivity. The use of habitat banking can also result in improved ecological connectivity, if the appropriate safeguards are in place. A land bank, where government-purchased land can be swapped for land that is important for ecological corridors, can also be a good instrument.

4. Some countries have demonstrated successful practices and frameworks, which can serve as learning points for others

Although ecological connectivity strategies and frameworks are not yet mainstream, there are notable examples from several countries which can serve as models. These include:

- **The Danube-Carpathian region**, which has demonstrated effective cross-border cooperation under the Carpathian Convention. Projects like TRANSGREEN and SaveGREEN have shown good results, although implementation at the national level varies. These projects highlight the importance of regional governance bodies and international treaties in promoting ecological connectivity. Collaboration between different sectors, like transport infrastructure and nature conservation were improved, and data was provided for

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Environmental Impact Assessments necessary for planning new motorways that were considered. The We Pass project (ongoing project), funded by the EU, aims to facilitate fish migration at the Iron Gates, improving ecological connectivity in the Danube River Basin by reconnecting the Lower with the Middle Danube.

- **Germany's Federal Green Infrastructure Concept (BKGI)** integrates ecological connectivity into spatial planning. This comprehensive approach aims to support the designation of ecological corridors and the implementation of Green Infrastructure projects at various administrative levels. Being developed in close cooperation with scientific research, the BKGI is rooted in the Federal Nature Conservation Law and provides more detailed information on ecological connectivity as well as guidance for ecological planning across national administrative and international borders, by providing nationwide thematic maps for the relevant Green Infrastructure networks.
- **Portugal established a pioneering legal framework in 1983 to protect natural resources**, particularly water and soil, through the creation of the Ecological National Reserve (REN) by Decree-Law (DL n.º 321/83). The aim of REN is to safeguard essential natural processes, promote biodiversity, and contribute to the connectivity and ecological coherence of the core network for nature conservation. The National Spatial Planning Policy Program, approved in 2019, defines strategic directions, ensures regional cohesion, and determines land planning instruments. It includes, as a strategic objective, the 'optimisation of environmental infrastructure and ecological connectivity,' from which other regional and national spatial planning tools are derived.

5. Public funding is available for ecological connectivity, but lack of post-project funding as well as protected area under-resourcing are key challenges. Private financing instruments are being developed and hold some promise

EU funds – notably Interreg and LIFE – offer opportunities for supporting transboundary collaborations, network planning, habitat restoration, land purchase, etc. However, the lack of funding after the project end is a significant threat to long-term success. In some countries, the protected area network is significantly under-resourced. Innovative opportunities for private financing are being developed though are still small scale. Promising tools are payments for ecosystem services schemes and the use of investments tied to insurance schemes or green bonds. The Common Agricultural Policy (CAP) funds and the European Regional Development Fund (ERDF) and Cohesion Fund could be used in a more targeted way to fund ecological connectivity creation and management. CAP programmes currently have few successful collaborative schemes where farmers work together at the landscape level with conservation experts to restore ecological networks and corridors; this option could be introduced in all programmes, linked to ecological network spatial planning, and supported by farmer advice, knowledge exchange, and payments for ecosystem services. ERDF and CF hold considerable untapped potential to fund larger-scale and more effectively targeted nature restoration and ecological connectivity projects, but large biodiversity projects face considerable barriers. Synergies could be gained by linking requirements to linear infrastructure investments such as roads and rail, or to investments in water management.

Land management tools, such as strategic and targeted use of conservation easements, land banks, habitat banks, and legal compensation obligations, can be used to repurpose land for nature goals, including the creation of ecological corridors. These tools are being increasingly used for ecological connectivity, but the current small-scale and fragmented initiatives should be scaled up.

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Step 3: How can the problem be addressed?

To tackle the problem, based on the analyses performed and the criticalities identified, we outlined **four different pathways of change and corresponding potential interventions.** Unlike other usages of the term, in PEA, pathways are not mutually exclusive but rather a set of conditions. We use 'pathway' here to maintain consistency with PEA literature.

Efforts to design effective TEN-N governance and land-use policies should include the application of pathways of change that focus on regulatory frameworks, land use, knowledge and capacity building, and empowerment and conflict management.

The challenges and best-practice examples both reveal the opportunities that exist for improving ecological connectivity governance across the EU, across various scales.

Pathways of change

Pathway 1 – Regulatory framework

If an appropriate ecological connectivity regulatory framework exists, it is implemented well, and it is backed by solid incentives, **then** the different stakeholder groups are supportive **because** they recognise the values, benefits and importance of the ecological connectivity for people and wildlife.

Conflicts can be turned into win-win situations where potential losses are prevented and/or compensated. A regulatory framework brings clarity for all players in terms of prevention and compensation mechanisms. Legislation should address the need for ecological corridor planning and design to be embedded in spatial planning and that guidelines be provided for all sectors and stakeholder groups involved. The legislation should also address tenure rights and provide the necessary funding, incentives, prevention and compensation schemes, clear governance and thorough consultation processes.

Pathway 2 – Sustainable economic development

If economic development is coupled with clear guidance for mitigation measures, accounting for ecosystem services, and preventing land use conflicts via collaboration across sectors, **then** it shifts towards a sustainable economic model that values and profits Green Infrastructure **because** the power of each sector is balanced when all have to work towards mutual benefits.

Social dilemmas can be addressed by taking leadership and encouraging collective thinking. If a solution is found to land use conflicts that is acceptable for all stakeholders and potential losers are compensated, then acceptance of the solution increases mainly if it helps improve economic development. Shared goals improve trust and implementation results.

A range of spatial planning mechanisms can be used to ensure the balance of economic development with ecological connectivity in a programmatic approach. Land use zonation, protecting ecosystem types throughout the landscape, strategic planning, impact assessments, integration of connectivity in project planning, design, construction and maintenance of transport infrastructure, retrofitting of existing hydropower and dam removal have emerged as key tools.

The development of Green Infrastructure will also contribute to providing non-market benefits and ecosystem services which are important for human well-being.

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Pathway 3 – Knowledge and capacity building

If the appropriate knowledge base, technical and human capabilities related to ecological connectivity are developed and communicated, **then** planning and design as well as the implementation of a well-connected, resilient TEN-N improves **because** they will facilitate the access of all relevant sectors to the most beneficial solutions, with optimised costs.

Improvements in the evidence base and information sharing can build trust and encourage collective action. Monitoring and data collection should be established and harmonised in this respect along with common, transboundary projects and networks that work together and share information to improve cross-border cooperation. Also, implementation capacities of ecological connectivity management institutions should be improved related to data collection, processing and stakeholder services. It should be ensured that ecological knowledge is strongly embedded in the teams involved with planning and deciding on land-use. Thus, ecologists and conservation scientists need to be hired in the key institutions involved in land-use planning, not just responsible for the impact assessments.

Professional organisations and local champions such as mayors and transmission system operators can play a key role in maintaining and strengthening ecological connectivity.

Pathway 4 – Empowerment and conflict management

If civil society working for ecological connectivity (NGOs, environmentally-friendly farmers and foresters, other green entrepreneurs) is empowered and causes of existing conflicts around connectivity are clarified by bringing actors together **then** engagement can be built, conflicts can be managed, and stakeholder trust and intersectoral and cross-border cooperation improved, **because** bottom-up initiatives and improvements are catalysing positive change.

A prerequisite for cooperative solutions is to develop a shared vision and framing, build trust and credible commitments and enable an acceptable distribution of costs and benefits (relational values, health benefits, ethics and aesthetics, and others). Our research shows that existing conflicts between sectoral stakeholders hinder realisation of ecological corridors. Conflict management can help in this respect to build mutual trust, improve stakeholder engagement and intersectoral and cross-border cooperation and coordination. Funding for cooperative actions, such as CAP funding for landscape scale ecological network creation, can overcome negative economic and motivational barriers and forge partnerships.

Governance arrangements are important for maintaining and enhancing ecological connectivity. In urban areas, financing and facilitating the organisation of citizens and flexibility with the rules are important for mobilising social capital, and supporting grassroots organisations can bring an independent voice for connectivity into urban planning.

Along with conflict management, awareness campaigns for the general public, behavioural change campaigns for targeted sectors can also be useful.

The above four pathways of change are complementary in many cases, and elements from all four pathways of change are needed to achieve a coherent, resilient and well-connected TEN-N for Europe.

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On the basis of the four pathways described above, we outline the following **potential interventions** that could be applied at different levels:

Interventions for regulatory frameworks (addressing Pathway 1)

Reviewing existing policies and legislation

The first step on this pathway is reviewing and, eventually, adapting the existing policies and legislation. In countries where there are no policies or legislation governing ecological connectivity, it is necessary to first adopt such policies or legislation. It is worth to underline here that biodiversity policy alone will not be sufficient to maintain and enhance ecological connectivity. For governments at any level the best practice is to have specific legal obligations, with a binding effect on spatial planning and sufficiently detailed protection of ecological corridors and their management. Adequate public participation in decision-making is a must during the adaption or amendment of any legislation.

It is also necessary to check at EU level whether existing policies support ecological corridors and TEN-N and revise those EU level policies that hinder their implementation. Additional policies might be needed in order for corridors to be formally designated or integrated into spatial planning, or to finance TEN-N. Finally, it is also important that the planning of ecological corridors and other actions for connectivity are based on the latest scientific evidence (see (Fernández et al., 2020) for an example at European level and (De La Fuente et al., 2018) for an example at national level).

Improving implementation

Where existing legislation and policies are adequate, the next step is to improve their implementation. The responsible authorities should have a political mandate for implementation, adequate staffing and financing. Given the importance of connectivity at the landscape level it is recommended to consider scaling up connectivity governance efforts in a way that increases the role of regional or national authorities. Implementation should be underpinned by adequate enforcement. For cross-boundary ecological connectivity, bilateral or multilateral agreements should be implemented, covering the key ecological corridors and ecosystems.

Integrating connectivity into other policies

Bringing coherence into the ecological connectivity agenda by including it in other policies is key. Crucial steps include fully implementing the Nature Restoration Law, in particular the national restoration plans, and integrating ecological connectivity into countries' National Biodiversity Strategies and Action Plans (NBSAPs) and the implementation of the relevant targets of the Global Biodiversity Framework. Of particular relevance are the targets on managing protected areas (Target 1), restoration of degraded ecosystems (Target 2), designation of protected areas and OECM (Target 3), reduction of the impact of Invasive Alien Species (Target 6) and minimising the impacts of climate change (Target 8). Member States can also revise their national Common Agricultural Policy (CAP) Strategic Plans to improve connectivity on farmland, including through targeted eco-schemes and agri-environment-climate measures and support for cooperative actions (see below).

Synergies with spatial planning legislation

Often, other spatial planning legislation offers synergies with implementing legislation on ecological connectivity. Examples are forestry zonation and spatial planning instruments protecting ecosystem categories or land use types. Designation of ecological corridors or stepping stones under such legislation can provide protection against specific threats.

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Addressing land use conflicts

The requirements of ecological connectivity can cause conflicts with existing land use, such as in ecological corridors for large mammals on pastures or structural connectivity for old-growth forest species in landscapes under intensive forestry. There are a range of voluntary approaches that can be explored and if successful embedded in regional or national policies and legislation. The use of OECMs, conservation easements, land swaps with government owned land, and strategic habitat banking are promising new approaches, in addition to land purchases.

Interventions for sustainable economic development (addressing Pathway 2)

For a well-connected TEN-N it is important to enhance ecological connectivity, but also to prevent further connectivity losses. A precondition for this is a balance of interests, as in the long-term ecological connectivity is incompatible with a maximisation of profits in agriculture, maximisation of yield of forestry and unlimited expansion of transport infrastructure.

Engaging farmers and foresters and addressing landowner conflicts

In order to maintain and enhance connectivity on farmland and in forests, active participation of farmers and foresters will be needed, along with other sectors of society. There are several forms of best practice. Targeted agri-environment-climate measures based on landscape level action, long-term commitments and building relations and trust can deliver connectivity on farmland. Conservation easements can deliver connectivity on any privately owned land, but are particularly relevant for forests as there are many small forest owners that are not utilising the existing funding under the CAP (Haeler et al., 2023).

Farmers receiving CAP funding are obliged to protect linear landscape features, buffer strips along watercourses and stepping stones such as wetlands, peatlands, and grasslands as part of the Good Agricultural and Environmental Conditions (GAEC). National authorities should ensure that these GAECs are well implemented and use their enforcement powers where needed. Under its Biennial Review (Regulation 2021/2115) the European Commission should ask for remedial action when Member States do not ensure the maintenance of landscape features.

Animals migrating through ecological corridors can cause conflicts with landowners, such as crop, livestock or forest damage from large mammals. It is particularly important that any compensation for damage on ecological corridors is adequate and timely with little administrative burden, to reduce conflict with landowners as far as possible.

Strategic planning for infrastructure projects

Strategic planning should be employed for large infrastructure projects. For large linear infrastructure projects such as roads and railways, ecological connectivity should be integrated in project planning, design, construction and maintenance, building on the IENE Handbook (Rosell et al., 2023). For hydropower, strategic planning across river basins should also be promoted to protect the remaining free-flowing rivers. On rivers with hydropower plants full connectivity cannot be achieved in spite of mitigation measures (Moreiro et al., 2024) so a combination of retrofitting of existing hydropower plans and dam removal should be employed.

Integrating connectivity in planning

Integrating ecological connectivity considerations into large infrastructure projects and hydropower can be promoted at the European level by including ecological connectivity in the Do No Significant Harm criterion under the EU Taxonomy Regulation (Regulation 2020/852). At national level, integrating ecological connectivity into the Strategic Environmental Assessment and the Environmental Impact Assessment procedures will promote better planning, project design and mitigation measures.

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Society and decision makers should recognise the positive effects of ecological corridors in their lives. Cost-benefit analysis of ecological corridor development could help achieve such perception changes.

Recognizing and assessing non-market benefits of ecological corridors

Ecological corridors are essential not only for preserving biodiversity but they also can provide non-market ecosystem services. For example, by integrating ecological functions with cultural and aesthetic values, ecological corridors promote a balanced approach to conservation that benefits both nature and people's wellbeing (e.g., recreation, landscape amenities, education, spiritual connection, and tourism). Assessing the non-market benefits of ecological corridors and conducting comprehensive cost-benefit analyses of their development could help shift perceptions and encourage broader societal support.

Interventions for knowledge and capacity building (addressing Pathway 3)

Enhancing ecological connectivity between protected areas is a complex process, and there are many governments and actors involved. Bringing in ecological expertise throughout planning, design and implementation of ecological corridors, and stepping stones and other interventions is therefore key.

Role of professional networks and institutions

Professional networks, research institutes and government agencies play a crucial role in coordinating, advising and monitoring the connectivity of protected area networks and the effectiveness of interventions. Networks of professionals working on ecological connectivity, such as working groups and platforms can connect all parties in the complex governance structures, and advise land use planners at municipal, regional and national levels. They can also provide input on the drafting of land use and infrastructure policies and on designing agri-environment-climate measures. Strengthening professional networks, research institutes and government agencies institutions by providing them with adequate resources is recommended to further connectivity.

Raising awareness and providing training

To address the lack of awareness by the government actors and the stakeholder groups, more public outreach is needed. In addition to awareness raising, there is need for training, detailed guidelines and standard setting, in which professional bodies, research institutes and government agencies can also play a role. Providing guidelines and setting standards is critical for the deployment of novel instruments, such as conservation easements and the strategic deployment of biodiversity offsets. Guidelines similar to the of the IENE handbook on biodiversity and infrastructure (Rosell et al., 2023) are necessary to support mitigation and compensation measures in other sectors.

Ensuring adequate funding and resources

Adequate funding at EU level should be ensured to establish advanced scientific solutions e.g. from the Horizon Europe programme. Creating maps of ecological corridors and monitoring those areas needs both funding and detailed knowledge. Training programmes, integrating ecology in university curricula for spatial planning and relevant engineering fields, peer-to-peer visits and good practice exchange all help increasing awareness and dedication of stakeholders. CAP programmes currently have few successful collaborative schemes where farmers work together at the landscape level with conservation experts to restore ecological networks and corridors; this option could be introduced in all programmes, linked to ecological network spatial planning, and supported by farmer advice, knowledge exchange, and payments for ecosystem services. ERDF and CF hold considerable untapped potential to fund larger-scale and more effectively targeted nature restoration and ecological connectivity projects, but large biodiversity projects face considerable barriers. Synergies could be gained

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by linking requirements to linear infrastructure investments such as roads and rail, or to investments in water management.

Raising awareness on the available funding options

It is important to increase the awareness of finance options for ecological connectivity among potential beneficiaries. LIFE funds are the most common instrument to finance connectivity and nature conservation in Europe but to fully finance a coherent TEN-N other types of funds will have to be used. This will be a mix of other public finance (mostly EU funds such as Interreg or Cohesion Funds), private finance (in the form of investments), philanthropic sources (in the form of grants) and blended finance a mix of the three. Yet, often the recognition that several funding sources and types are available is very limited. Note that NaturaConnect is developing a series of fact sheets on public and private sources of finance to raise the profile of little-known solutions to relevant stakeholders.

Building business and economic skills in the professional community

To unlock innovation in funding connectivity action, it is strategic to employ experts with business and economic skills. The lack of dedicated human resources with the capacity to create new funding opportunities and pilot new nature-based business models is a clear barrier to access new funding. The nature conservation community in Europe (protected area managers, NGOs, universities etc.) has little to no human resources with training and/or background in economics or business. People who speak the language of private investors, who have a business mindset to problems and that can help unlock new funding sources. In order to fully fund the TEN-N and meet EU 2030 biodiversity targets, the number of people with skills and studies in business and economics in the nature conservation sector needs to increase.

Interventions for stakeholder and public engagement (addressing Pathway 4)

Empowering civil society for ecological connectivity

Empowering civil society working for ecological connectivity (NGOs, environmentally friendly-farmers and foresters, other green entrepreneurs, urban grassroots) and improving conflict management can be a pathway to enhancing ecological connectivity at local and landscape levels. This involves working bottom-up through creating a policy environment that is inclusive and open to change, providing initial financing and developing a common vision. Ecosystem services, in particular flood protection and carbon sequestration and storage, can play a key role by widening the community of stakeholders. Finding a common idea that captures the essence of the connectivity challenge and inspires a wide community of stakeholders to take action can create momentum for connectivity. Local champions such as mayors, NGOs, National Park Directorates, and transmission system operators and other agencies managing linear infrastructure can drive the connectivity agenda if provided with adequate resources and an opportunity to challenge the current practices.

Increasing stakeholder engagement

It is necessary to increase engagement of different sectoral stakeholders at national but also transboundary level e.g. by proactive communication, organising consultations, sharing information, establishing cross-sectoral networks. For example, landowners should be clearly informed about land use restrictions and human-wildlife conflicts, and previous misconceptions should be clarified.

Importance of conflict management and collaborative learning

Conflict management is a crucial measure. While not all conflicts can be avoided, adequate and easily accessible financial compensation can reduce conflict substantially. Conflicts based on past communication failures should be mitigated. As an alternative, collaborative learning can also be successful. This involves a long process of stakeholders working as equals and

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developing a joint vision in an environment with little regulations and carefully tracking the outcomes, adjusting where needed.

Interventions for public institutions

For national and regional governments:

- Review policies and legislation to ensure that ecological connectivity is addressed, ensuring adequate public participation in the decision-making process.
- Provide the planning authorities with a political mandate for implementation, adequate staffing, training, and financing of ecological connectivity contributing to TEN-N.
- Prepare bilateral and multilateral agreements to implement trans-boundary connectivity.
- Ensure the integration of ecological connectivity conservation and restoration measures in sectoral policies, in particular infrastructure, forestry and agricultural policy, in close cooperation with experts on ecological connectivity and with participation of the public.
- Ensure strategic planning of transport and energy infrastructure, including through the use of Strategic Environmental Assessments and Environmental Impact Assessments.
- Utilise a programmatic approach to enhance river connectivity, combining of strategic planning, retrofitting of existing hydropower dams and dam removal.
- Utilise a programmatic approach to remove or reduce barriers to connectivity by roads and other transport infrastructure, combining strategic planning, construction of wildlife overpasses, the maintenance of these overpasses and monitoring of their effectiveness.
- Ensure coordination of ecological connectivity planning and implementation to a level appropriate for landscape scale actions (the national or regional level).

For authorities responsible for implementing nature conservation at national and regional levels:

- Promote knowledge exchange and capacity building by creating a community of practice on ecological connectivity.
- Support capacity building, knowledge development and exchange, training and the creation of a community of practice on ecological connectivity through the Horizon Europe and LIFE funds.
- Create science-based standards and minimum requirements for ecological corridors and river connectivity.
- Raise awareness on the importance and benefits of a well-connected TEN-N and organise trainings for civil servants and stakeholders.
- Raise awareness on the potential public and private funding available for protecting and restoring ecological connectivity.
- Integrate ecological connectivity in the implementation of the Nature Restoration Law and the National Biodiversity Strategy Action Plans.
- Create an enabling environment with guidelines and standards for novel approaches to ecological connectivity and conservation (OECMs, land swaps, conservation easements) and novel financing mechanisms (payments for ecosystem services, strategic use of biodiversity offsets).
- Ensure the adequate and timely prevention and compensation mechanisms in cases of human-wildlife conflicts, forest management, use of water resources, practices in agriculture, appropriation of public land etc. Encourage and support the operators of linear infrastructure in using their land and capacities for enhancing ecological connectivity.

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For authorities responsible for agriculture and forestry at national and regional levels:

- Review and revise the CAP Strategic Plans to ensure the effective use of support under the CAP for connectivity action, in particular by the use of landscape scale long-term cooperative agri-environment-climate schemes.
- Use forestry zonation where possible to ensure the creation and maintenance of ecological corridors, and use synergies with wildfire management or non-forest habitat restoration.

For authorities responsible for nature conservation at landscape or local levels:

- Foster a policy environment for connectivity action that is inclusive and open to change, providing initial seed financing for grassroot initiatives.
- Explore collaborative learning where traditional approaches fail, by developing a common vision and framing and by working as equals with all stakeholders.
- Support local champions working for connectivity such as mayors, authorities managing reserves, or transmission system operators.

For the European Commission:

- Integrate the maintenance of ecological connectivity in the Do No Significant Harm requirements.
- Ensure coordination of ecological connectivity planning at European level between EU Member States and with third countries.
- Assess the maintenance of landscape features and the impact of the GAEC8 changes during the biennial CAP Strategic Plan review and promote the use of the cooperation instrument for ecological networks.
- Support capacity building, knowledge development and exchange, training and the creation of a community of practice on ecological connectivity. These activities can be funded through the Horizon Europe and LIFE, but also through the European Social Fund and the other cohesion funds.

The NaturaConnect project aims to support the realisation of an effective TEN-N by 2030 through **the provision of relevant scientific and policy data, knowledge, and tools.**

The research results highlight that countries are facing significant data, knowledge, and capacity gaps, which hinder ecological connectivity planning and implementation. As EU Member States progress with the design and implementation of the TEN-N, the resources generated by the NaturaConnect project can provide essential planning support and serve as a resource base for decision-makers and other stakeholders. Some key resources developed or in development by the NaturaConnect project include:

- Maps and underlying data and methods that provide a pan-European **Blueprint for a Trans-European Nature Network** that addresses gaps in coverage for underprotected habitats and species, that is functionally well connected, and is resilient to climate and land-use change. These outputs will support Member States by helping them determine **spatial priorities in Europe for connectivity conservation, restoration, and corridors** for the long-term conservation of populations, species and habitats. National and regional governments can use these maps and datasets to ensure that connectivity planning addresses gaps in coverage for underprotected habitats and species. The data can also aid in the strategic planning of linear infrastructure, renewable energy, forestry and agricultural policies, to minimise impacts on ecological connectivity.
- An **online interactive tool, 'NaturaConnector'** (in development), which will enable stakeholders to visualise where priority areas for nature protection and ecological

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connectivity could be located, depending on selected parameters and stakeholders' preferences for conservation. The NaturaConnector tool can be leveraged by national and regional governments to support strategic planning and the integration of ecological connectivity in policy and legislation. By allowing stakeholders to visualise priority areas for nature protection and connectivity based on selected parameters, this tool can help authorities prepare more effective bilateral and multilateral agreements for trans-boundary connectivity and facilitate the integration of conservation measures into sectoral policies such as infrastructure and agriculture. For local authorities, the tool can aid in creating a common vision for collaborative learning and fostering a policy environment conducive to connectivity action.

- Guidelines **for connectivity conservation** and planning in Europe, along with a supporting online database **of European connectivity projects**. Provide science-based standards and good practices for ecological corridors and connectivity projects. Useful for all levels to guide policy integration, capacity building, and collaboration.
- A report detailing the methodology and narratives developed using the **IPBES Nature Futures Framework**, in a process of engagement with stakeholders, to consider and integrate societal perspectives on future biodiversity protection in Europe, accounting for multiple values and perspectives of nature.
- Training Needs Assessment tool**:** The Training Needs Assessment is based on the conceptual framework published by the International Union for Conservation of Nature (IUCN) A Global Register of Competences for Protected Area Practitioners (Appleton, 2016)**.** The framework defines possible skills, knowledge and personal qualities (=competences) required by people working in planning or managing protected and conserved areas. This tool is designed to help authorities at all levels identify skill and knowledge gaps among their staff and stakeholders. It can support the development of targeted training programs for technical specialists, senior managers and decision-makers, enhancing capacity for effective conservation planning and implementation. National and regional governments can also use it to foster a community of practice on ecological connectivity.
- A Learning Platform with free e-learning modules and other capacity building resources on conservation planning, including policy and governance aspects of the TEN-N.
- A series of **finance factsheets** (in development) on public and private financial support options for TEN-N, including information for non-technical audiences on accessing these financial resources. They provide critical information on funding opportunities for connectivity conservation efforts, supporting authorities in accessing public and private financial resources. National and regional authorities can use these factsheets to raise awareness among stakeholders and civil servants about available funding mechanisms, and the European Commission can use them to promote strategic use of the EU funds and public-private financing mechanisms.
- A portfolio of **spatial datasets** (in development) on biodiversity, ecosystem services, Green Infrastructure and ecological connectivity, land use, and opportunity costs of conservation. All datasets produced by the project will be open access. National and regional governments can use these datasets for strategic planning, while local authorities can leverage them for effective landscape-level action planning. The datasets can also support coordination between EU Member States for cross-border connectivity planning.
- Report on **experiences** in planning, designing and implementing the TEN-N across the project's 6 **case study areas** (in development). This report will provide valuable and practical experiences from the case studies that can guide national and regional authorities in reviewing and refining their policies, legislation, and implementation strategies for ecological connectivity. Local authorities can learn from these experiences to support grassroots initiatives, while the European Commission can use the insights to ensure a coordinated approach at the EU level.

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1. Introduction

1.1. Purpose of this report

The conservation of biodiversity and ecosystems stands as one of the paramount challenges of our time. With the recognition of this urgency, the EU Biodiversity Strategy for 2030 envisions the creation of a truly coherent and resilient network of conserved areas across Europe. At its core, this strategy aims to safeguard at least 30% of land while ensuring that these conserved areas are intricately connected to support thriving biodiversity, resilient ecosystems, and people.

The EU Biodiversity Strategy for 2030, along with the EU Green Infrastructure (GI) Strategy, both propose comprehensive approaches to address the pressing issues of biodiversity loss and ecosystem degradation. Through the enhancement and conservation of natural habitats, the strategies endeavour to foster ecological resilience and promote sustainable land use practices across European landscapes.

At the heart of these strategies lies the concept of the Trans-European Nature Network (TEN-N). The TEN-N serves as a pivotal mechanism for achieving the overarching goals outlined in the EU Biodiversity Strategy and the GI Strategy. This endeavour will leverage the established Natura 2000 network by evaluating the potential for connectivity among Natura 2000 sites and other types of protected areas through the integration of GI landscape features crucial for providing ecosystem services.

One of the key challenges for the TEN-N is to create and maintain ecological connectivity: the movement of organisms and the occurrence of ecological processes through a landscape (Crooks and Sanjayan, 2006). The different approaches to ecological connectivity have been extensively reviewed in a European context (Moreiro et al., 2024). The two most important concepts of connectivity are structural connectivity (the physical configuration of areas of habitat and their connections) and functional connectivity (the (potential) movement of individual organisms and genetic material in the context of populations and ecological functions).

The main conservation interventions employed for ecological connectivity are ecological corridors and stepping stones (Moreiro et al., 2024). Ecological corridors are continuous linear connections between two habitat areas. Stepping stones are smaller habitat patches which form a network between larger habitat areas which provide temporary or permanent habitat and allow for movement and exchange between the larger areas. In networks of protected areas both interventions can be employed at the same time. The conservation of river ecosystems has further dimensions, notably the connection between upstream and downstream regions, the connection of the river to its floodplains or other riparian areas. A final type of ecological connectivity for this report is that between freshwater and terrestrial areas.

The realisation of a truly cohesive and effective TEN-N hinges upon addressing several key questions:

- How can EU Member States and other stakeholders harness best practices in governance and land-use policies to successfully implement and manage the TEN-N?
- What are the essential elements of governance frameworks that can ensure the integrity and functionality of the Network?
- Are there valuable lessons and insights to be gleaned from existing case studies and initiatives that can inform future policy decisions and actions?

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NaturaConnect, a Horizon Europe funded project, aims to support EU Member States in addressing these and other key issues concerning planning and designing the TEN-N. In particular, the project is providing targeted knowledge, tools and capacity building to decision makers to support European Union Member States in realising an ecologically representative, resilient and well-connected network of conserved areas across Europe.

This research aims to offer insight and direction on the above questions by thoroughly examining European strategies, policies, and legislation to uncover optimal governance and land-use policies in the context of Green Infrastructure and ecological connectivity. Governance in this context refers to the frameworks, processes, and policies guiding the planning, implementation, and management of networks. Green Infrastructure includes parks, forests, rivers, and other natural landscapes providing ecosystem services and enhancing biodiversity, while ecological connectivity ensures these areas are linked, allowing species movement and ecosystem functionality. Effective governance can integrate Green Infrastructure into urban and rural planning, promote ecological connectivity, and support sustainable development and biodiversity conservation. Our primary goals are to identify both direct and indirect factors impacting the establishment of a robust TEN-N, and to evaluate and recognise exemplary practices within policies and governance frameworks across EU Member States at various administrative levels.

The analysis is centred on examining the EU-wide context, with a primary focus on the six case studies within the NaturaConnect project, which encompass various geographic scales including local, national, and cross-border contexts.

To achieve these objectives, a qualitative research approach was adopted, embedded into a Political Economy Analysis (PEA) framework. Semi-structured interviews with and questionnaires for key local, national, regional and European-level stakeholders, as well as literature reviews, support the data collection and analysis. The approach involved developing a better understanding of the context by analysing structural building blocks that form part of the PEA framework (Foundational Factors, Rules of the Game, People and Organisations, Political Economy Dynamics). The results are meant to highlight best practices that lead to recommendations for pathways of change towards a well-connected TEN-N.

1.2. Justification of the research approach

Political Economy Analysis (PEA) is a framework for understanding why change does or does not happen. The approach unpacks the arrangement of power in specific contexts (who has power, what determines levels of power and how power is exercised). This understanding of different relative levels of power can help to map the extent to which people (and organisations they rely on) support conservation or can take action on it.

PEA is important for nature conservation as the design and implementation of conservation interventions need to consider the complexity of the contexts, organisations and people that surround, influence and have an impact on their effectiveness. To achieve conservation goals, the power system needs to be mapped, to try to influence the dynamics and find viable pathways of change and interventions.

PEA is increasingly being used to identify opportunities for leveraging policy change and supporting reform (Copestake and Williams, 2014). By better understanding the political and economic constraints that protected areas and the implementation of TEN-N across the European Union face, we can work more effectively with EU Member States to identify how to better shape EU policies while ensuring the conservation of valuable areas. As such, the analysis can contribute to improved prioritisation and sequencing of efforts towards a well-connected TEN-N. Moreover, PEA is important for increasing our understanding of the context of the situation to be analysed, and can play a key role in changing how we work to achieve a resilient TEN-N.

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The application of a PEA approach at the conceptual and design stage of a biodiversity policy intervention can help with:

- Elucidating potential consequences of government policies on biodiversity.
- Assessing the relative influence of environmental and conservation structures within decision-making processes.
- Gauging the impact of scientific analysis on legislative change.
- Deepening understanding of contextual factors and stakeholder dynamics.
- Informing strategies that account for both legal frameworks and practical realities within local environments.

1.3. Research questions

This research addresses three overarching questions aimed at elucidating the governance, land-use policy elements, and financing mechanisms crucial for fostering ecological connectivity within the framework of the EU Green Infrastructure Strategy and the Trans-European Nature Network (TEN-N). The questions have been extracted from the problem analysis, which is the first step of the PEA analysis (see Section 2.1.) The overarching questions are the following:

1. What are the governance, land-use policy elements and financing mechanisms that support ecological connectivity at both national and sub-national levels?
2. What are the primary governance, policy, and financial barriers to and enablers for designing and implementing a well-connected TEN-N?
3. Which models or frameworks have been successful, and what can be learned from them?

2. Methodology

The research adopted a qualitative approach to data collection and analysis. This section describes the research methods, including the use of the PEA framework (Section 2.1); an overview of the geographical scope of analysis (Section 2.2.); data collection and analysis (Section 2.3); and the limitations of the research (Section 2.4).

2.1. Analytical framework: Political Economy Analysis

Political economy analysis (PEA) is a broad conceptual framework and management tool designed to understand economic, political, and social processes ‘that drive or block policy reform’ (Copestake and Williams, 2014). It is ‘the attempt to find out what is really ‘going on’ in a situation, what lies behind the surface of the immediate problem, for example, whether competing interests exist’ (Whaites et al., 2023) and recognises complexity and uncertainty.

Historically, PEA was established in the context of development aid, formerly mainly driven by donor stakeholders. It was based on the recognition that there was more to be done than providing technical support or capacity building for people to improve a situation successfully. The context of the situation, as well as the politics, economics, and social structures, are all important to understand how a system works and where there are entry points for changes involving more and more local people and their knowledge and networks.

There are many types of PEA (Applied PEA, PEA for Conservation Impact (PEACI), Context Analysis, Everyday PEA, Power Analysis, Drivers of Change, Problem-Driven Iterative

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Adaptation, and many others, (McGregor et al., 2020)) and levels (from global to local, to issue-specific). The many tools for undertaking a PEA all share an overarching goal to understand how things work or not in a given environment. We focus our research on the Applied PEA, which is geared to understanding and resolving a particular problem concerning a specific issue (Harris, 2013).

The following **three steps** illustrate the general PEA framework:

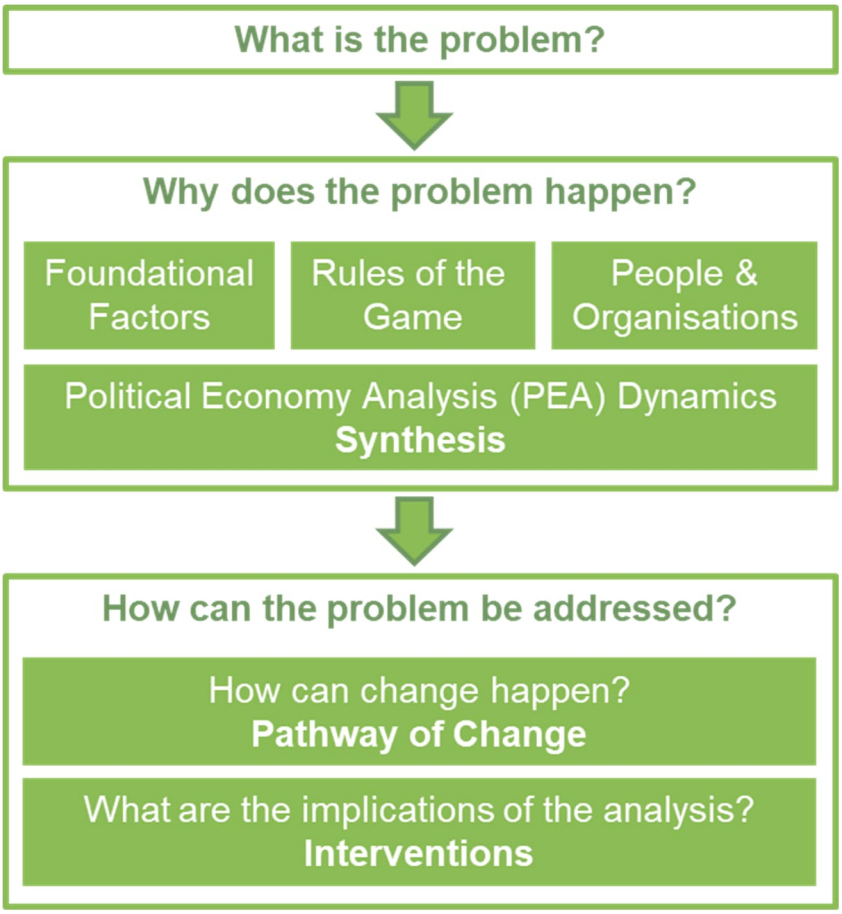

Figure 3. The three main steps of the Political Economy Analysis framework (adapted by WWF-CEE after Copestake and Williams, 2014)

2.1.1. Step 1: What is the problem?

The first step of the method is to define the problem and to understand its main drivers and root causes. The main principle of defining a problem is to ask why things are the way they are. Several tools guide the definition of the problem. In our case, we used a Framework Approach called Ishikawa diagram or Fishbone diagram (Figure 10) that illustrates the problem and related root causes for the defined problem.

For this analysis, the problem was explored and defined by the research team as **the weak ecological connectivity and on-going loss of ecological connectivity of protected and conserved areas.** It was further developed and refined through subsequent workshops, interviews and surveys.

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2.1.2. Step 2: Why does the problem happen?

The second step aims to address the question 'Why does this happen?' through the PEA building blocks (Figure 4), which are as follows (Fritz et al., 2014; (Australian Government - Department of Foreign Affairs and Trade, 2022).

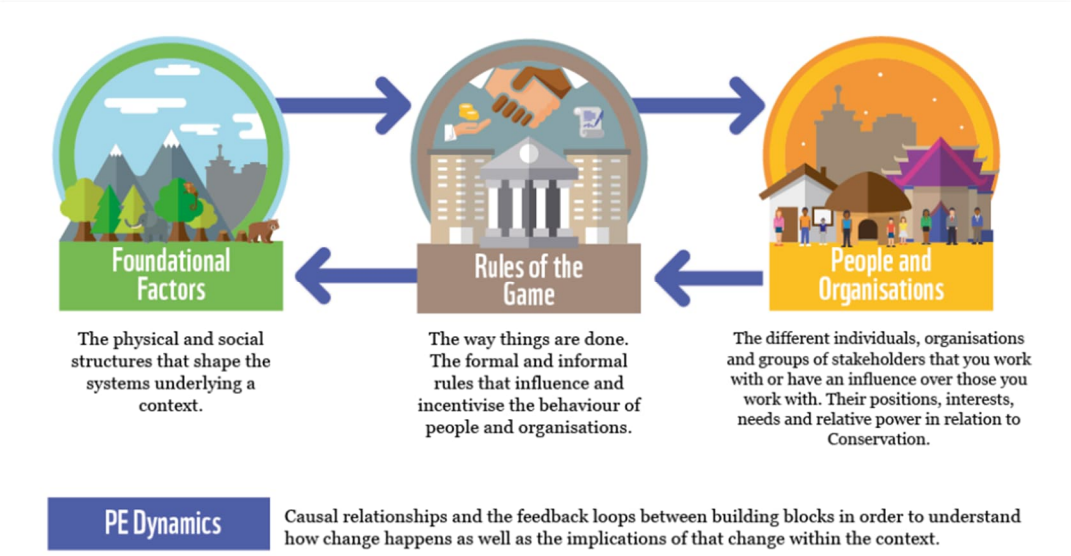

Figure 4. Building blocks and their relationship of the PEA Framework. Source: (Alexander and Williams, H., 2020)

Foundational factors

Foundational factors are tangible and intangible factors formulated in the past and strongly rooted in society as basic physical and social structures and rules. They cannot be changed or can only be changed slowly, in principle not by a project or program. PEA identifies five main elements:

- Physical and geographical structures, for example, the area of interest is a mountainous area that has specific characteristics.
- National or regional demographics, for example, rural-urban migration.
- Geo-political factors, for example impact of climate change or wars.
- Social structures, for example, how people live together in a certain environment.
- Historical legacies, for example, the fall of communism.

It is to be noted that among these categories, the goal is not to be exhaustive but to find the main elements that are relevant to the problem.

Rules of the game

Rules of the game are existing formal and informal agreements, ways of acting and power relations between stakeholders in the present. They explain how things are done and what the incentives are to support, oppose or be neutral to change. They are divided between formal and informal rules of the game, often referred to as institutions. They can be of an economic, political or social/cultural nature and are central to all that follows in the analysis. Formal rules are, for example, laws and norms, or written agreements. Informal rules are values, expected behavioural patterns in society, customs, or the unofficial information flow within an

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organisation. Rules of the game influence and affect people and organisations, including the actions that are taken.

People and organisations

Here the analysis focuses on identifying stakeholders and their relationships mainly with elements of power, influence and exclusion, including, but not restricted to: positions, interests and needs, power and relative power, incentives and disincentives, and their space to act. Interests are not the only drivers for certain behaviour; ideology, affiliation, constraints and knowledge can be drivers too. Effective influence is all about power and its direct and visible forms as well as hidden forms. We used the matrix of stakeholders (Figure 5) to map the involved actors' support, influence and interest in relation to TEN-N.

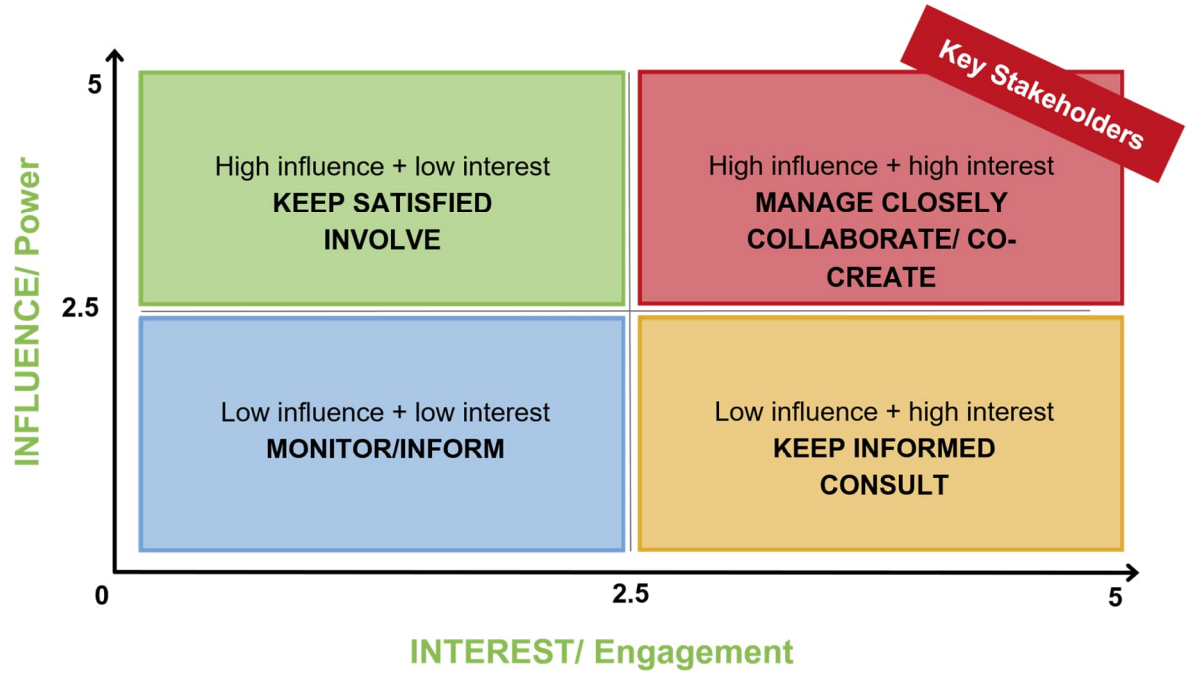

Figure 5. Mendelow stakeholder matrix applied by the NaturaConnect project, adapted by NaturaConnect/EUROPARC Federation based on (Mendelow, 1981).

Synthesis of building blocks – PEA dynamics

The synthesis creates the big picture of the context based on the building blocks defined in the previous steps. The outcome reveals the relevant dynamics that are important for creating the next steps, the pathway of change and interventions. It explains how the foundational factors, rules of the game and people and organisations influence one another to identify how change happens. This step also reveals what we have learned from the most influential building blocks and how they interact. The building blocks are then used to answer the question 'How can the problem be addressed?', with a more enlightened vision. This enables the identification of pathways of change, which is an explanation of how change can happen, given a particular starting point and a desired outcome, and the possible interventions (Australian Government - Department of Foreign Affairs and Trade, 2022).

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2.1.3. Step 3: How can the problem be addressed?

The third step of the method aims to identify how the problem can be addressed, through examining pathways of change and possible interventions. This part of the PEA analysis is reflected in the discussion (Section 4), conclusions and recommendations section of this report (Section 5).

Pathways of change

A pathway of change is an explanation of how a desirable outcome might arise due to the actions of (possibly multiple) other actors. Pathways of change are driven by a whole host of mechanisms, many of which cannot easily be influenced by external actors. They should be understood as conditions and therefore they are not mutually exclusive. There might be more than one pathway of change. The possible pathway of change draws on the knowledge gained from the steps described above. Usually, the pathway of change can only support parts of existing change processes or try to lead these in a different direction.

A useful way of writing a pathway of change is to use the **if … then … because** notation.

'**If** situation S occurs, **then** change process C occurs **because** of reason R':

- **If …**: This describes the situations under which the pathway of change becomes active.
- **Then …**: This describes the change that takes place in terms of changing actor behaviour and institutions.
- **Because …**: This explains how and why the change takes place and must be consistent with the incentives, interests, actors and institutions identified in the PEA.

This exercise can also identify which pathways of change are not feasible.

Interventions: What are the implications of the analysis?

The intervention strategy describes what activities can contribute to support the pathways of change, who should carry them out and when.

In this assessment, the activities are formulated as potential policy interventions to foster the establishment of TEN-N for the European Commission, international treaties, national authorities and agencies in the fields of nature conservation, spatial planning, agriculture, forestry, water management, and energy and transport infrastructure.

Throughout the analysis process, we applied triangulation, a research technique that involves the use of multiple methods or sources of data to increase the validity and reliability of findings (Hassan, 2024). We realised triangulation through assessing the findings from different angles to avoid biased assumptions. This involved discussions and workshops with colleagues and project partners who were not part of the analysis, as well as a literature review.

2.2. Geographical scope of analysis

This research employs a comprehensive methodology to identify the governance, land-use policy elements, and financing mechanisms crucial for fostering ecological connectivity within the framework of the EU Green Infrastructure Strategy and the TEN-N through a literature review and critical review of strategies with focused insights from the six case studies that are part of the NaturaConnect project (Figure 6). These case studies provide detailed insights into

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real-world conservation and planning contexts, essential for establishing a robust Trans-European Nature Network (TEN-N).

The NaturaConnect project case studies were strategically selected to showcase the diverse ecosystems and governance frameworks across Europe and serve as critical points for applying and testing theoretical models into actionable network designs. Combining the review of the literature with insights from the six case studies ensures that the project's findings are both broad in scope, capturing the varied EU-wide contexts, and precise in application, tailored to specific regional and administrative realities. The case study areas are described below.

Cross-border region:

The Danube-Carpathian region

The region spans ten EU Member States (Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Poland, Romania, Slovakia, and Slovenia) and five neighbouring countries that are all EU candidate states (Bosnia and Herzegovina, Moldova, Montenegro, Serbia, and Ukraine). Featuring Europe's vast expanses of wilderness and virgin forests, this region is pivotal for its biodiversity, including species like the brown bear, wolf, lynx, sturgeon and imperial eagle. The region will require collaborative planning to ensure ecological connectivity, utilising frameworks like the Carpathian Convention, the International Commission for the Protection of the Danube River and the EU Strategy for the Danube Region including protected area networks.

National level:

Finland

As the EU's northernmost Member State, Finland shares with Sweden most of the EU's boreal and sub-arctic ecosystems, home to rare and endangered species like the Siberian flying squirrel and arctic fox. Finland borders Russia and this connection, as for all nordic states, is the only land connectivity for animals with the Eurasian continent. With vast forests covering 75% of its land, Finland is a crucial carbon sink for the EU. A major challenge in connecting the protected areas in Central and Southern Finland is that they are located on privately owned lands. Northern Finland hosts Europe's only indigenous group, the Sámi, whose traditional livelihood depends on land management.

France

With a variety of landscapes from continental to coastal and overseas territories, France holds a critical role in European biodiversity conservation. It is home to a wide range of habitats that support species such as the European brown bear and the Corsican red deer. The French government is committed to expanding its network of protected areas to meet the EU's biodiversity targets, particularly focusing on strict protections that are significantly below the 10% target (currently, 1.6% of metropolitan France is under strict protection). Challenges include integrating climate adaptation into biodiversity strategies and managing overseas territories that host a significant portion of France's endemic species.

Portugal

Situated on the Iberian Peninsula, Portugal is characterised by its Mediterranean forests, rivers and extensive coastal systems that support a rich biodiversity, including the Iberian lynx and the Mediterranean monk seal. The challenge lies in enhancing the connectivity of protected areas across varied landscapes that include both densely populated urban areas

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and agricultural lands. With over 84% of forests privately owned, a multi-sectoral approach involving public and private sectors is crucial.

Sub-national level:

Doñana region in Spain

The Doñana region, a key biodiversity area in Southern Spain, includes critical wetlands and coastal ecosystems that are vital for migratory birds and local endangered species such as the Iberian lynx. Managing connectivity in this region involves navigating a complex landscape of agricultural, urban, and natural areas, with a particular focus on enhancing Green Infrastructure to mitigate pressures from intensive land use.

The peri-urban area of Leipzig-Halle in Germany

This region represents a unique blend of urban and natural landscapes in Eastern Germany, hosting a variety of ecosystems within its urban floodplains and surrounding drylands. Key challenges include integrating biodiversity conservation into urban planning and addressing the ecological needs of species adapting to urban environments. The area is significant for species such as the European beaver and various migratory birds.

Figure 6. The NaturaConnect case studies map highlights the regional case study in green (the Danube-Carpathian region), the national case studies in blue (France, Finland, and Portugal), and the sub-national case studies in orange (Doñana and Leipzig).

2.3. Data collection and analysis

Conducting a PEA requires a comprehensive gathering of information, encompassing the issue at hand, its root causes, contextual factors, formal and informal regulations, stakeholders involved, their influence, as well as their motivations and challenges.

To collect primary data, we employed a qualitative research approach using a variety of methods, including semi-structured interviews, surveys, and workshops (Figure 6). To further enhance the robustness of our research and mitigate the biases inherent in any single method, we used a mixed-method triangulation technique. This technique combines multiple research methods to cross-verify data and ensure comprehensive and reliable results.

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Moreover, we compared and validated our findings through extensive literature. This entailed searching and reviewing academic literature, grey literature and official documents such as laws, regulations, policies, criteria and guidelines. This integrated approach ensured a comprehensive analysis of the governance and land-use policies related to establishing the TEN-N (Figure 7).

Figure 7. Sampling methods used to obtain the necessary information for this report; details are explained in the following. The appendices offer additional information on each section.

2.3.1. Interviews

Semi-structured one-hour interviews in English, using guiding questions (Appendix 4), were carried out with targeted persons via video conference. However, due to difficulties with the English language, some persons answered in writing or in their mother language, but this was the minority (7 of 67).

For selecting the participants for the interviews, we used a mix of purposive and snowball sampling methods to identify key informants on the topic of our research. Purposive sampling means the identification of experts on the research topics from different institutions and sectors. Those who were available for the interviews indicated further relevant persons to be addressed (snowball sampling). The focus centred on the six NaturaConnect project case studies representing local, national and cross-border contexts within the European Union and neighbouring countries.

Initial interviews were conducted with the NaturaConnect project case study leads, acting as central figures within each case study. These primary interviews aimed to gather comprehensive insights also for the problem analysis, aided by sharing questions in advance to ensure focused discussions. Following these primary interviews, the case study leads

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recommended additional stakeholders for further interviews and specific documents for review, employing a sequential approach.

At the national level, we tried to obtain at least three interviews for each country, distributed as follows: the Ministry of the Environment departments related to Natura 2000, protected areas, Green Infrastructure development, implementing the EU Biodiversity Strategy, etc.; a protected area or nature conservation agency if present (in some cases this agency is embedded in the ministry); and an environmental NGO to gain an outside view. A total of 67 interviews (7 interviews in written form) were conducted (Appendix 3 and Figure 8).

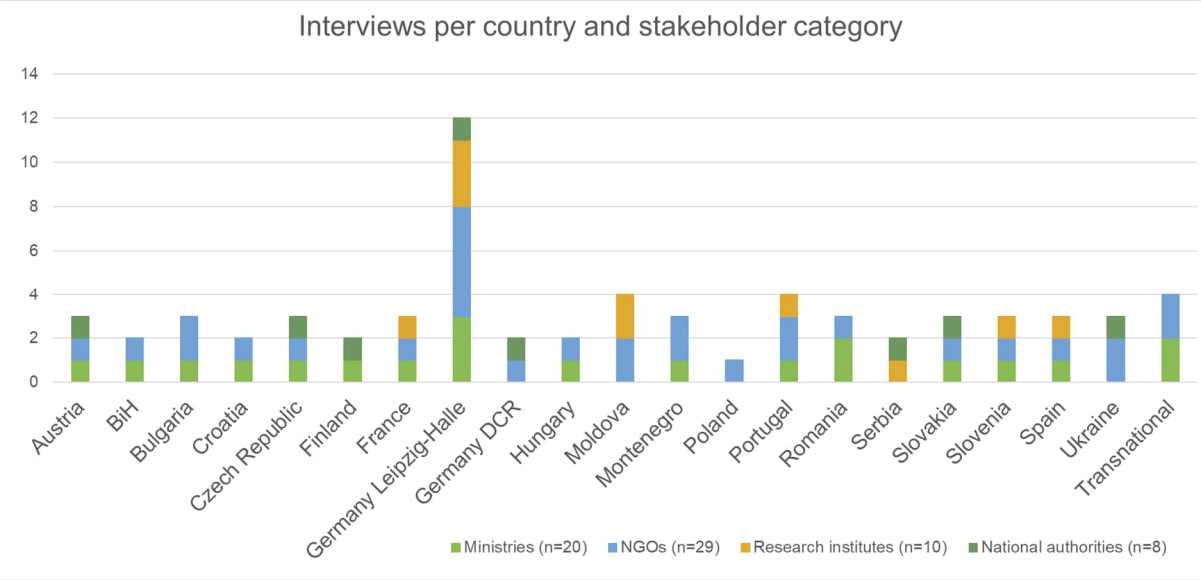

Figure 8. Number of interviews per country and stakeholder category, 67 in total (including 7 in writing), BiH Bosnia and Herzegovina; DCR Danube-Carpathian region.

2.3.2. Surveys

Two distinct surveys were designed to gather insights on the integration of ecological connectivity within sector-specific planning processes, as well as the existence of supporting laws, regulations or strategies. The first survey (Appendix 5) targeted professionals involved in nature conservation, while the second (Appendix 6) was directed at individuals working in other sectors which impact and are impacted by conservation, such as agriculture, forestry, energy, transport, spatial planning, and water management.

The response rate to the surveys was lower than expected, which is a common challenge in survey-based research. The nature conservation survey

Figure 9 received a total of 67 responses, comprising 56 responses directly through the survey online, and an additional 11 responses from the BirdLife partnership in an earlier edition of this survey, indicating a strong engagement from this community. Out of the 67 responses, 47 responses were from 16 Case Study countries whereas the representatives from NGOs dominated (n=22), followed by protected area professionals (n=6), public authorities, science institutions and private sector representatives (n=4 each) and representatives of transnational organisations (n=2). Four participants did not determine their affiliation. The survey for other sectors garnered 30 responses, 27 of them were from Case Study countries and three outside

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our study area and therefore, not considered. Responses were predominantly from individuals in the Danube-Carpathian region (DCR; n=27).

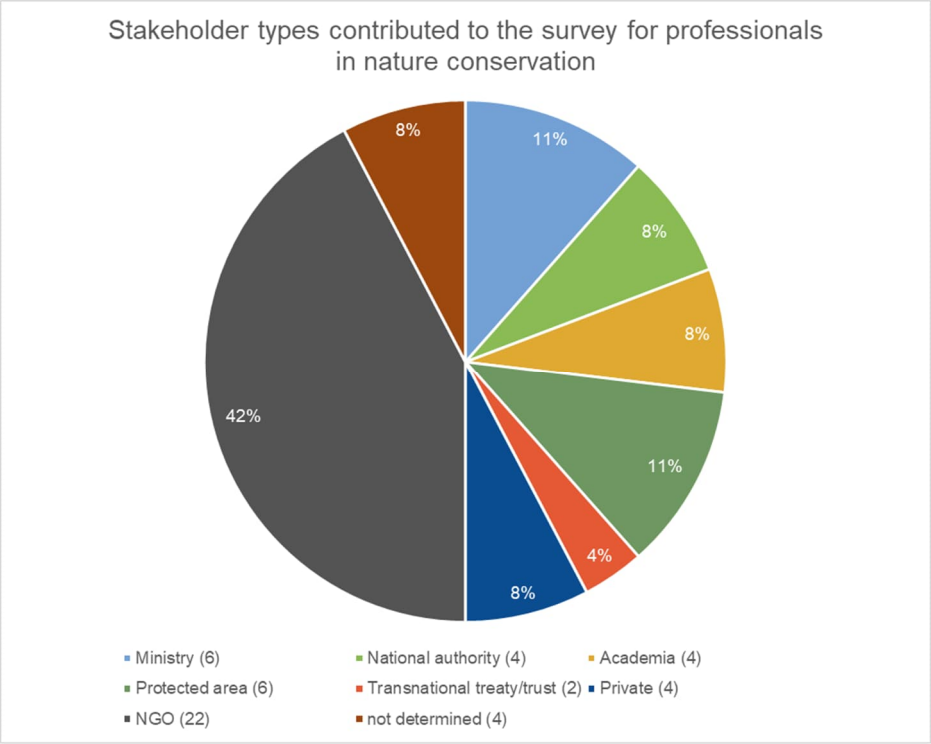

Figure 9. Stakeholder categories represented by the participants in the survey for the nature conservation professionals; n = 52; 17 out of 19 countries responded; whereas 4 were from the transnational level.

Both surveys were distributed across diverse networks to capture a broad spectrum of insights on ecological connectivity integration. Utilising the WWF Connectivity Network, including partnerships with TRANSGREEN, ConnectGREEN, and SaveGREEN, and working groups from the Carpathian Convention on Biodiversity, Forestry, and Spatial Planning, the surveys reached professionals in transport, spatial planning, and water management. Additional distribution channels included the International Commission for the Protection of the Danube River (ICPDR) groups, Danubeparks, the EUROPARC Federation, and various EU Strategy for the Danube Region (EUSDR) Priority Areas such as Road & Rail, Water, Environmental Risks, and Biodiversity. We also engaged the BirdLife network, specifically the Nature and Climate Task Force and the Agriculture Task Force, along with other EU networks like the farmers' associations and spatial planners. Outreach was further extended through NaturaConnect's social media channels, ensuring a comprehensive reach across relevant sectors. Altogether, approximately 900 people were addressed directly.

2.3.3. Workshops

As part of our analysis on connectivity challenges in Europe, we organised a series of workshops aimed at fostering collaborative engagement and sharing of best practices and political tools (Table 2). The workshops employed a structured format to facilitate in-depth discussions and a holistic exploration of strategies. Participants from various sectors including government, academia, environmental organisations, private sector and local communities were involved to ensure diverse perspectives were represented.

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The methodology included organising participants into roundtable discussions in a world café style setting (Löhr et al., 2020) or simple breakout groups, allowing flexibility to accommodate varying dynamics and demographics. In total, five key workshops were conducted partly following the Appreciative Inquiry approach (Cooperrider, D.L. and Whitney, D., 1999) which focuses more on what should be done in the future than on the current problems ('Methods | Art of Hosting,' n.d.)

More details on the workshops can be found in Appendix 7.

Table 2. Workshops organised by the research team to gather information for the PEA analysis

Workshop title	Location	Date	Participant details	Focus of workshop
NaturaConnect at BirdLife International Partnership meeting	Edinburgh, UK	17 May 2023	39 participants from BirdLife partnership institutions representing 22 countries	Governance challenges for connectivity, identifying challenges, exploring solutions, envisioning necessary steps
NaturaConnect at EUROPARC conference	Leeuwarden, the Netherlands	4 October 2023	20 participants including protected area managers and NGO representatives	Enabling factors for effective governance, innovative funding opportunities, discussions on barriers and solutions
NaturaConnect Doñana stakeholder workshop	Sevilla, Spain	1 December 2023	19 participants from public administrations, private sector, universities, NGOs	Identifying barriers to a coherent nature network around Doñana, discussions on possible improvements
Workshop at the 14th Meeting of the Biodiversity Working Group of the Carpathian Convention	Vsetín, Czech Republic	22-24 May 2023	28 participants including representatives of ministries and NGOs	Barriers and enablers for a well-connected protected areas network, stakeholder engagement strategies
NaturaConnect at the 7th Carpathian Convention Conference of the Parties	Belgrade, Serbia	11 October 2023	Approx. 40 participants from governments, public administrations and agencies, research institutions, NGOs and private sector	Implementation of ecological networks, discussions on how the Carpathian Convention can foster collaboration

Each workshop was tailored to the specific types of participants and adjusted according to logistic considerations, ensuring effective discussions and meaningful outcomes by adapting both the questions asked and the feedback collection format.

2.3.4. Literature review

Identification and selection of literature

A literature review was conducted to gather information, published as peer-reviewed scientific papers as well as reports from administrative bodies and NGOs, on the governance practices and challenges of maintaining and enhancing ecological connectivity and environmental protection in EU Member states, as well as countries neighbouring the EU that are ecologically connected to the TEN-N by shared case-study regions, such as the Danube-Carpathian region.

The literature review´s objective was to contribute information on enablers for and barriers to ecological connectivity, challenges for the governance of ecological connectivity and best

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practice examples for overcoming ecological connectivity barriers rooted in governance procedures.

We followed the PRISMA methodology (Page et al., 2021) for the identification, screening, eligibility, and selection of relevant literature.

The Scopus database was utilised for the search, employing various search strings containing relevant keywords (Appendix 2).

Testing of search strings was conducted to optimise results, considering differences in keyword spelling and formulation. The aim was to find the maximum number of potentially relevant records.

The combination of search strings also included terms to explicitly include all EU Member States as well as those neighbouring countries that were considered relevant in the context of the Danube-Carpathian transboundary case study region.

Screening process

Abstract screening for relevance (as per step 3 in the PRISMA Methodology) utilised a machine-learning (ML)-assisted approach, specifically ASReview Lab 1.4 (ASReview LAB developers, 2023).

The machine-learning software solution supported the abstract screening by sorting the most likely relevant records to the top of the list. It was trained by a human reviewer to determine the relevance and prioritisation of an abstract. Ultimately, human reviewers made the final judgments based on relative relevance.

Inclusion of grey literature

Grey literature, which has not undergone scientific peer-review, was also incorporated into the literature review. Its sources encompass publications from administrative bodies, NGOs, and private sector companies involved in environmental protection.

A snowball-search approach, supported by expert knowledge, was used to gather relevant grey literature. The snowball-search approach uses a search strategy that follows references in reviewed literature to find additional relevant sources. Expert knowledge was key to identify possibly relevant sources.

A two-tiered approach was adopted for grey literature screening due to challenges associated with using machine learning for this purpose. The screening was done for the peer-reviewed literature to train the algorithms to properly identify the eligible scientific papers which were then verified as relevant by expert decision. The pretrained algorithm was then applied to the grey literature. This way the structural differences between the peer-reviewed and the grey literature couldn´t influence the machine learning and the relevant content is more influential for the machine learning.

Evaluation and synthesis

Records identified through the screening process were assessed for eligibility and evaluated based on qualitative indicators derived from the research questions (see Appendix 2). In total, 400 peer-reviewed papers and grey literature reports were screened for relevance, 253 from the keyword-search and 157 from the snowball-search. After the screening 69 papers remained, of which 47 were peer-reviewed papers, 2 book-chapters and 20 grey literature reports. A qualitative synthesis of the literature was then conducted, incorporating relevant findings into the PEA.

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2.3.5. Review of legislation, policies and governance in case study countries

In addition to the literature review, a supplementary review was carried out to gather factual information on the current state of legislation, policy and governance of protected area networks and ecological connectivity in the EU Member States of the NaturaConnect case studies, and all countries in the Danube-Carpathian region. Additionally, spatial planning tools and funding sources are identified where possible. These can be considered as part of the formal rules of the game in the PEA framework.

The method used combines information from a literature review and internet search (including legislative texts) and input from the case study interviews (Appendix 3). Key resources that were integrated into the review include the European Environment Agency Biodiversity Information Service (BISE), a survey of EU Member States' protected area approaches carried out for the European Environment Agency (EEA) (Naumann et al., 2022), and the outcomes of the European Spatial Planning Observation Network (ESPON) LinkPAs project (ESPON, 2018), as well as other recent Interreg projects on ecological connectivity, e.g. (Borlea et al., 2022). The review also relied to a large extent on a recent publication on nature conservation across Europe (Tucker (ed), 2023).

The resulting content gathered during this review has been compiled into Table 3 and a series of data sheets outlining the ecological connectivity relevant legislation, policies, and governance for each case study country, which can be found in Appendix 1.

2.4. Limitations in our research

Acknowledging limitations in our research is crucial for ensuring transparency and understanding the scope of our findings.

Changing political landscape: During our research, the political landscape in Europe has been evolving. The 2024 European farmers' protests, the EU Parliament elections, and national elections in several Member States are significantly impacting the implementation of the European Green Deal. As a result, some of the insights and opinions from interviews conducted in 2023 – specifically 25 out of 67 – may now be outdated.

Interviews: One notable limitation has been the response rate to our interview invitations. Despite reaching out to a significant number of stakeholders through 300 email addresses, we were able to conduct a total of 67 interviews. This low response rate may have been influenced by various factors, including the possibility that some contacted individuals were not the appropriate contacts for our inquiries. However, valuable insights were gained from those who did respond, and we were guided to better contacts through their assistance.

Surveys: Another limitation we encountered in our research pertains to the response rate for our surveys, particularly the non-conservation sectors survey. Despite our efforts, obtaining responses from stakeholders in certain sectors proved challenging. This effort resulted in more than 900 addresses being contacted, along with our announcements on social media. Notably, we received only two responses from the agriculture sector and linear infrastructure sector, respectively (Figure 10). This limited participation may have been influenced by various factors, including the complexity of the questions or constraints on stakeholders' time and resources, as well as some of the identified problems, such as a lack of awareness of the issue. While response rates were in line with other empirical social research studies, we had anticipated a higher level of engagement and found it challenging to involve people.

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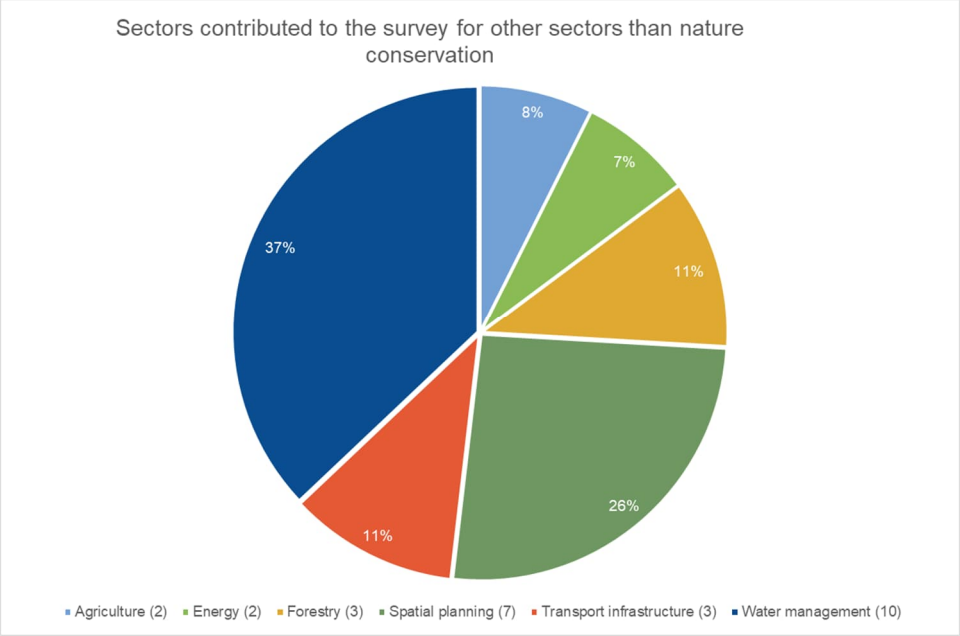

Figure 10. Sectors represented by the stakeholders that participated in the survey for sectors other than nature conservation; n=27

Literature review: Using the machine learning approach for grey literature was challenging. Experiences with using machine learning for grey literature are scarce, and to control the quality of the output, scientific literature was separated from grey literature for the screening. To solve the challenges, we adopted a two-tiered approach. In the first tier, the scientific literature was screened with the machine learning software as described above. The relevance was verified in a first round of full-text reading. The sources that were identified as relevant by full-text assessment were then used as prior knowledge for the abstracts screening of the grey literature list.

Geographical scope: Not all European countries were included in the research; only those which were part of a NaturaConnect project case study. Altogether, 19 countries were examined, 14 EU Member States and 5 EU neighbouring countries. This geographical limitation may affect the generalisability of the findings to other regions.

Qualitative approach: The research adopts a qualitative methodology, with a large part relying on semi-structured interviews, surveys and workshops. While this approach provides in-depth insights, it is inherently subjective and may be influenced by the perspectives and biases of the participants/reviewers. Additionally, the relatively small sample size in some surveys may limit the robustness of the conclusions.

Data availability and reliability: The availability and reliability of data, particularly from grey literature and stakeholder interviews, can vary significantly. Some data sources were outdated or incomplete, and the reliance on self-reported information from stakeholders could have introduce bias. The integration of different data sources aimed to mitigate this, but some inconsistencies may remain.

Language and communication barriers: Conducting interviews and surveys across multiple countries with diverse languages posed challenges. Although efforts were made to accommodate language differences, including translating interview questions and responses, some nuances and contextual meanings may have been lost or misinterpreted.

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3. Results

This section presents the results of the applied Political Economy Analysis (PEA) at both the EU level and for the six NaturaConnect case studies. To set the context, we begin with an overview of existing ecological connectivity governance, policies, and laws at various scales, including both EU and national levels (Section 3.1). A summary table is provided, highlighting and contrasting the ecological connectivity laws, legislation, and strategies for the 19 case study countries.

Following this, we present the results of the Political Economy Analysis (Section 3.2). This section starts by defining the problem (Section 3.2.1) and then explores the reasons behind this problem (Section 3.2.2). It includes an analysis of the literature review, an examination of each of the NaturaConnect case studies, and a discussion of existing and novel financing mechanisms.

3.1. Critical review of governance, policies, laws

3.1.1. EU level

This section reviews the EU legislation and governance mechanisms relevant for ecological connectivity and the most relevant sectoral policies. The EU has included the restoration and maintenance of ecological connectivity in legislation that is binding for the EU Member States. In addition, there have been a series of strategies, projects and initiatives for ecological connectivity since the 1990s. The Council of Europe's Pan-European Ecological Network and the European Green Belt Initiative are at the continental scale. The European Commission has launched the Green Infrastructure Strategy and is promoting the establishment of the TEN-N as part of the EU Biodiversity Strategy for 2030.

It is important to highlight that there is a large diversity among the policies in this section; ecological connectivity is, in some cases, a side result rather than the objective. For example, not all of the measures under the Water Framework Directive or Floods Directive will provide connectivity and assessing whether the measures provide ecological connectivity needs to be done on a case-by-case basis (Lázaro et al., 2021).

Legal mechanisms

The EU **Nature Restoration Law** (Regulation (EU) 2024/1991) aims at the long-term and sustained recovery of biodiverse and resilient ecosystems in the EU. The key obligation under the Regulation is for the Member States to prepare and implement a National Restoration Plan. Ecological connectivity for species is an integral part of this plan. For species mentioned in Article 4 the quantification of the habitats required for reaching favourable conservation status is explicitly required to take connectivity into account.

Member States are specifically required to map the agricultural and forest areas in need of restoration, in particular the areas that, due to intensification or other management factors, need enhanced connectivity and landscape diversity. Article 12 addresses the restoration of forest ecosystems. Member States are required to achieve an increasing trend at national level of at least six out of seven indicators, one of which is forest connectivity. The Regulation also foresees the planting of three billion additional trees by 2030 in the EU. The measures to achieve this commitment should aim to among others increase ecological connectivity

Article 9 addresses river connectivity. The Regulation requires Member States to make an inventory of barriers that need to be removed to contribute to the restoration of ecosystems and to restore 25 000 km of free-flowing rivers by 2030. The removal is then governed by the National Restoration Plan. In addition, for floodplains Member States should take

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complementary measures to improve their natural function. The restored connectivity of rivers and floodplains should then also be maintained.

The **Habitats Directive** (Directive 92/43/EEC) aims to restore and maintain ecological connectivity. The Directive established the Natura 2000 network in Europe. Article 10 of the EU Habitats Directive states that:

> '*Member States shall endeavour, where they consider it necessary, in their land-use planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species*.'

This article explicitly includes ecological connectivity in the form of linear features, stepping stones, migration, dispersal and genetic exchange. The **Birds Directive** (Directive 2009/147/EC), while not explicitly mentioning ecological connectivity, also includes the management of habitats outside protected areas under Article 3, as well as areas along migratory routes under Article 4. The European Commission issued a guidance document on Article 10 of the Habitats Directive and Article 3 of the Birds Directive in 2007 (Kettunen et al., 2007). In its 2023 assessment of investment needs and priorities for Natura 2000 and for Green Infrastructure, the European Commission urged the Member States to include Green Infrastructure for Natura 2000 in their Prioritized Action Framework (PAF) (European Commission, 2023).

The **Water Framework Directive** (Directive 2000/60/EC) requires Member States to achieve good ecological status or good ecological potential of water bodies on their territory. Ecological connectivity is included in the assessment of several quality elements of surface water bodies. River continuity, hydrological regime and connection of rivers to groundwaters and riparian zones are direct quality elements providing ecological connectivity, while thermal and oxygenation conditions can, in some cases, constitute a barrier for migratory fish.

Member States are, therefore, expected to take measures to maintain or re-establish continuity. This may include removing barriers and dams, or building fish passes or other passes around barriers. Member States may designate rivers or sections of rivers as river reserves where connectivity must be preserved. Protected areas under the Water Framework Directive can also protect ecological connectivity as they include Natura 2000 areas, drinking water protection areas, and areas designated for the protection of economically significant aquatic species. The Water Framework Directive also provides for cooperation across Member States through international river basin management plans under Article 13.

Smart implementation of the Water Framework Directive provides further opportunities for ecological connectivity. Natural water retention measures (NWRM) are natural or nature-based structures that slow down the flow of stormwater, increase infiltration and reduce pollution through natural processes. The Water Framework Directive Common Implementation Strategy (WFD CIS) recommends NWRM as cost-effective measures to achieve the goals of the Water Framework Directive (WFD CIS Working Group Programme of Measures, 2014). Riparian buffer zones or strips with a minimum width and permanent vegetative cover along water bodies, created to maintain water quality (under the Water Framework Directive and/or the **Nitrates Directive** (Directive 91/676/EEC) can also provide linear connectivity.

Ecological connectivity can also be maintained by flood protection areas under the EU **Floods Directive** (Directive 2007/60/EC). The EU Directive does not directly require legal restrictions

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in areas with high flood hazard risk, but Member States can choose to restrict potential land uses in flood-prone areas. Flood risk management measures must take account of EU environmental objectives and must address the potential effects of flooding on Natura 2000 and protected waters.

EU Strategies and initiatives addressing ecological connectivity

The **EU Biodiversity Strategy to 2030** (European Commission, 2020) provides the overarching policy framework for biodiversity conservation in the EU. The Strategy sets priorities for strengthening the legal framework implementing and enforcing EU nature legislation. The Strategy follows and integrated and whole-of-society approach, covering all relevant sectors including agriculture, forestry and renewable energy. The Strategy builds upon the previous EU Biodiversity Strategy (European Commission, 2011).

In 2013, the European Commission launched the **EU Green Infrastructure Strategy** as part of its commitments to the EU Biodiversity Strategy 2020 and the Aichi Biodiversity Targets (Convention on Biological Diversity, 2010). The European Commission has defined Green Infrastructure as (European Commission, n.d.):

> *'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, while also enhancing biodiversity.'*

The key principles of Green Infrastructure are connectivity, spatial planning, and multifunctionality; it has wider aims than ecological networks, promoting the multifunctional nature of space and the benefits that appropriate management approaches can deliver (van der Sluis and Schmidt, 2021). The EU strategy aimed to create an enabling framework for green infrastructure using existing EU legal, policy and financial instruments.

The EU Green Infrastructure Strategy has been complemented by the **Guidance on a strategic framework for further supporting the deployment of Blue and Green Infrastructure**. The Guidance aims to integrate Green Infrastructure into key EU policies, improve information, strengthen the knowledge base and promote innovation, improve access to finance and foster investments in EU-level Green Infrastructure projects and promote good practices. The Guidance specifically requires EU level Green Infrastructure projects to contribute to the goals of the Birds and Habitats Directives, including via implementing Article 10 of the Habitats Directive and connecting Natura 2000 with buffer zones to defragment the landscape.

The EU **Forest Strategy for 2030** promotes closer-to-nature forestry in the EU through technical support and a voluntary certification scheme. The Guidelines on Closer-to-nature forest management include a toolbox with several interventions for ecological connectivity such as setting areas aside for biodiversity networks and corridors and landscape scale planning and management ('mosaic' approaches).

The EU **Pollinators Initiative,** revised in 2023, aims to improve the conservation of pollinators and tackle the causes of their decline. To achieve this the Initiative promotes strategically planned restoration activities to ensure adequate areas of well-connected, high-quality habitats for pollinators through species conservation plans. By 2027, the Initiative foresees the development of a blueprint of a network of 'Buzz lines' - ecological corridors for pollinators - with an accompanying implementation plan. The Initiative calls on Member States to integrate the 'Buzz lines' into spatial planning at national, regional and local levels.

At European level there have been several regional initiatives which include cooperation between EU Member States and third countries. Under the Council of Europe, there have been efforts to design, plan, and implement a **Pan-European Ecological Network** (PEEN) since 1996 (Bouwma et al., 2002). The PEEN was developed in three subprojects: Central

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and Eastern Europe, completed in 2002; South-eastern Europe, completed in 2006; and Western Europe, also completed in 2006. The Network consists of core areas (sites of Pan-European importance), buffer zones, ecological corridors and nature restoration areas. The methodology of the development of the three maps was broadly comparable but data availability, differences in national databases, technical developments and geographical differences caused variations in the detailed approach (Bouwma et al., 2002). The maps have no legal standing and there is no enforcement mechanism.

The **European Green Belt Initiative** has ecological connectivity as its goal (Zmelik et al., 2011). It aims to create a chain of protected areas along the former Iron Curtain between Western and Eastern Europe from the Barents Sea at the Russian-Norwegian border, along the Baltic Coast, through Central Europe and the Balkans to the Black and the Adriatic Sea.

The **Carpathian Biodiversity Framework** under the Carpathian Convention aims among others to restore and safeguard ecological connectivity in the Carpathian area especially linked to large carnivores' protection. The **International Commission for the Protection of the Danube River** (ICPDR) advocates for the implementation of the Water Framework Directive in the Danube River basin including activities to enhance migratory fish, especially sturgeon protection. The EU **Strategy for the Danube Region** (EUSDR) Priority Areas 6 (Biodiversity) and 4 (Water Quality) have initiated a number of activities related to ecological connectivity and migratory fish protection.

[Box 1] The Trans-European Nature Network

In 2020, the European Commission published the new EU Biodiversity Strategy for 2030 (European Commission, 2020), which states that the EU must build a truly coherent Trans-European Nature Network (TEN-N), and defines one of the three leading goals as: *'to legally protect at least 30% of the land, including inland waters, and 30% of the sea in the EU, of which at least one third (10% of land and 10% of sea) to be under strict protection.'*. The Strategy mentions the following as components of the TEN-N:

- Designation of a minimum extra 4% of land and 19% of sea, either to complete the Natura 2000 network or under national protection schemes, with the exact area depending on which national protected areas Member States consider contributing to the 30% targets. The land target is to be achieved in each EU biogeographical region.
- Strict protection of an additional 7% of land and 9% of sea. All remaining primary and old-growth forests need strict protection. Significant areas of other carbon-rich ecosystems, such as peatlands, grasslands, wetlands, mangroves and seagrass meadows should be strictly protected. Strict protection of coastal ecosystems and wetlands for climate adaptation.
- Designations can include the spatial protection measures to comply with the EU Water Framework Directive and the EU Marine Strategy Framework Directive.
- Designations can include Other Effective area-based Conservation Measures (OECMs) – these are areas that have a form of legal protection that is not related to the protection of habitats and species but that indirectly promotes the conservation of biodiversity. Administrative or contractual arrangements should have a minimum duration that is set on the basis of the ecological requirements of the species or habitats to be protected (European Commission, 2022).
- All protected areas should have clearly defined and tailored conservation objectives and measures. This applies to both the new designations, OECMs, and all existing areas including Natura 2000 sites and other protected areas.
- All protected areas (including OECMs) must have effective management and monitoring of the biodiversity in the area in place.

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In order to have a truly coherent and resilient TEN-N, the Strategy underlines the importance of:

- Setting up ecological corridors to prevent genetic isolation, allow for species migration, and maintain and enhance healthy ecosystems.
- Promoting and support investments in Green and Blue Infrastructure, as well as cross-border cooperation among Member States.

Both new designations and the process of defining or adding conservation objectives to existing designations are expected to:

- Protect species and habitats covered by EU nature legislation (even if they are not Natura 2000 sites) if the protection is needed to address gaps in coverage of habitats and species. For example, those gaps highlighted by the sufficiency assessments performed by the European Environment Agency on behalf of the European Commission, or identified through scientific analyses
- Protect species and habitats covered by EU nature legislation to buffer the effects of climate change on Natura 2000 sites or to facilitate species migration.
- Protect species identified in European or national red lists (that are not covered by the EU nature legislation).
- Protect areas hosting wild pollinating insects, such as semi-natural grasslands, to help restore pollinator populations.
- Protect land that falls under one or more of the categories of the LULUCF Regulation (Annex III point b).
- Protect land that has been restored under the requirements of the EU Nature Restoration Law.

Sectoral EU policies

Several sectoral policies also support the maintenance of ecological connectivity. The **Renewable Energy Directive (**Directive 2023/2413) requires Member States to exclude major bird and marine mammal migratory routes from their renewable energy acceleration areas. The **Trans-European Network for Transport Regulation** (Regulation 2024/1679) specifically refers to the connectivity of free-flowing rivers in relation to the construction of new inland waterway infrastructure and includes road overpasses for animals as elements of road infrastructure and thus as projects of common interest.

The **Common Agricultural Policy** conditionality rules require the protection of linear landscape features on farmland (Regulation 2021/2115, GAEC 8), and the creation of buffer strips along watercourses (GAEC 4) which could also provide linear connectivity. The protection of grassland outside Natura 2000 (GAEC 1) and the protection of wetlands and peatlands (GAEC 2) could provide stepping stones and structural connectivity.

The **Regulation on deforestation-free products** (Regulation 2023/1115) aims among other things to protect primary forests from conversion into plantation forests, other forests and shrublands by prohibiting the marketing of timber from such clear-cuts. Given the high degree of fragmentation of primary forests in the EU, this prohibition can be relevant for ecological connectivity. The prohibition is scheduled to enter into force on 30 December 2024. The LULUCF Regulation (Regulation 2018/84) addresses the impact of land use on sources and sinks of greenhouse gases in the EU. While it does not directly address connectivity directly, the Regulation does require Member States to keep an account of the area of forests, wetlands and grasslands on their territory.

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3.1.2. Global biodiversity policy

Initiatives to maintain, enhance and restore ecological connectivity are a key feature of global biodiversity policy. Global Goal 'A' for 2050 of the Kunming-Montreal **Global Biodiversity Framework** (GBF) under the Convention on Biological Diversity (CBD) is 'The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050'.

The second and third Global Targets for 2030 also refer to connectivity. The second Global Target for 2030 is to 'Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and *connectivity'*. The third Global Target for 2030 is to 'Ensure and enable that by 2030 at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, *well-connected* and equitably governed systems of protected areas and other effective area-based conservation measures [...]'.Finally, the first Global Target to 2030 is also relevant for connectivity through its reference to 'biodiversity inclusive spatial planning'.

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3.1.3. Strategies and frameworks in the case study countries

The realisation of ecological connectivity and Green Infrastructure will predominantly occur through national laws, frameworks, and policies. Despite the importance of these strategies, a comprehensive summary of ecological connectivity strategies and frameworks across EU countries has not yet been developed. The table below presents a detailed summary of the ecological connectivity strategies and frameworks from the NaturaConnect case study countries. This represents 17 countries including 12 EU Member States. The table includes information on the types of designated protected areas, the ecological connectivity strategy or legal framework across administrative levels, the name and legal basis of these frameworks, governance mechanisms (including the responsible authority for implementation), the stated connectivity goals (structural connectivity, functional connectivity, or none), the integration or linkage of the strategy/legal framework to Natura 2000 sites, the types of connectivity included, and the estimated coverage of the national territory included under each strategy or law (Table 3).

Table 3. Summary of ecological connectivity strategies and legal frameworks at national level across project case study countries (for more information on regional/municipal levels, please, check Table 1 or Appendix1).

Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Austria	*National, regional, local* *Natura 2000 sites: 15.4% of land area.* *29.2% of land covered by protected areas*	National level: No Regional level: partly yes	N/A	N/A Provincial government, district authority	N/A .	N/A	N/A Green zones/green corridors	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Bosnia and Herzegovina	*National, regional, local* *4.1% of land covered by protected areas*	National level: No	Federal Environmental Strategy	Division of Environmental Responsibilities	N/A	N/A	N/A	N/A
Bulgaria	*International, National, regional, local* *34.9% of land covered by protected areas*	National level: Yes	Spatial Development Act; The Law on Biological Diversity, National Ecological Network; Lower Danube Green Corridor Declaration	Ministry of the Environment and Water	Structural, functional connectivity	Yes	Principal features of the landscape (rivers and riverbanks and water-logged old riverbeds, natural marshes, lakes, wet meadows and other wetlands, caves, rock edges, faces and dunes, valleys and other natural landforms linking separate mountains, field boundary markings, forest shelter belts, dry meadows and pastures, flood plains and riverside vegetation, and forests located at an altitude not exceeding 500 m above sea level)	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Croatia	*International, National, regional, local* *38.1% of land covered by protected areas*	National level: No (partially integrated into other laws, e.g. transportational one)	N/A (integrated into 'The Ordinance on Wildlife Crossings', 'The Common Agricultural Policy Strategic Plan')	Ministry of Economy and Sustainable Development	N/A	N/A	Due to size and location Natura 2000 is functionally connected; in transport it's 'green bridges', in agriculture it's Environmentally Sensitive Permanent Grasslands (ESPG)	N/A
Czech Republic	*International, National, regional, local* *21.9% of land covered by protected areas*	Yes - Three interconnected levels: supra-regional, regional and local	Nature and Landscape Protection Act Territorial System of Ecological Stability of the Landscape (TSES)	Ministry of the Environment, Nature Conservation Agency	Structural and functional	Yes	Green Infrastructure, biocentres and bio corridors, interactive elements	more than 56% of the country
Finland	*International, National, regional, private* *13.3% of land covered by protected areas*	No national but regional level: Yes	Legal framework of the Land Use and Building Act on a regional level, through two major government-funded programmes: METSO and HELMI; Nature Conservation Act; Act on the Protection of Rapids; Forest Act and Strategy;	Ministry of the Environment Ministry of Agriculture and Forestry	functional	N/A	Green Infrastructure	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
France	*International, National, Regional, Departmental* *28% of metropolitan land covered by protected areas*	Yes (National, Regional, Departmental, Territory, municipal level)	Trame Verte et Bleue/Green and Blue Network (GBN) (Law)	French Biodiversity Agency, Regional directions, Ministry of Environment	Structural, functional	Yes	Reservoirs, corridors, watercourses and wetlands	N/A
Germany	*International, National, Regional* *37.4% of land covered by protected areas*	National level: Yes	Federal Nature Conservation Act (national ecological network, Biotopverbund); European Green Belt Initiative (German Green Belt); States´ Nature Conservation Acts; Regional - Bavarian Nature Conservation Act (BayNatSchG)	Ministry for the Environment On the state level: Highest nature protection administration (states´ environment ministries) Higher nature protection administration (Regierungsbezirke) Lower nature protection administration (Landkreise)	Structural, functional	Yes	Landscape planning, defragmentation, Green Infrastructure;	Federal Nature conservation Act: 10% of each federal state´s territory to be destined for biotope network

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Hungary	*International, National, Municipal* *22.2% of land covered by protected areas*	National level: Yes	National Ecological Network/ Instrument	The Ministry of Agriculture - Department for Nature Conservation or the Department of National Parks and Landscape Protection	Structural, functional	Yes	Core areas, ecological corridors, buffer zones,	36% of the total area of the country
Moldova	*International, National* *5.66% of the country's territory*	National level: Yes	National Ecologic Network/Law	Ministry of the Environment	Structural goal	N/A (Natura2000 sites is in preparation)	Corridors	N/A
Montenegro	*International, National, Regional* *13.9% of land is covered with protected areas*	National level: No	N/A	The Ministry of Ecology, Spatial Planning and Urbanism; the Nature and Environment Protection Agency	N/A	N/A (Natura2000 sites is in preparation)	N/A	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Poland	*International, National, Regional.* *39.6% of land area (excluding Biosphere Reserves, Natural Monuments, Ecological Areas and Nature Landscape complexes)*	National level: Yes	The Polish Nature Conservation Act, The National Spatial Development Concept 2030	The Ministry of Climate and Environment, The General Directorate of Environment Protection (GDOŚ) at the national level and the 16 Regional Directorates of Environment Protection (RDOŚ) are responsible for management of Natura 2000 sites and Nature Reserves, as well as species conservation	Structural and functional	Yes	Corridors for fighting defragmentation, spatial instruments, buffer zones	N/A
Portugal	*International, National, regional,*	National level: Yes	To ensure the protection of ecological sensitive areas and promote ecological connectivity, these areas are defined and protected by decree(s): Decree-Law – DL n.º 321/83 (defines the REN and RAN) Water Public Domain	Direção Geral do Território (DGT) defines tPNPOT. Strategic guidelines defined by the REN National Commission; delimitation of the REN and the EEM is done at the local level by each municipality with the support of the Agencies for	Structural and functional	Yes	Connectivity areas defined based on the protection of the hydrological regime, including water bodies, rivers and riparian habitats; coastal areas. Terrestrial connectivity aims to link core conservation sites between protected areas.	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
			Fundamental Network of Nature Conservation (RFCN) Ecological connectivity is referred as a key component in the Legal framework for Nature Conservation (RJCN) and in the National Spatial Planning Policy Program (PNPOT). Decree-Law – DL nº 142/2008 (defines the RJCN) Law nº. 99/2019 (approved the PNPOT)	Regional Development (CCDR), who are also responsible for the definition of the ERPTVA, with the involvement of Portuguese Environmental Agency (APA).				
Romania	*International, National, regional,* *23.4% of the national territory covered by protected areas*	National level: No (although the spatial planning legislation mentions ecological corridors)	N/A; Spatial legislation is National Spatial Plan, County Spatial Plans, and Zonal Regional Spatial	The Ministry of Environment, the Water and Forests Agency and the Protected Area Agency	Structural and Functional (as part of land-use planning)	N/A; Spatial planning legislation refers to Natura2000 cites	Ecological corridors (e.g. natural river valleys, semi-natural recreation areas for local settlements), core areas,	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Serbia	*International, National, regional,* *10.5% of land covered by protected areas*	National level: Yes Regional level: Autonomous Region Vojvodina	Law on Nature Conservation, The Serbian Regulation on the Ecological Network, The Spatial Planning legislation 'Law on Planning and Construction'	Ministry of Environment, provincial Secretariat for the Environment	Structural	N/A	Ecological corridors, mainly larger and smaller watercourses including structural and functional connectivity, ecologically significant areas, protection zones	N/A
Slovakia	*International, National, regional, local* *37.4% of land covered by protected areas*	National level: Yes	State Nature Protection Act No. 543/2002 on Nature and Landscape Protection; Spatial law - Territorial System of Ecological Stability (TSES)	Ministry of the Environment; Regional Environmental District Offices; State Nature Conservancy	Structural	Yes	Bio-centres, bio-TSES corridors, interacting elements and eco-stabilising measures	N/A
Slovenia	*International, National, regional, local* *40.5% of land covered by protected areas*	National level: Yes	Spatial Planning Strategy of Slovenia 2050	The Ministry of Natural Resources and Spatial Planning	N/A	Yes	Ecological networks, Green Infrastructure	N/A

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Country	Types of designated protected areas	Ecological connectivity strategy or legal framework across administrative levels	Name/legal basis	Governance mechanisms (incl. responsible authority for implementation)	Stated connectivity goal (structural connectivity/ functional connectivity /none)	Does the strategy/legal framework integrate/link to Natura 2000 sites?	Types of connectivity included	Estimated coverage of national territory included under strategy/law
Spain	*International, National Regional,* *36.7%% of land covered by protected areas*	National level: yes	National strategy for Green Infrastructure and ecological restoration	Regional governments	Structural and functional	Yes	Nuclear areas, Ecological corridors, Multifunctional elements, Buffer zones, Urban green areas and elements	Not known
Ukraine	*International, National, regional,* *10.4% of land covered by protected areas*	National level: Yes	'On the National Programme for the Formation of the National Ecological Network of Ukraine for 2000-2015'; the Law of Ukraine 'On the Ecological Network'	Ministry of Environmental Protection and Natural Resources of Ukraine; Regional Environmental Departments	Structural and functional	No	Ecological corridors, stepping stones, rivers and riparian zones, reservoirs, forests, windbreaks, and grasslands, core-areas	N/A

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3.2. Applied Political Economy Analysis

3.2.1. What is the problem?

The TEN-N centres around the idea of creating an ecologically connected network of protected areas and corridors in Europe. This is in tune with the increased attention given to safeguarding ecological connectivity in international policy. TEN-N, in alignment with the Kunming-Montreal Global Biodiversity Framework, will represent a significant leap forward in EU Member States' collective ability to deliver connectivity impact at scale. A common problem in this context is the **weak and on-going loss of ecological connectivity of protected and conserved areas**, as revealed in the problem analysis as part of this research and supported by interviews and workshops on this issue by stakeholders and case study leads. This issue can be attributed to several causes that are consistently observed across various national contexts, despite specific local nuances. The underlying causes for the problem stem from a mix of economic, social, governance, and capacity aspects (Figure 11).

Considering the weak ecological connectivity between protected areas and conserved areas, it is important to highlight the need to look beyond national borders, both at regional and transnational levels. There has been a move in the last decades towards decentralised land planning, with power moved downwards to regions, provinces and municipalities. This comes with local pressure for specific infrastructure to the detriment of nature, with lack of coordination across local actors, fragmentation, diversity of governance models, and lack of capacity. At the transnational level, more and more organisations acknowledge the connectivity problem; an example is the Danube-Carpathian region, one of the NaturaConnect case studies. Here several transnational organisations have endorsed the 'Declaration on Achieving functional biodiversity in the Danube-Carpathian Region by mainstreaming ecological connectivity'. In addition, Interreg projects like SaveGREEN, ConnectGREEN or TRANSGREEN have provided additional insights to the problem at the transnational level.

Another aspect that needs to be highlighted is the complexity of the problem. There are a significant number of players at national, regional and transnational levels, from multiple sectors, and with different interests, understandings and powers.

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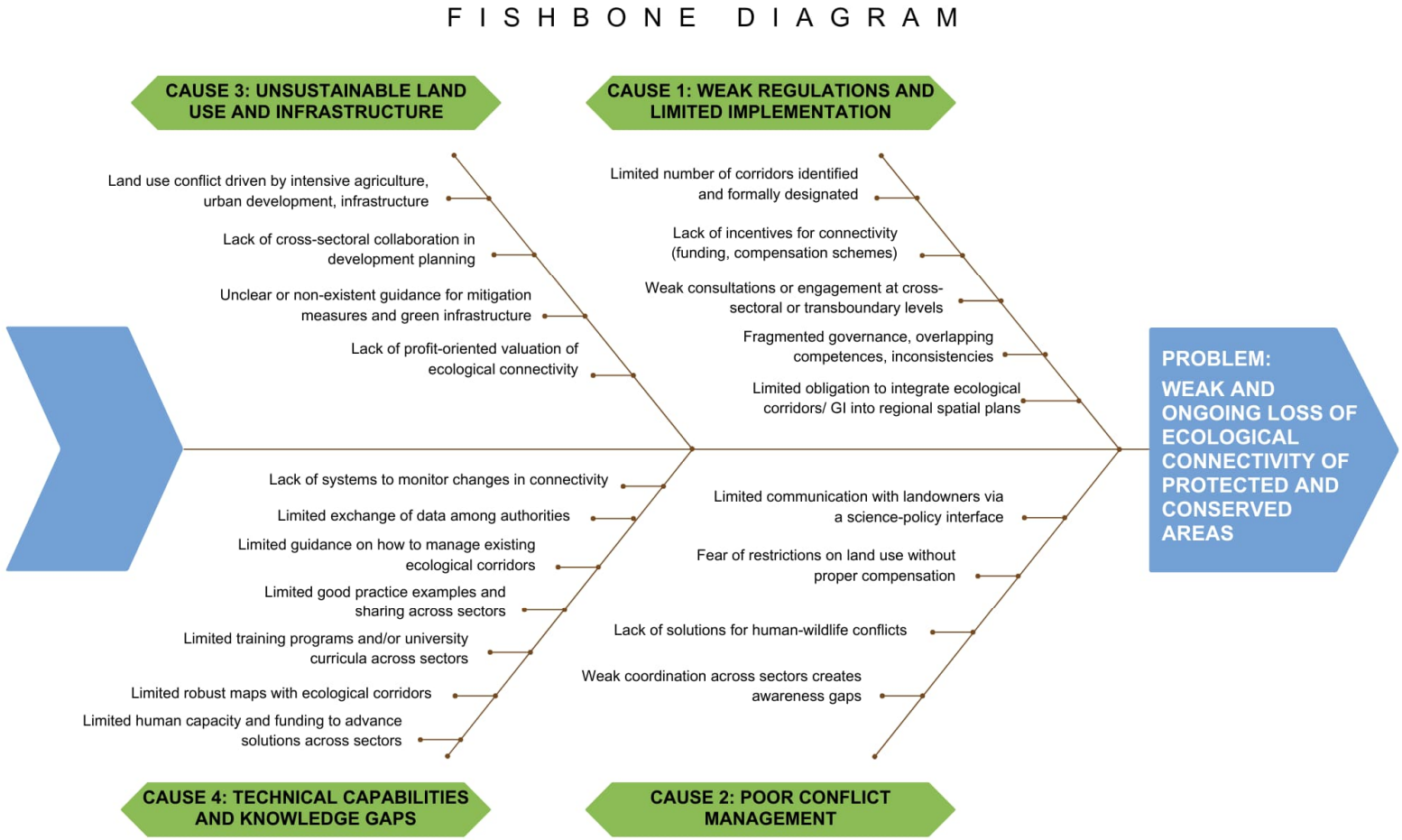

Figure 11. Fishbone diagram. To distil the problem's root causes, the team organised a Political Economy Analysis workshop in Bucharest. One of the outcomes was a visual of the problem and its causes, in the form of a cause-and-effect diagram.

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Cause 1: Weak regulations and limited implementation

In many countries, regulations intended to support ecological connectivity exist but are poorly implemented due to fragmented governance frameworks and lack of political incentives. For example, fragmented governance frameworks and insufficient funding pose significant challenges in the implementation of ecological corridors in France and Spain. Similarly, Finland and Portugal experience difficulties in implementation due to weak cross-sectoral cooperation and lack of political incentives In the Danube-Carpathian region, the limited number of formally designated corridors and poor cross-sectoral cooperation further hinder effective implementation.

- **France**: The governance framework is fragmented, leading to inconsistent implementation of ecological connectivity measures. Local authorities often lack the necessary guidance and political incentives to integrate these measures into spatial plans. The National Strategy for Green and Blue Infrastructure aims to create ecological corridors but faces implementation challenges due to fragmented governance and insufficient funding.
- **Spain**: Despite having a national strategy, there is a limited obligation to integrate ecological corridors into regional spatial plans. This weak governance framework hinders effective implementation. The National Strategy for Green Infrastructure is well-conceived but not fully operationalised at the regional level, leading to inconsistent ecological connectivity measures. Furthermore, the autonomy of each region to propose its own strategies may result in transboundary inconsistencies.
- **Finland**: Laws and regulations are in place, but there is difficulty in implementation due to weak cross-sectoral cooperation and lack of engagement with stakeholders. Programs like Forest biodiversity programme for Southern Finland (METSO) and Helmi Habitats Programme encourage private land conservation, but their impact is limited by insufficient political and financial support and fragmented land ownership.
- **Portugal**: While there are national strategies and legal frameworks in place, the selection of core connectivity areas is done at the local and regional level, often decision-making is not based on scientific information. There is a gap between research and policy implementation and a lack of capacity in regional and local administrations for the use of land planning instruments that would enable the implementation of ecological corridors.
- **Danube-Carpathian region**: Limited overall number of corridors identified and formally designated, along with limited formal guidance on how to manage existing ecological corridors. In cases where laws and regulations are in place, their implementation proves difficult due to poor cross-sectoral cooperation. Furthermore, the laws and regulations contain weaknesses due to limited engagement of stakeholders in the design process. More concretely, there is a limited obligation to integrate ecological corridors in spatial/development plans (with small exceptions like Czech Republic, Hungary and Slovakia) and a lack of incentives for tackling connectivity (in terms of funding, compensation schemes).
- **Leipzig-Halle** (Germany): In the context of the Leipzig-Halle region constraints concerning regulation are more based on the complicated procedures that are required by the regulatory framework. Especially for the stakeholder in scientific organisations and NGOs this is a major regulation-related barrier.

Cause 2: Poor conflict management

A common problem is the lack of awareness and common understanding of the need for ecological connectivity among stakeholders, which leads to conflicts and resistance to connectivity measures. Many stakeholders, including decision-makers, landowners, and

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farmers across EU countries, fear land use restrictions and lack adequate awareness of the importance of ecological connectivity.

- **France**: Many stakeholders, including decision-makers, landowners, and farmers, lack awareness of the importance of ecological connectivity. This results in conflicts, especially regarding land use and agricultural practices.
- **Spain**: Stakeholders often fear restrictions on land use without proper compensation, leading to resistance against ecological connectivity measures. This is compounded by the complexity of involving multiple players from different sectors.
- **Finland**: There is insufficient communication of the benefits of ecological connectivity at the science-policy interface, causing a gap between scientific knowledge and policy implementation.
- **Portugal**: There is a strong sentiment among landowners regarding private property, with many feeling strongly about their right to use their land as they see fit, leading to a fear of land use restrictions. This sentiment underscores a lack of understanding of the social responsibility that comes with land ownership. Most protected areas encompass a high percentage of privately-owned land; for instance, in Portugal, only 3% of forested areas are public, 14% is communal land, and the rest is private (Forti, R. ed., 2017). Consequently, the state can only influence these private lands through regulations, prohibitions, or incentives. Unfortunately, there are poor fiscal incentives for management measures focused on natural capital, and an extractive and productive approach to land management prevails.
- **Danube-Carpathian region**: Limited communication of the advantages of ecological connectivity via a science-policy interface creates little awareness of the function of ecological connectivity across stakeholders, both at national and transboundary levels. Moreover, there is a fear of restrictions for landowners' activities on their land without proper information and compensation. Another sensitive aspect is the human-wildlife conflict that comes with complex social dynamics, in a context where development, habitat degradation, and climate change put pressure on wildlife.
- **Leipzig-Halle** (Germany): Land-use conflicts and conflicts in terms of prioritising land uses are heightened by the urban context of the region. There is competition for space to be allocated for the needs of a region that is growing after a period of decline and stagnation. There is also a demand for recreational green space from the growing urban population constituting potential conflict with the protection status of highly protected areas.

Cause 3: Unsustainable land use and infrastructure development

Economic development pressures frequently override conservation efforts, posing a significant threat to ecological connectivity. In addition, measures are not sufficiently responding to climate impacts like droughts, and rising temperatures that threaten to destabilise natural areas. Intensive agriculture, urban development and infrastructure projects in countries like France, Spain and Portugal disrupt ecological corridors. In Finland, economic pressures from forestry and urban development conflict with conservation goals. The Danube-Carpathian region faces similar challenges, where rapid economic development and unclear implementation of mitigation measures lead to land use changes that disrupt natural habitats. The combined impacts of land-use change, climate change, and existing and new physical infrastructure are an important part of the problem.

- **France**: Land use changes such as intensification agriculture, urban development, and infrastructure projects pose significant threats to ecological connectivity. Unlimited agricultural intensification and urban and transport infrastructure expansion is incompatible with maintaining connectivity.

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- **Spain**: Infrastructure and primacy of agricultural profits leads to land use changes that disrupt ecological corridors. There is also a lack of profit-oriented valuation of ecological connectivity.
- **Finland:** Maximum yield forestry and further urban development often conflict with conservation goals. Mitigation measures are not adequately enforced.
- **Portugal**: The intensification of agriculture and urbanisation leads to land conversion and disrupts natural habitats. For instance, Common Agricultural Policy (CAP) subsidies often have a perverse effect on soil health, leading to erosion due to bare soil exposure. Additionally, intensive farming, with its high levels of water consumption and use of agro-chemicals, significantly impacts biodiversity and habitats.
- **Danube-Carpathian region**: Rapid economic development tends to be decoupled from balanced environmental safeguards and is in many cases compounded by a lack of cross-sectoral collaboration in development planning. The need for new linear infrastructure, and the intensification of agriculture, forestry and water management practices leads to land use change that transforms natural areas into areas that can no longer function as ecological corridors. In addition, unclear implementation and enforcement for mitigation measures and Green Infrastructure make these economic sectors more likely to overlook biodiversity and connectivity aspects.
- **Leipzig-Halle**: The challenges for Green Infrastructure and connectivity in this case are more regional. For example, the structural change from landscape heavily influenced by mining and industry in the upper Weiße Elster catchment, or the growing city of Leipzig with high demand for housing, especially on the peri-urban fringe, exert pressure on Green Infrastructure.

Cause 4: Technical capabilities and knowledge gaps

There is a widespread lack of technical capabilities and knowledge, which hampers the effective management of ecological connectivity. The relevant authorities are short on time, resources, or in-depth knowledge, making it difficult to decide how to assess connectivity in a practical yet meaningful way. In countries like France, Spain, Finland and Portugal there is a lack of systems to monitor changes in connectivity and limited technical capabilities to develop advanced solutions. Additionally, georeferenced information, which could facilitate the assessment of connectivity, is difficult to access. While existing information is limited, even what is available is not readily accessible. The Danube-Carpathian region also faces a lack of expertise, clear standards, and inadequate systems to monitor connectivity changes, along with insufficient training programs and limited knowledge sharing across sectors.

- **France**: There is a lack of systems to monitor changes in connectivity. Local authorities need clear standards and expertise to manage ecological corridors.
- **Spain:** Limited technical capabilities and capacity to develop advanced solutions hinder the effective management of ecological connectivity.
- **Finland**: There is a need for training programs and clear standards for ecological connectivity. Current systems to monitor changes and trends are inadequate.
- **Portugal:** Like other countries, there is a lack of technical capacity and knowledge sharing across sectors.
- **Danube-Carpathian region**: There is limited expertise and clear standards for ecological connectivity. This can be seen in the limited robust maps with ecological corridors that need to be recognised by local authorities or in the lack of systems to monitor changes and trends in connectivity. While funding and capacity to develop advanced technical solutions across sectors are lacking, the few examples of good practice or other knowledge across sectors are hardly shared. Limited training programs and/or university programs in different sectors also contribute to the current knowledge gap.

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- **Leipzig-Halle** (Germany): Gaps in knowledge manifest on several scales and are addressed differently by the stakeholder groups. From the side of the administrative stakeholders there is a knowledge gap concerning privately owned Green Infrastructure elements as these are not publicly registered. The NGO side reports gaps in information about responsibilities as well as limited opportunities for participation.

3.2.2. Why does it happen?

In this section of the text, the literature review and the different building blocks of the PEA for each case study are analysed to contextualize the reasons behind **the weak and on-going loss of ecological connectivity of protected and conserved areas.**

3.2.2.1. Danube-Carpathian region

Foundational factors

The foundational factors frame the context of the study, which cannot be changed over a long time. They form the basic conditions of living and acting in the region.

Geography and biodiversity

The Danube-Carpathian region (DCR) comprises eleven EU Member States (Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Poland, Romania, Slovakia, Slovenia, Italy), and nine non-EU countries (Albania, Bosnia and Herzegovina, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, Switzerland, Ukraine), see Figure 12. This study focuses on all countries that are either Parties to the ICPDR and/or the Carpathian Convention. Thus, Italy, Albania, Kosovo, North Macedonia, and Switzerland are not included, mainly because of their small share in the region.

The total area of the region is more than 801,000 km² and has a population of approximately 80 million people. (ICPDR, 2009)

Figure 12. The Danube-Carpathian region, WWF.

The region comprises five biogeographic regions, whereby the Continental, Alpine, and Pannonian regions cover 94% of land area and the Steppic and Black Sea regions only 6%. Most of the Pannonian and Continental regions are used for agriculture. Most of the protected areas are located in the mountains. Forest coverage is around 35% on average with higher percentages in the mountain areas (Figure 13).

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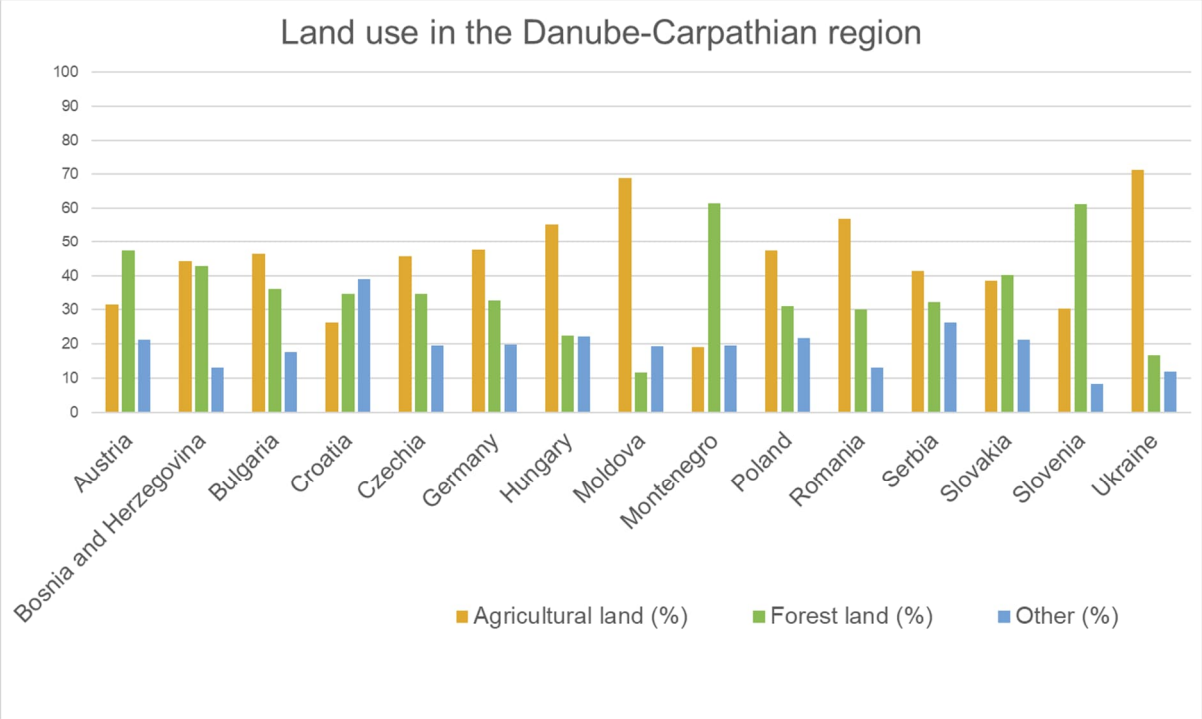

Figure 13. Land use in the countries of the Danube-Carpathian region, agricultural and forest land highlighted, FAOSTAT, 2021.

The Danube-Carpathian region is a biodiversity hotspot in Europe. It harbours Europe's greatest natural values, including primary and old-growth forests, wetlands, free-flowing rivers as well as areas of wilderness. Seven of eight European sturgeon species are critically endangered according to the IUCN Red List of Species. The Danube River provides the last remaining refuge in Europe where four sturgeon species still reproduce naturally (Jahrl, 2013) (Striebel, 2023). Two exceptional areas have been put under protection: At 6 750 km², the delta of the Danube River is one of the world's largest wetlands (and Europe's largest remaining natural wetland) featuring rare fauna and flora, as well as 30 different types of ecosystems. Located in the territories of Romania and Ukraine, it became a UNESCO World Heritage Site in 1991. In 2021, the world's first 5-countries UNESCO Biosphere Reserve and Europe's largest riverine complex was established to protect 700 km of free-flowing rivers of Mura, Drava and Danube (WWF, 2021).

The Carpathians, the second-largest mountain range in Europe, feature a huge diversity of valuable habitats such as natural ecosystems or cultural mosaic landscapes for over 60,000 animal and plant species (UNEP, 2007) including numerous endemic taxa (Mráz and Ronikier, 2016). Two-thirds of Europe's large carnivore populations - brown bear, wolf, lynx - live in the Carpathian Mountains and so do bison ('WWF - Welcome to the Green Heart of Europe,' n.d.). These migratory species are particularly vulnerable to habitat fragmentation and barriers to ecological corridors due to linear infrastructure development such as roads (Papp et al., 2022) and other economic activities.

The Dinaric Arc is home to one of the largest disappearing lakes in Europe (Cerknica, Slovenia), the world's deepest subterranean free waterfall (the 513 m high Divka Gromovnica shaft in Northern Velebit National Park, Croatia), one of two remaining old growth forests in Europe (Perućica in Sutjeska National Park, Bosnia and Herzegovina), one of the deepest canyons in Europe and the 10th largest in the world (Tara river, Montenegro), and the oldest lake in Europe and one of the deepest (Lake Ohrid, North Macedonia; ('People and Nature | WWF,' n.d.), WWF-Adria). Like in the Carpathians, viable populations of large carnivores roam the area. Many endemic plant species account for the mountains' high biodiversity.

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Overall, large and complex natural landscapes are better preserved in Eastern and South-eastern than in Western Europe (Germany & Austria). An interviewee from Slovakia emphasised that Slovakia still had rich biodiversity in many larger ecosystems or habitats compared to the Western European countries which would be more degraded and smaller.

Historical legacies

Almost all countries in the Danube-Carpathian region except for Germany, Austria, Italy and Switzerland, were part of the Eastern Bloc until the fall of communism in the early 1990s. They all had a centralised economy. The land was mainly state-owned (interviews, all South-eastern countries), and collectivised for agriculture in the lowlands of most countries. In Poland, the resistance of Polish farmers led to the failure of collectivisation (Bauerkämper and Iordachi, 2014), as well as in Slovenia. (Young et al., 2007) Collectivisation caused a loss of the former biodiversity-rich, cultural landscapes in the lowlands with their hedgerows, flower stripes and other landscape features which were shaped by co-evolution of human and nature. These areas, at least in the Czech Republic (interview), were replaced by large fields with intensive agriculture that needed drainages and irrigation, high amounts of fertilisers and biocides.

Despite intensification trends, many countries in the region have sustained, through historical and cultural factors, relatively large areas of extensive farming and semi-natural ecosystems (Young et al., 2007), especially in the mountainous regions where the landscape did not allow for larger fields (interviews, Czech Republic and Romania).

During communism, the protected area management approach was the 'fine and fence' one, with strict rules on natural resource use and limited public access (Stanciu and Ioniță, 2014). ‘Although this was also the case across most of Europe, the difference is that when the first protected areas were established in the 1960s, they were strictly protected and not open to the public. The protected areas focused on biodiversity conservation and restricting people’s activities' (interview, Serbia).

Thirty-five years after the fall of communism, the countries in the region have developed various forms of democracy with market capitalism; still, the communist legacy is noticeable (several interviews in the Eastern and South-eastern countries) and impacts the current situation.

The **connection between rural communities and the land** got lost because of collectivisation (Szabo et al., 2008) and with it the knowledge of traditional management practices. 'There is a lack of responsibility or it’s like an irresponsible attitude to land and nature in our country because somehow we lost this tradition of private lands' (interview, Ukraine). Through **land restitution**, many people had their land parcels returned or were financially compensated. Once in private hands, many landowners rented or sold their land to big (often foreign) companies that created large privately-owned corporate farms (interviews, Czech Republic and, Bulgaria). In protected areas that had been established during communist times and were entirely state-owned (Bulgaria), the situation after restitution looked different. Despite potential restrictions on their activities without prior agreement, many new private landowners engaged in agriculture or forestry within protected areas (interview, Montenegro). In almost all countries of the region, land ownership has changed in protected areas toward multiple entities, such as state, local governments, agencies, companies, communities, individuals etc. 'And that’s why in some national parks there are more than 50% private ownership. But these people say that they have never given consent to the establishment of these national parks, and this creates problems even nowadays' (interview, Slovakia). At least in Slovakia, the new owners have never received compensation, because the protected area was established during communism (same interview). In Hungary, the ownership in protected areas is mixed, with larger state-owned areas (Stanciu et al., 2013). In Ukraine, most of the protected areas are still state-owned, but according to one interviewee from Ukraine 'land

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ownership is now a significant political issue for Ukraine and there are ongoing changes in land policies'.

State agricultural cooperatives forced on small farmers during communism and disassembled during restitution caused scattered and unclear property rights - it still results today in problems with difficult stakeholder discussions with many owners, e.g. when it comes to wetland restoration. Nowadays, in some countries, landowners are not known as they are scattered around the globe (interview, Croatia) due to the Balkan War in the 1990s or the economic situation. These circumstances make negotiations difficult when a new protected area is to be designated. 'It is very difficult, from a state point of view, to know exactly who owns that piece of land and to address the right person' (interview, Romania).

Moreover, after the fall of communism, countries underwent **legal reforms**, also under the 'acquis' communautaire which refers nature conservation. Many new protected areas, including Natura 2000 sites, have been designated in preparation for **EU accession**. In 2004, the Czech Republic, Hungary, Poland, Slovakia and Slovenia joined the EU. They were followed by Bulgaria and Romania in 2007, and Croatia in 2013. Bosnia and Herzegovina, Montenegro, Serbia and recently Ukraine and Moldova became candidate countries.

In the former strictly hierarchical system, stakeholder participation was unusual. Nowadays, authorities and agencies organise consultations, but the timing and content of stakeholder engagement during policy development and the way authorities use input received from interested parties often is not according to good practice.

However, it needs to be taken into consideration that people in these countries still have a culture of leaving decisions to a higher hierarchical level, especially for environmental decisions (Stanciu and Ioniță, 2014). An interviewee from Romania stated that 'the ability of the Eastern Bloc to respect authority should be used for the benefit of biodiversity. We must not consider it a weak point. If you find financial incentives and instruments you can really protect biodiversity, at least in this part of Europe'.

Nevertheless, the former Czechoslovakia established the Terrestrial System of Ecological Stability of the Landscape (TSES) in the 1990s (Mackovčin, 2000), which is still part of the spatial plans in the Czech Republic and Slovakia. The first concepts were developed in the 1970s as a reaction to landscape fragmentation and land use change.

Demography

The decrease and ageing of the rural population lead to **land abandonment** and loss of traditional land management followed by natural succession. In the Western Balkans, people left because of the Balkan War and afterwards due to economic reasons. Younger people move to cities or western countries for work. 'Demographically, the population is in decline, which appears to be a problem for maintaining some important habitats, such as mountain grasslands, which are the result of a hundred-years-long traditional land use for agriculture, now being abandoned and given up to its natural succession' (interview Croatia). Negative or mixed effects of abandonment on biodiversity prevail in cultural landscapes and closely interwoven socioecological systems that are characterized by low-intensity, often subsistence farming. The long co-evolutionary history of these landscapes and their people, found in, for example, Eastern Europe, has created high habitat heterogeneity that can disappear after abandonment and lead to the loss of locally rare species and to biodiversity homogenization (Fischer et al., 2012) (Daskalova and Kamp, 2023). An interviewee from Moldova observed that abandoned land was more and more included in agricultural activities. And an interviewee from Slovakia stated that 'it means that even if there is an interest and financing for the environment, demographic processes will not allow doing… management on a small scale, which is very important in the case of Slovakia, because the biodiversity was created mainly on small patches by traditional management'.

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While in Eastern countries, depopulation leads to the loss of certain habitats and associated biodiversity, Germany and Austria are too densely populated. 'Germany is so densely populated and overdeveloped that we hardly have any nature left, in the truest sense of the word' (interview, Germany).

Socio-economic structures and relation to the environment

After the fall of communism, the new EU members have become significantly healthier and wealthier. Their economic growth is predominantly driven by industrial development (car, food industries, etc.) and is generally higher than those from the candidate countries (Figure 14).

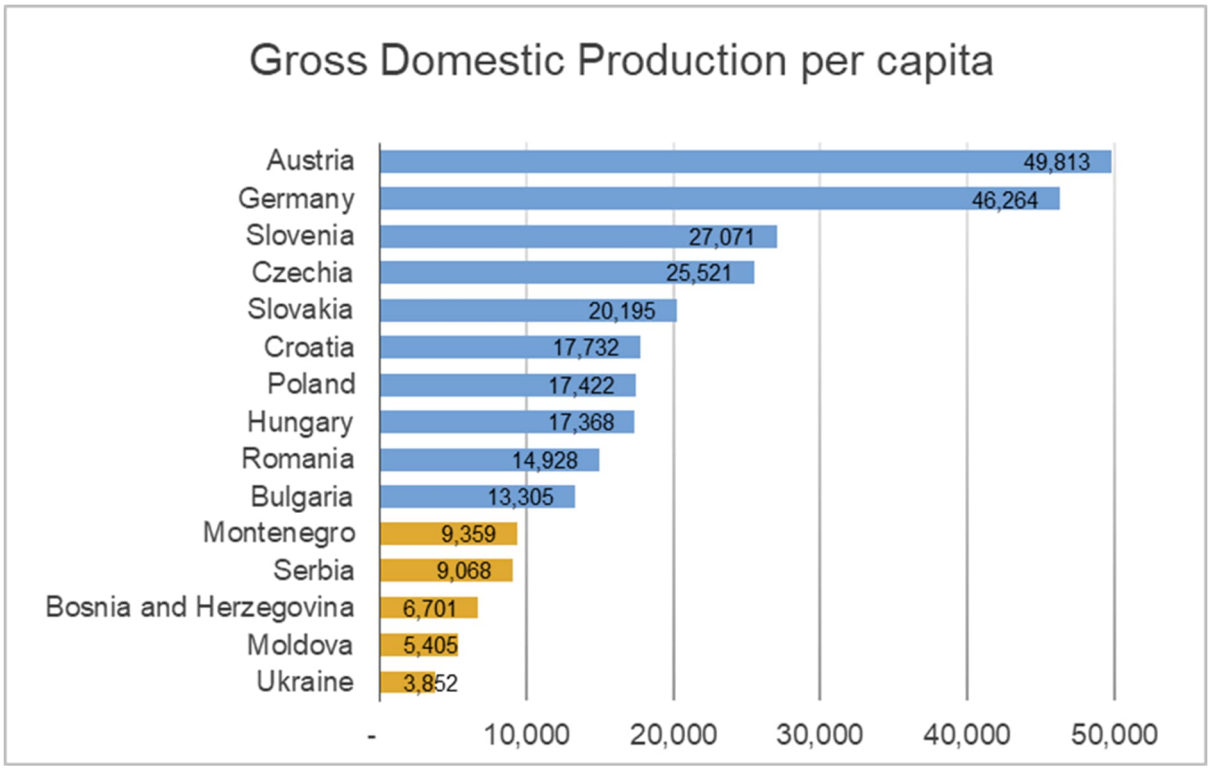

Figure 14. Gross Domestic Production (GDP) per capita in Euro (blue = EU member states, orange = candidate countries), source: ('FocusEconomics - Global Economic Data, News & Forecasts,' n.d.), data are from 2022, except for Ukraine (2021).d

The road and rail networks and energy infrastructure are undergoing modernisation to provide better access to economic centres, education and health care. 'We want to develop our structure of roads, infrastructure of railways, etc. Those are the priorities for us' (interview, Poland). Moreover, people think there is enough nature and do not see the necessity to protect it (interview, Romania). 'Nature is not really that important. We still have quite a lot of it, so that we don't have to really protect it' (interview, Poland). In reality, nature is quite under pressure due to rapid economic development (Stanciu et al. 2013; interviews, Poland and Serbia), but also illegal activities like the establishment of second homes and ski resorts ('White Elephants in the Green Mountains - Ski developments in Bulgaria, Romania, Slovakia and Ukraine,' n.d.) in protected areas or illegal logging ('Illegal logging,' n.d.)

Many interviewees said that historically, nature was part of the culture and valued as the basis for living (interviews, Bulgaria and Slovakia). Also, a Ukrainian NGO wrote that 'Ukraine is rich in millennia-old glorious customs and rituals regarding the protection, careful treatment of the

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environment, its non-exhausting use, and harmonious coexistence within it. … The first important habit of ancient Ukrainians was to take from nature only what was necessary without causing significant harm to the environment'.

Landowners are proud of their land. 'The land is seen very often here as a symbol of resilience and independence. Also, this is somehow a national pride' (interview, Montenegro). 'The Slovenian population has a strong connection to the land and nature, viewing it as a source of national pride and heritage' (in writing, Slovenia). In Germany as well as in Austria, landowners have strong bonds to their land since the former generations 'wrested it from nature. Otherwise, we wouldn't have agriculture, well, and we wouldn't be able to feed so many people' (interview, Germany). In the second half of the 20th century, Austria drained many wetlands to receive arable, productive land (interview, Austria). Thus, it might be understandable why farmers or landowners most likely oppose any rules applied to their property since their ancestors put a lot of effort into turning it into arable land.

Nowadays, nature/land is mainly considered a resource for generating income. People do not see the full implications of having an intact nature or using it sustainably. 'The role of nature is not very well understood. The main driver is development and nature, and it comes just with supplementary constraints for development' (interview, Romania). Also, an interviewee from Serbia mentioned 'Now the general understanding is … more about the natural resources, and the other values of nature are not that well understood and not integrated into the policies'. In Hungary, people perceive nature conservation as a kind of control or enemy that needs to be defended. Landowners sometimes successfully influence governmental decisions (interview, Hungary).

Besides the common view that land as such must be utilised economically, valuable natural places provide the basis for tourism and therefore, need to be protected. This is the case in some countries with a high share of mountainous areas and rich biodiversity, the natural value is assessed through the lens of tourism. 'The main tourist potential of the country is with nature' (interview, Slovenia). This is true for Austria, Croatia and many other countries in the region. Especially since COVID-19, nature has become more and more valuable for and used by local people, which has caused pressure on nature. Some protected areas are managed like tourism areas, for example, Plitvice waterfalls in Croatia (interview, Croatia).

On the other side, organic production increases with Austria as a forerunner with 26.2% of the total agricultural land (‘FocusEconomics - Global Economic Data, News & Forecasts,’ n.d.), especially in mountainous areas where large-scale agriculture is difficult to implement. Small-scale, secondary farms still contribute to the mosaic landscape shape that creates biodiversity hotspots, for example, the hay meadows in the Apuseni mountains, Romania, with multiple vascular plant species.

(Geo-) political factors

The Russian invasion of Ukraine shifted the priorities of Ukraine with less focus on nature conservation. Various players in the region have already started working on how to rebuild Ukraine, once the war is over. The nature conservation community is advocating for integrating nature conservation and nature-based solutions into reconstruction plans (WWF and Boston Consulting Group, 2022). The war does not only impact the economy but also the environment. Many protected areas suffer from devastation and pollution due to military manoeuvres (‘New coordination center to assess environmental impacts of the war on Ukraine | United Nations Development Programme,’ n.d.).

Many interviewees perceive nature conservation as becoming less important for politicians due to the energy crisis caused by the Russian invasion. 'Since all the crises are now present, biodiversity really needs an additional push to be left on the top of the discussions since the

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energy crisis, the emergence of war in Ukraine, climate crisis, are all present. This green wave that was happening is a little bit lowered' (interview, transnational actor).

The European Union provides an excellent framework for nature conservation in Europe. However, countries encounter problems translating the Green Deal targets into implementation. The total percentage of protected areas (Figure 15) in the EU Member States varies between 21.9% in the Czech Republic and 41% in Bulgaria, whereas in non-EU countries between 4.1% in Bosnia and Herzegovina and 13.9% in Montenegro.

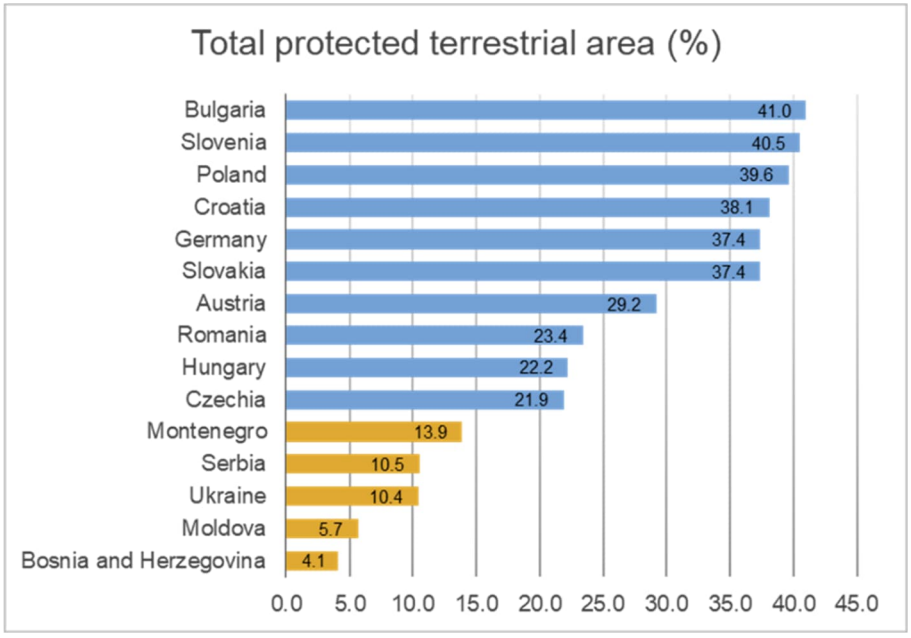

Figure 15. Percentage of protected areas in the study area (blue = EU member states, orange = candidate countries); for resources see Annex 1.

The Natura 2000 network was established with some gaps and still not all designated habitats and species have a management plan or are in a favourable status. Candidate countries in preparation for EU accession partly analysed their territory for potential Natura 2000 sites based on formerly assessed Emerald networks under the Bern Convention. In Montenegro, for example, the territory found suitable for protection is more than 50% (interview, Montenegro).

Interviewees perceive the **European Union** as unstable, as it seems the EU wants to roll back the Green Deal, the fundamental policy to preserve nature in Europe due to the war in Ukraine and the economic/energy crisis (interview, Austria). The ongoing increase of populism could reinforce the tendency and undermine evidence-based decision-making. Nature conservation could be pushed into the background.

Internal political instability at the national level: eroding democracy in Hungary and Slovakia. Hungary implemented a special decree due to the war in Ukraine and the energy crisis. It overrules all laws which not only makes nature conservation difficult. 'Overall, the government's conflict with the EU has a very negative impact on nature conservation' (interview, Hungary). Since the Slovakian elections in the autumn of last year, the country has become politically polarised, bearing the risk of losing cohesion with the European Union.

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Rules of the game

According to the Political Economy Analysis Framework, rules of the game (RoG hereafter) can be divided into formal and informal and can have various levels as international, regional, national etc. Formal rules can be various legislations, laws, directives, and protocols. These formal rules are usually known and publicly available to everyone (WWF & Integrity, 2020). The informal rules can be adopted from the formal ones and constructed from the social structures, norms, and perceptions (WWF & Integrity, 2020). Several questions of the interviews (see Appendix 1 - interview questions 2, 3, and 4) were set to understand the Rules of the Game related to the extension of protected areas and the establishment of TEN-N, to open the discussion on their efficiency, and to reveal informal, but accepted procedures or circumstances.

Formal rules of the game

Most of the interview participants referred to the formal rules of the game, summarised for all case study countries in Appendix 1. All countries in the region have centralised nature conservation laws in contrast to Germany and Austria, where each federal state has its own nature conservation law and is responsible for its implementation. 'Austria is a federal state, and everything related to nature protection is the responsibility of the regional governments. Having nine regions makes it very difficult to establish overall goals or coordinate approaches' (interview, Austria). The most relevant international treaties, strategies and laws related to ecological connectivity in the Danube-Carpathian region are highlighted below.

Formal and informal rules of the game at the international and transnational level

An important global policy framework for the Danube-Carpathian region is the **Convention on Biological Diversity** (CBD) and the related Global Biodiversity Framework (GBF). All countries in the region are parties to the CBD, which provides an overarching direction for the extension of protected areas to 30% of the land surface, with 10% of land strictly protected and the ecological network creation. Although it is not legally binding, the global goals and targets in this agreement give countries a set of markers to guide action. One interviewee acting transnationally mentioned 'Even if the GBF does not have any implementing power, it ensures that all counties have a common set of objectives, which is a first step to open the discussions'. In the context of the Carpathian region, the Parties to the **Carpathian Convention** (CC) have aligned the Carpathian Biodiversity Framework to the GBF and adopted the new Framework at the 7th Conference of the Parties in autumn 2023. The results of the interviews data on Connectivity barriers at the transnational level is possible to see below (Figure 16).

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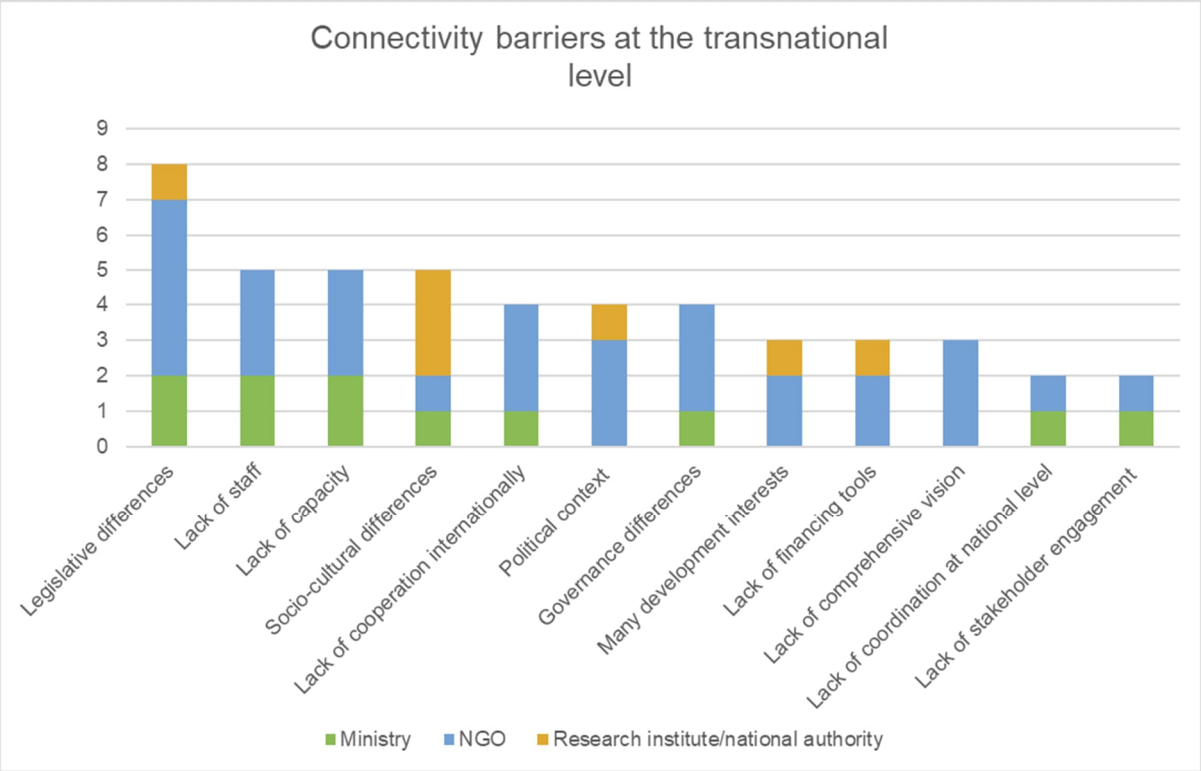

Figure 16. Connectivity barriers at the transnational level; results of 43 interviews analysed using MAXQDA software.

The **International Commission for the Protection of the Danube River** (ICPDR), the **Carpathian Convention** and the **EU Strategy for the Danube Region** (EUSDR) provide good transnational cooperation platforms in the region. Their strategic directions and action plans are dedicated to cooperation in line with the principles of sustainable development, for the benefit of the people living in the region. The formal and informal rules associated with the aforementioned bodies were explored via perceptions expressed by interviewees and workshop participants. Emphasis was placed on the role of regional governance bodies in facilitating transboundary cooperation in the designation/connection of protected and conserved areas.

There is a certain lack of awareness of the functions of such bodies like ICPDR or EUSDR or a lack of participation in joint actions. For example, there is a lack of national representation in the conventions, in strong connection to the lack of political will, as stated by an interviewee from Serbia.

Hereafter are several positive elements mentioned by the interview participants in relation to the ICPDR, EUSDR and the Carpathian Convention:

Space for discussion: Regional governance bodies provide a platform for effective communication and allow parties to meet and discuss in person and exchange experience (interview, Czech Republic). Regional governance bodies were mentioned by several interviewees (ten) as extremely important tools for promoting dialogue and coordination at the regional level and ‘helping to address transboundary environmental challenges and the exchange of perspectives (interview, Slovenia).

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Guidance and protocols: Four interviewees described the development of protocols as useful (Czech Republic), guidance (Slovakia), joint monitoring programs, information sharing mechanisms, and capacity-building activities by regional governance bodies (Slovenia).

Pressure to act: Two interviewees described the mechanisms of regional governance bodies as helpful in creating pressure for the governments to act. For instance, one NGO representative mentioned the following 'demonstration effect', when one country implements the decision (often to 'impress') and its neighbouring countries follow the example (interview, Romania). Additionally, it is said that regional governance bodies 'create some kind of international pressure where the national government can feel uncomfortable with doing the 'bad' things.' (interview, Slovakia).

Some of the issues associated with regional governance bodies and cross-border facilitation programs include, but are not limited to, the following:

Limited stakeholder involvement (interview, Hungary), especially NGO participation, due to the communication only through a governmental associated Focal Point which is restricted and not inclusive enough; therefore, the operational effectiveness can be questioned, despite having a potential to influence the decisions (interview, Croatia). Some environmental NGO representatives were not familiar enough with the activities of regional governance bodies, which consequently can lead to lower levels of engagement. This assumption is in contrast to the principles of the Carpathian Convention where all interested players in the region including NGOs, academia etc. are welcome to participate in the role of observers.

Lack of effective national involvement because appointed ministries lack staff capacity (interview, Montenegro) and also knowledge (interview, Austria). Some interviewees implied that the decision process of regional governance bodies take a long time (Austria).

It is important to note that the interview participants' perceptions related to transnational and regional cooperation bodies are varied. In Figure 17 below, the various perceptions related to regional governance bodies are illustrated based on the interviews. The graph represents the views of three groups of interviewees: NGO representatives, ministry representatives, and representatives of either research institutes or national authorities (e.g., National Conservancy Agency).

According to the interview results, ministry representatives are more likely to attribute a key role to regional governance bodies compared to NGO representatives, with a ratio of 6 to 5. Additionally, NGO representatives are more inclined to describe regional governance bodies as 'soft tools' or 'weak' compared to ministry representatives, with a ratio of 10 to 2. Furthermore, NGO representatives provided more suggestions for improvements for these bodies, whereas ministry representatives preferred to mention solely the positive sides attributed to the regional governance bodies.

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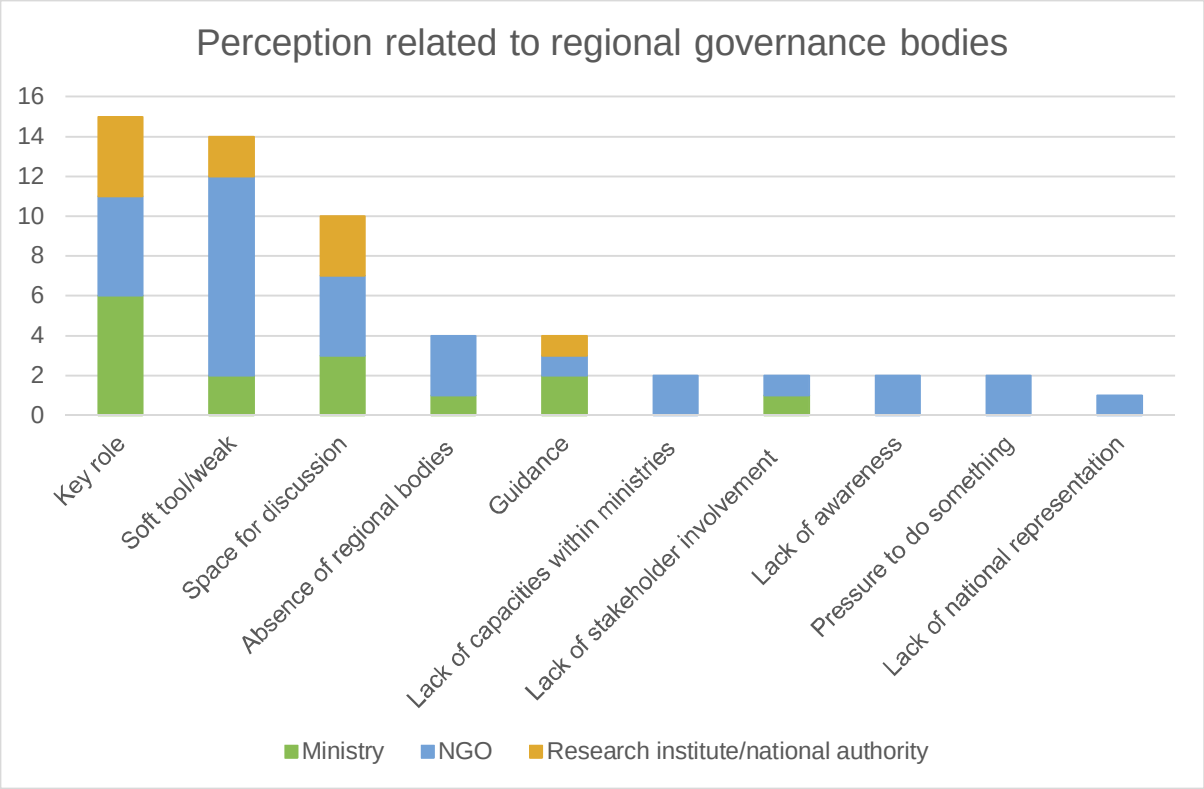

Figure 17. Perception related to regional governance bodies; results of 43 interviews analysed using MAXQDA software.

Hereafter, are some successful examples of cross-national collaboration within regional governance bodies, provided by the interviewees:

- Successful usage of the 'methodologies issued from the projects developed under the Carpathian Convention' (interview, Romania).
- Projects under the umbrella of the Carpathian Convention such as TRANSGREEN or SaveGREEN are said to have good results, although implementation is still lacking at the national level (interview, Slovakia).

International treaties, regional frameworks and EU legislation are connected and do not work independently from each other. The CBD signed a Memorandum of Cooperation with the Carpathian (CC) and the Alpine Convention, CC signed various memoranda of cooperation with the EUSDR Priority Areas (PA)1b Mobility - Rail-Road-Air, PA2 Energy, PA4 Water Quality, PA5 Environmental Risks and PA6 Biodiversity, and an Initiative of Mutual Observership Status between the Secretariat of the CC and the ICPDR. EUSDR Priority Areas 4 and 5 signed a Joint Paper on Cooperation and Synergies with the ICPDR.

The Joint Declaration 'Achieving functional biodiversity in the Danube-Carpathian Region by mainstreaming ecological connectivity' laid the basis for cooperation between the ICPDR, CC and EUSDR PA4, PA5 and PA6 where they committed to strengthen cooperation on the implementation of ecological connectivity at all levels and sectors (‘Achieving functional biodiversity in the Danube-Carpathian Region by mainstreaming ecological connectivity,’ 2022).

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However, according to some interviewees, they are too theoretical, 'We are generally a little bit reluctant when it comes to having these kinds of MoU because it's the activity that matters, not the process.' (interview, international actor).

The European Green Deal, EU Biodiversity Strategy for 2030, Habitat and Birds Directives, Environmental Impact Assessment Directive, Water Framework Directive, Common Agricultural Policy and other EU agreements create a comprehensive framework which unites the Member States in the call to address environmental challenges. The obligations of the EU Member and candidate states for the mentioned frameworks are very often referred to by the interviewees as the main drivers for the legislative change in the country (interview, Montenegro). It is important to note that some interviewees mentioned that the national governments lack a proactive approach towards implementing the EU policies related to nature protection (interview, Bulgaria. For some ministries in the EU countries, meeting the obligations under the EU Biodiversity Strategy 2030 (interview, Austria) and Nature Restoration Law (interview, Hungary) is considered 'unrealistic'.

Biodiversity-related EU directives are not implemented sufficiently. 'The EU sits on the Habitats Directive, and they don't impose it in the way that we would like them to impose it', interview, transnational actor. According to this actor, the EU should strengthen the legislation and the implementation mechanisms at the national level.

Nevertheless, most interviewees consider EU legislation as helpful. With regards to Austria, the current infringement procedure was recognized as a driver for the administrations to work on the issues raised and take steps forward. The pressure from the European Union and the Commission played a role in reaching a satisfactory level of protected areas (interview, Austria). An additional influence factor is funding from the EU for infrastructure projects, where it is required to take into consideration Natura 2000 sites and other impacts on protected areas (interview, Hungary). On top of that, the existence of such a 'request from a higher institution or a higher competence' highly contributes to the enhanced collaboration between federal states and lands that are usually separated and complex to coordinate (interview, Austria).

Rules of the game related to protected areas governance and management at the national level

In the Danube-Carpathian countries, various bodies are in charge of governing and managing protected areas: environment ministries, protected area agencies, regional/local governments or agencies, state-owned agencies and NGOs. The set of formal rules at the national level (laws, strategies, governance structures etc. related to TEN-N implementation) is described in Appendix 1 and the summary for better comparison capabilities of the national legislation in regard to the protected areas and ecological connectivity is synthesised in Appendix 1.

The two survey participants from the agricultural sector responded to the question about the main barriers to integrating ecological connectivity into their field as follows: lack of coordination between authorities and/or no functional administrative authorities, lack of legislation, lack of data and monitoring, non-secure tenure rights for connectivity, land abandonment and vegetation succession, intensive agriculture and primacy of agricultural profits, and lack of awareness. Interestingly, these points are similar to what the environmental sector analysed as barriers.

Protected areas are core areas for a well-connected TEN-N, therefore, their efficient and proper management toward a favourable conservation status of the area is of utmost importance for ecological connectivity. The interviewees from all countries pointed out that protected areas lack capacity in various ways. The main barriers around protected areas, as reflected by the interviews, are displayed in Figure 18. It presents the results of the questions posed for the interviewees regarding the main barriers to ecological connectivity (Figure 19).

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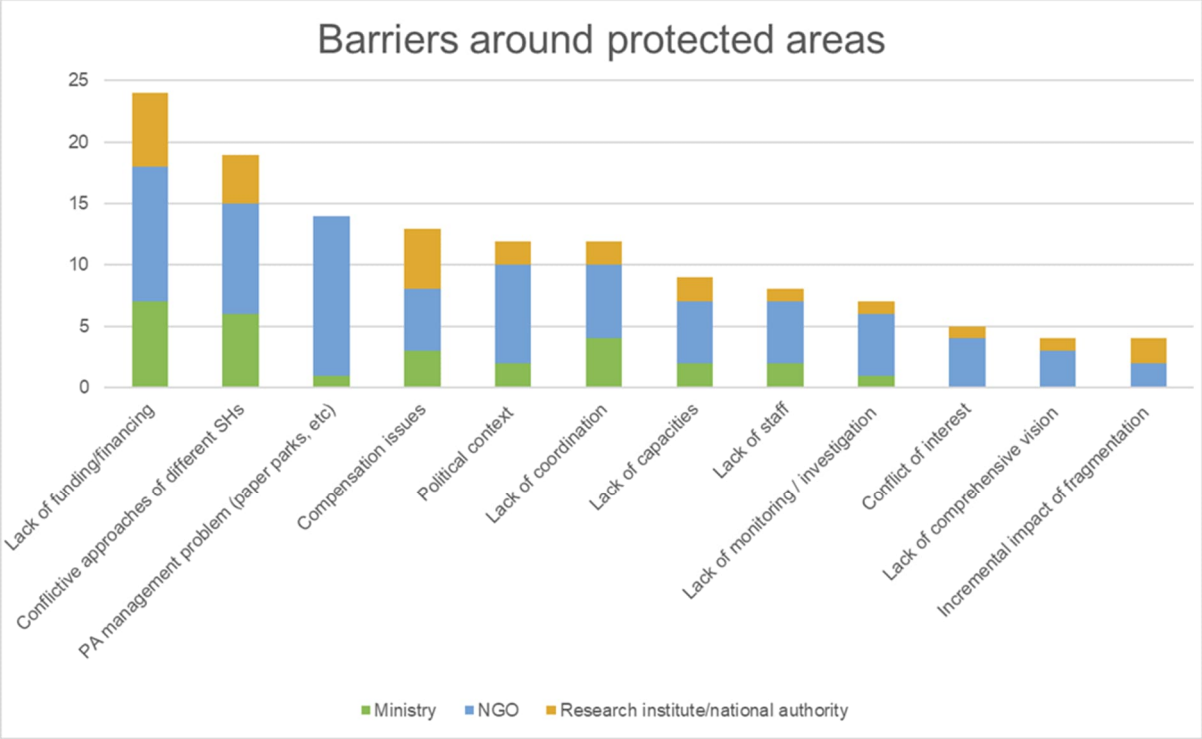

Figure 18. Barriers around protected areas related to their management; results of 43 interviews analysed using MAXQDA software (SH = stakeholder)

Table 4. Description of barriers around protected areas related to their management; results of 43 interviews conducted in the Danube-Carpathian region.

Barrier	Explanation
Lack of funding/ financing	As we can see in the visualisation of the interview results (Figure 18), the lack of funding is mentioned by the largest number of interview participants i.e. 24 participants in total. In general, this is described as the main issue in the way of effective management of protected areas at the national level. For example, 'the funding is very often not enough and not sufficient for effective management of protected areas. So, this is the big issue here in Montenegro; funding is not enough for effective governance of the protected areas.' (interview, Montenegro).
Conflictive approaches of different stakeholders	Conflictive approaches of other stakeholders are mentioned as one of the biggest issues by most of the interviewees. The detailed description is available in the People and Organisations section below (20).
Protected area management problem	The following major problem was revealed during the interviews. Many interviewees mentioned the problem of 'paper parks', a wording first developed for marine protected areas (Di Cintio et al., 2023) (Relano and Pauly, 2023) (Perry et al., 2020). 'Paper parks' are designated protected areas without management and thus, are not effective in conserving natural features. For example, one interviewee from Hungary said 'On paper we have a lot of protected forests. But on the other hand, the management of those forests is not really different from the management of those which are not protected or not under Natura2000.'
Compensation issues	According to the results of the interviews, the absence of a compensation mechanism for income forgone due to the protection status of land is an important barrier to effective protected area designation and to reaching a good level of ecological connectivity. This issue is observed in many countries such as Austria, Slovenia, Germany, Serbia, Bulgaria, Romania, and Slovakia.

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Political context	Political context, which includes the level of political will, and the dynamics of political powers in the country, plays a crucial role in protected area management effectiveness. The political context was mentioned most frequently as a barrier by the participants (27 times throughout the interviews). According to the interviewees, the effectiveness of the protected area instruments and legislation cannot be measured solely based on the official description of the protected area management system and it is highly dependent on the political context. For example, an interviewee from Serbia mentioned that: 'The main barrier is the political context, the political issues. At the operational level, the protected area managers are finding a way, somehow, to cooperate. For example, with Croatia, we have a border dispute along the Danube. And it's really complicating the whole situation. But you can see that at the operational level, at least something is happening there. I would say that the political context is still one of the big obstacles in the region, depending on the country'.
Lack of coordination	Lack of coordination among ministries, NGOs, and academia poses a challenge to the effectiveness of managing protected areas. In some countries, the level of coordination is very low due to the complicated political system and division (Bosnia and Herzegovina), or due to the federal structure of the lands in the country (Germany, Austria). The issue of effective coordination can be seen in Ukraine mainly due to the war. In Croatia, one interviewee mentioned 'One of the biggest problems is that ministries do not communicate very well between them because one minister is from one political party, and another is from another. And this is a huge problem.'
Lack of capacities	It is mentioned by a few interviewees that especially authorities in rural communities have rather limited capacities to support the implementation of the frameworks on the ground (interview, Moldova). There is also a lack of technical equipment at the local level (interview, Montenegro). On top of that, some interviewees referred to the general lack of expertise, both at the ministry level (interview, Montenegro), but also at the local level (interviews, Bosnia and Herzegovina, and Montenegro).
Lack of staff	The lack of staff in ministries and other authorities creates a significant disturbance in the efficient management of protected areas. In this sense, the flawed capacity loop triggered by low motivation and low salaries was mentioned (interview, Bulgaria). Some interviewees referred to the capacity issue relating to the burnout of existing staff due to heavy workload (interview, Slovenia).
Lack of monitoring/ investigations	The lack of monitoring or investigation was mentioned several times in connection to the issue of corruption (Moldova, Bosnia and Herzegovina, Ukraine). Corruption is driving environmental degradation and biodiversity loss, enabling the illegal exploitation of the natural environment.
Conflict of interest	National forest administrations are responsible for both the conservation of the protected areas and the economic activities meant to generate profit and pay salaries (Romania, Serbia).
Lack of comprehensive vision	The lack of a comprehensive vision of protected areas and the absence of clear strategies at the national level play a negative role in effective protected area management and designation. The interviewee from Slovenia said, 'The policy system in general is not very effective because the state doesn't have a clear perspective on what they would like to do with nature at all. … The ministry is weak, the parks are weak, and funding from the national budget is very poor. We have a concession for one state-owned nature reserve, and we are managing the site. With the funds from the government, we could not run it. We always need to apply for additional projects to cover all the costs of staff and material.'
Incremental impact of habitat fragmentation	The urgent need to address the rapidly advancing process of habitat fragmentation was mentioned by several interviewees (Austria, and Slovenia). 'The main problem, not only in our country, is the small steps. For example, if a young family wants to stay in a village and build a house bordering Natura 2000 sites, the impact of that house on the site is small. You can't say no, but when is it enough? These small steps, calculated over a year, cover a large area and have a significant impact on our environment and natural values year after year. We can't stop this, and it's a huge problem.' (interview, Slovenia).

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Rules of the game related to ecological connectivity at the national level

All EU Member States have a National Biodiversity Strategy, and non-EU Member States in the region are updating their National Biodiversity Strategy and Action Plans (NBSAP) under the Convention on Biological Diversity. Various strategies include laws/rules on the identification and management of ecological connectivity. These laws/rules are mostly broad and vague. For example, the **Polish** Nature Conservation Act defines an ecological corridor as 'an area for the migration of animals, plants and fungi''. However, there is no legal form of protection (interview, Poland). Poland can use one of their nine categories of protected areas, the landscape protected area, as a corridor. 'It is explicitly stated that one of the aims of this protected area type is ecological connectivity. So, it should fulfil the role of an ecological corridor' (interview, Poland).

On the other hand, there are countries in the DCR that include ecological networks in spatial planning. In the **Czech Republic** and **Slovakia**, in the 1990s, the Territorial System of Ecological Stability of the Landscape (TSES) was established and must be taken into account in spatial planning. It comprises three components, bio-centres, bio-corridors and interacting elements connected by ecological corridors.

According to the interviews, TSES still has design and implementation problems. First, the TSES should be better designed and updated since it was created in the 1990s. Being a spatial planning instrument and elaborated by spatial planners, interviewees suggested that nature conservation experts revise the TSES (interviews, Slovakia, and Czech Republic). The TSES does not integrate any new infrastructure development or changes in biodiversity (interview, Czechia). Moreover, some parts of the Slovakian TSES are not digitised and are, therefore, not accessible to all experts. Consequently, they are not used regularly. Nevertheless, an interviewee from Slovakia observed positive but slow progress.

Second, when designated, the corridors should be protected in the Czech Republic and Slovakia. In many cases, they are not secured due to contradicting interests around the area of ecological corridors - linear transport infrastructure, agriculture, forestry, and settlements. An interviewee from the Czech Republic stated that nature conservation was not a priority. Moreover, there is no control system if ecological corridors are respected. Several interviewees called for stronger legislation. In the Czech Republic, nature conservation took a step forward and put under protection a network of migratory routes for large carnivores in 2020 which must by law be considered at all levels of land use plans. However, the corridors were put under protection without the participation of local stakeholders who were not informed about the corridor areas.

Hungary established the National Ecological Network with core and buffer zones, and ecological corridors as a spatial planning instrument. Rules were set, like establishing a new mine is forbidden, but their implementation was weakened recently during the period of special legal order when the government rules by decrees. The new decrees allow for opencast mining and other infrastructure development in ecological corridor zones (interview, Hungary). The interviewee resumed, 'The good news is that we have a national ecological network; the bad news is that it does not work'.

In many countries in the region (e.g. Austria, Poland, Romania) teams of experts modelled and partly verified ecological corridors mainly through short-term projects. In Romania, a working group started creating a methodology for identifying and designating ecological corridors in 2014. So far, the ministry has not made any decision, even though ecological corridors are mentioned in the spatial planning legislation (interview, Romania). An interviewee stated that the decision-making process would take so long as the subject is rather delicate to deal with related to the landowners who have a share in the ecological network (interview, Romania). There are no formal rules for the corridor designation and their

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management and monitoring. This leads to the fact that their locations are undefined. Regular monitoring is necessary to assess trends in connectivity (structural and functional) and settle efficient management measures (workshop participants). In response to this situation, new Natura 2000 sites could be established as stepping stones for connectivity. 'Now we have to improve the legislation (...) to identify and designate (these sites) with a legal act as corridors and not to be confused or assimilated with protected areas' (interview, Romania).

Financial contributions to establish landscape elements improving ecological connectivity are scattered across different policies (CAP, ERDF, rural development funds, etc.). CAP in Austria, for example, funds farmers who establish flower strips or hedgerows on their territory only. There is no connection to the neighbours' territories; only in case they collaborate. The broader view of connectivity is missing.

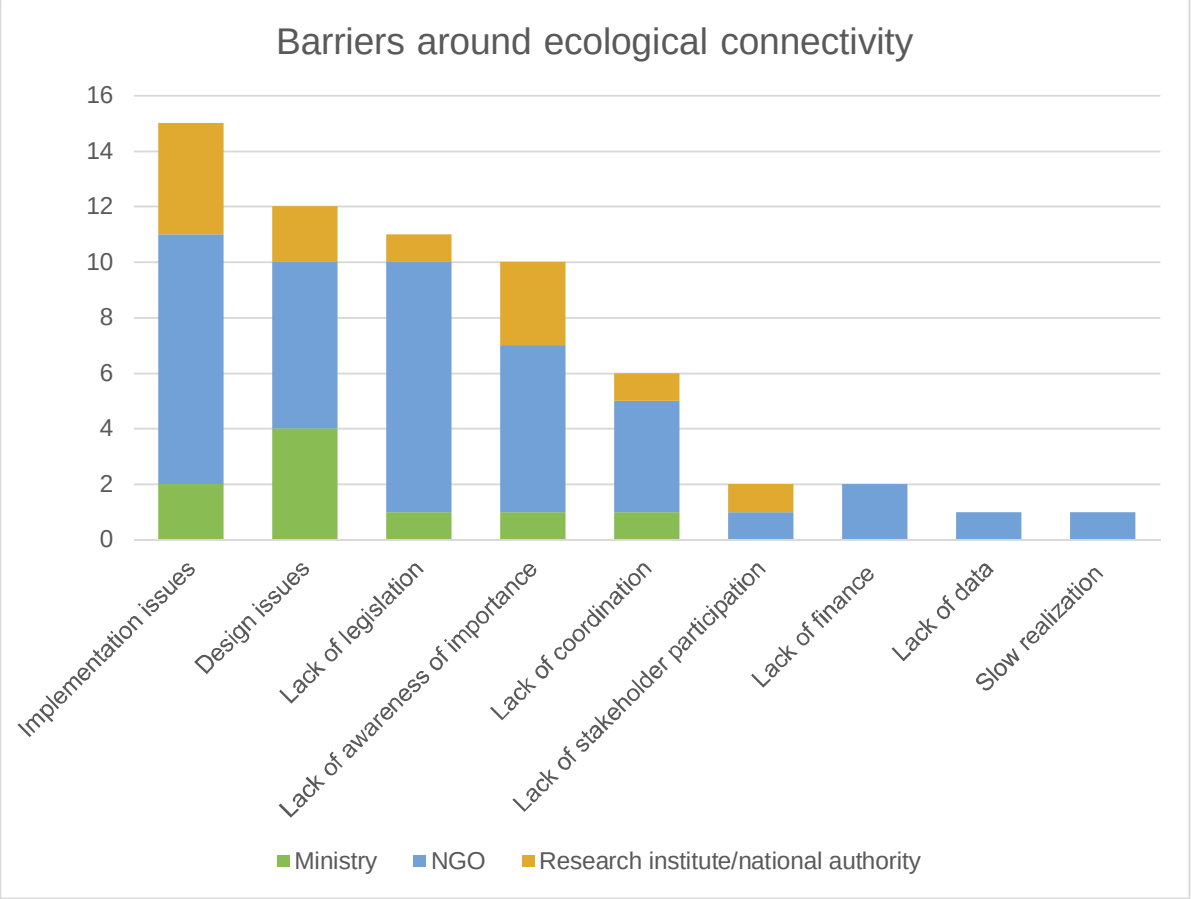

Figure 19. Barriers around the establishment of ecological connectivity in the Danube-Carpathian region; results of 43 interviews analysed using MAXQDA software.

Implementation issues

Implementation issues for ecological connectivity are referred to by the interview participants the most, in particular in 15 interviews. The issues connected to the implementation of ecological corridors are the following:

- Despite legal provisions and mapping efforts, actual management of ecological corridors remains inadequate. In Serbia, for instance, there is recognition on paper but

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little to no practical implementation or conservation efforts in the field (interview, Serbia).

- Political will and financial support are crucial but often missing. Interview participants from countries such as Hungary and Germany highlight the discrepancy between legislative mandates and actual financial allocations for managing and expanding ecological corridors (interviews, Hungary and Germany).
- Even with the official implementation of an ecological corridor, there are still doubts as to whether these corridors fulfil their function - 'In case by case decision, there are often discussions and I'm not sure if it really works or whether these overall goals are overridden by spatial interests like wind turbines or things like that, or hunting grounds or fences' (interview, Austria). Lack of strategy towards the establishment of ecological connectivity is often referred to (interview, Germany).

Addressing these implementation issues requires enhanced financial resources, improved coordination among stakeholders, strengthened political commitment for transboundary cooperation, and bridging the gap between legislative frameworks and on-ground action. Only through concerted efforts can countries effectively realise the ecological benefits of interconnected protected areas and corridors across Europe.

Design issues

Among design barriers is the lack of data and information (interview, Romania), as pointed out by an interviewee from Slovakia, 'We lack the complete database about where they [ecological corridors] are. We are working on that, but it's still not done.'

A significant design issue is the prolonged discussion and insufficient implementation of the zoning system in national parks. An interviewee from Hungary pointed out that the need for a zoning system has been stipulated in conservation law for more than 25 years, but little progress has been made. Despite ongoing negotiations among key stakeholders, including National Park Directorates, the Ministry of Agriculture, and State Forest Companies, the establishment of these zones remains largely unfulfilled. One successful example is the implementation of a zoning system at Hortobágyi National Park, but this remains an exception rather than the norm (interview, Hungary). Another design flaw identified by the interviewees is the failure to identify ecological corridors for various species. Although the ConnectGREEN project has mapped corridors for large carnivores, this crucial information is lacking for most species (interview, Romania). This omission leads to protected areas becoming isolated, which hinders species movement and genetic exchange, threatening biodiversity (interview, Montenegro).

Lack of legislation

The challenge of establishing effective ecological corridors is exacerbated by insufficient legislative support across many countries in the Danube-Carpathian region:

- Absence of legislation - ‘absence of legislation on their regard’ (interview, Serbia), Bosnia and Herzegovina (BiH), ‘There is no specific legislation addressing ecological corridors in Bosnia and Herzegovina. The absence of legal frameworks hampers coordinated conservation efforts and sustainable development planning’.
- Important habitat corridors are not legally protected and rely on voluntary guidelines, varying in the federal states, ‘Although Austria has identified important habitat corridors, these designations lack legal protection status. They serve more as guidelines without enforceable protection measures, varying in implementation across different federal states’ (interview, Austria).
- Absence of clear national-level legislation hampers biodiversity initiatives and local conservation efforts - ‘Biodiversity advisors in Germany struggle with poor framework conditions and a lack of clear legislation at the national level. Local initiatives often

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face challenges in transposing into comprehensive legal protection' (interview, Germany). Despite consultation efforts, comprehensive legal frameworks for conserving ecological corridors are lacking (interview, Romania). Another issue connected to it is fragmented efforts due to the ineffective state-level legislation, 'Slovenia lacks state-level legislation specifically addressing ecological corridors. This gap results in fragmented conservation efforts and uncertain protection measures' (interview, Slovenia).

- The mapped ecological network lacks legislative support for monitoring, hindering effective implementation, 'The Ukrainian ecological network, while mapped, lacks effective legislative support for monitoring and conservation (interview, Ukraine). The construction of major infrastructure projects such as highways without adequate consideration for ecological corridors has been identified as a spatial planning oversight in Slovakia (interview, Slovakia). Additionally, there is a significant gap in translating this data into actionable policies or legislative frameworks, which limits its real-world impact. (interview, Slovakia).

These examples underscore the critical need for robust legislative frameworks across Europe to ensure the effective establishment and protection of ecological corridors. Clear and enforceable laws are essential to safeguarding biodiversity and promoting sustainable development amid increasing pressures from human activities.

Lack of awareness of importance

Ecological connectivity faces significant challenges globally due to a pervasive lack of awareness among stakeholders and decision-makers. Key observations from the interview participants underscore this critical issue in the following way:

- Misunderstanding - stakeholders often misunderstand the goals of ecological connectivity, viewing it as a hindrance rather than a necessity for biodiversity conservation (interview, Austria). On top of that, 'Financial sectors have the misconceptions that conservation designations decrease land values, contributing to societal apathy towards supporting ecological connectivity' (interview, Germany).
- Lack of integration into planning processes - municipalities and regional planners frequently fail to integrate ecological corridors into their planning processes, despite acknowledging their existence on maps (interview, Slovenia,).
- Insufficient governmental recognition - governments exhibit inadequate recognition of the importance of ecological corridors, leading to a lack of supportive policies and funding (interview, Bulgaria).
- Limited engagement with stakeholders illustrates the communication gap between conservationists and stakeholders (interview, Austria).

Lack of coordination

The challenge of achieving effective ecological connectivity is compounded by a notable lack of coordination and integration as highlighted by the interview participants:

- Exclusion of NGOs from decision-making processes (Hungary), discords between environmental experts and the ministries regarding the implementation and definition of biotope networks (Germany).
- Efforts to establish transboundary ecological connectivity, such as for Lake Skadar in Montenegro and Albania, often face political challenges and a lack of cooperative frameworks (survey, Montenegro).
- There is a disconnection between legislative frameworks and practical implementation. In many countries such as Ukraine and Moldova, the ecological network exists on paper but lacks the necessary resources, funding, and coordinated efforts for effective establishment and maintenance (interviews, Ukraine and Moldova).

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People and organisations

Two main types of stakeholders have been identified by the case study team as playing a role in establishing TEN-N in the Danube-Carpathian region. Firstly, those involved in nature conservation or its regulation, and secondly those involved in land use (agriculture, forestry, etc.) and development (transport and energy infrastructure, etc.). Ideally, those sectors collaborate for the best solutions integrating the needs for biodiversity, ecosystem services, ecological connectivity and with it, human welfare.

Actors at the transnational level in the Danube-Carpathian region

There are three international treaties in the DCR, all of which commit to sustainable development of the region which comprises a balance of social, economic and environmental aspects. In the following the International Commission for the Protection of the Danube River (ICPDR), the EU Strategy for the Danube Region (EUSDR) and the Carpathian Convention are briefly described.

International Commission for the Protection of the Danube River (ICPDR)

The International Commission for the Protection of the Danube River (ICPDR) is a transnational body established in 1994 to implement the Danube River Protection Convention (DRPC), the major legal instrument for cooperation and transboundary water management in the Danube River Basin. It works to ensure the sustainable and equitable use of water in the Danube River Basin. The ICPDR is the platform responsible for the implementation of all transboundary aspects of the EU Water Framework Directive and Floods Directive.

The ICPDR is formally composed of the Delegations of all Contracting Parties to the Danube River Protection Convention and is assisted by a permanent secretariat including technical experts. The technical work is carried out in the Expert Groups composed of national experts from the Contracting Parties and representatives from ICPDR observer organisations.

The most relevant Expert Groups related to ecological connectivity are

- Hydro-morphology Task Group (HYMO TG) and the
- River Basin Management Expert Group (RBM EG).

While Observers are not granted decision-making rights, they actively participate in all meetings of the ICPDR experts and task groups, as well as plenary meetings. Delegates of Observers have access to information including all technical meeting documents and the right to contribute to all technical discussions.

EU Strategy for the Danube Region (EUSDR)

Countries of the Danube region supported by the EU established in 2010 the European Union Strategy for the Danube Region (EUSDR), identifying common needs, challenges and opportunities that can be fully exploited only in cooperation to boost regional cohesion.
EUSDR's mission is to protect nature and people, build a prosperous region with a healthy environment, equal societies and high living standards, create sustainable jobs and open fair opportunities from the Black Forest to the Black Sea. It is meant to provide platforms of exchange, guidance and networking, coordination of policies and joint actions.
The Commission´s Directorate General for Regional Policy helps to implement the Strategy by facilitating and supporting the actions of the participating countries. The High-Level Group (HLG) on macro-regional strategies is made up of official representatives from all countries involved. It assists the Commission in the policy coordination of the Strategy.

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The National Coordinators (NCs) have a strategic coordination function within their national or regional government. The NCs coordinate and keep an overview of the participation of their country in the implementation of the EUSDR including all Priority Areas.

The Danube Region Strategy addresses a wide range of issues; these are divided into 4 pillars and 12 Priority Areas (PAs). Each Priority Area is managed by at least two countries as Priority Area Coordinators (PACs) and assisted by the Danube Strategy Point. The PACs organise Steering Group meetings in which mainly the representatives of the ministries of foreign affairs of the Danube countries participate along with other stakeholders as observers.

The most relevant priority areas for ecological connectivity are included in the Environmental Pillar composed of Priority Area 6 ‘Biodiversity, Landscapes, Quality of Air and Soils', PA 4 ‘Water Quality’ and PA5 ‘Environmental Risks’. Also, PA1b Road & Rail and PA1a Navigation are relevant.

The Danube Civil Society Forum is the platform for civil society dialogue and networking in the Danube basin under the EU Strategy for the Danube Region (EUSDR). It functions as the interface for structured consultations between civil society and public and private authorities on the regional, national and EU levels as well as to international and intergovernmental organisations active in the region.
The Danube Civil Society Forum is dedicated to supporting civil society organisations in the Danube basin. It aims to promote and enhance civil society participation and networking in the framework of the European Union Strategy for the Danube Region.

Interview observations concerning ICPDR and EUSDR

The ICPDR is viewed positively for its multifaceted contributions, benefiting various sectors beyond just the environment, as noted by several interviewees. This comprehensive benefit highlights the organization's broad and effective approach to addressing various aspects of societal development.
Additionally, it is recognized for setting long-term agendas rather than immediate implementation, as emphasized by other interviewees. Cooperation with the EU Strategy for the Danube Region (EUSDR) is noted for its effectiveness in fostering knowledge exchange, identifying joint priorities, and gaining political support.

The Carpathian Convention (CC)

The Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) unites the 7 Carpathian countries of Central and Eastern Europe in a unique partnership, providing a transnational framework for cooperation and multisectoral policy integration. It is an open forum for stakeholder and public participation and a platform for developing and implementing transnational strategies, programmes and projects for protecting and sustainably developing the region. The Convention was signed in 2003 and ratified in 2006 by all 7 Parties. It is the only multi-level governance mechanism and international legal framework that covers the entire Carpathian region. In addition, it is the second sub-regional treaty-based regime for the protection and sustainable development of a mountain region worldwide, following the Alpine Convention.

The following bodies are relevant:

- Secretariat of the Carpathian Convention
- Carpathian Convention Implementation Committee (country focal points from the Carpathian ministries of the environment)
- CC Working Groups of Biodiversity, Forestry, Sustainable Transport, and Sustainable Agriculture comprising representatives of the respective ministries and observers

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(research institutions, NGOs, consultants, interested groups, representatives of other relevant projects in the region)

Observations by the interviewees, workshops and surveys participants

Workshop participants at the 14th Carpathian Convention Working Group on Biodiversity Meeting in the spring of 2023 agreed that the transnational treaties function as enablers across the regions, also based on EU legislation, funding mechanisms and projects. Mainly initiatives around raising awareness about the natural value of biodiversity and harmonising research and monitoring efforts were highlighted. This involved cross-sectoral cooperation and stakeholder engagement. Barriers to better collaboration across borders include different legislations in the countries in and outside of the EU with diverse entities in charge. The participants regret the lack of capacity concerning coordination of the relevant sectors and a comprehensive vision for the TEN-N. Participants concluded that countries do work together in different ways, officially, for example, the ministries of the environment or state conservation agencies of the Czech Republic and Slovakia, or unofficially through personal contacts. Mainly EU-funded projects allow for cooperation across borders (Interreg, Cross-border cooperation programs, Cohesion Funds, etc.), but unfortunately, only on a short-term basis. The Carpathian Countries Integrated Biodiversity Information System is an open online information hub that provides GIS data and publications for policymakers, project managers and scientists. The conclusion was that this platform should be maintained and developed further.

'The Secretariat of the Carpathian Convention took part in the preparation of project proposals, and they helped them in it. So, at this level, we are cooperating with them, and we are trying to use their power to support our projects' (interview, Poland).

A representative of the Czech Republic said that the Carpathian Convention 'can also have some direct impact in terms of implementation of those projects as, you know, we are all involved'. A representative of Slovakia wrote that the Carpathian Convention accounted for reliable partners and solid resources of knowledge in nature protection, underlined by an interviewee in Slovakia. The interviewee stated that the main role of the Convention was to facilitate cross-border projects that develop concrete results. To conclude, 'there were some good ideas and some good results, but the implementation is still lacking at the national level. This is a problem everywhere'.

'Animals and plants do not recognise borders and migrate. That's why cooperation is important here. And these bodies, since many countries are involved, can act as coordinating offices. They also involve … networking and the creation of a network of experts who are interested and qualified in creating such facilities or fulfilling the relevant obligations' (interview, Ukraine).

Representatives of NGOs from Poland, Serbia, Hungary and Romania share the opinion that the Convention was rather weak since the instruments are not legally binding, and their representatives are not active enough to get recommendations in policy papers and afterwards in implementation.

Protected area networks

- The members of the various protected area networks play an important role in developing and implementing nature conservation projects also related to ecological connectivity. Their protected areas represent core areas for the future TEN-N. Some administrations were project partners in connectivity projects and bear the technical know-how and experience in identifying and monitoring ecological connectivity in the field. Their strength is their knowledge and eagerness to improve the conservation status of their protected area and are close to local players.

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- Members of the Danubeparks, which bring together national and nature parks, biosphere and nature reserves from nearly all the Danube countries including Romania, Moldova, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, and Germany
- Members of the Carpathian Network of Protected Areas (CNPA; park administrations from the 7 Carpathian countries)
- Members of the EUROPARC Federation, the protected area network for the entire of Europe, in and outside the EU
- Members of Parks Dinarides, based in Montenegro and comprising 100 protected areas in the Dinaric Arc
- Members of ALPARC, the network of protected areas in the Alps; collaborate and support the CNPA

NGOs active in the case study area

Both globally and nationally active organisations (e.g. BirdLife, WWF, Greenpeace) are committed to nature conservation and related policy and advocacy work, but also to awareness raising of civil society, including youth. They are also committed to scientific research and fieldwork. The NGOs act as watchdogs and can draw the public's attention to environmental problems. They are important drivers of the topic, support governments, and mediate between the sectors, but are often opposed or ignored. Representatives of the economic sectors perceive them as 'green dreamers', meaning their claims are unrealistic (workshop result, TRANSGREEN Kick-off Meeting, 2017).

Actors at the national level

It is obvious from the number and diversity of players involved that the topic requires a complex approach to achieve concrete implementation of the ecological network at the national level. There are many interests in land use and management. There is no guarantee of completeness for actors listed in the following since the NaturaConnect team engaged mainly with actors on the transnational level representing their governments. In addition, all 15 analysed countries have their particularities in governance and law enforcement.

National public authorities/institutions:

- Ministries of the environment, agriculture, forestry, spatial, urban and land use planning, rural development, water management, transport, tourism and energy
- Regional governments responsible for the environment, agriculture, forestry, spatial, urban and land use planning, rural development, water management, transport tourism and energy like in Austria and Germany
- Regional and local agencies for nature conservation and protected areas like in Romania
- Spatial planning and rural development institutions
- Forest management institutions
- Water management institutions
- Chambers of agriculture, forestry, etc.
- Public service providers related to transport and energy infrastructure
- Municipalities, local communities

Interest groups:

- Landowners
- Farmer associations
- Hunting and fishing associations
- Industry

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- Tourism organisations
- Companies
- Academia
- NGOs
- Media
- Citizens

To simplify, the actors per sector are described jointly in the following.

Environmental actors at the national level

The **ministries** of the environment of each country are important players when it comes to decision-making. They work on new laws or frameworks for nature conservation. Many interviewees agree that their influence is limited compared to other ministries. Most countries have a **protected area and/or a nature protection agency**, either embedded in the ministries of the environment or as a separate entity. In Austria and Germany, the federal states are responsible for nature conservation in their territory, making it difficult to have a joint vision and direction of activities. However, the interviewees agreed that most agencies have insufficient funding and capacity to cope with the wide portfolio of tasks, including administration. 'There are a bunch of people in Bucharest in the office. They basically issue permits. In the field, two or three people per county are in charge of managing tens of Natura 2000 sites. In many cases, there are no funds for field trips, monitoring and other key elements that should be part of the management.' (interview, Romania).

The **European legislation framework** concerning nature conservation gives organisations and persons the right to submit complaints to the European Court when serious implementation failures occur (for example building an illegal ski resort in the Pirin National Park in Bulgaria). In this way, the Lech Valley, a natural jewel in Austria could be saved from the construction of river dams and is now a sustainable tourism destination. European legislation is a powerful tool for nature conservation at the national level. With the help of the European Court of Justice, non-transparent dealings at the national level can be revealed and stopped.

Other actors at the national level and their relationship to nature conservation

Many interviewees, workshop and survey participants stressed the importance of cross-sectoral cooperation at the national and transnational level to achieve a better conservation status of protected areas and create robust ecological corridors. To reach this objective, sectors which impact and are impacted by conservation efforts (e.g. agriculture, energy, transport, forestry, industry) need to integrate environmental and biodiversity aspects in their planning and management. There are some positive examples of integration but in reality, this is often hard to attain due to land management mainly being driven by economic interests.

According to the participants in the interviews, surveys and workshops, the main sectors impacting conservation/ecological connectivity/TEN-N are agriculture, forestry and energy, followed by transport, water management and industries (mining), and the main stakeholder groups are landowners and communities (Figure 19).

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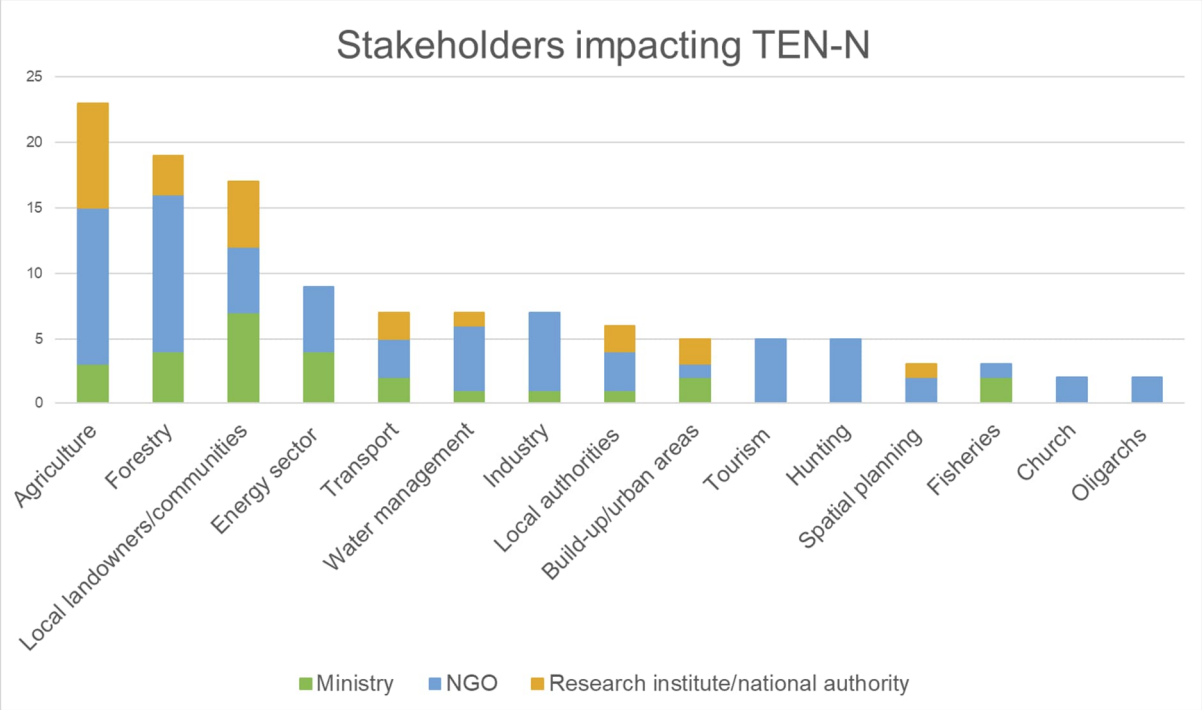

Figure 19: Stakeholders impacting TEN-N, results of 43 interviews analysed using MAXQDA software.

Agricultural actors

The agricultural sector is very powerful across the region. The average share of agricultural land in the DCR countries is approximately 45%, with fewer shares in Montenegro and Croatia. Important players are the ministries of agriculture, sometimes covering the ministries of the environment and forests, chambers for agriculture, associations and farmers. Overall, the interviewees report that cooperation with the agricultural sector is difficult. Actors argue to be responsible for food security and therefore, changing the land use towards providing land for nature conservation is not aligned with their mandate (interview, Austria). This is a topic of discussion and demonstrations in the EU concerning the Nature Restoration Law. At the same time, the landowners sell arable land for settlements or industrial and infrastructure development. This land can no longer be used for cultivation. Agri-environmental schemes and contractual nature conservation are in place in some countries with national rules. Still, most farmers do business as usual. The intensification and expansion of agricultural land are continuing on the one side, and on the other side, land abandonment is increasing too, depending on the relief and the associated workability of the soil.

In Romania, the Ministry of the Environment and the Ministry of Agriculture had a conflict about the compensation system and land management in protected areas, which the interviewees from an NGO and a public authority confirmed. The Ministry of the Environment opted for some obligatory management measures in the protected areas, which was opposed by the Ministry of Agriculture. In their view, such measures would not receive any financial compensation, neither from the agri-environmental schemes nor from Natura 2000 payments. This illustrated the 'financial conflict about subsidies for farmers', stated an interviewee from Romania and a 'political decision in favour of the Ministry of Agriculture'.

'We have much lower influence in the case of agricultural land in comparison to the cooperation in the management of forests' (interview, Slovakia).

'The Ministry of Agriculture is not really the easiest partner when it comes to the expansion of protected areas. They are usually against it' (interview, Poland).

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'The agricultural sector has a huge standing in Austria though when it comes to hard figures about the economy, the importance of the agricultural sector is very low (...). But when it comes to political influence, it's huge' (interview, Austria). Similarly, an interviewee from Germany said that farmers' associations strongly influence the Ministry of Agriculture. Farmers' demonstrations in Germany in early 2024 show the strong opposition toward nature conservation.

Based on compensation measures, farmers are more willing to integrate biodiversity into their fields. For example, in Austria the share of organic production is around 26%, which is rather high in comparison to other countries. 'We have 26% of the agriculture areas under organic farming. So that also indicates that we have quite a lot of landowners who are interested in ecology and farming, who are interested in the environment, in protecting nature (...) And that also includes that species can move and migrate from one area to the other. And they [farmers] are interested in getting information.' (interview, Austria).

Small-scale farmers in many of the investigated countries in the Danube-Carpathian region manage their mosaic landscape with more sustainable practices and thereby, contribute substantially to biodiversity conservation.

Forestry actors

Forestry actors comprise the ministries of forestry, agencies and institutions for forestry, the state and private forestry companies, and forest owners and users. On average, the DCR has a forest coverage of 35.7%, with high shares in Slovenia (61.4%), Montenegro (61.5%), and less in Ukraine (16.7%), Moldova (11.7%) and Hungary (22.7%), see Figure 13. Forests represent an important natural resource which is an essential source of income in the region. The forest sector has an ambiguous relationship with nature conservation. Forests provide various ecosystem services, like the uptake of greenhouse gases, wood and non-timber forest production, recreation for people and more. Forests with high biodiversity values are often protected and represent core conservation areas or can serve as ecological corridors.

Through discussions and interviews with people in the DCR, some good examples of collaboration between the forest sector and nature conservation were mentioned. In Austria, the integration of ecological corridors in the forest development plans is being tested in pilot areas. However, no specific management measures are recommended. Forest owners and managers are encouraged to voluntarily manage the identified ecological corridors. An interviewee from Germany stated similarly, 'This is extremely pronounced and is of course also strongly championed by the relevant groups, whether it's the farmers' association or the forest owners' association, all these property owners' associations emphasise that everything should be done on a voluntary basis.' (interview, Germany)

The forest's area size can determine the resistance to change, and the level of collaboration with the nature conservation sector. 'When we want to restrict the management of small areas for some birds or some plants, something in the forest, the large state forest companies can easily change their planned activities and switch from one area where there is a restriction to another, whereas a small landowner cannot easily change because he only has that little bit of forest or farm' (interview, Hungary). In Montenegro where forests cover more than 60% of the land and therefore are especially important for the local economy, an interviewee said 'the forest owners... are very much in conflict with new protected areas because there is a part of Montenegro where the logging or timber extraction is a significant local industry. So, a lot of people depend on this industry and don't want to see the new protected areas because, for them, that means that they cannot extract the forest anymore.'

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For some politicians, reputational incentives are of interest. An interviewee from Montenegro said, ‘The biggest obstacle is political willingness. If there is a mayor who wants to be remembered as a person who designated an area as protected, or if he sees that this could bring him votes, then good. If not, then we are in trouble.’

'Most of the forests are managed by state-owned forest companies. Their political power is stronger than the national parks or the conservation itself. This management and good production orientation are still in place after many years since the first national parks were established.’ (interview, Hungary)

‘The largest owner of the forests is the church, and this is a problem because the church is exploiting forests massively without mercy. They were the first to purchase the largest machinery to massively exploit forests. They log, sell, and get money.’ (interview, Slovenia)

In some countries like Hungary, Serbia, Czech Republic, and Romania, actors from the forest sector manage protected areas. Thus, collaboration is fundamental. For example, the state forest company Romsilva manages almost all national parks in Romania based on a contract with the Ministry of the Environment. The forest companies shall apply sustainable forest management by integrating conservation goals, and at the same time pay for the salaries of the protected area staff.

The forestry sector can strongly oppose extending new protected and conserved areas because new ways of management could cause a loss of income (interview, Romania). This is especially true for the strictly protected areas. ‘The tensions are really long lasting for many decades. So, this is not a stable situation. For example, the conservation and forestry sectors are always in a kind of dispute.’ (interview, Hungary)

‘There are also cases in which the forestry institutions disagree with the designation of new protected areas in forest lands because of the quite strict regimes and with the argument that those areas are already included in Natura 2000 sites and are being protected as Natura 2000 sites.’ (in writing, Bulgaria)

When looking at the implementation of the Terrestrial System of Ecological Stability (TSES) in the Czech Republic, one interviewee said that ‘the System only applies to forests with naturally occurring tree species which can barely be found in commercial forests and are also important for large carnivores. It is recommended to grow tree species naturally occurring in a location, but in reality, this is not easy. There is no power to change the artificial forests which are focused on production.’

Despite all the above-illustrated difficulties, many interviewees observed a trend for better cooperation between the forest sector and nature conservation in the DCR.

Spatial planning actors, landowners and communities

Important actors in this field are the ministries of spatial planning, regional branches, sectoral agencies, consultant companies and politicians. The contribution of this sector to ecological connectivity is highly dependent on the legislation and the political environment. Who oversees the law implementation and whether the laws are complied with represent other relevant components.

For example, the response to the potential collaboration between the Ministry of the Environment and the Ministry of Spatial Planning in Romania was as follows: 'It’s not a collaboration. They came with some strategies and some projects, and we needed to approve them’ (interview, Romania). Spatial planning systems are different in the examined countries,

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but at the local level, the responsibility for designating areas for certain purposes is with the municipalities. In most countries, there are national, regional and local authorities building on a top-down approach that involves the ministries, regional and local authorities. Since in most countries ecological corridors are not part of the spatial plans, they are not known to decision-makers, and thus not integrated into development plans. In some cases, like in Austria, a map of ecological corridors exists, but without legal protection, they are not considered by spatial planners. However, spatial planning is a political issue with many incentives for municipalities, companies and landowners. Designating areas for commercial purposes benefits the mayor and the municipality economically in contrast to ecological corridors - therefore there is no short-term and clearly visible benefit.

Overall, according to many interviewees and survey participants, landowners and managers are concerned about limitations on their land or their land losing value because of environmental measures. 'If you design a migration corridor somewhere, you want to protect the land from being built up or from intensive use. This is the problem with the landowners because, of course, they do not want such a limit on their land use' (interview, Czech Republic). Also, in Bulgaria, landowners are reluctant to designate additional protected areas on their land after the Natura 2000 designation process in 2007 (in writing, Bulgaria). The coverage of protected areas in Bulgaria is 41% and one of the most extended ones in Europe. In Austria, it was mentioned that the landowners and farmers do not want to restrict their descendants when agreeing to longer-term nature conservation measures (e.g. planting hedgerows, which could limit them from certain future activities (interview, Austria). The same interviewee also stated that not all landowners and farmers can be lumped together since there are some who are in favour of ecological corridors or protected areas on their territory and produce organically.

Landowners and managers are reluctant to accept environmental measures because of the weak compensation schemes connected to an administrative burden (interviews Czech Republic and Romania). In addition, the communication between the environmental authorities, landowners and managers on the subject appears insufficient. Thus, this group does not understand why it should make any effort to protect nature. An interviewee from Slovakia said 'Nothing is really working towards the stakeholders. So not the communication, even not the financing'. Raising awareness for landowners was also mentioned by an interviewee from Ukraine, 'People don't always understand the benefits of declaring a territory a nature reserve. But we are working on this, holding meetings, working with people. It is explained that this can give them certain advantages in terms of raising additional funds. This means working with village councils, working with communities, working with landowners.'

A Serbian interviewee observed some local initiatives to protect valuable areas, but the decision about where protected areas should be located is made top-down in his country. 'I would say that we also have to improve our support to them [local landowners] and somehow empower them', (interview, Serbia), since Serbia's protected coverage is only around 10% and needs to be increased. In Moldova, awareness of the importance of nature protection slowly increases through the many conversations with the landowners who usually oppose new protected areas on their territory (interview, Moldova).

In the Czech Republic, where theoretically, a good compensation scheme is in place, farmers and managers complain about the complicated administrative procedures to get compensation (interview, Czech Republic). The situation seems to be worse in other countries as stated by several interviewees from Slovakia and Romania, where the compensation scheme is delayed.

These are two problems many interviewees mentioned, the insufficient awareness of the importance of an ecological network including protected areas and the deficient compensation schemes for efforts in biodiversity-friendly management.

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Transport infrastructure actors

Transport infrastructure development and extension are high on the agenda in many countries of the Danube basin. This is subject to the ministries of transport and its motorway or railway companies as contractors and service providers. The EU supports these economic activities with huge investments, but in some countries, there is not enough experience in preparing bankable projects. Although the EU aims at financing only sustainable transport infrastructure, there is little knowledge on how to integrate mitigation measures in road and rail projects to serve nature conservation and reduce habitat fragmentation. NGOs and other players therefore often oppose the plans which leads to lengthy delays of the construction, as can be seen in the case of the Lugoj-Deva highway in Romania. In other countries such as Croatia or Austria, it is obligatory to construct green bridges for a new motorway and to retrofit existing motorways to make the linear infrastructure permeable again. In the Czech Republic, transport projects comply with good practice standards concerning ecological connectivity. A representative of the transport sector stated, 'The fact is that in the past years, environmental measures have been more accepted by the transport sector' and '... we have good cooperation with the Directory of Roads and Highways, so I don't think that the roads are the most conflictive sectors.'

Energy development actors

Since the European Union and its Member States are under high pressure to reduce procurement of fossil fuels from Russia, the switch to renewable energy has to be accelerated with less stringent environmental impact assessment obligations. For example, in Romania, hydropower projects that had been stopped in the past for reasons of nature conservation are being reactivated. Photovoltaic power plants are often fenced and used for grazing, reducing the movement of wildlife.

Water management actors

Results of the survey (from 11 respondents from the water management sector in 7 countries across the region) reveal that all participating countries integrate ecological connectivity in their river basin management plans, according to the EU Water Framework Directive (WFD) and ICPDR policies.

The main objective of the WFD is to achieve good chemical and ecological status of surface waters. Classification of the ecological status of rivers includes hydromorphological quality elements such as river continuity when the continuity of the river is not disturbed by anthropogenic activities and allows undisturbed migration of aquatic organisms and sediment transport. In addition, morphological conditions include an appropriate structure and condition of the riparian zone.

The WFD is implemented at the transboundary Danube basin level under the Danube River Protection Convention implemented by the ICPDR. Concerning ecological connectivity, the most important objectives at the ICPDR level are migratory fish protection and sediment management, with sturgeon being the flagship species. Food protection activities sometimes reduce the longitudinal and/ or lateral connectivity of rivers. To re-establish former floodplains and wetlands, several projects are going on in the Danube basin. This is why nature-based solutions are being promoted by the ICPDR to complement or replace grey infrastructure solutions integration of river basin management. Flood risk management plans have become the aim. Stumbling blocks for these integrated solutions are property rights and a high number of stakeholders that need to be involved and agreed with, including from the agricultural sector.

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Besides agriculture, hydropower and navigation sectors can harm ecological connectivity and their impact needs to be mitigated. Discussions around free-flowing rivers and dam removals have just started in the region.

Actors from tourism

Tourism relies on the beautiful scenery of an intact natural landscape. Tourism facilities and tourists often deteriorate popular areas such as the High Tatra Mountains in Poland or the Plitvice Lakes in Croatia. For some countries, tourism is an important source of income for local people, thus this industry has a strong lobby. The challenge is to find a balance between tourism development and the natural and cultural aspects.

Other actors

Actors from other sectors, like mining and fisheries, were mentioned by a few interviewees but did not appear to be as important as the previous ones. This might be connected to their small-scale impact on the landscape.

Collaboration across borders

As already described above, transnational treaties provide a good platform for exchange and collaboration. The EU supports projects that foster cross-border cooperation e.g. through Interreg Programmes. Various projects have been conducted on the topic of ecological connectivity in terrestrial and freshwater ecosystems.

There are good examples of cooperation in the Czech Republic and Slovakia, where cross-border meetings take place to discuss the environmental impacts of linear transport infrastructure on nature. Representatives of the ministries of the environment and transport, the motorway companies and national authorities for nature conservation participated. Five countries in the region agreed on the establishment of the Mura-Drava-Danube Biosphere Reserve and work together for its conservation and joint management. There are many more, project-based collaborations across borders mentioned by the interviewees and communicated by the survey participants.

In some areas, there are difficulties. Ongoing resentments between the former countries of Yugoslavia (Serbia, Kosovo, …) hinder certain countries from collaborating across borders and even at the national level (Bosnia and Herzegovina). According to an interviewee, Montenegro seems isolated, and we really believe in cross-border cooperation, especially in the area of nature protection and management of shared natural resources, because nature does not know about the borders, is of immense importance for Montenegro' (interview, Montenegro).

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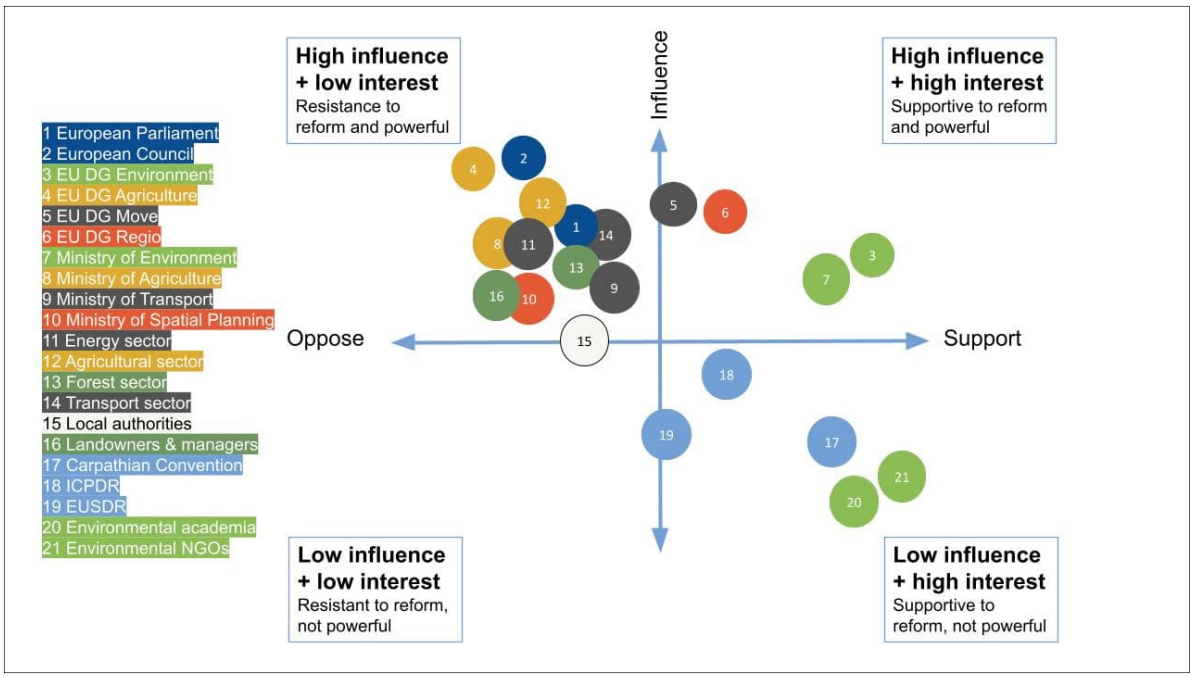

Figure 20. Stakeholder matrix for the Danube-Carpathian region based on workshops and discussions, WWF-CEE.

The stakeholder matrix shows that currently most of the powerful stakeholders are rather resistant to support the introduction of ecological connectivity.

To the group of the supportive or neutral but influential stakeholders belong some European Commission Directorate General, mainly DG ENV but also DG REGIO and DG MOVE. Unfortunately, the on the other hand DG AGRI does not support / is not interested in ecological connectivity, while at the political level lately also the European Council and the European Parliament also favours believed agricultural needs over nature conservation and the need to restore nature outside Natura 2000 areas.

From the national ministries and sectors agriculture, energy and spatial planning are very reluctant towards change and the forest and transport sector also, although with less resistance. Landowners and managers are also against the change. Environmental ministries, academia, NGOs are supportive, but they have much less power when it comes to taking political decisions.

There are some macro-regional players (Carpathian Convention, ICPDR, EUSDR) that are supportive towards new ideas on ecological connectivity especially at transboundary level, but they have limited power when it comes to national implementation on the ground.

The stakeholder matrix shows that currently less powerful stakeholder groups support ecological connectivity and more numerous and powerful groups are reluctant to introduce it. There is a need to convince reluctant stakeholder groups on the importance of ecological connectivity and to make them interested in establishing ecological corridors and build ownership of the issue among them. At the same time macro-regional stakeholders as well as environmental institutions and NGOs should be empowered to have equal voice in the political debate.

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3.2.2.2. France

Foundational factors

Natural Resource Endowments

France's diverse landscapes are characterised by various bioregions. The Atlantic bioregion in western France has a maritime climate with deciduous forests and rich birdlife. Central and northeastern France, part of the Continental bioregion, boasts mixed forests and fertile plains, especially known for vineyards. The Mediterranean bioregion in the south features hot, dry summers with olive groves and evergreen shrubs, while the Alpine and Pyrenean bioregions in the east and southwest, respectively, have high-altitude conditions supporting unique flora and fauna. The Aquitaine Basin in the southwest is known for intensively managed pine forests and wetlands. The Massif Central in south-central France features mixed forests and volcanic plateaus. The Paris Basin is dominated by agricultural land and urban areas, while the Rhône Valley towards its estuary in the southeast supports diverse ecosystems.

Its forests house diverse species, including deer and wild boar, while the Alps and Pyrenees host unique alpine fauna like ibex and marmots. Coastal and marine ecosystems teem with marine life, and wetlands like the Camargue are crucial for migratory birds. The country's flora ranges from Mediterranean vegetation to alpine meadows.

Historical Context

The Renaissance and Early Modern periods saw increased agricultural expansion, which began fragmenting natural habitats. However, large estates and traditional agricultural practices still offered refuges and minor corridors for wildlife.

The French Revolution and 19th-century industrialisation brought significant changes, with rapid urbanisation and industrial agriculture causing further habitat fragmentation. Already in the mid-19th century, rural depopulation began and generated land abandonment with major consequences on biodiversity.

After World War II, France faced the immense task of rebuilding its cities and infrastructure. This period of rapid reconstruction and modernisation led to significant urban expansion and industrial development. Post-war reconstruction and urban sprawl highlighted the need for ecological connectivity.

In the 1960s until the 1990s, France began to develop a more structured approach to environmental protection and land use planning. Key legislative measures included the Loi Parcs nationaux (1960), Loi sur la Protection de la Nature (1976) and Loi Littoral (1986), aimed at protecting coastal areas, and the Loi Montagne (1985), focused on mountainous regions.

During the late 1990s and early 2000s, the concept of Green Infrastructure began to gain traction in France. This approach emphasised the integration of natural and semi-natural areas within urban and rural planning to maintain ecological connectivity.

Regional Ecological Coherence Schemes (SRCE) are planning documents introduced in 2010 to identify and protect ecological corridors, guiding regional and local planning to maintain habitat connectivity. These documents implement the Trame Verte et Bleue (Green and Blue Network), the country’s network of ecological continuities, at the regional level. SRCEs have now been replaced by a new integrating planning scheme which will integrate the mapping of regional ecological continuities. In France, land use is diverse, with approximately 53% of the land dedicated to agriculture, including arable land, permanent crops, and pastures. Forests cover about 31% of the land, providing ecological and economic benefits. Urban and built-up areas account for around 10%, encompassing residential, commercial, industrial, and transport infrastructure. The remaining 6% of the land includes wetlands, water bodies, and unproductive areas like rocky or mountainous regions.

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Demographics

The diverse demographics of France, characterised by an aging population, significant urbanisation, and a rich mix of cultural and ethnic backgrounds, profoundly impact the country's connectivity. The high urbanisation rate, with about 80% of the population living in cities, necessitates robust infrastructure and transportation networks to connect densely populated urban areas with rural regions. This urban concentration also demands efficient public transit systems, advanced telecommunications, and digital connectivity to support economic activities and social integration.

Rules of the game

France has established a comprehensive legal framework to enhance ecological connectivity through the Green and Blue Network (GBN). Introduced by the 'Grenelle I and II' laws in 2009 and 2010, the GBN is governed by the Environmental Code and the Urban Planning Code. The national strategy sets ambitious goals, however, actual implementation on the ground often falls short of these targets. As one interviewee noted, 'In France, there is a lot of discussion about these goals, but we still have a way to go before we see significant action.' Another interviewee emphasized, 'The percentage of protected areas is relatively low in metropolitan France due to human activities and various conflicts.'

The funding landscape for ecological connectivity in France is multi-faceted, involving state budgets, the Green Fund, EU funds, and private sector contributions. The Green Fund, established to support various biodiversity strategies, including the GBN, has allocated substantial resources, yet accessing these funds can be cumbersome. 'Navigating the funding process, especially for smaller organisations, can be quite challenging due to its complexity,' an interviewee pointed out. Another added, 'It's often a case-by-case basis, and even though there are funds available, securing them requires significant effort and preparation of detailed project proposals.'

There is considerable resistance from local populations and economic stakeholders when connectivity projects interfere with human activities. 'Balancing conservation goals with local economic activities is often challenging,' remarked an interviewee. Additionally, lack of coordination among governmental departments and local authorities leads to fragmented efforts. One interviewee stated, 'Improving communication and coordination between various departments could significantly enhance the implementation of these strategies.' Another noted, 'There's often a disconnect between the goals set at the national level and the practical realities at the local level.'

Socioeconomic factors are major barriers to effective implementation. Projects that require changes in land use or restrictions on human activities often face opposition due to economic implications for local communities. 'It's not just about the funding; balancing local needs and conservation efforts is crucial,' an interviewee explained. Moreover, another interviewee noted, 'The socioeconomic context, especially in rural areas, plays a significant role in how these policies are received and implemented.' Other barriers include the difficulty for the regional planning of ecological networks to be sufficiently integrated into urban planning policies. The GBN is however an established and well-known tool that has a real impact on regional planning policies despite the change in governance, as explained by an interviewee.

There is a notable discrepancy between the perspectives of government officials and NGOs. Government representatives often highlight the existence of policies and plans, while NGOs emphasise the lack of tangible results and practical implementation. For instance, one government official mentioned, 'We have comprehensive policies in place,' while an NGO representative countered, 'The policies are well-formulated, but we need more on-the-ground action to see real results.'

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People and Organisations

The Ministry of Ecological Transition plays a pivotal role in formulating and implementing environmental policies, including those related to ecological connectivity. The ministry oversees the Green and Blue Network (GBN) and ensures that national strategies align with international biodiversity commitments.

The French Biodiversity Agency (Office Français de la Biodiversité (OFB)) is responsible for the national implementation of biodiversity policies. It coordinates efforts across various protected areas and supports the creation and management of ecological corridors. The agency provides scientific and technical expertise to local authorities and stakeholders.

Regional and local governments play a crucial role in the practical implementation of ecological connectivity strategies. They are responsible for integrating national policies into regional and local planning documents, such as the Regional Ecological Coherence Schemes (SRADDET) and local urban development plans (PLU). Their involvement ensures that ecological connectivity efforts are tailored to the specific needs and conditions of different regions.

Municipal councils are key players in the ground-level implementation of connectivity projects. They work with local communities to identify and manage biodiversity reservoirs and ecological corridors within their jurisdictions.

Non-Governmental Organisations (NGOs) are crucial in the development and implementation of ecological connectivity strategies in France. They often engage in advocacy, public awareness campaigns, research, and on-the-ground conservation projects. NGOs collaborate with government bodies, provide expert advice, and play a significant role in monitoring and assessing the effectiveness of connectivity initiatives. Some prominent examples include LPO (Ligue pour la Protection des Oiseaux), WWF France or FNE (France Nature Environnement).

3.2.2.3. Portugal

Foundational factors

Natural Resource Endowments

Portugal's land use planning addresses the challenges of its Mediterranean, Atlantic, and Macaronesian biogeographic regions. The Mediterranean region, covering much of southern and central Portugal, features evergreen forests and diverse agricultural landscapes, but faces connectivity challenges from agricultural intensification, monoculture plantations and increased urbanisation. Conservation efforts focus on creating ecological corridors and protecting natural habitats. The Atlantic region, with its mild, wet climate and lush deciduous forests, supports rich biodiversity but deals with habitat fragmentation due to urban development, agriculture and forestry. Efforts to restore riparian corridors and establish protected areas aim to enhance connectivity. The Macaronesian region, including the Azores and Madeira, is a biodiversity hotspot with unique species. Conservation strategies on these islands focus on habitat restoration and controlling invasive species to maintain ecological networks.

The country is home to approximately 3,600 species of plants, 69 terrestrial mammal taxa, 313 bird species, and numerous amphibian and reptile species. This rich biodiversity includes unique species such as the Iberian lynx, the golden eagle, and the common chameleon. The diverse ecosystems range from the lush forests of Peneda-Gerês National Park to the marine life along the Algarve coast, and the unique cork oak forests on the plains south of the Tagus River (‘Portugal Biodiversity and the Built Environment,’ n.d.).

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Historical Context

Portugal established itself as an independent kingdom in 1139 and solidified its borders in the 13th century, earlier than many other European countries. Land productivity differences between north and south, led to two types of land management situations. South of the Tagus, less productive and extensive flat lands are characterised by large properties, owned by a few private individuals, where a similar feudal system lasted until last century. Whereas in the north, propriety would been fragmented in each generation; some bigger areas under community ownership (*baldios*).

The **medieval period** saw the establishment of agricultural practices that continue to influence land use today. The extensive use of terracing in the northern regions and the development of irrigation systems in the south under Moorish influence created a diverse agricultural landscape.

From the 15th century, Portugal's Age of Discovery led to the establishment of a global maritime empire. The wealth generated from colonies was reinvested in the homeland, leading to significant agricultural and infrastructural developments. Introduction of new crops from the colonies, such as maize, potatoes, and tomatoes, diversified Portuguese agriculture and impacted land use by integrating these crops into the farming systems. The influx of wealth from overseas colonies funded the construction of roads, ports, and urban development. This period saw the growth of cities like Lisbon and Porto, shaping urban land use patterns that persist today. Large-scale agricultural estates (latifundia) in Portugal were further developed during this period, particularly in the Alentejo region, establishing a pattern of extensive farming that influences land use planning and conservation efforts today.

The 19th century was marked by liberal reforms, including the dissolution of monastic orders and the expropriation of their lands (Desamortização). These lands were often sold to private individuals, leading to a fragmented land ownership pattern that affects current land use planning. Industrialisation and urbanisation began to take hold, particularly in coastal areas, influencing transportation and urban planning.

The early and middle 20th century witnessed significant rural depopulation as people moved to urban areas for better economic opportunities. This migration led to abandoned agricultural lands and changes in rural land use, especially in mountain regions and along border areas north of the Tagus river. The depopulation trend created opportunities for rewilding and the restoration of natural habitats, which are central to current conservation strategies, but also lead to increased risk of extremely dangerous mega wildfires as in 2017.

Portugal's **accession to the European Union** in 1986 brought substantial funding for infrastructure, agricultural modernisation, and environmental protection. The construction of dams and highways funded by the EU has had a significant impact on habitat fragmentation. EU policies and funding programs have significantly shaped land use planning, emphasising sustainability and conservation. The implementation of the Common Agricultural Policy (CAP) has influenced agricultural practices, promoting sustainable land use and environmental stewardship, as well as agriculture intensification and increased habitat fragmentation.

The establishment of the Institute for Nature Conservation and Forests (ICNF), which replaced the Institute for Nature Conservation (ICN) and the National Service of Parks, Reserves, and Nature Conservation created in 1983, reflects a centralised approach to managing natural resources and protected areas. The ICNF's role in coordinating national conservation efforts is critical for effective land use planning. Regional governments of Azores and Madeira also play a vital role in implementing local conservation measures, leading to a multi-tiered governance structure that ensures both national coherence and regional specificity.

Demographics

Portugal has an estimated population of about 10.3 million people, with a density of 113.5 inhabitants per square kilometre. The population is unevenly distributed, with higher

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concentrations in urban areas, particularly along the coast (Freire, S. et al., 2009) and in metropolitan areas such as Lisbon, Porto, and the Algarve. Conversely, many rural areas, especially in the interior, are experiencing depopulation (this is not a recent phenomenon) (Almeida, 2018) and an aging population.

Tourism plays a crucial role in Portugal's economy, contributing significantly to GDP (Gross Domestic Product) and employment. However, the surge in tourism in the last 15 years, particularly in coastal regions and urban centers, strains local infrastructure and natural resources.

Rules of the game

Portugal has several key strategies aimed at improving ecological connectivity, including the National Ecological Reserve (REN), National Agricultural Reserve (RAN), Fundamental Network of Nature Conservation (RFCN), and the National Special Planning Policy Program (PNPOT). While these strategies are robust on paper, their effectiveness is often hampered by **fragmented implementation and lack of coordination.**

A major theme that emerged from the interviews is the disconnect between national policies and local implementation. One conservationist explained, 'There's a significant disconnect between national policies and local implementation, which undermines the effectiveness of conservation efforts'. This sentiment was echoed by other interviewees who pointed out that while the REN and RAN provide essential protections, their isolated implementation at the municipal level often leads to fragmented efforts. 'The National Ecological Reserve is essential for protecting ecologically sensitive areas, but its effectiveness depends heavily on municipal compliance and national oversight,' noted one interviewee. Other interviewees mentioned that if even in REN and RAN strategies the connectivity is not taken into account, a good use of them could help improve the connectivity in the country, as they are powerful strategies.

Furthermore, the Fundamental Network of Nature Conservation (RFCN) aims to integrate various protected areas into a coherent system of core and connection areas. However, site designations often lack consideration for ecological connectivity, focusing instead on protecting individual biodiversity hotspots. According to one expert, 'Protected areas in Portugal were historically designated without a network mindset, which hampers efforts to ensure ecological connectivity'.

The National Special Planning Policy Program (PNPOT) establishes ecological connectivity systems as fundamental territorial systems, including natural, social, economic, urban, and connectivity systems. Despite this, implementation is often inconsistent. 'The National Spatial Planning Policy Program recognises the importance of ecological connectivity, but implementation is often inconsistent' a stakeholder mentioned.

People and organisations

The Ministry of Environment and Energy is responsible for developing, managing, implementing, and evaluating a wide array of policies. These policies cover environmental protection, land use planning, urban development, suburban and road passenger transport, mobility solutions, climate action, forestry management, nature conservation, energy resources, geological studies, and forest management ('Governo de Portugal,' n.d.). These initiatives aim to promote sustainable development and ensure social and territorial cohesion. However, their implementation often faces challenges due to fragmented efforts and a lack of coordination with other sectors.

The Ministery of Agriculture is responsible for developing, leading, executing, and assessing policies related to agriculture, agribusiness, and rural development. This role also involves planning and coordinating the use of national and European funds allocated for agriculture

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and rural development and establishing the relevant strategies and priorities. The Ministry of Agriculture influences land-use policies that affect ecological connectivity, often conflicting with conservation goals.

The Institute for Nature Conservation and Forests (ICNF) is tasked with formulating, supervising, and ensuring the implementation of policies focused on the conservation of nature and forests. Their objectives include preserving natural resources, promoting their sustainable use, enhancing their value, ensuring public access and enjoyment, and achieving widespread recognition of the significance of natural heritage ('ICNF - Instituto da Conservação da Natureza e das Florestas,' n.d.).

Regional Coordination and Development Commissions (CCDR) is a public institute with administrative and financial autonomy, responsible for defining and executing regional development strategies. It coordinates essential public policies in areas such as environment, economy, education, health, and land planning. The CCDR also manages cohesion policy within regional and European programs, aiming for economic, social, and cultural development. Additionally, it provides technical support to local authorities. Each region in Portugal mainland has its own CCDR (5 in total).

In an opinion piece from the Portuguese newspaper Público, the ICNF is described as poorly structured, lacking strategic vision, and having weak results on the ground (Veríssimo, 2023). The article also highlights the poor coordination in the transfer of functions from the ICNF to the CCDR, with disagreements about responsibilities. It emphasises the need for a single entity dedicated to the conservation and restoration of nature in the country.

3.2.2.4. Finland

Foundational factors

Natural Resource Endowments

Finland shares its northern latitude with Alaska and Central Siberia. About a quarter of the country is north of the Arctic Circle. Finland's biodiversity is shaped by its location both in the Boreal and Arctic biogeographic regions. The Boreal region, with its extensive coniferous forests, numerous lakes, and peatlands, supports diverse wildlife such as elk, wolves, and bears. The Arctic region, characterised by tundra landscapes and extreme climates, is crucial for species like reindeer. While it faces fewer human-induced connectivity issues, climate change poses significant threats to habitats and migration patterns.

Forests, covering about 75% of the land area, make Finland Europe's most forested country (aucor, 2011). These are vital for maintaining ecological balance and carbon sequestration.

Finland, also known as the Land of a Thousand Lakes, with around 188,000 lakes, which significantly influence ecological connectivity and land-use planning (Marttunen et al., 2001). The lakes provide essential habitats and migratory routes for various species, acting as natural corridors for aquatic and semi-aquatic species while posing as barriers for terrestrial ones. They are also central to Finland's tourism, like ski resorts (Kangas et al., 2012) and hold cultural significance, necessitating balanced management to support development, conservation, and community well-being.

Historical Context

Finland was part of the Swedish kingdom (12th century to 1809), which established Swedish laws and administrative practices. These early legal structures and agrarian practices laid the foundation for Finland's current land use patterns.

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From 1809-1917 despite being a Grand Duchy under Russia, Finland retained its legal and administrative systems from the Swedish era, allowing it to maintain its land use practices. This period saw infrastructural developments, like railways, influencing urban planning.

Finland's independence from Russia in 1917 and subsequent civil war led to significant territorial and population changes. The Land Acquisition Act of 1945 redistributed land to war veterans and evacuees, reshaping rural land use. Post World War II led to a rapid urbanisation, and industrialisation led to comprehensive urban planning. The Land Use and Building Act of 1958 provided a framework for systematic land use planning, updated over time to include sustainability and environmental protection.

In recent decades, Finland has integrated environmental considerations into land use planning. Agencies like Metsähallitus manage state-owned land with a focus on sustainable forestry and conservation. Finland employs a multi-tiered land use planning system with national, regional, and local levels. This structure supports sustainable development, economic growth, and environmental stewardship.

Conservation efforts in Finland have a long history, influenced by its extensive forests and unique northern ecosystems. Finland's conservation policies have been shaped by its commitment to international agreements and EU directives.

Demographics

Finland has a population of approximately 5.5 million, but it features a relatively low population density, with around 18 people per square kilometre. The population is primarily concentrated in urban areas, particularly in the southern regions, with major cities including Helsinki, Espoo, Tampere, and Turku. These urban centers are experiencing growth, whereas many rural areas are facing depopulation and aging populations (‘Population: demographic situation, languages and religions,’ n.d.). The country’s northernmost province, Lapland, accounts for about 28% of Finland’s total area, but only 4% of the population (aucor, 2011).

Rules of the game

Finland's efforts to improve ecological connectivity are anchored in a robust legal framework, spearheaded by the Nature Conservation Act (NCA). Recent revisions to the NCA have introduced crucial provisions for connectivity and climate change adaptation, marking a significant advancement in Finland's conservation policy (‘Reform of the Nature Conservation Act,’ n.d.). The NCA now explicitly includes connectivity as a criterion for establishing protected areas, which underscores the government's commitment to creating well-connected ecological networks. This was a positive development highlighted by one of our interviewees, who emphasised the importance of this addition for enhancing Finland’s network of protected areas.

The Land Use and Building Act requires regional plans to incorporate corridors and spaces aimed at maintaining ecological connectivity. Despite this, practical enforcement remains a challenge, particularly in Southern Finland, where land ownership is highly fragmented. The Water Act and Wilderness Act also contribute to the legal framework, offering additional protection for aquatic and wilderness areas. However, as noted in interviews, aligning these laws with broader conservation goals often proves difficult, indicating a **need for more integrated approaches.**

The METSO program, which encourages private landowners to conserve their lands, is particularly crucial in Southern Finland. Here, the fragmented nature of land ownership makes it challenging to create large, connected conservation areas. One of our interviewees highlighted the program's significance but also noted that its voluntary nature limits its reach. ‘Basically, we need the privately owned lands for conservation because otherwise, there's just no way to have a well-connected, well-rounded network in Southern Finland,’ they explained.

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The Natura 2000 network is central to Finland's conservation strategy. While the network is comprehensive, the interviews revealed that better regional coordination and more robust enforcement mechanisms are necessary for its success. Programs like the HELMI (Habitat Program) focus on restoring various habitats, including peatlands and wetlands, which are vital for maintaining connectivity. Interviewees pointed out that while HELMI is effective, its impact is limited by insufficient funding and political support.

Recent developments, such as the introduction of voluntary nature compensation mechanisms, provide new tools for biodiversity conservation. However, these mechanisms are still in their infancy and need to be tested in practice to gauge their effectiveness fully. Our interviewee mentioned, 'The voluntary nature compensation is a new tool in Finland and has not yet been used because it's very new, with the new law only coming into effect last June'.

Despite these initiatives (and others not mentioned in this text but included in Appendix 1), significant challenges hinder the full realisation of Finland's conservation goals. The fragmented land ownership in Southern Finland remains a primary barrier, complicating efforts to establish large, contiguous protected areas. Political will is another major hurdle. Although the recent legal reforms indicate some level of commitment, broader political support is lacking, particularly due to resistance from influential sectors like forestry. 'One major issue is that Finland lacks political will to make changes necessary for increasing the area of conservation areas and to improve connectivity,' they stated.

Although programs like Helmi and METSO receive some funding from national and EU sources, the levels are inadequate to meet the ambitious goals of halting biodiversity loss and improving ecological connectivity. 'The funding to halt biodiversity loss in Finland is just not enough; it should be at least 10 times higher,' an interviewee emphasised, reflecting a common sentiment among interviewees about the need for increased investment.

People and organisations

The Finnish Ministry of Environment plays a central role in managing the Natura 2000 network and other conservation efforts. They are responsible for overarching policy and coordination. Insights from the interviews emphasise the need for enhanced coordination and political will to effectively implement conservation measures, highlighting the political challenges in enforcing biodiversity protection.

The ELY Centres (Centres for Economic Development, Transport and the Environment) oversee the implementation of environmental policies, including Natura 2000 sites and are subordinated to the administrative branch of the Ministry of Employment and the Economy. ELY Centres also deal with tasks coming under the administrative branches of the Ministry of the Environment, Ministry of Transport and Communications, Ministry of Agriculture and Forestry, Ministry of Education and Culture and Ministry of the Interior. These centres face practical difficulties in regional implementation, particularly in areas with fragmented land ownership.

The Ministry of Agriculture and Forestry is another crucial player, managing policies related to land use, agriculture, and forestry. Their policies often conflict with conservation efforts, making coordinated action challenging.

The Finnish Environment Institute (SYKE) provides research, data analysis, and recommendations on environmental issues. They contribute significantly to conservation strategies and are involved in new initiatives like the process to define Other Effective area-based Conservation Measures (OECMs) in Finland. This institute's research underpins many conservation strategies, providing essential scientific support for policy development. Research institutions like the University of Helsinki conduct research on biodiversity and conservation strategies, often collaborating with SYKE and other bodies to inform policy and practice.

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Municipal governments play a significant role by implementing local land use plans and designating areas for conservation within their jurisdictions. Their involvement is crucial for the local implementation of conservation strategies, although they are often limited by local political and economic pressures.

Nature conservation NGOs, such as the Finnish Association for Nature Conservation, advocate for stronger conservation policies and engage in on-the-ground activities. However, these organisations often face resource constraints, limiting their impact despite their critical role in advocacy and practical conservation work.

Hunting and fishing associations are also important stakeholders, managing species populations and sometimes opposing conservation measures that restrict their activities. The forestry industry is a major land user with significant influence on land use policies. Their interests often conflict with conservation goals, making them a powerful opponent to stricter conservation measures. Similarly, the agriculture sector's land management practices impact conservation efforts, requiring policies that balance agricultural productivity with biodiversity conservation.

3.2.2.5. Spain

Foundational factors

Spain’s historical context significantly shapes its current conservation challenges and opportunities. Understanding the legacy of past land use, socio-political changes, and economic development is crucial for addressing ecological connectivity issues. Spain's governance involves both national and regional levels. The Ministry of Ecological Transition and the Demographic Challenge (MITECO) oversees national policies, while regional governments implement local conservation measures. This analysis focuses on Spain in general and Doñana specifically.

Natural Resource Endowments

Spain's diverse geography results in several biogeographic regions, each with unique climatic, geological, and ecological features. The Mediterranean region, with its hot, dry summers and evergreen forests, covers most of the Iberian Peninsula, while the Atlantic region in the north features a mild, wet climate and deciduous forests. High mountain areas like the Pyrenees and Sierra Nevada form the Alpine region and are characterised by alpine meadows and montane forests. The Canary Islands comprise the Macaronesian region, with its subtropical climate and unique laurel forests. Central Spain's Steppe region has a continental climate with steppe vegetation. Spain is a biodiversity hotspot due to its diverse ecosystems, including Mediterranean forests, mountain ranges, wetlands, coastal areas, and unique island habitats (Pascual et al., 2011). The country hosts over 8,000 plant species (‘Home | Convention on Biological Diversity,’ n.d.), many of which are endemic, and a wide range of animal species, including the Iberian lynx, Spanish imperial eagle, and numerous migratory birds. Spain's renewable energy potential is significant, with abundant solar energy in regions like Andalusia and substantial wind energy resources in Galicia, Castilla and León, and the Basque Country.

Doñana in Andalucia is Europe’s largest sanctuary for migrating birds. This extensive coastal marshland, located where the River Guadalquivir meets the Atlantic Ocean, is highly productive, well-preserved, and largely inaccessible. It features a diverse array of habitats, including beaches, marshes, lagoons, dunes, pine and cork oak woodlands, and heath. The area supports three threatened bird species, hosts one of the largest heronries in the Mediterranean, shelters over 500,000 wintering waterfowl, and serves as a crucial stopover for millions of migratory birds (‘DOÑANA NATIONAL PARK - World Heritage Datasheet,’ n.d.).

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In Spain, land use is predominantly dedicated to agriculture, livestock farming, and forestry, covering more than 42 million hectares or 80% of the country's total area. Of this, slightly over 30% is allocated to dry-farmed crops, another 30% to forestry, and 12% to grazing and drought-tolerant plant species (‘La Moncloa. Geography of Spain [Geography],’ n.d.)

Historical Context

Spain's diverse civilisations, including Islamic rule, the Christian Reconquista, and the Spanish Empire, have shaped its contemporary governance and cultural norms. Historical land uses and traditional agricultural practices continue to influence current conservation efforts. Spain's historical context includes Roman infrastructure, Islamic irrigation, and the socio-political upheavals of the Reconquista and Franco era, leading to significant habitat fragmentation, the introduction of barriers like roads or irrigation canals, alteration of ecosystems, and creation of new habitats.

- Islamic Rule (8th to 15th Century): Developed sophisticated irrigation systems (acequias) (Squatriti et al., 2000), supporting extensive agriculture and altering landscapes.
- Christian Reconquista (11th to 15th Century): Involved significant land redistribution, converting land to agriculture and grazing, leading to habitat fragmentation (Oto-Peralías and Romero-Ávila, 2016).
- Desamortización (18th to 19th Century): Forced sale of church, municipal, and crown forests, reducing connectivity between natural areas (Schmithüsen, 2013).
- Spanish Empire (16th to 19th Century): Agricultural expansion and infrastructure development for trade contributed to habitat fragmentation.

Throughout history, agricultural practices have shaped cultural landscapes and are currently essential for the maintenance of biodiversity in many protected areas. However, in the last three decades the process of agricultural intensification has often been negative (Pineda, 2001), involving loss of landscape features and biodiversity.

The history of Doñana starts with Neanderthal settlers around 28,000 years ago in the Gulf of Cádiz. Around 2000 BC, a tsunami transformed the Guadalquivir estuary, causing a long period of instability (Ojeda Rivera, 2023). Roman settlements appeared between the 2nd century BC and the 5th century AD, primarily focused on fishing. In the 13th century, King Alfonso X designated Doñana as royal hunting grounds. In the 18th century, Doñana saw forest exploitation, livestock grazing, and maintained hunting grounds. Scientific interest grew in the 19th century with ornithological catalogues and collection of samples by numerous naturalists. The owners of Doñana at the beginning of the 20th century performed practices such as the introduction of species, the transformation of the habitat by planting stone pines, and organisation of regular hunting events. In the 1950s the faunistic richness of Doñana attracted numerous ornithologists which started a process of increased conservation awareness that culminated in 1963 with the establishment of the Doñana Biological Reserve and the designation of Doñana National Park in 1969. The park has since expanded and received various international protections.

Demographics

Spain’s demographic landscape is characterised by diverse regional identities, urbanisation trends, and rural depopulation, all of which significantly influence local governance and conservation strategies. Each of Spain’s 17 autonomous communities has its own unique identity and approach to conservation. This regional autonomy allows for tailored conservation efforts that address local environmental and cultural priorities but can also lead to inconsistencies in national conservation strategies. For instance, Catalonia and the Basque Country have strong regional identities and significant autonomy, which they use to implement specific environmental policies and conservation measures suited to their unique landscapes and biodiversity needs. However, this autonomy can also result in uneven implementation of national conservation policies, impacting ecological connectivity on a broader scale.

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Major cities like Madrid, Barcelona, and Valencia have seen significant growth, leading to habitat fragmentation and increased demand for infrastructure. Rural depopulation presents challenges for maintaining traditional land-use practices but also opportunities for rewilding and habitat restoration.

Doñana National Park is situated in southern Spain, spanning parts of the provinces of Huelva, Seville, and Cádiz. The surrounding area has a sparse population, with local communities traditionally engaged in agriculture, fishing, and tourism. The park attracts numerous tourists, researchers, and birdwatchers, significantly contributing to the local economy. Conservation efforts have heightened awareness and involvement from both local and international communities in preserving the park's natural resources (‘DOÑANA NATIONAL PARK - World Heritage Datasheet,’ n.d.).

Rules of the game

Spain’s conservation policies and efforts are significantly influenced by its commitments at the EU level since it joined the European Union in 1986. Spain adheres to EU environmental directives, including the Water Framework Directive, the Marine Strategy Framework Directive and the Habitats and Birds Directives, integrated into national law through the Law on Natural Heritage and Biodiversity (42/2007).

Spain's governance involves both national and regional levels. The Ministry of Ecological Transition and the Demographic Challenge (MITECO) oversees national policies, while regional governments implement local conservation measures. The responsibility for designation and management of PAs in Spain lies with the 17 Autonomous Regions with the central government just retaining minimal coordination competencies over the National Park Network across the country (Rodríguez-Rodríguez and López, 2020).

The country has a comprehensive network of protected areas, including national parks, Natura 2000 sites, and marine reserves (EUROPARC-España., 2024).

For effective conservation management, Spain uses Natural Resources Management Plans (PORN) and Management and Use Plans (PRUG). While the PORN serve as a reference framework for all instruments within a Protected Natural Area (ENP), the PRUG establish guidelines that will direct the development of actions within the boundaries of the ENP and, in some cases, its immediate area of influence. There is significant variation in how different regions implement PORN and PRUG. Some regions have well-developed and actively managed plans, while others lack the resources or political will to implement them effectively. As noted in the interviews, ‘Many PRUGs are expired and not reviewed, affecting their effectiveness.’ This leads to outdated management practices that do not reflect current conservation needs or scientific knowledge. Both financial and human resources for managing protected areas are often insufficient. This results in inadequate enforcement of management plans and insufficient monitoring of conservation outcomes (COMMS and http://palace.co, 2017).

Spain's National Strategy for Green Infrastructure and Ecological Connectivity, which came into effect on July 14, 2021, through Order PCM/735/2021 (MITECO, 2022), aims to assist the government, the autonomous regions, and local authorities in developing plans, programs, and actions aimed at strengthening the connectivity of ecosystems, mitigating the effects of climate change, and reinforcing ecosystem services (Fernández-Pablos et al., 2021). This strategy requires regions to develop their own plans. The government mentioned that the autonomous regions would have their strategies in place by 2024 and emphasised the importance of integrating Green Infrastructure into various sectoral policies, including transport, urban development, and agriculture (‘El Gobierno anuncia que las autonomías tendrán sus planes de Infraestructura Verde en 2024 – Fundación Alternativas,’ n.d.).

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However, its implementation has been inconsistent and often lacks the necessary support. From the interviews and our research, we conclude that the main barriers to implementation are the following:

- There is significant variation in how regions implement the strategy. While some regions have made substantial progress, others face resource constraints or lack the political will for effective implementation.
- Effective implementation requires coordinated efforts across different levels of government and sectors. Bureaucratic hurdles and varying priorities among stakeholders complicate the integration of Green Infrastructure into land-use planning, agriculture, and urban development.

Results from the interviews indicate that although some regions have created maps and identified areas, only a few small projects – mainly funded by European funds – have been implemented. One interviewee suggested that increased pressure from the European Union is necessary: 'Improving connectivity requires a shift in priorities and increased pressure from the European Union on governments to prioritise and implement conservation efforts, with the Nature Restoration Law (NRL) serving as the foundation for these changes'.

In the region of Andalusia in which the Doñana region falls, the Master Plan for Ecological Connectivity for the conservation and enhancement of ecological connectivity has been in place since 2014 (de Andalucía, 2018). The plan categorises areas into landscapes of value for ecological connectivity, priority areas for intervention (APIs), areas of reinforcement, and pilot areas. The Master Plan identifies areas around Doñana as being of high priority for increasing connectivity, meaning that they are considered crucial for the ecological network in the region due to their location or low state of connectivity (Junta de Andalucía, 2016). A large portion of the area that does not fall within Natura 2000 is classified as API. Each area has a management plan and intervention strategy (Junta de Andalucía, 2016). It is considered to be the responsibility of the regional governments to ensure ecological connectivity as mentioned by an expert in one of the interviews.

Specific to the Doñana area is the 2014 Plan for the Management of Irrigation located in the North of the Doñana Forest Crown (Junta de Andalucía, 2014). An objective of this plan is to increase the ecological connectivity of key habitats along this particular area in Doñana. This is in part realised through favouring the ecotones between particular land cover types and the optimisation of ecological corridors, managing cattle trails and connecting isolated forest patches. Connectivity is furthermore increased in the area by utilising natural features to connect patches, such as waterways. This is considered the most suitable option for the establishment of ecological corridors in and around Doñana (Junta de Andalucía, 2014). The importance of restoring waterways for connectivity is well known and featured in management plans, but it has not been carried out to date due to the prioritization of economic objectives.

If combined with the other relevant management plans for the area, the API plan for Doñana-Sierra Morena and the 2014 Plan for the Management of Irrigation located in the North of the Doñana Forest Crown, are ambitious enough in scope to remedy the reported lack of ecological connectivity in the area. This is, however, assuming that they are implemented in full, and as of today they are not applied beyond some smaller projects. The Master Plan for Ecological Connectivity in Andalusia is likewise not being implemented due to a lack of political will, with only a single stream restoration project being implemented as one of interviewees mentioned. The heavy reliance on ecological corridors along waterways may showcase how unique landscape features are more important for connectivity than any habitat banking solution merely replacing lost habitats with similar ones after development.

The implementation of ecological connectivity in Doñana is hindered by several barriers. These barriers include inadequate coordination and political will among various administrative levels, multiple overlapping and sometimes conflicting management plans, local pressures, budget constraints, and a lack of consultation with key stakeholders such as farmers.

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Additionally, the excessive politicisation of agriculture and the insufficient alignment of Common Agricultural Policy (CAP) interventions with the needs of Doñana's farmers further complicate efforts to enhance connectivity.

The Master Plan for Ecological Connectivity in Andalusia is funded through NextGenerationEU (European Union, 2020), the European Agricultural Fund for Rural Development (EAFRD) and the European Regional Development Fund (ERFD) (Government of Spain, 2020). The availability of funding outweighs the available personnel to utilise it, this means funding and financial aspects are not a limiting factor to the implementation of this management plan, but knowledge of and subsequent utilisation of the available funding mechanisms are (pers.com. Junta de Andalucía, 2024). The Spanish and Andalucian governments have signed a joint agreement to abolish destructive agriculture methods and invest 1.4 billion Euros in sustainable farming in the Doñana region, halting plans to expand irrigable land around the Doñana National Park, which marks a significant milestone for restoration efforts and demonstrates the possibility of political collaboration for wildlife protection ('The rebirth of the Doñana,' 2023).

People and Organisations

The Ministry for the Ecological Transition and Demographic Challenge (MITECO) is responsible for developing and implementing national policies on climate change, pollution prevention, and the protection of natural resources, including biodiversity, forests, marine environments, water, and energy. It also addresses demographic challenges and territorial depopulation. The Ministry oversees public water and coastal domains, manages national legislation on these topics, and represents Spain in relevant international organisations. MITECO leads the National Strategy for Green Infrastructure and Ecological Connectivity, working to integrate Green Infrastructure into various sectoral policies across Spain. Despite strong policy frameworks, regional disparities and resource constraints pose significant barriers to effective implementation.

Regional Governments (Autonomous Communities): Each of Spain's 17 Autonomous Communities has significant autonomy in implementing local conservation measures and managing protected areas within their jurisdictions. These regional governments develop and enforce regional conservation policies, manage regional parks and natural reserves, and develop regional strategies for Green Infrastructure and ecological connectivity. This regional autonomy allows for tailored conservation efforts that address local environmental and cultural priorities.

NGOs like SEO/BirdLife and WWF Spain are prominent conservation NGOs focused on biodiversity protection and sustainable development. SEO/BirdLife conducts research, advocacy, and education on bird and habitat conservation, while WWF Spain works on various conservation projects, emphasising sustainable development and biodiversity protection. Both organisations are actively involved in monitoring and conservation efforts in Spain, including the Doñana region, engaging in policy advocacy, habitat restoration, and species protection initiatives.

In the case of Doñana, local agricultural associations like 'Asociación de Agricultores Puerta de Doñana' represent the interests of local farmers and engage in sustainable agriculture practices. They advocate for farmer interests, participate in conservation dialogues, and implement sustainable farming practices. Collaboration with these associations is vital for aligning agricultural activities with conservation goals in Doñana.

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3.2.2.6. Leipzig-Halle region

Foundational factors

Landscape

The Leipzig-Halle region is situated in central Germany. The geological formation is called the Leipziger Tieflandbucht. Main geomorphological features are flat moraines with loess and sandy loess cover. The landscape in the study area belongs to the lowlands, with 95-179 meters above sea-level and is mostly flat to hilly (Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie - Referat 61: Flächenschutz, Natura 2000, n.d.). Between the moraines lie the floodplains of the Weiße Elster, Luppe, Parthe and Pleiße Rivers, extending to 5900 ha, of which 1860 ha are covered by floodplain forest (Haase and Gläser, 2009). The alluvial clay soils of the floodplain originate from high sediment loads of the main tributaries Weiße Elster, Pleiße and Parthe during deforestation in the bronze and Middle Ages (Wirth et al., 2021).

In the city of Leipzig, the human influence has led to a variety of 'urban soils' with sealed surfaces, parts of the unsealed soils are gardening soils as well as remnants of the naturally occurring soil formation of the cities´ surrounding landscape (Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie - Referat 61: Flächenschutz, Natura 2000, n.d.).

To the south of Leipzig, just beyond the city a large-scale pit-mining operation in the 20th century had a profound impact on the hydrology of the Leipzig-Halle floodplains. The flow of the Weiße Elster was redirected around the mining areas and the mining operations led to a reduction of the groundwater table in the floodplain area (Wirth et al., 2021). After termination of the lignite mining, the flooding of the lakes started as part of the reclamation of the landscape. Lakes are unusual for the glacially formed moraine-floodplain landscape. The artificial lakes and the related restoration of the landscape provide opportunities to increase ecological connectivity along the lakeshores and recultivated mining dumps (Larondelle and Haase, 2012). Predominant vegetation types and land-uses in Leipzig are typical urban land uses such as settlement and traffic areas covering approx. 61% of the land surface within Leipzig. Other land uses include agricultural land uses (15%), forest (4%), pasture (11%) and ruderal vegetation (5%). Five small-scale land areas protected under national law make up 10.5% of the city area, these are made up of parts of the floodplains and remnant forests, about 2.5% are protected as FFH and SPA under EU Natura 2000 regulations, these include the floodplain forest (Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie - Referat 61: Flächenschutz, Natura 2000, n.d.).

The countryside between Leipzig and Halle is dominated by agricultural land uses (69%) on the loess soils and pasture (7%) on the floodplain soils. Forests make up about 9% of the land cover, 1.2% of the area, especially the Elster-Luppe floodplain forest, are strictly protected under national law, 6% of the areas surrounding Leipzig are protected as FFH and 13% as SPA under EU Natura 2000, these areas are also mainly situated in the floodplain forest (Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie - Referat 61: Flächenschutz, Natura 2000, n.d.).

Historical land use

Traditionally the floodplain forest was used for coppice management, leaving the oak trees (*Quercus robur* L.) standing for construction wood and acorn fattening, while the other hardwood tree species, among them Elm species (*Ulmus spec.*) and Ash (*Fraxinus excelsior* L.) underwent short rotation coppice for fuelwood (Wirth et al., 2021). This traditional form of forestry is a main reason for the structural diversity that resulted in the establishment of the hardwood floodplain forest with its high biodiversity (ibid.).

With agricultural intensification and the growth of the city of Leipzig the conditions for the floodplain changed. The settlement and agricultural use of floodplain areas required drainage

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of the floodplain and the channelling of the Weiße Elster and Luppe rivers, which led to a reduction of the groundwater table and the drying out of parts of the floodplain forest (Haase and Gläser, 2009; Wirth et al., 2021).

Rules of the game

In Germany the designation of types of protected areas is legally based on the 'Gesetz über Naturschutz und Landschaftspflege (Bundesnaturschutzgesetz – BNatSchG)' (federal nature protection law). Due to the history of Germany the nature protection laws underwent several transformations during the 20th and early 21st centuries. The BNatSchG was applied to the former GDR territory after reunification in 1990. It was reformed in 2007 to implement the Fauna-Flora-Habitat directive and again in 2020 to regulate the growing population of *Canis lupus* L. ('Bundesnaturschutzgesetz,' 2024). The federal law sets the guiding principles for nature conservation and the states´ legislation pass laws that regulate largely according to these principles with respect to the states´ special conditions and necessities, including the executive regulations for designating nature conservation areas below the national level.

At the national level federal planning concepts are introduced for infrastructure planning processes requiring nationwide guiding principles. These include for example spatial or nationwide traffic planning, which also influences the state, region of municipal administrative levels. To introduce ecosystem services and nature-based solutions into the nationwide plans the 'Federal Green Infrastructure Concept' (Bundeskonzept Grüne Infastruktur - BKGI) was set up (Mayer and Schiller, 2017). The BKGI serves the purpose of implementing the EU Biodiversity Strategy based on the concept of green infrastructure, into national planning (Mayer and Schiller, 2017, p. 10). The objectives and goals of the BKGI are (Heiland et al., 2017, p. 26):

- Implementation of the EU GI concept at the national level
- Facilitate coordination with neighbouring countries
- Provide the foundation for all nationally relevant environmental protection requirements
- Merge the existing environmental protection concepts at federal administrative level
- Concretize the spatially relevant objectives of the National Biodiversity Strategy
- Identify key tasks and areas of nature conservation at the federal level to allocate activities and financial resources more efficiently
- Support nature conservation agencies at all administrative levels by providing nationwide information and evaluation criteria
- Provide information for other sectoral planning at federal and state level to identify areas of relevant GI, to enhance ecological considerations in planning processes.

Being developed in close cooperation with a scientific research and development project, the BKGI is rooted in the BNatSchG and provides more detailed information on the types of landscapes, conservation hotspots and connectivity bottlenecks of the national network of protected areas, landscapes and natural monuments, as well as guidance for ecological planning across national administrative and international borders, by providing nationwide thematic maps for the relevant Green Infrastructure networks (Heiland et al., 2017; Mayer and Schiller, 2017). The BKGI is not part of the federal legislation and thus not legally binding.

For the case study area of Leipzig-Halle both the federal as well as the state nature conservation laws (Naturschutzgesetz des Landes Sachsen-Anhalt NatSchG LSA, Sächsisches Naturschutzgesetz SächsNatSchG) contain regulations referring to the protection and conservation of nature as well as connectivity of these protected areas, as well as regulations concerning the development and protection of the Natura 2000 network. The state laws paragraphs refer to the corresponding paragraphs in the federal law. Further influence on environmental and landscape protection and nature conservation comes from the

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spatial planning laws of the administrative levels, the federal spatial planning law, in German: Raumordnungsgesetz (ROG) and the state spatial planning laws of Saxony (Landesplanungsgesetz SächsLPlG) and Saxony-Anhalt (Landesentwicklungsgesetz Sachsen-Anhalt LEntwG LSA). In urban areas the demand for multiple different landscape functions leads to the inclusion of different regulatory frameworks needing to be integrated in the process of planning, conserving and developing urban Green Infrastructure, protected areas and connectivity. To accomplish this in the complex urban setting the city of Leipzig has an urban development strategy that is based on the integrated urban development concept 2030 (Integriertes Stadtentwicklungskonzept (INSEK) 2030), that combines the relevant departmental plans and their essential development-specific messages (City of Leipzig, 2024). The department-specific plan relating to urban Green and Blue Infrastructure is the specialist concept for open space and the environment. The INSEK´s concept for open space and the environment reflects the challenges of urban development of a growing city between Green-Blue and Grey Infrastructure development (City of Leipzig, 2018). The structure of connectivity within the city and beyond is oriented towards a ring-radial system, that aims to include the riparian zones of the urban riverbanks and floodplains as axis to connect Green and Blue Infrastructure elements (ibid.).
Another key concept of the plan is termed ‘Doppelte Innenentwicklung’, which can be translated into ‘two-fold inner development’ and describes the idea of treating the development of grey infrastructure equal and in relation to the development of green and blue infrastructure (City of Leipzig, 2021, p. 16). Brownfields left from the period of shrinkage following the reunification shall be developed into new greenspaces serving as recreational areas for the densely built-up inner-city quarters. Processes of proactive planning and civil society engagement are key to achieve a feeling of ownership among Leipzig´s residential population (City of Leipzig, 2018, p. C–3). However, it has to be acknowledged, that the concept for open space and the environment is only one departmental plan including eleven others, among them Housing or Economy and Employment, which can lead to conflicts, especially when different actors are involved in the procedures.

In 2021 the Masterplan ‘Green’ Leipzig 2030 (Masterplan ‘Grün’ Leipzig 2030) was introduced with the objective to counter unbalanced growth in favour of buildings and traffic infrastructure construction (City of Leipzig, 2021, p. 11). The Masterplan was also showcased as a model-project in the urban green labs project by the Federal institute for Research on Building, Urban Affairs and Spatial Development (Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumforschung (BBR), 2021). The Masterplan can be interpreted as an addition to the INSEK with a special focus on the green space development, as it aims to identify the potential for improving existing greenspaces as well as developing new ones. The planning process started in 2017. Initiated by the City of Leipzig, Office for Urban Greenery and Waters the process of developing the Masterplan was based on a broad citizen involvement including online-surveys, open meetings, city-walks and workshops for stakeholders such as allotment-garden associations, which increased awareness of the masterplan and its objectives (City of Leipzig, 2021). The main topics of the Masterplan are adapting to climate change, biodiversity, health, environmental justice and active mobility, and it builds on the two tasks of safeguarding Green and Blue Infrastructure and developing and qualifying Green and Blue Infrastructure areas and their connectivity (City of Leipzig, 2021, p. 11). The Masterplan extends beyond the city limits of Leipzig by identifying so-called landscape development corridors (Landschaftslinien) to connect the Green and Blue Infrastructure in the city with protected areas outside the city limits (City of Leipzig, 2021, p. 19). The corridors are a strong concept of green connectivity and extend the guiding concept of the ring-radial-structure envisioned in the INSEK 2030 by providing clear designations and development objectives.

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People and Organisations

In the City of Leipzig several organisations from the city administration, scientific community and NGOs are working on projects related to nature conservation and ecological connectivity. Some of these projects are related to urban greening within the City of Leipzig, others, especially the projects concerning the floodplain forest go beyond the city limits and address ecological connectivity between the urban and the peri-urban landscape.

In the city of Leipzig, the city administration´s Office for Urban Greenery and Waters is an important actor for the Green Infrastructure development and ecological connectivity. The 'Masterplan Green Leipzig 2030' is an example of how the development of Green Urban Infrastructure can be strengthened in comparison to other urban land uses (Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumforschung (BBR), 2021) (see also Box 4). Despite being an informal planning-tool, a decision by the city council highlights the importance of considering the Masterplan's guiding principles in planning processes (City of Leipzig, 2021, p. 4). The relevant stakeholders of Leipzig were involved in the conception of the Masterplan to include all relevant viewpoints of urban life end well-being (City of Leipzig, 2021, p. 6). The City of Leipzig´s Office for Environmental Protection also operates an environmental information centre (UIZ), that provides ecological advice, education and communication for citizens and organisations. The UIZ is supported by a support association made up of local stakeholders from the local economy and civil society ('Environmental Information Center (UiZ) - City of Leipzig,' n.d.).

In Leipzig there are also a number of NGO as well as scientific organisations working on conservation and development of urban green spaces, biotopes and ecologic connectivity. These are either the regional chapters of national conservation NGOs such as the 'Bund für Umwelt und Naturschutz' (BUND) or the 'Naturschuzbund Deutschland' (NABU), and also a local environmental NGO, the 'Ökolöwe Leipzig'. The environment NGOs in Leipzig work mainly in educating the public and providing guidance for citizen based greening projects, such as greening backyards and cemeteries, or facade greening ('Grüne Höfe - BUND Leipzig,' n.d.; 'Insektensommer,' n.d.; 'Projekt Kletterfix - Ökolöwe,' n.d.). Scientific organisations based in or near Leipzig-Halle (Helmholtz Centre for Environmental Reserch – UFZ, German Centre for Integrative Biodiversity research – iDiv) are also active in environmental education in Leipzig, partly in cooperation with the city´s Office for Urban Greenery and Water ('Leipziger BlauGrün,' n.d.; 'VielFalterGarten - City of Leipzig,' n.d.).

In the area surrounding Leipzig, the Green Infrastructure connectivity requires connected initiatives directed at planning across administrative borders at the municipal level. The initiative 'Grüner Ring Leipzig' ('Green Ring Leipzig') provides the framework for regional consultation and cooperation based on an agreement according to the Law of municipal cooperation ('Was wir tun — Grüner Ring,' n.d.). The action plan of the Grüner Ring contains a number of key projects that are directed at stable ecosystems and experienceable landscapes, including stabilising floodplain ecosystems, water management, sustainable forestry, urban gardening and sustainable regional mobility (Becker et al., 2015; Regionales Handlungskonzept Grüner Ring Leipzig 2014 - Katalog Schlüsselprojekte, Stand Februar 2015, 2015). The first key project in the action plan concerns the revitalisation of the Leipzig-Halle floodplain landscape which requires restoring the groundwater situation of the Weiße Elster, Pleiße and Luppe Rivers (Regionales Handlungskonzept Grüner Ring Leipzig 2014 - Katalog Schlüsselprojekte, Stand Februar 2015, 2015, p. 2,3).

The revitalisation of the floodplain landscape is a major building block of the ecological connectivity in the region and an example for an integrated project involving municipal administrations of the respective municipalities, scientific organisations and environmental NGOs in the cooperative project 'Lebendige Luppe' (Living Luppe) (Scholz et al., 2022). Project partners were the city administrations of Leipzig and Schkeuditz, the NABU Saxony, the UFZ and the Leipzig University, project funding is provided by the 'Bundesprogramm Biologische Vielfalt (Federal Program for Biodiversity) ('Lebendige Luppe,' n.d.).

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Funding of local and regional nature conservation and ecological connectivity depends on the actors involved in the respective initiatives. Projects from the city administration are mainly financed by public money, in detail federal, state and communal funding. A notable exception is the street tree sponsorship initiative, which enables citizens to sponsor the planting of and care for an urban tree in the city of Leipzig. This initiative is based on donations and thus uses mainly private funding to support communal tree planting efforts (‘Baumstarke Stadt - Baumpatenschaft und Spendenaktion - Stadt Leipzig,’ n.d.). Science institutions that are also involved in nature conservation, restoration and connectivity are financed mainly from federal as well as state funding. NGO's local nature conservation and connectivity initiatives are mainly financed by donations, with a smaller proportion of federal and communal funding, depending on their respective projects.

At present and in the near future, the successful promotion and implementation of nature conservation and green connectivity will increasingly depend on the potential of environmental planning professionals and the political will of elected decision-makers. The NC interviews on the one hand and the European elections on the other have given clear indications to this effect.

3.2.3. People and organisations at the international level

At the global level, key players like the Convention on Biological Diversity (CBD) and the International Union for Conservation of Nature (IUCN) provide platforms for discussions and the development of knowledge and frameworks essential for nature conservation. The CBD, an intergovernmental process governed by a convention, and the IUCN, a membership organization comprising government and civil society members, are influential in shaping biodiversity policy. The CBD's Global Biodiversity Framework lays out common goals and objectives, providing an overarching structure for developing National Biodiversity Strategy and Action Plans (NBSAPs). The EU Green Deal also aligns with the broader CBD Post-2020 Global Biodiversity Framework, as does the Carpathian Convention's Biodiversity Framework.

The EU is a dominant player in environmental policies within its Member States, but the implementation of connectivity-related legislation varies significantly across the Union. This variation is influenced by the Member States' legal and institutional setups, socio-economic characteristics, time of accession, and key political moments, such as rulings from the Court of Justice of the EU. The Nature Restoration Regulation will add another dimension to this work through national restoration plans aimed at establishing an ecological network via the Trans-European Nature Network (TEN-N), a key element of the European Commission's Biodiversity Strategy.

Despite being the original architect of the TEN-N concept, the EU faces challenges in integrating environmental matters into broader policy areas. Various Directorates-General (DGs) often work in silos (according to various interviewees), leading to contradictory signals sent to stakeholders. For instance, the EU promotes strategies for developing energy and transport infrastructure through the Trans-European Networks for Energy and the Trans-European Transport Network, which are not always sufficiently integrated with nature protection efforts. This lack of integration is evident in Romania where an interviewee mentioned the contradictory EU financing concerning water dams: EU funds simultaneously support dam removals for river restoration and the completion of large hydropower projects on the last free-flowing rivers.

During interviews, it was highlighted that the EU's role is crucial in pressuring Member States to implement and maintain ecological connectivity. The prime example is the EU's involvement in Doñana in Spain, where an infringement procedure was instrumental in addressing environmental concerns.

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In addition to its environmental policy, the EU is also an important source of funding and has the power to ensure this funding maintains and enhances connectivity. In some Member States the EU is the major funder of large infrastructure projects. The European Commission's decisions on which infrastructure projects to fund under the Connecting Europe Facility, and how to address environmental concerns during design and construction can have a major impact. A similarly important decision is the approval and amendments to CAP Strategic Plans (see section Opportunities to use EU funding for TEN-N). Given the apparently low ambitions of the CAP Strategic Plans (Nemcová et al., 2022), requesting remedial action to address the deficiencies such as in the share of land under management for landscape features can make a difference for connectivity in countries or regions.

Financial resources allocated for nature protection in the EU Budget 2021-2027 (€29.2 billion) are considerably less than those for other sectors, such as the Common Agricultural Policy (CAP) with €386.6 billion. This funding disparity reflects the balance of power among DGs. Moreover, the EU plays a crucial role in pressuring Member States to maintain and enhance ecological connectivity, as seen in the infringement procedure in Doñana, Spain, which addressed environmental concerns.

Intergovernmental organisations, in particular the Convention on Biological Diversity (CBD) play a role in the EU through agenda setting at EU and national level. The CBD has promoted concepts such as ecosystem services and No net loss and framing the conservation debate through protected area targets and OECMs, as well as providing technical guidance. Importantly, the EU Biodiversity Strategy to 2030 is built on the global biodiversity framework of the CBD. Other agencies of the UN also support policy and action for ecological connectivity. In particular the IUCN and its World Committee on Protected Area Connectivity Conservation Specialist Group contribute to knowledge sharing and capacity building via guidance documents and its Transport Working Group, a community of professionals working on transport, which covers roads, railways and canals.

The Network of Regional Governments for Sustainable Development (nrg4SD) aims to advance sustainable development globally at the subnational level. It serves as the sole international network exclusively representing subnational governments in sustainable development matters, providing a unified voice on the global stage.

The EUROPARC Federation is a network of European protected areas that promotes sustainable management and conservation practices. It provides support, best practices, and advocacy for protected area managers. The Federation facilitates cross-border conservation initiatives and supports the implementation of EU directives, playing a critical role in enhancing ecological connectivity and biodiversity conservation across Europe.

3.2.4. Insights from the literature on the rules of the game

The governance of ecological connectivity has been the subject of many studies over the years and a range of best practice has been identified. Most of these studies address the rules of the game – the informal and formal arrangements that govern policy design and implementation. This section provides a short summary of a number of key studies, on barriers, the role of Green Infrastructure, legal protection mechanism and spatial planning and financial support mechanisms, as well as informal arrangements facilitating civil society initiatives in urban and rural settings.

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Barriers to ecological connectivity

Some rules of the game can be a major barrier to maintaining and enhancing ecological connectivity, that no best practice can overcome. The maximisation of profit in agriculture, as an informal rule, is one of the most important barriers. In the Couesnon river basin in France, further agriculture intensification was forecasted to strongly decrease the connectivity of wetlands, woodlands and grasslands (Houet et al., 2022). The Blue and Green Infrastructure network in France (*La trame verte et bleue)* while effective at protecting corridors from infrastructure, was unable to make a significant difference. Instead, connectivity depended on the global economy and the demand for bioenergy. An agroecological transition on the other hand was able to greatly increase the connectivity.

In forested landscapes maximum sustained yield forestry results in similar problems. This was illustrated by a review of forestry practice in the Bergslagen region in Sweden (Angelstam and Elbakidze, 2017). Following changes in the land tenure system in the 18th century from a communal system to individual tenure, maximum sustained yield emerged as the dominant informal rule for land use. Currently the forests in the region and the rest of Sweden are expected to be harvested every 60–80 years. Combined with the small network of protected areas this has resulted in a rapid and ongoing loss of connectivity.

Even with mitigation measures and best practice in spatial planning, a large expansion of the transport network will be a major barrier to connectivity. The future transport infrastructure networks will reflect the demand for the different transport modes (road, rail, inland navigation etc.). The lack of management can be a barrier for maintaining connectivity and mirrors the points above in terms of primacy of profits. At the local level a study on connectivity in the Poznan metropolitan area in Poland forecasted the effects of different transport policies (Gadziński, 2015). Transport policy has a strong effect on the degree of fragmentation of Green Infrastructure, through its effects on traffic density and future network development.

Linking Green Infrastructure to connectivity

Green Infrastructure is a ‘boundary concept’, a concept that is flexible enough to be adapted to local needs and different perspectives, but robust enough to keep its coherence when used in communication by different groups. A review of GI in the context of biodiversity conservation found that while GI’s strength in combining connectivity with bringing in planners and the private sector, for many projects biodiversity conservation is a co-benefit or desirable side-effect (Garmendia et al., 2016). It is important to acknowledge uncertainty of GI in providing connectivity, to handle unintended consequences of GI for biodiversity and connectivity, follow EIA and other safeguards for biodiversity during GI deployment and address trade-offs between ecosystem services and connectivity.

[Box 2] Pathways to protected area designation

There is a large diversity of protected area designations in the European Union. A survey by the European Topic Centre for Biological Diversity examined the current practices in protected area designation in 12 EU Member States. The most relevant types of protected areas for nature conservation in the EU are Natura 2000 sites, UNESCO World Heritage sites and Biosphere Reserves, however in several countries National Parks or Reserves, Natural Monuments and Landmarks and Protected Landscapes are also relevant.

The Natura 2000 network is the main driver for the designation of new protected areas and the expansion of existing ones, based on the specific obligations under the Birds and the Habitats Directive. However, the survey found that designation of new Natura 2000 sites

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has slowed down in recent years in some Member States and has become increasingly difficult, as the conflict with local stakeholders has become greater. There is a trend that new protected areas tend to be smaller and isolated, which means that the administration costs can be higher and protecting their ecological integrity can be more difficult.

NGOs in Denmark detailed in their response that the agricultural and forestry sectors play a key role in decision-making on designation, as these sectors are powerful interest groups and economic losses for these sectors are of political importance. Because of this, several large, protected areas have not been designated on farmland. Conservation easements on private forests are largely unsuccessful due to opposition to restrictions or demands for high compensation.

In general, to improve the designation of new protected areas the development or improvement and implementation of a national strategy for protected areas, includes designation parameters and specification of conservation objectives was seen as best practice. Survey participants mentioned the need to development guidance on stakeholder participation in decision-making and on the balancing of legal interests of landowners.

Source: (Naumann et al., 2022)

Legal protection of connectivity

Many EU Member States have formally designated ecological networks (see table 3). Providing the ecological corridors, rivers, stepping stones and other landscape elements of ecological networks with an adequate degree of legal protection is important for the long-term functionality of such networks. This section complements the review of legislation in the case studies. It is also worth noting that designating corridors with legal protection is very similar to designating protected areas in terms of challenges and best practice.

An example of best practice for the legal protection of connectivity is the protection of the network of protected areas in the Czech Republic (Václav et al., 2021). The Czech Republic has a network of protected areas based on Act 114/1992 on Nature and Landscape. This Act is complemented by Act 183/2006 on Spatial planning and Buildings Regulations. The Nature and Landscape Protection Agency AOPK of the Czech Republic is responsible for implementing this act developed guidance on how to integrate connectivity requirements for large mammals into spatial planning.

The guidance introduces a map of biotopes, migratory corridors and bottlenecks. Bottlenecks have a high degree of protection. The AOPK will not permit buildings or infrastructure that would reduce passage by large mammals. Migratory corridors have a lower degree of protection. When constructing new buildings, a minimum corridor width of 500 meters needs to be maintained. New linear infrastructure can be subject to mitigation measures. Most types of fences are prohibited. New waterworks are assessed on a case-by-case basis.

Implementing a legally protected network can be challenging. The Institute for Nature and Forest Research INBO carried out an in-depth evaluation of the implementation of the Flanders Ecological Network (VEN) in Belgium (INBO, 2023). Ecological corridors in Flanders are multifunctional areas, which are habitats for some species and corridors for others. Realisation of the network has been slow, and the ambition for the network have been lowered considerably over the years.

To get implementation to move forward, INBO identified a series of best practice measures. The Flemish government should use their own land including through land exchanges and be willing to expropriate where needed. Increasing of funding is needed, but employing other financial tools payments for ecosystem services, if these are beneficial for conservation and

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do not become the main motivation for stakeholders and using the Municipal fund for paying municipalities for provisioning ecosystem services are also key. Broadening offsetting and the mitigation hierarchy beyond the Habitats Directive to other species and to grasslands. Finally, INBO recommends experimentation in a low-regulated context, and increasing inclusivity for example by urban dwellers owning land in the countryside.

Legal protection of wildlife crossings is a best practice measure to ensure their functionality. Croatia has a substantial population of large carnivores. Wildlife crossings allow these mammals to cross highways for example the highway from Zagreb to Rijeka through the Dinaric Alps which were found to be highly effective (Kusak et al., 2009). The legal basis for wildlife overpasses is the Ordinance on Animal Crossings (Government of Croatia, 2006). This Ordinance divides corridors into category I corridors (crossings for small wild animals (up to 20 meters wide, existing crossings for all wild animals up to 600 meters wide, and specially constructed crossings) and category II (corridors wider than 600 meters).

The Ordinance obliges the developer to construct wildlife crossings, and the legal entities responsible for roads, railways, forests, water and water resources to maintain their permeability, as well as to maintain the vegetation in a radius of 300 meters. On category I crossings all human activities (hunting, economic activities, recreation, etc.) are prohibited that temporarily or permanently affect the functionality of the corridor.

Using spatial planning for connectivity

Without designated ecological corridors, spatial planning can still be effective in preserving connectivity. A study examined spatial planning on the Italian island of Sardinia (Isola et al., 2022) where there is a network of protected areas such as Natura 2000 sites and regional parks, public woods and ‘permanent oases of faunal protection’. The Regional Landscape Plan identifies environmentally relevant landscape components and awards them a varying degree of protection. All transformation of natural and seminatural areas is forbidden if it undermines ecosystem integrity. There are specific restrictions on new buildings, infrastructure and recreation for the ecosystem types.

The study overlaid the maps of optimal ecological corridors with the environmentally relevant landscape components and found that all landscape components increased the suitability of an area as an ecological corridor. In particular protection woodlands and oak and chestnut woods were found to be beneficial.

Zonation of land use can also be a powerful tool. A study investigated the performance of forestry zonation with the Forest Stewardship Council (FCS) certification in terms of maintaining structural connectivity in Lithuania (Elbakidze et al., 2016). The low intensity forestry management in Lithuania in the 1990s was a legacy from Soviet occupation. The country rapidly transitioned to a market economy. The forests are about 50% state-owned. Forestry zonation is based on the 1994 Forest Law and introduces strict reserves (group I), protective, restorative and recreational forests functions with significantly prolonged rotations and no clear felling permitted (II); forests to protect soil, air, water in combination with forming productive forest stands with prolonged forests rotations (III) and economic forest (IV).

The formally protected forest areas (group I and II) provided greater habitat connectivity of all forest types, as well as functional patches for most species, compared to voluntarily set-asides under FSC which provided poor habitat, poorly connected habitat and covered a low percentage of old-growth forests. However, for species that require habitat patches of more than 1 000 hectares the functionality of formally protected areas was still limited.

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Finally, integrating connectivity requirements into permitting procedures is also a form of best practice. A report by WWF (WWF, 2018) identified a network of ecological corridors on mainland Spain. A key problem is the construction of transport infrastructure, that has been increasing over the last two decades. The impacts of transport infrastructure practically extend over the whole country and have likely had severe impacts on the populations of large mammals. Fragmentation by agricultural changes and irrigation have also been important.

WWF recommends integrating the conservation and expansion in any type of spatial planning (infrastructure plans, modernisation of irrigation, CAP implementation). In particular, the ecological corridors should be included in the processes for **environmental assessment of projects and strategic environmental assessment** at national level and in the autonomous communities. This should be done on the bases of the map of current and potential ecological corridors to identify specific measures for these plans and projects.

Rivers are often important structural connections between protected areas. A study on river connectivity on the Balkan peninsula found that 52% of the protected land area is connected by rivers without large dams generating more than one MW (Papazekou et al., 2022). Planned dams will reduce this area to 33%. Strategic planning of hydropower is considered best practice, on a basis of optimal selection of further sites for hydropower in combination with dam removal. Local communities have been key stakeholders in preserving connectivity in several countries, and empowering them in decision making is crucial, as is ensuring international cooperation and funding for non-EU countries.

Combining connectivity with ecosystem services

If connectivity measures are implemented across the EU, they have the potential to contribute to a range of **ecosystem services**. A study investigated how an EU Green Infrastructure network could be designed that would cover the distribution of 767 vertebrate species and 229 habitats (under a ‘conservation management zone’) and would support the provision of five ecosystem services, while connecting existing Natura 2000 areas (Hermoso et al., 2020). The study used two planning scenarios: 1) EU based planning, with the full network planned at the continental scale, and 2) country-based planning, with each EU Member State doing an independent planning exercise.

The study found that an EU based approach was more efficient at achieving intermediate and large targets for ecosystem services, as an EU based approach required less area. The EU based approach also led to a better Trans-European Network, with more comprehensive cross-border connections. A country-based planning required more area to be specifically designated for connectivity.

Combining floodplain restoration with flood protection has shown its potential in the Netherlands and Hungary. A study reviewed floodplain restoration initiatives and policies in these countries and four others (Schindler et al., 2016). Historic and recent losses in floodplain connectivity occurred due to many different pressures including hydrological alterations, agricultural intensification, hydroelectric dams and urban development. The major successes in floodplain restoration in the Netherlands and Hungary shared extensive stakeholder involvement in all stages of the process and a task for the relevant agencies managing floodplains to address flood protection as the number one priority. In addition, cooperation between multiple levels of government played a key role in the Netherlands, while National Park Directorates played a key role in Hungary as local champions.

Combining connectivity with carbon neutrality was found to be best practice in Southern Finland. This region is largely covered by forests, but only patches hold high-biodiversity value.

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A study developed a framework for integrating carbon neutrality with conservation (Forsius et al., 2021). One of the metrics for biodiversity conservation was connectivity measured as distances between high value sites and structural connectivity between forests with dead wood potential. The study found strong potential for a policy which jointly promotes carbon neutrality and biodiversity conservation, based on mitigation actions, land use planning and payments for ecosystem services by landowners. The payments can be implemented by extending the existing payments for biodiversity.

Financial tools

Agri-environment(-climate) measures are an important tool for maintaining and enhancing connectivity. Several forms of best practice have been identified for these. Semi-natural grasslands in South-Western Finland are severely fragmented. While some of the most well-connected grasslands are in Natura 2000 sites, many others are not. Conservation of these grasslands can be supported by agri-environment schemes for biodiversity management traditional biotopes. A study found that integrating connectivity considerations into agri-environment measures was a crucial measure, as there was a mismatch between the support under the CAP and the quality of the grasslands (Arponen et al., 2013). The study recommends a targeted dialogue with the farmers managing the most well-connected grasslands, to increase participation and long-term commitment, and adequate financial incentives for this group.

In agricultural landscapes, there are small remnants of natural vegetation, typically small and narrow strips. Effective implementation of connectivity in these landscapes depends on the restoration of riparian vegetation and enhancing and maintaining landscape complexity. Agri-environment measures can be employed for this, including by promoting agroforestry and restoring and conserving the remnant vegetation, on the basis of landscape level collaboration between farmers.

Spain has a rich biodiversity and an extensive Natura 2000 network. A study looked at governance tools for restoring forest and woodland connectivity in this network (De La Fuente et al., 2018). Public forests are an **OECM** that are strategically located for functional connectivity. They have typically been managed sustainably for a long time and have been successful in maintaining or restoring forest cover.

[Box 3] Collaborative learning

'Collaborative learning is a means of identifying a common frame for complex situations and from this base to define and develop new opportunities by joint learning. It is a transdisciplinary approach […]. Collaborative learning emerged out of a frustration with more conventional processes of public involvement in planning that have done little to share power and involve diverse groups of stakeholders. Pre-requisites for collaborative learning include that stakeholders share a willingness to collaborate (San Martín-Rodríguez et al., 2005) work as equals (Arnstein, 1969), respect each other's opinions,interests and professions (San Martín-Rodríguez et al., 2005), and empower each other'(Fung and Wright, 2001).

'Practically, collaborative learning includes identification of the potential among stakeholders, setting up a series of events to promote learning and creative thinking, contributing new knowledge to the process and arranging constructive debates to support stakeholders and their learning. In addition, it also includes the implementation of these

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ideas, assessment of outcomes and thoughtful reflection (Daniels and Walker, 2001). To handle this, collaborative learning is built on approaches and practices from the fields of negotiation, conflict management, deliberative democracy and soft systems theory that are put together as a framework for development and change through joint learning' (Cheng and Fiero, 2005).

Source: (Angelstam and Elbakidze, 2017) page 138.

3.2.5. Insights from the literature on people and organisations

People and organisations can drive the implementation of ecological connectivity. There is a limited number of studies and reports that cover people and organisations. This section summarises a few key studies and reports on civil society initiatives, including in urban areas, professional organisations, local champions and agencies managing linear infrastructure.

Civil society initiatives

Many initiatives to restore or maintain ecological connectivity are driven by civil society. The governance frameworks discussed in this section are different of the top-down, legislative and planning approaches described in the previous section. We understand civil society as groups of people working together, including the nonprofit sector, grassroots associations and social movements, and green enterprise and entrepreneurs (Edwards, 2011).

Supporting **collaborative learning approaches** (see Box 3) is considered a best-practice governance for civil society initiatives. Due to the rule that stakeholders work as equals while collaboratively learning, it is best suited for initiatives aiming at restoring or maintaining ecological connectivity where this is not a legal requirement.

A shared vision on the future can inspire and support the restoration ecological connectivity and the creation of Green Infrastructure. Two types of visions can be considered best practice: urban visions and landscape visions.

Urban visions are a powerful tool for creating ecological connectivity in urban landscapes. A review of urban river restoration systems in several major cities examined the factors that enabled these projects (Perini and Sabbion, 2016). The restoration of the corridor along the Paillons River in Nice has been based on the Paillons River Contract for the river and its tributaries (*Contrat de Rivière des Paillons*). This Contract is a technical and financial commitment between the national government and local authorities and stakeholders. The project aims at flood protection and the improvement of water quality, the restoration of the river landscape. In the city of Nice, the design of the *Promenade du Paillon* was the result of a design competition and combines grey and Green Infrastructure.

In the Ruhr area the restoration of 120 km of the Emscher river was driven by the Emschergenossenschaft, a water management organisation. This organisation held a design competition which resulted in the Future Emscher Masterplan[i] at the urban landscape level. The plan brought together NGOs, municipalities and the *Land* Nord Rhine-Westphalia. Rather than a radical urban landscape redesign, the Emscher river involve using the available spaces along the river, with 'assisted natural restoration' only in some areas.

The power of **landscape visions** has been illustrated in two landscapes in the Netherlands (van Rooij et al., 2021). The concept of a Bee landscape was used as a boundary concept. This boundary concept brought a regional authority (Province of South Holland), a company (Heineken) and a research institute (Wageningen University and Research) together, joined

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later on by another 20 organisations. For creating connectivity for pollinators in the intensive agricultural landscape, ecological expertise was brought in.

'Plan Ooievaar' united the water management authorities and conservation NGOs with the Black Stork as boundary object. It restored connectivity of rivers to their floodplains on the back of two flood events in 1993 and 1995 and growing awareness on climate change, resulting in a paradigm shift in flood management. The project also benefited from innovative policy instrument that changed the parameters for civil engineering.

Both landscape vision benefited from well-chosen boundary concepts, a landscape dimension, a link with landscape services in particular climate change adaption, and a landscape-based plan. Opportunities for transformative change were created by developments that put an end to business as usual and encouraged transformative innovation.

Urban connectivity

Governance of green spaces in cities varies widely. A review across Europe (Buijs et al., 2016) found that two types of governance arrangements were promising in realising connectivity outcomes: strategic planning instruments that invited grassroots and citizens to participation in spatial planning or green space creation and maintenance ('municipality mobilising social capital') and grassroots initiatives.

The rules of the game in a municipality are an important determinant for the mobilisation of social capital. Best practice is for the municipality to finance and facilitate the organisation of citizens, and to ensure inclusiveness (see Box 4). Municipalities should also ensure flexibility in the formal and informal rules, including a flexible time planning. Grassroots initiatives play a different role. While most grassroots initiatives work on relatively small scale, they can be strong advocates for realising ecological connectivity.

[Box 4] Best practice example urban Green Infrastructure planning and public participation

The Office of Urban Greenery and Water of the city of Leipzig initiated a planning process to emphasize the benefits of urban Green and Blue Infrastructure and relating them to current and future urban development challenges.

The main objective of the 'Masterplan Green 2030 Leipzig' is to prevent unbalanced urban development at cost of the Green and Blue Infrastructure. The background for Leipzig´s office of Urban Greenery and Water to initiate the planning process that was explicitly focussed on strengthening the role of urban greenspace planning was the dynamic situation of urban growth of unique proportions compared to the rest of the region which lead to increasing land-use pressures, from housing and traffic sectors, on the areas of partially spontaneous urban nature originating from post-socialist urban shrinkage. The Masterplan emphasises the ecological functions of urban natural ecosystems and ecologic connectivity as nature-based solutions to meeting current and future challenges for urban areas, which were identified as guiding topics for the masterplan:

- Climate change adaption – heat resilience and water management
- Biodiversity – providing protection to valuable biotopes in the city
- Urban Health – mitigating the urban health hazards noise, heat and air pollution
- Environmental justice/equity – ensuring equal distribution and access to greenspaces in planning processes.
- Active mobility – shifting the modal split from motorized to non-motorized individual traffic.

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The process of the Masterplan involved intensive engagement of Leipzig´s stakeholders including city administration, civil society organisations, urban service providers, politics, citizens, planners and the economy in ongoing participative processes. The Masterplan also includes concepts for ecological connectivity to the surrounding region.

The strength of the 'Masterplan Green 2030 Leipzig' lies in the early, almost pre-emptive, explicit emphasis on nature as important objective in urban development. This set the agenda for early integration of ecological considerations in urban land-use planning and allowed for a participative process focussed on Green Infrastructure and ecological connectivity planning on equal terms with other urban land-use requirements.

Source: (Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumforschung (BBR), 2021, pp. 38–41; City of Leipzig, 2021)

Professional organisations

The Infrastructure and Ecology Network Europe (IENE) brings together a range of experts on transportation, infrastructure and ecology from a range of ministries and agencies, universities and research institutes, enterprises and NGOs from more than 50 countries, with a focus on Europe ('Harmonizing Transportation and Nature | IENE,' n.d.). The network organises conferences and workshops for knowledge exchange and collets relevant guidance from its member countries. The IENE Handbook on Transport and infrastructure (Rosell et al., 2023) brings together best practice in addressing biodiversity impacts of roads, railways, powerlines and pipelines, waterways and ports and airports. The Handbook identifies best practice on a range of topics such as policy and strategic planning, implementation of the mitigation hierarchy, monitoring and maintenance.

Local champions

The Province of Trentino in Italy developed a well-connected network of protected areas under a LIFE Project (Bassan, 2023). The territory of the Province was divided into 14 homogenous areas. For each of these areas, a network was established with a network president (a mayor, community leader etc.), a coordinator, a working group and a participatory forum (a body with the relevant stakeholders) were established. In total ten areas in Trentino have now such networks. These networks are formalised through nine agreements and three-year programmes. The Province provides up to 50% cofinancing for activities in the network.

Agencies managing linear infrastructure

The Transmission System Operator (TSO) ELIA and the TSO RTE are responsible for the electricity grid in respectively Belgium and France. Under the LIFE Project LIFE ELIA-RTE they developed guidance for TSOs and landowners under the electricity grid (LIFE ELIA-RTE, 2017). The guidance showcased corridors under high-voltage power lines that are managed for ecological connectivity, in particular as ecological corridors but also as stepping stones (ponds, area under pylons in agricultural land). TSOs from nine EU Member States and the TSO from Switzerland have developed best practice on vegetation management. The guidance calls for an environmental right of way, on the basis of a fitting regulatory framework for management and the right the manage the vegetation under the power lines even if not owned by the TSO.

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3.3. Critical review of existing and novel financing mechanisms

3.3.1. Land-use policy options to implement TEN-N

The review of the governance challenges to creating and maintaining ecological corridors and ecological connectivity areas in the previous sections highlights that a major challenge is finding legal and governance structures and adequate funding flows to get private land committed to ecological connectivity objectives and to compensate landowners for economic losses from designation or protection. Box 5 explains some key governance instruments for nature conservation and safeguarding ecological corridors on privately owned land.

[BOX 5]: Land use governance instruments for private land

Conservation agreement

Voluntary contractual tool that can either transfer land use rights/competencies relevant for conservation from a landowner to an organisation with nature conservation objectives (NGO, public authority, or other type of organisation) or restrict uses of land for conservation purposes when it is leased to an external party (conservation lease contract) (Pons and Brummer, 2023). The agreement can be of a range of durations but ends with the sale of the land.

Conservation easement/covenant/servitude/restriction

Tool of property law that grants a right to a public authority or a qualified conservation organisation to restrict land use on properties not in their ownership, i.e. restrict land-use rights that are otherwise held by the landowner. The primary goal is to protect the land and its conservation values. The easement functions similarly to regulatory restrictions on land use but results from a direct voluntary contractual agreement between two private parties (Pons and Brummer, 2023). The easement is registered under the title of the property in a public land registry and thus restrictions remain in effect when the property changes ownership – this is referred to as the easement 'running with the land'. The voluntary contract is generally long term or permanent but can be short term (5 to 10 years). The easement may be tied to a financial incentive for the landowner in the form of a tax reduction, but not always.

Land bank

A land bank is a public or community-owned entity created for a defined purpose to acquire, manage, maintain, and repurpose land (Veršinskas et al., 2022). This purpose can be to find new land uses for vacant or abandoned land, or to reorganise land uses in an area in order to restore a floodplain and so improve flood management, or to create or buffer a protected area, or to re-organise agricultural land parcels to make agricultural operations more efficient.

Habitat banking

Habitat banking involves establishing a land bank of specific area sizes linked to a system where conservation actions benefiting biodiversity produce credits that can be traded to offset detrimental actions that represent the debit. This system allows for the independent production, purchase, sale, and storage of credits over time. The term habitat banking is used interchangeably with 'mitigation/conservation/bio banking' or 'eco accounts' (Santos et al., 2015), (Wende et al, 2018). Habitat banks are most often set up by public entities such as local authorities in order to 'bank' land that can be used to offset biodiversity losses under a legal requirement. As such, habitat banking is a tool that supports biodiversity offsetting. Biodiversity offsets are a category of conservation actions aiming to compensate for biodiversity loss with an equal or more significant gain in biodiversity in another form, as

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specified by the Business and Biodiversity Offsets Program (BBOP) (BBOP, 2012). According to the **mitigation hierarchy** within the assessment of environmental impacts, any environmental impact must first be avoided to its fullest extent (Tucker et al., 2020)). Unavoidable impacts must be as far as possible minimised through implemented efforts during the project. Remaining (residual) unavoidable environmental impacts must be directly compensated through restoration – preferentially on or close to the affected land. The final step in the mitigation hierarchy involves compensating for the residual unavoidable environmental impact in another location through biodiversity offsets.

Conservation easements, also known as covenants or servitudes, are tools of real property law that restrict certain land use rights through a legal agreement, transferring these restrictions to an easement holder, typically a public authority or a conservation organisation (see Box 5). Easements vary widely in form and scope, as the examples from the case studies below illustrate. Easements have been made available in national law in France, Spain, Estonia, and are possible under existing law in other countries, but are still not yet widely utilised in the EU (Pons and Brummer, 2023). There is no EU-wide policy framework for conservation easements and existing practices therefore depend on the legislation and choices of Member States. Consequently, Member States must rely on existing tools to effectively implement current schemes or develop new ones based on best practices.

Conservation easements can help safeguard biodiversity values in the areas bordering protected areas, forming buffer zones, and link them together by forming ecological corridors. This is possible if the easement can be agreed with landowners on the properties that have been identified in the local or regional ecological network map or plan. For example, in France they are being used mainly in protected areas, but also to safeguard ecological compensation (offset) areas, in ways that benefit ecological connectivity (Box 6).

[Box 6] France: Obligations Réelles Environnementales (OREs)

Under the Obligations Réelles Environnementales (ORE) instrument, a property owner can voluntarily sign a contract with an organisation (either a local authority, the State, an environmental protection NGO or foundations with similar goals) to maintain, conserve, manage or restore biodiversity elements or their ecological functions on the land for up to 99 years. Introduced in 2016 as part of the renewed French Environmental code, OREs represent a shift in France's approach to nature conservation to a bottom-up model that involves private actors. OREs are characterised by their high flexibility, adapting to the specificities of each situation: the contracts must only mention the parties' commitments, the contract duration and the possibilities for revision and termination. Landowners who sign OREs do not necessarily receive monetary compensation. The law allows municipalities to offer an exemption from the municipal share of property tax on undeveloped land if they choose to do so.

In practice, OREs are mostly used for contracts between private landowners and Conservatoires d'Espaces Naturels (CENs), which are environmental protection NGOs managing protected areas. These contracts are based on a voluntary initiative by landowners to protect their land and to receive advice and expertise on how to do so. There appears to be growing interest from private landowners to enter into such contracts, which are growing in size. While primarily used for land protection, OREs are also employed, though less frequently, for ecological compensation.

In Spain, conservation easements are being used to stimulate and safeguard hábitat restoration outside protected areas (Box 7).

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[Box 7]: Custodios del Territorio in Doñana

The Spanish legislation provides for the creation of long-term agreements between landowners and public nature protection authorities for the management of land for conservation objectives, known as Custodios del Territorio. Successful habitat restoration efforts to increase connectivity have been accomplished through agreements with local landowners on a case-by-case basis through public-private collaboration. These agreements depend on the long-term maintenance of restored areas by landowners and the voluntary reporting of any issues that may arise.

For more details on the Doñana case study see the case study report in NaturaConnect WP7.

In Finland, the METSO and HELMI programmes are enhancing forest biodiversity and ecosystem services by establishing protected areas through voluntary agreements with landowners (METSO) and by implementing targeted habitat restoration and conservation actions (HELMI) (Box 8) (see Appendix 1 for further information).

[Box 8]: Finland's Forest Biodiversity Programme (METSO) 2008-2025

The Forest Biodiversity Programme (METSO) 2008-2025 is a payment scheme for forest ecosystem services, where protected areas are designated through voluntary conservation agreements between authorities and forest owners. Coordinated by the Ministry of Environment and the Ministry of Agriculture and Forestry, it is implemented by regional environmental and forest authorities. Landowners can voluntarily offer their forest habitat to permanent or temporary protection (10 to 20 years) and receive full monetary compensation based on the value of timber. The government evaluates eligible areas that qualify for METSO based on ecological criteria and then negotiates with the landowner on a price, which varies with the length and level of protection chosen.

The scheme has proved quite successful in protecting forest habitat. By the end of 2021, 88% of the goal to establish 96,000 hectares of protected forest habitat had been achieved. Additionally, 68% of the goal to safeguard biodiversity on 82,000 hectares of forest habitats in commercially managed forests with environmental forestry subsidy agreements and nature management projects had been met. The programme has also succeeded in gaining the landowners' trust, with its voluntary nature being a key factor in this success.

Under existing systems such as those described above, there are multiple opportunities for both landowners and organisations to engage in conservation easements to achieve conservation goals. This will need to overcome current barriers.

Incentives for landowners to enter into conservation easements are often perceived as insufficient. In France, for instance, the lack of monetary incentives may discourage the signing of such contracts. Resources are often limited, as illustrated by the METSO programme. This impacts the marketing of the scheme to forest owners and the proposals made to them. Being a government programme, securing consistent financing across different administrations is particularly challenging.

The lack of awareness and knowledge about these tools also hinders their uptake. Ensuring that landowners understand their rights and obligations under these contracts is crucial. In France, the Fédération des CEN is addressing this by building capacity and knowledge through communication campaigns and training courses. They have also developed a blueprint for OREs for potential holders.

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To address the lack of incentives, agreements could be linked with other types of payments, as is already the case in some countries. For example, conservation easements could be connected to carbon payments, as mentioned in the legal article establishing OREs in France, potentially encouraging more landowners to participate. Easements could also be integrated with CAP payments, serving as a valuation factor for biodiversity-related CAP payments. Some initiatives aim to link these tools with biodiversity protection on agricultural land, such as in France and in Finland. Conservation easements can be linked with Payments for Ecosystem Services (PES), as seen in Finland and Catalonia within the forest sector.

In Member States without an existing structure for signing conservation easements, the question arises: should they use existing property rights or introduce new legal instruments? In the meantime, environmental protection organisations and companies can collaborate to implement similar contracts without stewardship funds. They should promote these initiatives and advocate for the creation of a legal framework to further develop these efforts.

As the practice is relatively new in the EU, clear examples of easements securing connectivity between protected areas are scarce. However, they are being increasingly used to safeguard conservation values, suggesting their potential applicability in local and regional contexts where connectivity objectives are established.

Land banks and habitat banking

Land banks could be used to create ecological connectivity. In Flanders, for example, land banks have been used to designate larger and connected Natura 2000 sites and to create natural flood retention areas in the river flood plain. For the Flemish government, land banks are a proactive policy for the acquisition of land and funding that overcome the strong resistance to land expropriation and create solutions without having a severe effect on land prices (Vermeulen and Hendrik, 2013).

Habitat banks could be used to assign compensation land to ecological connectivity objectives in those countries that have a legislation that obliges developers to offset their residual impacts on biodiversity, habitats or species (going beyond the requirements of the EU Habitats Directive). Private developers can in some cases do part of their compensation through a payment to the public authority, which then buys an offset credit from the habitat bank (Wende et al., 2018).). The public authority may also use the habitat bank to offset impacts on public land. There is, however, no EU legal framework for the implementation of land banks or habitat banking tied to offsetting and no standardisation of principles and best practices across the habitat banking systems that do exist (Wende et al., 2018). In Spain, habitat banking has not been taken up and is considered controversial.

[BOX 9]: Limits to usefulness of habitat banking in Doñana region

The legal framework for habitat banking in Spain was established in 2013, but there has been minimal development of such systems since then (Maestre-Andrés et al., 2020). In 2014, WWF Spain advised against implementing habitat banking, arguing that it would lead to the approval of environmentally damaging projects under the mistaken belief that their negative impacts could be successfully compensated for, resulting in increased biodiversity loss (‘WWF alerta de los riesgos de los bancos de hábitat para el medio ambiente | WWF España,’ n.d.). These risks are particularly relevant in Spain due to the unreliability of the environmental impact assessment process and the supervising and regulating mechanisms that would need to accompany habitat banking and compensation (‘WWF alerta de los riesgos de los bancos de hábitat para el medio ambiente | WWF España,’ n.d.), as well as one of our interviewees).

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The Doñana case study identifies challenges to implementing a habitat banking system to enhance ecological connectivity in the area. While there is potential for habitat banking as a complementary approach, the conservation effort required to address the lack of ecological connectivity in Doñana is shaped more by competing interests and low political will than by economic factors. Notably, one of our interviewees highlighted the need for increased pressure and accountability on local governments to shift priorities and achieve positive outcomes for conservation efforts. Local land users' attitudes significantly influence the conservation efforts and outcomes in Doñana, according to one of our interviewees. This interviewee also mentioned that media attention and political discourse on connectivity can draw attention to the need for effective conservation efforts but can also create barriers. The politicisation of conservation may complicate the implementation of controversial land management strategies, such as habitat banking, especially since it has previously been met with skepticism in Spain ('WWF alerta de los riesgos de los bancos de hábitat para el medio ambiente | WWF España,' n.d.)

The diversity of circumstances where land banks or habitat banks have been successfully applied show that they could be an effective conservation tool to gain access to land with high biodiversity value and maintain it in the long-term or in erpetuity for biodiversity conservation purposes (Briggs et al., 2009) (Van Hoorick, 2014). Habitat banking could be used to enhance ecological connectivity through the strategic spatial placing of biodiversity compensation or offset areas to create ecological corridors or buffers around and between protected areas (EFTEC and IEEP, 2010). The bundling of compensations through strategic planning combined with a habitat banking system could ensure that the offset measures are strategically placed and structured to create a greater benefit for ecological connectivity.

Habitat banking can be successful for a local government when sufficient frameworks are in place to enforce, quantify, and monitor restoration success, but may fail to prevent biodiversity loss and create low quality habitats if this is not the case. The potential for habitat banking in the EU is limited by the demand for credits, which in turn is linked to a lack of requirements for biodiversity offsetting in national legislation. The lack of clear EU-level guidance on habitat banking has been highlighted as leading to inconsistencies in its implementation across Member States (Maestre-Andrés et al., 2020). Of fundamental importance is a strong legislative framework that ensures that planning and development permissions always apply and adhere to the mitigation hierarchy, and only apply offsetting and habitat banking as the final step in this hierarchy. Many of the weaknesses of biodiversity offsetting also apply to the habitat banking of the credits. The impact assessment should include an assessment of the impact on ecological connectivity and require a correspondingly higher value offset. The impacted site and the restored area should be as closely ecologically related as possible to ensure that offsetting measures are as appropriate as possible. In the event that restoration is unsuccessful in an offset area, a system must be in place that replaces or augments the offset with additional areas and credits. The responsibility to ensure that restoration is successful and compensated for in the event that it is not, should lie with the owner of the habitat bank. Pre-emptive establishing of habitat banks should always be preferred as it reduces the risks and uncertainties of the system. This will ensure that development projects are not wrongfully approved at the promise of compensatory measures that are never successfully implemented or achieved. Involving locals in implementing restoration measures and monitoring their success will help ensure the long-term permanence of restored areas and corridors used as offsets.

3.3.2. Financial support options for TEN-N

According to the United Nations report 'State of Finance for Nature', if the world wants to meet its targets on climate change, biodiversity and land degradation, it needs 4.1 trillion USD to be

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invested in nature through several types of nature-based solutions. Europe is no different; if the European Union wants to meet the goals set out in its 2030 Biodiversity Strategy**, including a coherent, well-connected TEN-N,** at least 20 billion euros needs to be unlocked for nature per year from public, philanthropic and private finance. **This section provides an overview of financial support options for the TEN-N, showcasing both existing public EU financing instruments, and more novel private financing options.**

Opportunities to use EU funding for TEN-N

The EU funds offer a range of opportunities for funding TEN-N, within the objectives and restrictions set by each fund legislation. The EU provides the biggest source of funding outside of national and regional government funds, which are often insufficient. This section briefly describes the main EU funding instruments that could be used for TEN-N. More detail can be found in Appendix 1 and in the factsheet series.

LIFE and Interreg funding are key opportunities for ecological connectivity projects and can fund transboundary initiatives within the EU and with EU neighbouring countries.

The **LIFE programme** administered by the European Commission has nature conservation and ecological connectivity as one of its core objectives. It offers clear opportunities to contribute to a coherent TEN-N as it encourages investments in designation of additional Natura 2000 sites, increasing connectivity and cross-border cooperation in Green and Blue Infrastructure projects. It provides opportunities for jointly funded projects with non-EU countries, which is relevant to cross-border green infrastructure projects, for example where a Natura 2000 site lies alongside a nationally protected area in a non-EU state. It also provides funding opportunities for cross-border marine protected areas. An important feature of LIFE funding is that it can be used for land acquisition. Land areas which are purchased and managed under LIFE projects are subject to protection requirements and usually become part of protected areas or another land stewardship arrangement to ensure their long-term dedication to nature conservation. The main limitations are the fact that funding is limited and competitive, project based and therefore not suitable for continuous needs such as maintenance, that it requires co-funding, and that application and management of projects is quite demanding.

The **European Territorial Cohesion (or Interreg) fund** is funded from the European Regional Development Fund (ERDF). It has the explicit objective to fund transboundary nature conservation initiatives, alongside its other objectives, so many of the cross-border, regional, and Europe-wide Interreg programmes include protected areas and ecological connectivity as a funding priority. The funding cannot be used for land acquisition or management directly, but is meant to support cross-border partnerships, e.g. to collaborate on protected area management, to support learning and training and exchanges of experiences, and to set up collective initiatives.

The **Interreg fund**, part of the European Regional Development Fund, is the most important source of transboundary funding for ecological connectivity. Examples of Interreg projects focused on ecological connectivity are described in Appendix 1. The Interreg **ESPON programme** (European Observation Network for Territorial Development and Cohesion or European Spatial Planning Observation Network) 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. The implementation of Green Infrastructure was one of the priorities of ESPON in the 2015-2022 programming period (e.g. Project GRETA: GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development).

The **EU cohesion funds** include the European Regional Development Fund (ERDF), the Cohesion Fund targeted at the EU Member States with lower GDP, and the European Social

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Fund Plus (ESF+). Member States may programme these funds together or separately, and in a single programme or several programmes at national or regional levels, and as these funds are targeted at a series of objectives, the programmes do not necessarily provide funding for protected areas. However, some of the programmes do provide scope for funds to flow to protected areas and their governance. In addition, some Member States have provided one-off grants or loans to protected areas through their **Recovery and Resilience Facility** funding programmes.

Other EU funds can be used to support land and water management within protected areas.

The most important in terms of volume of funding are the two **Common Agricultural Policy (CAP) funds EAGF (European Agricultural Guarantee Fund)** and **EAFRD (European Agricultural Fund for Rural Development)** for the management of farmed land. The CAP is the main source of funding for arable land and most types of grazed and/or mown land including meadows and pastures, scrub, heathlands, and wooded meadows and pastures (including dehesa and montado) within protected areas. CAP funding can also be used for the management of farmland in ecological corridors. It is important to note that Member States have a huge amount of freedom to design the interventions according to their needs - so what is eligible as an investment or possible under an intervention instrument in one country may be completely different to what is offered elsewhere.

The main CAP instruments for land management in protected areas and ecological corridors are:

- Ecoschemes (funded by EAGF) – annual payments for relatively simple ecological actions and management and/or for refraining from doing something (such as applying pesticides).
- Environment-climate contracts (funded by EAFRD) – 5-year contracts (previously known as agri-environment or forest-environment) to fund defined management activities, or alternatively to achieve a certain ecological result.
- Natura 2000 payments (funded by EAFRD): annual payments for farmland or forest in a Natura 2000 site tied to conforming to the constraints or management requirements defined for that site and/or general management requirements for all sites.
- Advice, training, knowledge exchange (funded by EAFRD): Member States must provide basic farmer advisory services, but can also fund targeted training and knowledge exchange for biodiversity objectives. Ecoschemes and env-clim schemes can be accompanied by obligatory training.
- Investment support: Farmers can apply for investment support for tree or hedge planting or other small-scale restoration activities on their land, or for afforestation or conversion of arable fields into grassland. Public authorities may have access to investment support for larger restoration actions such as recreating flooded grasslands and removing dams along rivers, rewetting peatlands, or replacing conifer plantations with deciduous woodland.
- Cooperation funding is available in most Member States for a group of farmers in an area to collaborate on a joint initiative such as watershed management or climate adaptation or the creation of an ecological network.

The **European Maritime, Fisheries and Aquaculture Fund (EMFAF)** can be used for the restoration of water bodies, such as river re-alignments, dam removals, coastal protection with Green Infrastructure, and so on. It can also fund research, communication, stakeholder engagement, and collaboration activities that can provide important inputs to projects for ecological connectivity along wetlands, rivers and coastlines. It does not provide ongoing maintenance support.

In most countries, the main source of funding for protected area governance is from national and regional public budgets. There is a great variation in the availability of funds and public administrations across protected area types and countries and regions, ranging from some

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quite well funded and resourced national parks with their own administrative bodies and income sources, to many protected areas with no dedicated funding at all and minimal administrative capacities in the relevant public authorities. National and subnational sources of funding are described in section 3.2.2.

Opportunities and challenges to mobilise private financing for TEN-N

In our research we aimed to identify both good examples that already exist somewhere that can be implemented or scaled up in Europe, as well as new innovative finance mechanisms that could be tried.

The user pays principle focuses on creating sources of revenues within protected areas and ecological corridors, mostly by entry fees, sleeping fees, commission on ecotourism tour operators and other similar type of charges. The main argument is that most well preserved or restored natural areas create revenues that are not captured by the entities that manage the nature reserves. This could in turn help ensure the long-term maintenance of the natural zones as well as finance further restoration actions.

Green bonds are similar to the classic bond instrument with the twist that the funds need to be invested in environmental related projects. The high demand from the market, leads to lower cost of borrowing for the issuer, more friendly interest rates, such as lower interest rates (which can be provided by the central or local government). Even though many have already been issued for investments in green energy projects and decarbonising transport networks as example, few have been issued with a focus on protected areas and ecological corridors.

Resilience bonds are an innovative type of finance instrument that aims to unlock direct and indirect resources from insurance companies to restore natural zones. Insurance companies' business model for natural disasters rests on the assumption that many years without extreme weather events will generate the funds necessary to cover the rare years with extreme weather events, the ones which cause costly damages to infrastructure. Yet with climate change making extreme weather events more regular and destructive, this business model is becoming less viable, making some zones uninsurable. Direct (by money transfers) or indirect finance (reduction in insurance premiums) could be used from insurance companies to increase landscape resilience to climate change, to reduce the risk of damage to insured infrastructure, saving insurance companies funds in the long term.

Debt for nature swaps have been used since the 1980s yet have experienced a new wave since the beginning of 2020 (due to an both increase in governmental debt and a need to find stable finance for nature), being mainly used for underdeveloped countries under debt stress, and often mediated through NGOs and development Banks. This instrument involves the refinancing of existing debt to friendlier terms with the compromise that a part of the savings is invested in nature protection and restoration. The countries in Europe with higher biodiversity are those around the Mediterranean region (Greece, Italy, Spain, Portugal); some countries in this region have the highest debt to GDP levels on the continent, so there could potentially be opportunities for Debt for Nature Swaps in these countries.

Blended finance rests on the assumption that different finance needs can be financed with different finance sources. The majority of funds going into nature conservation and restoration initiatives are financed through public or philanthropic funds. Nevertheless, there are cases as with tourism infrastructure that could be partly or totally financed with Public Private Partnerships (PPP). The idea of blended finance deals would be to use public and philanthropic funds to derisk or leverage private investment into nature, in this way increasing the amount of funds available. Some cases include debt for nature swaps or resilience bonds.

Aligning subsidies for nature involves incentivising nature restoration through private funds. This instrument increases the funds being channelled to nature restoration actions as well as eliminating a key threat to nature conservation.

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For further information please consult the complete list of factsheets, which includes a brief presentation of the instrument, the reasons why it was considered suitable to implement the TEN-N, in which conditions it is relevant, main strengths and weaknesses and cases where the instrument has been used or could be used.

In this research the main challenges identified to access private finance for TEN-N were:

- Legal framework - Governments need to create an enabling environment for the development of *nature markets* (e.g. biodiversity offsets and ecosystem services payments).
- Specialised human resources – Governmental Institutions and NGOs working on nature protection and restoration rarely have people with business backgrounds to explore novel finance instruments.
- Cultural – Nature protection and restoration actions have traditionally been financed through grants, making the shift to an investment that needs to be repaid and provide an added gain is something new to practitioners.
- Knowledge Gap – Connecting the business world with the nature world is challenging as there are few people who have an in-depth knowledge of both fields and can identify and explore innovative private finance solutions.

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4. Discussion and interventions

4.1. Political Economy Analysis Dynamics

This section brings together the commonalities and specificities identified across the research in terms of PEA dynamics, and analyses the relationships between the three building blocks, providing a deeper understanding of the factors contributing to the weak ecological connectivity of protected areas.

The building blocks (foundational factors, rules of the game and people and organisations) are not independent of each other but rather interact. In the following, the most relevant interactions are described.

Political Economy Analysis building blocks	Political Economy Dynamics
Foundational factors **&** **Rules of the game**	• **Historical legacies and policy implementation**: Many regions and countries have land use and governance histories that shape current conservation strategies and land management practices. For example, the centralization under communism in the Danube-Carpathian region has left a legacy of unclear property rights, fragmented land ownership, and continued centralization of power that poses challenges to effective environmental governance and ecological connectivity. Another example is the creation of large estates in southern Spain that historically dominated agricultural practices and land ownership patterns, with impact on current conservation efforts; in France, local authorities' tendency to favour economic interests undermines the effectiveness of national policies, illustrating the gap between formal rules and practical outcomes in ecological connectivity. • **Urbanisation, demographic trends, and spatial planning:** High levels of urbanisation and demographic shifts impact land use and conservation policies (e.g. urban-rural disparities and demographic shifts in Portugal, such as rural depopulation, impact the effectiveness of national conservation policies, emphasising the need for tailored approaches at different administrative levels; in the Leipzig-Halle region, urban expansion and post-mining landscape changes affect the implementation of national policies on ecological corridors, underscoring the need for strategies that address both historical and contemporary land use changes.) • **Implementation challenges and policy instruments:** All regions and countries face difficulties in effectively implementing national policies and legislation through the lens of foundational factors (e.g. Finland has to focus on climate change vulnerability, with Arctic and boreal regions facing unique challenges; in Portugal, disparities between coastal

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	urban areas and rural interior regions affect conservation efforts and land management, while increased tourism strains local infrastructure and natural resources.)
Foundational factors **&** **People and organizations**	• **Historical land use influences**: *Professional Bodies and Research Institutes* (e.g. organisations like the Infrastructure and Environment Network Europe IENE and SYKE in Finland) provide expertise and historical context, helping governments understand how past land use affects current ecological connectivity and guiding more informed decision-making, including for linear transport infrastructure development. • **Land restitution** in regions with a communist history like the Danube-Carpathian region led to multiple ownership and lengthy negotiations in the designation of protected areas. On the other hand, the communist heritage led to a hierarchical order and poorly structured stakeholder involvement. • **Local stakeholders** *Landowners, Farmers, and Foresters* groups often oppose ecological corridors due to perceived or real restrictions on land use and poorly designed/ communicated compensation mechanisms or conflict management strategies. Their opposition is often linked to their political and economic position and their intensity of land use. • **Rural depopulation:** *Local Governments and Ministries for Rural Development* are responsible for managing such demographic trends. They need to both counter abandonment with alternatives for economic development and manage the transition in a way that considers nature restoration or conservation. In depopulated areas, green entrepreneurs and conservation NGOs may find opportunities to implement rewilding and habitat restoration projects, though the success of rewilding and restoration depends heavily on public participation and inclusive decision-making. • **Political instability**, influenced by external factors like the war in Ukraine or by internal factors like unstable governments and frequent new elections, threatens to deprioritize conservation efforts at national level. The role of the EU legislative framework and international cooperation then becomes crucial in maintaining focus on ecological connectivity. • **High demand for land in urban areas:** The high demand for infrastructure in urban areas poses challenges for *Urban Planning Authorities* in maintaining ecological connectivity. Spatial planning authorities must navigate the tension between development needs and environmental protection. *NGOs and Civil Society* groups advocate for the integration of green infrastructure within urban planning, often pushing for policies that incorporate ecological corridors into city designs.
	• **Gaps in the legislative framework:** Even where the legislative framework encompasses ecological connectivity,

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People and organizations **&** **Rules of the game**	there are often gaps, such as legal loopholes or missing requirements, which hinder effective implementation. • **Ineffective spatial planning integration:** Many policies do not effectively integrate ecological connectivity into spatial planning, leading to potential threats from land use changes and infrastructure developments. • **Lack of political will:** Some countries face challenges due to a lack of political will to enforce legislation, leading to ecological corridors existing only on paper. This reflects a lack of incentives for enforcement and political motivation to prioritise ecological connectivity. • **Mismatch between administrative level responsible and scale of action:** Responsibility for ecological connectivity often falls on regional or municipal authorities, leading to a mismatch between the scale of action needed and the scale of implementation possible. • **Sectoral planning gaps:** There is often a lack of strategic planning in sectors like transport and hydropower, which impacts ecological connectivity, especially in some countries from the Danube-Carpathian region. • **Transboundary coordination:** Lack of cross-border coordination hinders efforts in maintaining connectivity, reflecting geopolitical and administrative challenges. Some positive efforts in this respect are the regional governance bodies (e.g. EUSDR, the Carpathian Convention and ICPDR in the Danube Carpathian region). • **innovative land use policies:** Instruments like conservation easements and habitat banking are emerging as successful strategies. These innovations show potential synergies between traditional land use policies and ecological connectivity goals. • **Integration with ecosystem services:** Linking ecological connectivity to ecosystem services (e.g., flood protection, carbon sequestration) expands stakeholder involvement and potential support. • **Power dynamics:** There is significant opposition in relation to new nature protection legislation from powerful organisations in farming and forestry or from other landowners; this is due to perceived restrictions on land use, mirroring conflicts in protected area designations. Stakeholder groups like national environmental bodies, macro-regional bodies and NGOs lack empowerment and participation in advancing, developing and implementing strong ecological connectivity related legislation. • **Economic compensation:** Economic solutions, including financial compensation, and other tools to reduce conflict are missing or hampered by ideological opposition to conservation.

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	• **Collaborative learning:** Collaborative learning processes to build common visions and joint stakeholder evaluation remain difficult to scale up, with only a few successful projects. • **Financing challenges:** the lack of financial resources is a common issue across case studies. There is potential for innovative financing mechanisms to support ecological connectivity initiatives.

4.2. How can the problem be addressed?

4.2.1. Pathways of change

To tackle the problem, based on the analyses performed and the criticalities identified, we outlined four different pathways of change and corresponding potential interventions. These four pathways to change should be pursued in parallel by EU Member States in order to achieve a coherent, resilient, connected TEN-N. Unlike other usages of the term, in PEA, pathways are not mutually exclusive but rather a set of conditions. We use 'pathway' here to maintain consistency with PEA literature. They should not be seen as individual scenarios to choose from, but rather as a mix of approaches that can be implemented together.

Efforts to design effective TEN-N governance and land-use policies should include the application of pathways of change that focus on regulatory frameworks, land use, knowledge and capacity building, and empowerment and conflict management.

The challenges and best-practice examples both reveal the opportunities that exist for improving ecological connectivity governance across the EU, across various scales.

Pathway 1 – Regulatory framework:

If an appropriate ecological connectivity regulatory framework exists, it is implemented well, and it is backed by solid incentives, **then** the different stakeholder groups are supportive **because** they recognise the values, benefits and importance of the ecological connectivity for people and wildlife.

Conflicts can be turned into win-win situations where potential losses are prevented and/or compensated. A regulatory framework brings clarity for all players in terms of prevention and compensation mechanisms. Legislation should address the need for ecological corridor planning and design to be embedded in spatial planning and that guidelines be provided for all sectors and stakeholder groups involved. The legislation should also address tenure rights and provide the necessary funding, incentives, prevention and compensation schemes, clear governance and thorough consultation processes.

A legal instrument for ecological connectivity is the most coherent and effective governance mechanism, if well-designed and implemented. It is important that ecological corridors are protected from construction and infrastructure and other activities that would undermine their functioning. The detailed protection provisions of the Czech Republic on corridors (Václav et al., 2021), and the legal requirements for wildlife crossings in Croatia (Government of Croatia, 2006) are examples of best practice legal instruments.

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Implementing legal instruments for connectivity can be challenging. A range of best practice was identified in the Belgian Region of Flanders (INBO, 2023). These included swaps of state land, a range of financial tools, the introduction of a biodiversity offsetting mechanism as well as encouraging experimentation. A previous review of protected area networks across the EU (Naumann et al., 2022) surveyed a range of experts across EU Member States for barriers and solutions for ecological connectivity, the latter equivalent to best practice. Their recommendations are featured in Box 2. The next sections on financial tools and case studies provide further examples.

Several studies identified best practice in financing connectivity. Voluntary payments for farmers, in the form of agri-environment(-climate) schemes have been used for connectivity implementation. Best practice is to target these payments to farmers contributing the most to connectivity, on the basis of landscape level connectivity considerations, and work towards high participation and building long-term commitments on the basis of dialogue and adequate and stable financing (Arponen et al., 2013). Depending on the landscape, landscape level agri-environment-climate schemes that promote agroforestry, landscape complexity and the restoration of riparian vegetation can also be a strong tool (De La Fuente et al., 2018).

Maintaining and enhancing ecological connectivity and ecosystem services are a promising combination. A strategically planned network at EU level can efficiently provide a range of ecosystem services, a robust TEN-N with adequate cross-border connections (Hermoso et al., 2020). Combining connectivity can overlap with achieving carbon neutrality in forested regions (Forsius et al., 2021).

Pathway 2 – Sustainable economic development:

If economic development is coupled with clear guidance for mitigation measures, accounting for ecosystem services, and preventing land use conflicts via collaboration across sectors, **then** it shifts towards a sustainable economic model that values and profits Green Infrastructure **because** the power of each sector is balanced when all have to work towards mutual benefits.

Social dilemmas can be addressed by taking leadership and encouraging collective thinking. If a solution is found to land use conflicts that is acceptable for all stakeholders and potential losers are compensated, then acceptance of the solution increases mainly if it helps improve economic development. Shared goals improve trust and implementation results.

A legal instrument can ensure the balance of economic development with ecological connectivity. In the absence of a legal instrument, spatial planning mechanisms can also be used. The protection of certain ecosystem types throughout out the landscape (Isola et al., 2022), the use of zonation in forestry (Elbakidze et al., 2016) can be very effectively used to maintain or enhance connectivity. Environmental Impact Assessment and Strategic Environmental Assessment can also be instrumental in maintaining connectivity if adequate guidance is in place (WWF, 2018). For transport infrastructure connectivity considerations can be integrated in planning, design, construction and maintenance (Rosell et al., 2023). For river connectivity, strategic planning of any new hydropower facilities combined with dam removal is a key method (Papazekou et al., 2022).

The development of Green Infrastructure will also contribute to providing non-market benefits and ecosystem services which are important for human well-being.

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Pathway 3 – Knowledge and capacity building:

If the appropriate knowledge base, technical and human capabilities related to ecological connectivity are developed and communicated, **then** planning and design as well as the implementation of a well-connected, resilient TEN-N improves **because** they will facilitate the access of all relevant sectors to the most beneficial solutions, with optimised costs.

Improvements in the evidence base and information sharing can build trust and encourage collective action. Monitoring and data collection should be established and harmonised in this respect along with common, transboundary projects and networks that work together and share information to improve cross-border cooperation. Also, implementation capacities of ecological connectivity management institutions should be improved related to data collection, processing and stakeholder services. It should be ensured that ecological knowledge is strongly embedded in the teams involved with planning and deciding on land-use. Thus, ecologists and conservation scientists need to be hired in the key institutions involved in land-use planning, not just responsible for the impact assessments.

Professional organisations can play a key role in maintaining and strengthening ecological connectivity. The Infrastructure and Ecology Network Europe (IENE) is a prime example of such an organisation. This network brings together a range of experts on transport and ecology in Europe. The network is instrumental in disseminating best practice, collected in the IENE Handbook on Transport and Infrastructure (Rosell et al., 2023).

A similarly crucial role can be played by local champions. The Province of Trentino used a bottom-up model of governance for developing its reserve network, in which the communities, local leaders, and stakeholders designed the network and identified the actions to take (Bassan, 2023). Transmission system operators can take the inititiatve to create ecological corridors under the power lines, if empowered by regulation and access to the land under the lines.

Pathway 4 – Empowerment and conflict management: If civil society working for ecological connectivity (NGOs, environmentally-friendly farmers and foresters, other green entrepreneurs) is empowered and causes of existing conflicts around connectivity are clarified by bringing actors together **then** engagement can be built, conflicts can be managed, and stakeholder trust and intersectoral and cross-border cooperation improved, **because** bottom-up initiatives and improvements are catalysing positive change.

A prerequisite for cooperative solutions is to develop a shared vision and framing, build trust and credible commitments and enable an acceptable distribution of costs and benefits (relational values, health benefits, ethics and aesthetics, and others). Our research shows that existing conflicts between sectoral stakeholders hinder realisation of ecological corridors. Conflict management can help in this respect to build mutual trust, improve stakeholder engagement and intersectoral and cross-border cooperation and coordination. Along with conflict management awareness campaigns for the general public, behavioural change campaigns for targeted sectors can also be useful.

Civil society can drive ecological connectivity in a bottom-up approach that is radically different from top-down legislative approaches. For such initiatives by civil society, there is also a range of best practice available. Most of the best-practice examples borrow elements from ‘collaborative learning’, a conflict management approach that has been applied frequently to natural resource management (see Box 3). A rule of the game of collaborative learning is that

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stakeholders work as equals, which means that there can be tension with top-down legislative approaches.

Common framing of a problem is crucial, and successful connectivity initiatives have been underpinned by shared vision. Some of these visions used a well-chosen concept to bring different groups together (van Rooij et al., 2021). These visions have been successfully employed at urban level (Perini and Sabbion, 2016), landscape level (van Rooij et al., 2021) or in between (Perini and Sabbion, 2016).

Governance arrangements are important for maintaining and enhancing ecological connectivity. A review across Europe found that mobilisation of social capital and grassroots initiatives were promising arrangement for increasing connectivity in urban areas (Buijs et al., 2016). For mobilising social capital, the financing and facilitating the organisation of citizens and flexibility with the rules are important. Urban grassroots initiatives can be strong advocates for realising ecological connectivity as an independent voice in urban planning.

[Box 10] Best practice on protected area connectivity from the European Topic Centre on Biodiversity Report on Protected Areas in Europe

- Creation of a strong legal basis, institutional framework and implementation plans
- Designation of **robust connectivity zones (such as ecological corridors, steppingstones**) and establishment of wildlife crossings, bridges and banks
- Systematic identification of **high-value ecosystems** (in agriculture/grasslands and forest) to inform land users and to address planning processes
- Dedicated, long-term **funding** options
- Dialogue and **communication formats and platforms** for involved stakeholders, especially also by involving local government structures (also to mitigate conflicts)
- Implementation of **changes in agricultural and forestry management** (e.g. by nature-based solutions, agri-environmental schemes or ‘close to nature’ forest management)
- Further development and improved use of **ecological maps** etc. to visualize and make data available showing the real functional and structural boundaries of habitats, migration routes and other.
- Better knowledge about **natural values in marine habitats**, directions and locations of animal migration routes and application of this knowledge for planning processes (wind parks, sea routes etc.)

Source: (Naumann et al., 2022) Page 38-39.

The above four pathways of change are complementary in many cases, and elements from all four pathways of change are needed to achieve a coherent, resilient and well-connected TEN-N for Europe.

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4.2.2. Potential interventions

Based on the suggested pathways of changes in the previous chapter 4.2.1, concrete interventions were elaborated for specific actors to improve the implementation of TEN-N at various levels.

4.2.2.1. Interventions for regulatory frameworks (addressing Pathway 1)

Reviewing existing policies and legislation

The first step on this pathway is reviewing and, eventually, adapting the existing policies and legislation. In countries where there are no policies or legislation governing ecological connectivity, it is necessary to first adopt such policies or legislation. It is worth to underline here that biodiversity policy alone will not be sufficient to maintain and enhance ecological connectivity. For governments at any level the best practice is to have specific legal obligations, with a binding effect on spatial planning and sufficiently detailed protection of ecological corridors and their management. Adequate public participation in decision-making is a must during the adaption or amendment of any legislation.

It is also necessary to check at EU level whether existing policies support ecological corridors and TEN-N and revise those EU level policies that hinder their implementation. Additional policies might be needed in order for corridors to be formally designated or integrated into spatial planning, or to finance TEN-N. Finally, it is also important that the planning of ecological corridors and other actions for connectivity are based on the latest scientific evidence (see (Fernández et al., 2020) for an example at European level and (De La Fuente et al., 2018) for an example at national level).

Improving implementation

Where existing legislation and policies are adequate, the next step is to improve their implementation. The responsible authorities should have a political mandate for implementation, adequate staffing and financing. Given the importance of connectivity at the landscape level it is recommended to consider scaling up connectivity governance efforts in a way that increases the role of regional or national authorities. Implementation should be underpinned by adequate enforcement. For cross-boundary ecological connectivity, bilateral or multilateral agreements should be implemented, covering the key ecological corridors and ecosystems.

Integrating connectivity into other policies

Bringing coherence into the ecological connectivity agenda by including it in other policies is key. Crucial steps include fully implementing the Nature Restoration Law, in particular the national restoration plans, and integrating ecological connectivity into countries' National Biodiversity Strategies and Action Plans (NBSAPs) and the implementation of the relevant targets of the Global Biodiversity Framework. Of particular relevance are the targets on managing protected areas (Target 1), restoration of degraded ecosystems (Target 2), designation of protected areas and OECM (Target 3), reduction of the impact of Invasive Alien Species (Target 6) and minimizing the impacts of climate change (Target 8). Member States can also revise their national Common Agricultural Policy (CAP) Strategic Plans to improve connectivity on farmland, including through targeted eco-schemes and agri-environment-climate measures and support for cooperative actions (see below).

Synergies with spatial planning legislation

Often, other spatial planning legislation offers synergies with implementing legislation on ecological connectivity. Examples are forestry zonation and spatial planning instruments

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protecting ecosystem categories or land use types. Designation of ecological corridors or stepping stones under such legislation can provide protection against specific threats.

Addressing land use conflicts

The requirements of ecological connectivity can cause conflicts with existing land use, such as in ecological corridors for large mammals on pastures or structural connectivity for old-growth forest species in landscapes under intensive forestry. There are a range of voluntary approaches that can be explored and if successful embedded in regional or national policies and legislation. The use of OECMs, conservation easements, land swaps with government owned land, and strategic habitat banking are promising new approaches, in addition to land purchases.

4.2.2.2. Interventions for sustainable economic development (addressing Pathway 2)

For a well-connected TEN-N it is important to enhance ecological connectivity, but also to prevent further connectivity losses. A precondition for this is a balance of interests, as in the long-term ecological connectivity is incompatible with a maximisation of profits in agriculture, maximisation of yield of forestry and unlimited expansion of transport infrastructure.

Engaging farmers and foresters and addressing landowner conflicts

In order to maintain and enhance connectivity on farmland and in forests, active participation of farmers and foresters will be needed, along with other sectors of society. There are several forms of best practice. Targeted agri-environment-climate measures based on landscape level action, long-term commitments and building relations and trust can deliver connectivity on farmland. Conservation easements can deliver connectivity on any privately owned land, but are particularly relevant for forests as there are many small forest owners that are not utilising the existing funding under the CAP (Haeler et al., 2023).

Farmers receiving CAP funding are obliged to protect linear landscape features, buffer strips along watercourses and stepping stones such as wetlands, peatlands, and grasslands as part of the Good Agricultural and Environmental Conditions (GAEC). National authorities should ensure that these GAECs are well implemented and use their enforcement powers where needed. Under its Biennial Review (Regulation 2021/2115) the European Commission should ask for remedial action when Member States do not ensure the maintenance of landscape features.

Animals migrating through ecological corridors can cause conflicts with landowners, such as crop, livestock or forest damage from large mammals. It is particularly important that any compensation for damage on ecological corridors is adequate and timely with little administrative burden, to reduce conflict with landowners as far as possible.

Strategic planning for infrastructure projects

Strategic planning should be employed for large infrastructure projects. For large linear infrastructure projects such as roads and railways, ecological connectivity should be integrated in project planning, design, construction and maintenance, building on the IENE Handbook (Rosell et al., 2023). For hydropower, strategic planning across river basins should also be promoted to protect the remaining free-flowing rivers. On rivers with hydropower plants full connectivity cannot be achieved in spite of mitigation measures (Moreiro et al., 2024) so a combination of retrofitting of existing hydropower plans and dam removal should be employed.

Integrating connectivity in planning

Integrating ecological connectivity considerations into large infrastructure projects and hydropower can be promoted at the European level by including ecological connectivity in the Do No Significant Harm criterion under the EU Taxonomy Regulation (Regulation 2020/852).

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At national level, integrating ecological connectivity into the Strategic Environmental Assessment and the Environmental Impact Assessment procedures will promote better planning, project design and mitigation measures.

Society and decision makers should recognise the positive effects of ecological corridors in their lives. Cost-benefit analysis of ecological corridor development could help achieve such perception changes.

Recognizing and assessing non-market benefits of ecological corridors

Ecological corridors are essential not only for preserving biodiversity but they also can provide non-market ecosystem services. For example, by integrating ecological functions with cultural and aesthetic values, ecological corridors promote a balanced approach to conservation that benefits both nature and people's wellbeing (e.g., recreation, landscape amenities, education, spiritual connection, and tourism). Assessing the non-market benefits of ecological corridors and conducting comprehensive cost-benefit analyses of their development could help shift perceptions and encourage broader societal support.

4.2.2.3. Interventions for knowledge and capacity building (addressing Pathway 3)

Enhancing ecological connectivity between protected areas is a complex process, and there are many governments and actors involved. Bringing in ecological expertise throughout planning, design and implementation of ecological corridors, and stepping stones and other interventions is therefore key.

Role of professional networks and institutions

Professional networks, research institutes and government agencies play a crucial role in coordinating, advising and monitoring the connectivity of protected area networks and the effectiveness of interventions. Networks of professionals working on ecological connectivity, such as working groups and platforms can connect all parties in the complex governance structures, and advise land use planners at municipal, regional and national levels. They can also provide input on the drafting of land use and infrastructure policies and on designing agri-environment-climate measures. Strengthening professional networks, research institutes and government agencies institutions by providing them with adequate resources is recommended to further connectivity.

Raising awareness and providing training

To address the lack of awareness by the government actors and the stakeholder groups, more public outreach is needed. In addition to awareness raising, there is need for training, detailed guidelines and standard setting, in which professional bodies, research institutes and government agencies can also play a role. Providing guidelines and setting standards is critical for the deployment of novel instruments, such as conservation easements and the strategic deployment of biodiversity offsets. Guidelines similar to the of the IENE handbook on biodiversity and infrastructure (Rosell et al., 2023) are necessary to support mitigation and compensation measures in other sectors.

Ensuring adequate funding and resources

Adequate funding at EU level should be ensured to establish advanced scientific solutions e.g. from the Horizon Europe programme. Creating maps of ecological corridors and monitoring those areas needs both funding and detailed knowledge. Training programmes, integrating ecology in university curricula for spatial planning and relevant engineering fields, peer-to-peer visits and good practice exchange all help increasing awareness and dedication of stakeholders. CAP programmes currently have few successful collaborative schemes where farmers work together at the landscape level with conservation experts to restore ecological networks and corridors; this option could be introduced in all programmes, linked to ecological

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network spatial planning, and supported by farmer advice, knowledge exchange, and payments for ecosystem services. ERDF and CF hold considerable untapped potential to fund larger-scale and more effectively targeted nature restoration and ecological connectivity projects, but large biodiversity projects face considerable barriers. Synergies could be gained by linking requirements to linear infrastructure investments such as roads and rail, or to investments in water management.

Raising awareness on the available funding options

It is important to increase the awareness of finance options for ecological connectivity among potential beneficiaries. LIFE funds are the most common instrument to finance connectivity and nature conservation in Europe but to fully finance a coherent TEN-N other types of funds will have to be used. This will be a mix of other public finance (mostly EU funds such as Intereg or Cohesion Funds), private finance (in the form of investments), philanthropic sources (in the form of grants) and blended finance a mix of the three. Yet, often the recognition that several funding sources and types are available is very limited. Note that NaturaConnect is developing a series of fact sheets on public and private sources of finance to raise the profile of little-known solutions to relevant stakeholders.

Building business and economic skills in the professional community

To unlock innovation in funding connectivity action, it is strategic to employ experts with business and economic skills. The lack of dedicated human resources with the capacity to create new funding opportunities and pilot new nature-based business models is a clear barrier to access new funding. The nature conservation community in Europe (protected area managers, NGOs, universities etc.) has little to no human resources with training and/or background in economics or business. People who speak the language of private investors, who have a business mindset to problems and that can help unlock new funding sources. In order to fully fund the TEN-N and meet EU 2030 biodiversity targets and increase in the number of people with skills and studies in business and economics in the nature conservation sector needs to increase.

4.2.2.4. Interventions for stakeholder and public engagement (addressing Pathway 4)

Empowering civil society for ecological connectivity

Empowering civil society working for ecological connectivity (NGOs, environmentally friendly-farmers and foresters, other green entrepreneurs, urban grassroots) and improving conflict management can be a pathway to enhancing ecological connectivity at local and landscape levels. This involves working bottom-up through creating a policy environment that is inclusive and open to change, providing initial financing and developing a common vision. Ecosystem services, in particular flood protection and carbon sequestration and storage, can play a key role by widening the community of stakeholders. Finding a common idea that captures the essence of the connectivity challenge and inspires a wide community of stakeholders to take action can create momentum for connectivity. Local champions such as mayors, NGOs, National Park Directorates, and transmission system operators and other agencies managing linear infrastructure can drive the connectivity agenda if provided with adequate resources and an opportunity to challenge the current practices.

Increasing stakeholder engagement

It is necessary to increase engagement of different sectoral stakeholders at national but also transboundary level e.g. by proactive communication, organising consultations, sharing information, establishing cross-sectoral networks. For example, landowners should be clearly informed about land use restrictions and human-wildlife conflicts, and previous misconceptions should be clarified.

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Importance of conflict management and collaborative learning

Conflict management is a crucial measure. While not all conflicts can be avoided, adequate and easily accessible financial compensation can reduce conflict substantially. Conflicts based on past communication failures should be mitigated. As an alternative, collaborative learning can also be successful. This involves a long process of stakeholders working as equals and developing a joint vision in an environment with little regulations and carefully tracking the outcomes, adjusting where needed.

4.2.2.5. Specific potential interventions for public institutions

On the basis of the four pathways described above, we outline the following **potential interventions** that could be applied at different levels:

For national and regional governments:

- Review policies and legislation to ensure that ecological connectivity is addressed, ensuring adequate public participation in the decision-making process.
- Provide the planning authorities with a political mandate for implementation, adequate staffing, training, and financing of ecological connectivity contributing to TEN-N.
- Prepare bilateral and multilateral agreements to implement trans-boundary connectivity.
- Ensure the integration of ecological connectivity conservation and restoration measures in sectoral policies, in particular infrastructure, forestry and agricultural policy.
- Ensure strategic planning of linear infrastructure and renewable energy, including through the use of Strategic Environmental Assessments and Environmental Impact Assessments.
- Utilise a combination of strategic planning, retrofitting of existing hydropower dams and dam removal to enhance river connectivity.
- Ensure coordination of ecological connectivity planning and implementation to a level appropriate for landscape scale actions (the national or regional level) and provide funding for cooperative action.

For authorities responsible for implementing nature conservation at national and regional levels:

- Promote knowledge exchange and capacity building by creating a community of practice on ecological connectivity.
- Support capacity building, knowledge development and exchange, training and the creation of a community of practice on ecological connectivity through the Horizon Europe and LIFE funds.
- Create science-based standards and minimum requirements for ecological corridors and river connectivity.
- Raise awareness on the importance and benefits of a well-connected TEN-N and organise trainings for civil servants and stakeholders.
- Raise awareness on the potential public and private funding available for protecting and restoring ecological connectivity.
- Integrate ecological connectivity in the implementation of the Nature Restoration Law and the National Biodiversity Strategy Action Plans.
- Create an enabling environment with guidelines and standards for novel approaches to ecological connectivity and conservation (OECMs, land swaps, conservation easements) and novel financing mechanisms (payments for ecosystem services, strategic use of biodiversity offsets).

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- Ensure the adequate and timely prevention and compensation mechanisms in cases of human-wildlife conflicts, forest management, use of water resources, practices in agriculture, appropriation of public land etc. Encourage and support the operators of linear infrastructure in using their land and capacities for enhancing ecological connectivity.

For authorities responsible for agriculture and forestry at national and regional levels:

- Review and revise the CAP Strategic Plans to ensure the effective use of support under the CAP for connectivity action, in particular by the use of landscape level long-term agri-environment-climate schemes and the cooperation instrument.
- Use forestry zonation where possible to ensure the creation and maintenance of ecological corridors.

For authorities responsible for nature conservation at landscape or local levels:

- Foster a policy environment for connectivity action that is inclusive and open to change, providing initial seed financing for grassroot initiatives.
- Explore collaborative learning where traditional approaches fail, by developing a common vision and framing and by working as equals with all stakeholders.
- Support local champions working for connectivity such as mayors, authorities managing reserves, or transmission system operators.

For the European Commission:

- Integrate the maintenance of ecological connectivity in the Do No Significant Harm requirements.
- Ensure coordination of ecological connectivity planning at European level between EU Member States and with third countries.
- Assess the maintenance of landscape features and the impact of the GAEC8 changes during the biennial CAP Stategic Plan review and promote the use of the cooperation instrument for ecological networks.
- Support capacity building, knowledge development and exchange, training and the creation of a community of practice on ecological connectivity. These activities can be promoted through the Horizon Europe and LIFE, but also through the European Social Fund and the other cohesion funds.

NaturaConnect support

The NaturaConnect project aims to support the realisation of an effective TEN-N by 2030 through **the provision of relevant scientific and policy data, knowledge, and tools.**

The research results highlight that countries are facing significant data, knowledge, and capacity gaps, which hinder ecological connectivity planning and implementation. As EU Member States progress with the design and implementation of the TEN-N, the resources generated by the NaturaConnect project can provide essential planning support and serve as a resource base for decision-makers and other stakeholders. Some key resources developed or in development by the NaturaConnect project include:

- Maps and underlying data and methods that provide a pan-european **Blueprint for a Trans-European Nature Network** that addresses gaps in coverage for underprotected habitats and species, that is functionally well connected, and is resilient

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to climate and land-use change. These outputs will support Member States by helping them determine **spatial priorities in Europe for connectivity conservation, restoration, and corridors** for the long-term conservation of populations, species and habitats. National and regional governments can use these maps and datasets to ensure that connectivity planning addresses gaps in coverage for underprotected habitats and species. The data can also aid in the strategic planning of linear infrastructure, renewable energy, forestry and agricultural policies, to minimise impacts on ecological connectivity.

- An **online interactive tool, 'NaturaConnector'** (in development), which will enable stakeholders to visualise where priority areas for nature protection and ecological connectivity could be located, depending on selected parameters and stakeholders' preferences for conservation. The NaturaConnector tool can be leveraged by national and regional governments to support strategic planning and the integration of ecological connectivity in policy and legislation. By allowing stakeholders to visualise priority areas for nature protection and connectivity based on selected parameters, this tool can help authorities prepare more effective bilateral and multilateral agreements for trans-boundary connectivity and facilitate the integration of conservation measures into sectoral policies such as infrastructure and agriculture. For local authorities, the tool can aid in creating a common vision for collaborative learning and fostering a policy environment conducive to connectivity action.
- Guidelines **for connectivity conservation** and planning in Europe, along with a supporting online database **of European connectivity projects**. Provide science-based standards and good practices for ecological corridors and connectivity projects. Useful for all levels to guide policy integration, capacity building, and collaboration.
- A report detailing the methodology and narratives developed using the **IPBES Nature Futures Framework**, in a process of engagement with stakeholders, to consider and integrate societal perspectives on future biodiversity protection in Europe, accounting for multiple values and perspectives of nature.
- Training Needs Assessment tool**:** The Training Needs Assessment is based on the conceptual framework published by the International Union for Conservation of Nature (IUCN) A Global Register of Competences for Protected Area Practitioners (Appleton, 2016)**.** The framework defines possible skills, knowledge and personal qualities (=competences) required by people working in planning or managing protected and conserved areas. This tool is designed to help authorities at all levels identify skill and knowledge gaps among their staff and stakeholders. It can support the development of targeted training programs for technical specialists, senior managers and decision-makers, enhancing capacity for effective conservation planning and implementation. National and regional governments can also use it to foster a community of practice on ecological connectivity.
- A Learning Platform with free e-learning modules and other capacity building resources on conservation planning, including policy and governance aspects of the TEN-N.
- A series of **finance factsheets** (in development) on public and private financial support options for TEN-N, including information for non-technical audiences on accessing these financial resources. They provide critical information on funding opportunities for connectivity conservation efforts, supporting authorities in accessing public and private financial resources. National and regional authorities can use these factsheets to raise awareness among stakeholders and civil servants about available funding mechanisms, and the European Commission can use them to promote strategic use of the EU funds and public-private financing mechanisms.
- A portfolio of **spatial datasets** (in development) on biodiversity, ecosystem services, Green Infrastructure and ecological connectivity, land use, and opportunity costs of conservation. All datasets produced by the project will be open access. National and regional governments can use these datasets for strategic planning, while local

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authorities can leverage them for effective landscape-level action planning. The datasets can also support coordination between EU Member States for cross-border connectivity planning.

- Report on **experiences** in planning, designing and implementing the TEN-N across the project's 6 **case study areas** (in development). This report will provide valuable and practical experiences from the case studies that can guide national and regional authorities in reviewing and refining their policies, legislation, and implementation strategies for ecological connectivity. Local authorities can learn from these experiences to support grassroots initiatives, while the European Commission can use the insights to ensure a coordinated approach at the EU level.

5. Conclusion

This report underscores the complex interplay between historical legacies, governance structures, and political economy dynamics that shape land use and conservation policies across the Trans-European Nature Network (TEN-N). The analysis reveals that while there are significant challenges to implementing cohesive and effective conservation strategies, there are also opportunities for improvement through targeted policy interventions and stakeholder engagement.

The historical context, particularly in regions like the Danube-Carpathian area, Spain, and France, demonstrates that past governance practices continue to influence current land management and conservation outcomes. These legacies often lead to fragmented land ownership, inconsistent policy enforcement, and a disconnect between national and local governance, which in turn hampers the effectiveness of conservation efforts.

The political economy analysis highlights the need for a more nuanced approach to policy implementation – one that accounts for the diverse economic interests, power relations, and degrees of regional autonomy that characterize the TEN-N landscape. Without addressing these underlying dynamics, conservation policies risk being undermined by local realities that prioritize short-term economic gains over long-term environmental sustainability.

As the project progresses, continued monitoring and adaptation will be necessary to respond to the evolving political, economic, and environmental landscape. To support this ongoing effort, the executive summary of this report will be translated into six different languages, ensuring that the findings and recommendations are accessible to a wider audience across the TEN-N regions.

By addressing these challenges head-on and leveraging the unique strengths of each region, the TEN-N can move closer to achieving its goal of a connected, resilient, and sustainable network of natural areas across Europe.

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Appendices

Appendix 1: Review of EU and selected European countries' laws, regulations and governance and finance mechanisms for designating, protecting, funding, and managing the Trans-European Nature Network (TEN-N)

Introduction

The purpose of this Appendix is to provide information on the legal, governance, and financial context and frameworks in place at the EU and regional level and in the NaturaConnect case study countries to designate, protect, fund, and manage their parts of the TEN-N network – the rules of the game. It covers only the **terrestrial parts** of the countries, corresponding to the scope of the NaturaConnect project.

This Appendix provides information for all case study countries on: i) their protected area network (including legal framework and designation categories, OECMs, overlaps, governance and management; ii) their ecological connectivity or green infrastructure strategy, legal framework, legal requirements to integrate into spatial planning, and non-legislative tools to integrate ecological connectivity into spatial planning; and iii) any public funding and private financing for protected area designation and management and for planning, safeguarding and restoring ecological corridors.

The NaturaConnect case study countries and regions are:

Danube-Carpathian region:

- Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany (Bavaria and Baden-Württemberg), Hungary, Moldova, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, Ukraine.

National case studies:

- Finland
- France
- Portugal

Regional case studies:

- Germany - Leipzig-Halle region in Saxony (regional and local nature conservation policy)
- Spain - Doñana region in Andalucía (national, regional and local nature conservation policy)

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1. EU WIDE INFORMATION

1.1. PROTECTED AREA NETWORK (TERRESTRIAL) IN EU

1.1.1. TYPES OF DESIGNATED PROTECTED AREAS

Europe's protected areas include:

- Areas designated under international conventions, including:
  - UNESCO World Heritage and Biosphere sites.
  - Ramsar Convention wetlands.
  - Emerald Network areas designated under the Convention on the Conservation of European Wildlife and Natural Habitats; a binding international legal instrument known as the Bern Convention.
- Areas designated under EU law:
  - Natura 2000 areas designated under the EU Birds and Habitats Directives. The Habitats Directive is the legal instrument to fulfil the EU's responsibilities under the Bern Convention.
- Areas designated under nationally, regionally, and locally defined legal designations.

Transboundary protected areas can be created by: a) designating the whole area in all countries under an international designation, as a World Heritage or Biosphere site and/or as a Ramsar area; and/or b) creating a specific intergovernmental agreement that defines a collaboration between the bordering nationally designated protected areas and/or setting up an organisation to manage the transboundary area. The EUROPARC Federation has set up a certificate for transboundary protected area regions.

The protected areas in Europe include many different designations which are managed with different objectives, many of which overlap partially or fully with each other on the same area. Sites designated under international conventions must all be protected through national-level instruments, as the international agreements do not have direct legally binding legislative power at the national level. Natura 2000 sites are directly protected under EU law but are designated and governed according to the national legislation that transposes the EU directives.

To foster the use of a common standard at international level, the IUCN designed a global **IUCN categorization of protected area types** (Table 1).

Table 5. An overview of terrestrial protected area designations in Europe is listed in the table, using the IUCN categories.

Designation	Legal framework and protection purpose	Governance
INTERNATIONAL		
World Heritage Site	Sites designated for their globally significant natural and/or cultural heritage under the World Heritage Convention overseen by UNESCO.	The World Heritage Committee is responsible for deciding if sites nominated by the Party countries should be registered on the World Heritage List. The Committee can also select sites that are under threat and request and publish reports on the state of conservation of the site, propose activities to mitigate threats, define corrective measures and a timeframe for their implementation.
Ramsar Wetland of International Importance	A wetland that meets the Ramsar Convention's Criteria for the Identification of Wetlands of	The Ramsar Convention Secretariat registers site Ramsar Information sheets, publish guidelines, and convene the

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	International Importance. All countries that have signed the Ramsar Convention (which includes all EU countries) must make a wetlands inventory according to scientific criteria and designate at least one wetland. The wetland must be designated with a clear statement of purpose and site conservation objectives based on these scientific criteria.	triennial meetings of the Conference of the Contracting Parties. Countries have to convene a National Ramsar committee or National Wetlands Committee which is responsible for the sites.
UNESCO Biosphere Site	Biosphere reserves are established under UNESCO's Man and the Biosphere (MAB) Programme dedicated to exploring and demonstrating interdisciplinary approaches to sustainable development. Each site should incorporate a highly protected 'core' area for nature conservation, and 'buffer' and 'transition' areas containing human settlements that are managed sustainably.	UNESCO accredits the biosphere sites that are nominated by the countries under the UN convention. The responsibility for monitoring biosphere reserves lies with the national MAB committee on behalf of UNESCO.
EU / EUROPE		
Natura 2000 – **Sites of Conservation Interest (SCI) / Special Areas of Conservation (SAC)**	Sites of Conservation Interest (SCI) or Special Areas of Conservation (SAC) designated under the EU Habitats Directive for EU priority habitat types (Annex I habitats) and/or EU priority species (other than birds) listed in Annex II. Designated sites must contain representative areas or populations of the priority habitats and species within the relevant biogeographical region(s). The network within the biogeographical region must be sufficient to protect a representative sample of those habitats and species.	Site protection must follow the EU law and can be enforced through Commission infringement proceedings and European Court of Justice cases. The European Commission and the Member States, in the biogeographical seminar process, review the SCI designation and level of sufficiency. The EU Commission with Birdlife International reviews the sufficiency of SPA designations.
Natura 2000 – **Special Protected Areas (SPA)**	Special Protected Areas (SPA) designated under the EU Birds Directive for EU priority bird species listed in Annex I, and/or to protect sites with a large share of the population of certain bird species, and/or to protect sites important for migrating birds and important wetlands.	

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Emerald Network[1] - **Areas of Special Conservation Interest**	Areas of Special Conservation Interest designated by European countries signatories to the Bern Convention. The signatories include Bosnia and Herzegovina, Montenegro, Moldova, Serbia, and Ukraine (as well as all EU countries through the Habitats Directive). The legal framework for site designation is similar to the EU Habitats Directive. Before being officially adopted as Emerald Network sites, all sites proposed for the Network are thoroughly assessed at the biogeographical level for their sufficiency to achieve the ultimate objective of the Network. This objective is long-term survival of the species and habitats of the Bern Convention, which requires specific protection measures. The Natura 2000 network is considered to contribute to the Emerald Network. In the EU accession countries, the network is designated according to lists of plant and animal species harmonized between the Appendices of the Convention and the Annexes of the Habitats Directive and the Birds Directives and will become the national Natura 2000 network upon accession.	The Council of Europe provides the secretariat and hosts the Standing Committee to the Bern Convention. The Committee monitors implementation and adopts reference documents and recommendations. Moldova and Ukraine are among the countries who have officially adopted Emerald Sites on their territories. The Committee regularly nominates officially as 'Candidate Emerald sites' sites proposed by countries currently working on the establishment of the Emerald Network).
NATIONAL CATEGORIES (Dudley, 2013)		
IUCN Category Ia – Strict Nature Reserve	Strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.	
IUCN Category Ib – Wilderness Area	Similar to a strict nature reserve, but generally larger and protected in a slightly less stringent manner. These protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.	
IUCN Category II – National Park	Protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	
IUCN Category III – Natural monument or feature	A comparatively smaller area that is specifically allocated to protect a natural monument and its surrounding habitats. Areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.	
IUCN Category IV – Habitat/species management area	Protected areas that aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category	

[1] Council of Europe website: https://www.coe.int/en/web/bern-convention/emerald-network

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IUCN Category V – Protected landscape/seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other value
IUCN Category VI – Protected area with sustainable use of natural resources	Protected areas that conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area

1.1.2. LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

Protected areas may have various national, regional, and local level governance arrangements. The IUCN has identified four broad governance types, nothing that any of these can be associated with any given management objective (Dudley, 2013):

A. Governance by government (at federal/state/sub-national or municipal level). A government body holds the authority, responsibility and accountability for managing the protected area, determines its conservation objectives, develops and enforces its management plan. Usually, the state also owns or holds the rights to the protected areas' land, water and related resources.
B. Shared governance. Shared governance, sometimes referred to as co-management, occurs in many forms. Varied institutional mechanisms and processes are employed to share management authority and responsibility among different formally and informally entitled governmental and non-governmental actors. In 'collaborative' management, one agency has decision-making authority and responsibility but is required – by law or policy – to inform or consult other stakeholders. In 'joint' management, various actors sit on a management body with decision-making authority and responsibility.
C. Private governance. Protected areas under individual, cooperative, NGO or corporate control and/or ownership. The landowner has authority for managing the protected area and determines the conservation objectives, develops and enforces the management plan and remains in charge of decisions, within the legal framework of the land designation.
D. Governance by indigenous peoples and local communities. The indigenous peoples and local communities have management authority and responsibility through customary or legal, formal or informal, institutions and rules.

The protection measures employed for the different protected area designations in Europe also vary widely. The protection regime differs if the land is under public ownership or owned by private individuals or organisations, and if there are stakeholders who own or have the use of private rights on the land such as hunting rights or water extraction rights. Broadly, protection regimes can be distinguished into four types (which may operate in combination or in different zones if the protected area is large):

1. Regulatory exclusion – strict protection that legally excludes most types of human activities.
2. Regulatory protection against development and other activities that cause degradation – established activities are allowed but statutory protection prevents activities that may be damaging or degrade the nature values of the area and control development. Certain activities are strictly prohibited (e.g. mining) whilst others may be permitted if they are assessed as not causing significant impacts. Sometimes developments are permitted because they are judged to be of overriding public interest.

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3. Planning restrictions – sites are mapped or listed in planning documents and their biodiversity importance must be considered in planning decisions. This is generally a relatively weak form of protection.
4. Contractual incentive-based schemes or measures – where landowners and stakeholders are encouraged to maintain or adopt desired management practices through the use of contracts or payments such as agri-environment agreements funded through the EU Common Agricultural Policy, or contracts supported by national or regional funds.

The European Commission has published guidance on how to interpret **strict protection of protected areas in the EU** (European Commission, 2022). In the context of the EU Biodiversity Strategy target for strict protection, strictly protected areas are defined as: '*Strictly protected areas are fully, and legally protected areas designed to conserve and/or restore the integrity of biodiversity-rich natural areas with their underlying ecological structure and supporting natural environmental processes. Natural processes are therefore left essentially undisturbed from human pressures and threats to the area's overall ecological structure and functioning, independently of whether those pressures and threats are located inside or outside the strictly protected area*.' If the protected area is sufficiently large and has more or less intact natural ecosystems and processes, strict protection may mean non-intervention, with only limited and well-controlled activities, though in many cases interventions are necessary to prevent disastrous wildfires and to control invasive alien species. Strictly protected areas may also be areas in which active management sustains or enhances natural processes, such as maintaining semi-natural grasslands in the absence of wild grazers, restoring peatlands and wetlands, or controlling the populations of wild ungulates when natural predation is insufficient, due to the absence of large carnivores. In practice, there are many degrees of strictness of protection, and different interpretations of what strict protection is.

For **Natura 2000 sites**, the EU Nature Directives set the legal requirements. Sites must be designated in a site designation instrument that describes the conservation objectives and conservation measures that apply to the site. The EU legal framework leaves open different approaches to designate the sites and Member States can use regulatory (statutory), contractual and/or administrative instruments to designate and manage sites. Management plans are not obligatory, and the conservation measures may instead be integrated into other development plans and statutory, administrative or contractual measures. The site must have legal protection that prevents significant deterioration of the conservation status of the habitats and species for which the site is designated. In general, however, other land uses that do not cause significant disturbance or deterioration to these habitats or species can continue in Natura 2000 sites, unless another national or regional designation rules them out.

1.1.3. LEGAL AND GOVERNANCE MECHANISMS FOR ECOLOGICAL CONNECTIVITY IN EU POLICY

This section covers pan-European and EU policies and legislation. The Council of Europe initiated ecological network activities in the 1990s under the Bern Convention. In the EU, three laws explicitly include requirements for ecological connectivity on land and freshwater: since the early 1990s, the EU Habitats and Birds Directives (the nature directives), which govern the Natura 2000 network, and since 2000, the EU Water Framework Directive, supported indirectly by the EU Nitrates Directive (1991) and the EU Floods Directive (2007). The EU has also published strategies and initiatives to realise the global targets for ecological connectivity agreed under the Convention on Biological Diversity in 2010 and 2022.

Pan-European initiatives

The Bern Convention on the Conservation of European Wildlife and Natural Habitats (known as the **Bern Convention**) does not explicitly mention ecological connectivity but does require

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cooperation between national states for nature protection and special attention to the needs of endangered and vulnerable migratory species and their habitats, as well as legislating for the Emerald Network of protected sites described above and protection and restoration of species and habitats.

Under the convention, the Council of Europe adopted an action to establish a **Pan-European Ecological Network** in 1995[4]. The PEEN was a key objective of the Pan-European Landscape and Biodiversity Strategy (PEBLDS)[2], published by the IUCN in 1997 and adopted by the Council of Europe, as a way of implementing the Convention on Biological Diversity in Europe. The PEEN was developed in three subprojects: Central and Eastern Europe, completed in 2002; South-eastern Europe, completed in 2006; and Western Europe, also completed in 2006. The methodology of the development of the three maps was broadly comparable but data availability, differences in national databases, technical developments and geographical differences caused variations in the detailed approach[5]. The maps identified the core nature areas of European importance, existing corridors between these areas, and where new corridors could and should be established to meet the connectivity requirements of key species[3]. The PEEN provided the first framework for strategic cooperation in planning for ecological connectivity across Europe, though the maps have no legal standing and there is no enforcement mechanism.

The **Council of Europe Landscape Convention** recognises the important public interest role of landscapes in the ecological field, though it does not explicitly refer to ecological connectivity. It was agreed by the Council of Europe in 2000 and entered into force in 2004[4]. It is ratified by 40 European countries to date. It proposes legal and financial measures at the national and international levels, aimed at shaping 'landscape policies' and promoting interaction between local and central authorities as well as transboundary cooperation in protecting landscapes.

The **European Green Belt Initiative** has ecological connectivity as its goal[6]. It aims to create a chain of protected areas along the former Iron Curtain between Western and Eastern Europe from the Barents Sea at the Russian-Norwegian border, along the Baltic Coast, through Central Europe and the Balkans to the Black and the Adriatic Sea. The European Green Belt Association e.V. is a legal entity with 17 member countries plus NGO members, including 12 of the Danube and Carpathian countries covered in this Appendix.[5]

EU legislation

The **Habitats Directive** (Directive 92/43/EEC) aims to restore and maintain ecological connectivity. The Directive established the Natura 2000 network in Europe. Article 10 of the EU Habitats Directive states that:

'*Member States shall endeavour, where they consider it necessary, in their land-use planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems*

[2] Council of Europe Committee of Ministers 1997. https://rm.coe.int/16804cb2d3 (Website accessed 27/5/2024)

[3] European Environment Agency. https://www.eea.europa.eu/data-and-maps/figures/indicative-map-of-the-pan-european-ecological-network-for-central-and-eastern-europe (Website accessed 27/5/2024)

[4] Council of Europe Landscape Convention (ETS No. 176). Details of Treaty No.176. https://www.coe.int/en/web/conventions/full-list?module=treaty-detail&treatynum=176 (Website accessed 27/5/2024)

[5] The membership includes 12 of the Danube and Carpathian countries covered in this Appendix (Germany, Poland, Czechia, Slovakia, Austria, Hungary, Slovenia, Croatia, Romania, Bulgaria, Montenegro, Serbia), as well as Finland, Estonia, Latvia, Lithuania, Russia, Italy, Greece, Albania, Macedonia, Turkey, Kosovo, and Norway.

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for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.'

This article explicitly includes ecological connectivity in the form of linear features, stepping stones, migration, dispersal and genetic exchange. The **Birds Directive** (Directive 2009/147/EC), while not explicitly mentioning ecological connectivity, also includes the management of habitats outside protected areas under Article 3, as well as areas along migratory routes under Article 4. The European Commission issued a guidance document on Article 10 of the Habitats Directive and Article 3 of the Birds Directive in 2007 (Kettunen et al, 2007). Member States are asked to plan measures and funding for green infrastructure – including buffer zones and ecological connectivity – in their Prioritized Action Framework (PAF), the document that plans funding for the Natura 2000 network in each multi-year EU budgetary period, including the use of EU funds (European Commission, 2023b).

The **Water Framework Directive** (Directive 2000/60/EC) requires Member States to achieve good ecological status or good ecological potential of water bodies on their territory. Ecological connectivity is a criterion to be used in the assessment of several of the water quality elements of surface water bodies. River continuity, the hydrological regime, and the connection of rivers to groundwaters and riparian zones are direct quality elements providing ecological connectivity, while thermal and oxygenation conditions can, in some cases, also constitute a barrier to migrating fish. Member States are, therefore, expected to take measures to maintain or re-establish continuity. Member States may designate rivers or sections of rivers as river reserves where connectivity must be preserved. Protected areas under the Water Framework Directive can also protect ecological connectivity as they include Natura 2000 areas, drinking water protection areas, and areas designated for the protection of economically significant aquatic species. The Water Framework Directive also provides for cooperation across Member States through international river basin management plans under Article 13.

Restoring upstream and downstream continuity may include removing barriers and dams, or building fish passes or other passes around barriers, and restoring the riverbed and banks to slow or vary the water flow so that the river restores sediments to places where they are missing and removes sediment from other areas. Restoring latitudinal connectivity includes restoring river meanders, removing dams and restoring natural riparian zones to allow access to floodplain areas, and restoring riparian forests and wetlands. Natural water retention measures (NWRM) are natural or nature-based structures that slow down the flow of stormwater, increase infiltration and reduce pollution through natural processes. EU guidance recommends NWRMs as cost-effective measures to achieve the goals of the Water Framework Directive[3].

The **Nitrates Directive** supports ecological connectivity indirectly by requiring measures to reduce water pollution from nitrates, notably riparian buffer zones or strips with a minimum width and permanent vegetative cover along water bodies.

The **Floods Directive** supports ecological connectivity indirectly by requiring measures to reduce flooding, notably by restoring natural river structures that slow water flow and restoring or recreating floodplain habitats and flood spill over areas. The directive does not directly require legal restrictions in areas with high flood hazard risk, but Member States can choose to restrict potential land uses in flood-prone areas. Flood risk management measures must take account of EU environmental objectives and must address the potential effects of flooding on Natura 2000 and protected waters.

The **Trans-European Networks for Energy (TEN-E)** and the **Trans-European Networks for Transport (TEN-T)** are policies to link the energy or respectively transport infrastructure of EU countries by identifying and supporting lists of Projects of Common Interest and Projects of Mutual Interest. The revised regulations in 2022 impose a new obligation for all projects in the EU list. PCIs and PMIs must meet mandatory sustainability criteria and, in compliance with the 'no significant harm' principle as per the EU Taxonomy Regulation, they must be implemented in a way that does not hinder the achievement of the environmental objectives.

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The TEN-E regulation is amended by the nature restoration regulation which gives renewable energy plants, connections, and grid the status of projects of overriding public interest, exempting them from the alternatives' assessment test.

The **EU Nature Restoration Law** entered into force in the EU on 18 August 2024[6]. It contains legally binding targets for the restoration and recreation of habitat types defined in the EU Habitats Directive (Annex I habitat types) and species protected by both Nature Directives, as well as marine habitats and species. It requires Member States to inventory and then remove artificial barriers to the connectivity of surface waters and to take measures to improve the natural functions of the related floodplains. It also includes targets to restore pollinator populations, and to achieve improving trends in farmland bird populations, grassland butterfly populations, forest birds, and other forest indicators. On agricultural land, Member States should put in place measures to increase the share of land with high-diversity landscape features. In their national nature restoration plans, Member States must consider the connectivity needs between habitats for the species populations to thrive, as well as ongoing and projected changes to environmental conditions due to climate change, the competing needs of the habitats and species, and the presence of high nature value farmland. They must identify and map the agricultural and forest areas in need of enhanced connectivity and landscape diversity, as well as restoration needs more widely.

EU policies

The **EU Green Infrastructure Strategy** was launched by the Commission in 2013 as part of its commitments to the global Aichi biodiversity target 11[7] and the EU Biodiversity Strategy 2020 (which had green infrastructure as headline target 2)[7]. The strategy sets objectives for green infrastructure to enhance connectivity between protected areas to allow species to thrive across their entire natural habitat and adapt to the effects of climate change and to contribute to the maintenance of ecosystem services delivery to society, as well as setting broader aims for natural and semi-natural areas and their ecosystem services to be considered in spatial and territorial planning, as well as restoring natural elements, to deliver benefits to people, nature, and the economy. The European Commission has defined green infrastructure as[8]:

> *'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, while also enhancing biodiversity.'*

The key principles of green infrastructure are connectivity, spatial planning, and multifunctionality; it goes beyond the aims of ecological networks, promoting the multifunctional nature of space and the benefits that appropriate management approaches can deliver (van der Sluis and Schmidt, 2021). The EU strategy aimed to create an enabling framework for green infrastructure using existing EU legal, policy and financial instruments. In 2019, the Commission provided guidance on how to integrate green infrastructure into key policies, improve information, strengthen the knowledge base and promote innovation, improve access to finance and foster investments in EU-level Green Infrastructure projects and promote good practices (European Commission, 2019). The guidance emphasises that EU level green infrastructure projects should contribute to the goals of the Nature Directives,

[6] Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance). Enters into force 20 days after publication on Official Journal on 29 July 2024.

[7] Target 11 of the Aichi Biodiversity Targets, signed at COP 10 of the Convention on Biological Diversity (CBD) in 2010, states that: By 2020, at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.

[8] https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en

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including via implementing Article 10 of the Habitats Directive and connecting Natura 2000 with buffer zones to defragment the landscape.

Many EU Member States and regions have progressively adopted national and/or regional green infrastructure strategies since 2011[8].

The **EU Biodiversity Strategy to 2030** (European Commission, 2020a) introduced the concept of the coherent and resilient Trans-European Nature Network (TEN-N), and set the target to make at least 25 000 km of rivers free-flowing again by 2030, for as well as setting goals to create an EU regulation for nature restoration and promote investments in green and blue infrastructure, amongst other related goals. Under the strategy, the Commission published a guidance on river barrier removal (European Commission Directorate-General for Environment, 2022).

The EU **Forest Strategy for 2030** promotes closer-to-nature forestry in the EU through technical support and the promotion of payments for ecosystem services and voluntary certification schemes (European Commission, 2021). The Commission guidelines on closer-to-nature forest management published in 2023 include a toolbox with several interventions for ecological connectivity, such as setting areas aside for biodiversity networks and corridors and landscape scale planning and management (‘mosaic’ approaches) (European Commission, 2023a).

The EU **Pollinators Initiative,** revised in 2023, aims to improve the conservation of pollinators and tackle the causes of their decline. To achieve this the initiative promotes strategically planned restoration activities to ensure adequate areas of well-connected, high-quality habitats for pollinators through species conservation plans. By 2027, the Initiative foresees the development of a blueprint of a network of ‘Buzz lines’ - ecological corridors for pollinators - with an accompanying implementation plan. The initiative calls on Member States to integrate the ‘Buzz lines’ into spatial planning at national, regional, and local levels.

1.2. FUNDING

The following section describes EU funding sources for protected areas and ecological connectivity. More information on the availability of EU funding for protected areas is provided in the factsheets available at the NaturaConnect website[9].

Information on national, regional, local and non-governmental sources of funding is given in the country sections of this Appendix. Emerging and potential sources of private funding for protected areas and ecological connectivity are provided in the factsheets available at the NaturaConnect website (see previous footnote).

1.2.1. PUBLIC FUNDING SOURCES FOR PROTECTED AREAS AND ECOLOGICAL CONNECTIVITY

The **LIFE programme** administered by the European Commission has nature conservation and ecological connectivity as one of its core objectives. It offers great opportunities to contribute to a coherent TEN-N as it encourages investments in designation of additional Natura 2000 sites, increasing connectivity and cross-border cooperation in green and blue infrastructure projects. It provides opportunities for jointly funded projects with non-EU countries, which is relevant to cross-border green infrastructure projects, for example where a Natura 2000 site lies alongside a nationally protected area in a non-EU state. It also provides funding opportunities for cross-border marine protected areas. An important feature of LIFE funding is that it can be used for land acquisition. The main limitations are the fact that funding

[9] Available from October 2024 at https://naturaconnect.eu/deliverables/

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is limited and competitive, project based and therefore not suitable for continuous needs such as maintenance, that it requires co-funding, and that application and management of projects is quite demanding.

The **EU cohesion funds** include the European Regional Development Fund (ERDF), the Cohesion Fund targeted at the eastern European Member States, and the European Social Fund Plus (ESF+). Member States may programme these funds together or separately, and in a single programme or several programmes at national or regional levels, and as these funds are targeted at a series of objectives, the programmes do not necessarily provide funding for protected areas. However, some of the programmes do provide scope for funds to flow to protected areas and their governance. In addition, some Member States provided one-off grants or loans to protected areas through their **Recovery and Resilience Facility** funding programmes.

The European Territorial Cohesion (or **Interreg**) fund is funded by the European Regional Development Fund (ERDF). It has the explicit objective to fund transboundary nature conservation initiatives, alongside its other objectives, so mainly the cross-border, regional, and Europe-wide Interreg programmes include protected areas and ecological connectivity as a funding priority. The funding cannot be used for land acquisition or management directly but is meant to support cross-border partnerships e.g. to collaborate on protected area management, to support learning and training and exchanges of experiences, and to set up collective initiatives.

Other EU funds can be used to support land and water management within protected areas.

The most important in terms of volume of funding are the two **Common Agricultural Policy funds EAGF** and **EAFRD** for the management of farmed land. It is the main source of funding for arable land and most types of grazed and/or mown land within protected areas - including meadows and pastures, scrub, heathlands, and wooded meadows and pastures (including the silvo-pastoral agroforestry habitats of the Iberian Peninsula - dehesa[10] and montado[11]). CAP funding can also be used for the management of farmland in ecological corridors.

The main CAP instruments for land management in protected areas and ecological corridors are:

- Eco-schemes (funded by EAGF) – annual payments for relatively simple ecological actions and management and/or for refraining from doing something (such as applying pesticides). Can support conversion of arable land into grassland and its maintenance.
- Agri-environment-climate contracts (funded by EAFRD) – 5-year contracts to fund defined management activities, or alternatively to achieve a certain ecological result.
- Natura 2000 payments (funded by EAFRD) – annual payments for farmland or forest in Natura 2000 sites tied to conforming to the constraints or management requirements defined for that site and/or general management requirements for all sites.
- These support schemes can be accompanied by advice or training for the task.
- Investment support: Farmers can apply for investment support for tree or hedge planting or other small-scale restoration activities on their land, or for afforestation or conversion of arable fields into grassland. Public authorities may have access to investment support for larger restoration actions such as recreating flooded grasslands

[10] A characteristic landscape of the southwestern quadrant of the Iberian peninsula in which crops, pasture land or Mediterranean scrub, in juxtaposition or rotation, are shaded by a fairly closed to very open canopy of native oaks. https://eunis.eea.europa/habitats/393

[11] The *montado* is a unique, endangered landscape in Portugal's Alentejo region, shaped by centuries of human activity. It integrates agriculture, forestry, and grazing, with cork oaks and holm oaks as key species. This ecosystem is a biodiversity sanctuary, home to hundreds of plant and animal species, including the endangered Spanish imperial eagle. The *montado* represents a harmonious blend of natural and human-altered environments. https://biodiversity.com.pt/biogallery/montado

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and removing dams along rivers, rewetting peatlands, or replacing conifer plantations with deciduous woodland.

Cooperation funding is available in most Member States for a group of farmers in an area to collaborate on a joint initiative such as watershed management or climate adaptation or the creation of an ecological network.

The **European Maritime, Fisheries and Aquaculture Fund (EMFAF)** can be used the restoration of water bodies, such as river re-alignments, dam removals, coastal protection with green infrastructure, and so on. It can also fund research, communication, stakeholder engagement, and collaboration activities that can provide important inputs to projects for ecological connectivity along wetlands, rivers and coastlines. It does not provide ongoing maintenance support.

In most countries, the main source of funding for protected area governance is from national and regional public budgets. There is a great variation in the availability of funds and public administrations across protected area types and countries and regions, ranging from some quite well funded and resourced national parks with their own administrative bodies and income sources, to many protected areas with no dedicated funding at all and minimal administrative capacities in the relevant public authorities. National and subnational sources of funding are described in the country sections.

1.2.2. PUBLIC FUNDING FOR ECOLOGICAL CONNECTIVITY

LIFE and Interreg funding are available for EU neighbouring countries and so enables transboundary initiatives.

As explained above, **LIFE** is a key fund for ecological connectivity projects. Land areas which are purchased and managed under LIFE projects are subject to protection requirements and usually become part of protected areas or another land stewardship arrangement to ensure their long-term dedication to nature conservation.

The **Interreg** fund, part of the European Regional Development Fund, is the most important source of transboundary funding for ecological connectivity. Examples of Interreg projects focused on ecological connectivity are:

- SaveGREEN (2020-2022) - Safeguarding the functionality of transnationally important ecological corridors in the Danube basin led by WWF-CEE. Aimed to demonstrate ways of designing appropriate mitigation measures and maintaining or improving the functionality of ecological corridors through integrated planning, building on key results of the previous Interreg projects TRANSGREEN, ConnectGREEN, and HARMON.
- ConnectGREEN (2018-2021) - Restoring and managing ecological corridors in mountains as the green infrastructure in the Danube basin. Led by WWF-DCP Romania and WWF-CEE with partners in Romania, Austria, Czech Republic, Hungary, Slovakia, and Serbia.
- TRANSGREEN (2017-2019) - Integrated Transport and Green Infrastructure Planning in the Danube-Carpathian Region for the Benefit of People and Nature. Led by WWF-CEE and with 9 associated partners in Czech Republic, Slovakia, Hungary, Romania, Ukraine.
- MEASURES (2018-2021) - Managing and restoring aquatic EcologicAl corridors for migratory fiSh species in the danUbe RivEr baSin. Led by BOKU Uni in Vienna with 24 partners in 13 countries.
- MaGICLandscapes (2017-2020) - Managing Green Infrastructure in Central European Landscapes. Led by Universität Wien with partners in Austria, Czechia, Germany, Italy

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and Poland. It introduced the green infrastructure concept and its benefits to the five country governments and in nine case study areas.

- PlanToConnect (ongoing: 2022-2025) - Mainstreaming ecological connectivity in spatial planning systems of the Alpine Space. This project is developing and testing an Alpine spatial planning strategy for ecological connectivity, and a capacity-building package for its implementation. The aim is to identify the key cross-border areas for planning of ecological connectivity and to facilitate the upgrade of spatial planning systems and territorial policies to preserve or re-establish them. It is working with 8 pilot areas, some of which are municipalities and some of which are intermunicipal, including one transboundary area. An overarching study is addressing observed difficulties in coordination across different territorial levels and challenges related to data harmonization in identifying Green Infrastructure components, as each alpine country utilizes different methodologies and tools.

The Interreg **ESPON programme** (European Observation Network for Territorial Development and Cohesion or European Spatial Planning Observation Network): 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. The implementation of green infrastructures was one of the priorities of ESPON in the 2015-2022 programming period (e.g. Project GRETA: GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development).

Common Agricultural Policy: there are opportunities for using CAP funds to support ecological connectivity, as detailed above.

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2. THE DANUBE-CARPATHIAN REGION

2.1. REGIONAL LEGAL AND GOVERNANCE MECHANISMS FOR ECOLOGICAL CONNECTIVITY

In the Danube and Carpathian regions, several international governance structures are in place, and these implement a series of policies and projects that promote protected area networks and ecological connectivity across the region.

Carpathian Convention

The Framework Convention on the Protection and Sustainable Development of the Carpathians (referred to as the Carpathian Convention) is an international agreement between the Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia and Ukraine. According to Article 4.1, the Parties shall pursue policies aiming at conservation, sustainable use and restoration of biological and landscape diversity throughout the Carpathians, and 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, in particular the protection of endangered species, endemic species and large carnivores.

The Carpathian Network of Protected Areas was established under the Convention in 2006 to foster cooperation between the protected areas in the Carpathians and connected mountain ranges[12]. The CNPA Coordination Unit is responsible for coordinating activities and preparing reports and recommendations to be submitted to the Carpathian Convention. The Secretariat of the Convention has an Initiative of Mutual Observership Status with the ICPDR.

International Action Plan on Conservation of Large Carnivores and Ensuring Ecological Connectivity (2020)

The International Action Plan was adopted by the parties to the Carpathian Convention in November 2020. It is designed to be a reference for the development of aligned national management plans in each country (it is not a legal act binding the Parties). The plan includes the strategic objective to prevent habitat fragmentation and ensure ecological connectivity in the Carpathians. This requires all parties to identify a) patches of suitable habitats including core areas and steppingstones for large carnivores, within and between protected areas, Natura 2000 and Emerald networks; and b) key ecological corridors including wildlife/movement/migration corridors between them, using the joint methodology. Parties will also work to improve planning processes, tools and practices to better reflect and integrate ecological networks into spatial planning.

Carpathian Convention information system, guidance and methods

The Carpathian Countries Integrated Biodiversity Information System (CCIBIS) is the platform that hosts the ecological network maps and other information and knowledge. Projects under the Convention (particularly the TRANSGREEN, ConnectGREEN, SaveGREEN, and projects) have developed methods and guidance documents on ecological connectivity, some of which are highlighted the Joint Strategic Action Plan 2021 – 2026 for the implementation of the Protocol on Sustainable Transport:

- Guidelines how to minimize the impact of transport infrastructure development on nature in the Carpathian countries (Hlaváč et al, 2019)

[12] http://www.carpathianparks.org/

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- Handbook of Best Practices for Planning and Implementing Mitigation Measures regarding Landscape Connectivity (Borlea et al, 2022)
- State of the Art and Gap Analysis in the field of environmentally friendly transport infrastructure development (Kovács et al, 2021; Papp and Berchi, 2019)
- Methodology for the Identification of Ecological Corridors in the Carpathian Countries by Using Large Carnivores as Umbrella Species (ConnectGREEN, 2020)
- Methodologies for standardised monitoring and assessment of ecological corridors (Sedy et al, 2022)

International Commission for the Protection of the Danube River (ICPDR)

The Danube River Protection Convention forms the overall legal instrument for co-operation on transboundary water management in the Danube River Basin, signed by eleven of the Danube Riparian States – Austria, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Serbia, Slovakia, Slovenia and Ukraine – plus the European Commission. The International Commission for the Protection of the Danube River is the implementing body of the Convention.

The ICPDR is formally composed of the Delegations of all Contracting Parties to the Danube River Protection Convention and is assisted by a permanent secretariat including technical experts. The technical work is carried out in the Expert Groups composed of national experts from the Contracting Parties and representatives from ICPDR observer organisations. The most relevant Expert Groups related to ecological connectivity are the Hydro-morphology Task Group (HYMO TG) and the River Basin Management Expert Group (RBM EG).

The Danube River Basin Management Plan includes a set of detailed maps on existing barriers and restoration priorities at the macroregional level, with a complete overview on restoration priorities, barriers to longitudinal connectivity and restoration priorities for aquatic connectivity and green/blue infrastructure[13]. The plan sets the goal to remove a considerable number of these obstacles to river continuity in the wider Danube Basin in the 2021-2027 period.

While Observers are not granted decision-making rights, they actively participate in all meetings of the ICPDR experts and task groups, as well as plenary meetings Delegates of Observers have access to information including all technical meeting documents and the right to contribute to all technical discussions.

The Lower Danube Green Corridor Declaration is an international declaration agreed in 2000 between Bulgaria, Moldova, Romania, and Ukraine, overseen by the International Commission for the Protection of the Danube River. Through the Declaration, these four countries established the Corridor and identified specific targets in terms of wetlands protection and natural floodplains restoration[14]. The Flood Protection Expert Group of the International Commission for the Protection of the Danube River also adopted a Flood Action Programme for the Lower Danube Corridor.

EU Strategy for the Danube Region (EUSDR)

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011.[15] The Strategy seeks to create synergies and coordination between existing policies

[13] http://www.icpdr.org/main/publications/maps

[14] TransNature map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

[15] https://danube-region.eu/

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and initiatives taking place across the Danube Region. The Commission´s Directorate General for Regional Policy helps to implement the Strategy by facilitating and supporting the actions of the participating countries. The High-Level Group (HLG) on macro-regional strategies is made up of official representatives from all countries involved. It assists the Commission in the policy coordination of the Strategy. The National Coordinators (NCs) have a strategic coordination function within their national or regional government. The NCs coordinate and keep an overview of the participation of their country in the implementation of the EUSDR including all Priority Areas.

The Danube Region Strategy addresses a wide range of issues; these are divided into 4 pillars and 12 Priority Areas (PAs). Each Priority Area is managed by at least two countries as Priority Area Coordinators (PACs) and assisted by the Danube Strategy Point. The PACs organise Steering Group meetings in which mainly the representatives of the ministries of foreign affairs of the Danube countries participate along with other stakeholders as observers.

Under the Strategy's priority area 6, two of the five targets are to: *Improve management of Natura 2000 sites and other protected areas through transnational cooperation and capacity building*; and to *maintain and restore Green and Blue Infrastructure elements through integrated spatial development and conservation planning*.[16] According to the action plan (European Commission, 2020b), the priority area 6 action points[17] include:

- *'Strengthen horizontal knowledge transfer and access to environmental data between national authorities responsible for nature conservation (especially those of neighbouring countries). For instance, the use of Strategic Environmental Assessments for decision making, integration of the blue-green infrastructure into planning documents, supporting sustainable use of protected areas in order to increase support and feeling of ownership of local people, etc.*
- *Development of a common approach to define and determine ecological corridors for key target species on land and improve the communication, knowledge and data sharing between environmental, transport and spatial planning sectors on spatial integration of green and blue infrastructure.*
- *Establish the cooperation between the MRS approaches in establishing ecological connectivity and Green Infrastructure.'*

The **Joint Declaration 'Achieving functional biodiversity in the Danube-Carpathian Region by mainstreaming ecological connectivity'** signed in 2022 lays the basis for cooperation between the ICPDR, CC and EUSDR and commits them to strengthen cooperation on the implementation of ecological connectivity at all levels and sectors.[18]

The **Strategy for ecological corridor conservation and restoration in the Danube catchment** developed by an Interreg project expands on these goals and describes the necessary supporting actions, including the continuation of the Local Migratory Fish Networks set up in the Interreg project (Haidvogl, Munteanu and Reinartz, 2021). As this document has no legal weight, the recommendations and actions will only be implemented if taken up by the ICPDR and the Danube countries.

The **Alps-Carpathian Corridor**[19] is the subject of an Austrian-Slovakian Action Plan for the Corridor covering land use, communication, scientific fundamentals, protection and spatial planning (Frey-Roos et al, 2021). The Corridor is being restored to reconnect the eastern

[16] https://nature.danube-region.eu/targets-of-the-priority-area-6/

[17] EUSDR Action Plan 2020 (COM(2020) 59 final)

[18] https://www.icpdr.org/about-icpdr/partners/international-cooperation/icpdr-reaffirms-goals-declaration-achieving

[19] https://cor.europa.eu/en/news/Pages/Alps-Carpathians-corridor.aspx

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reaches of the Alps to the Western Carpathians and to support ecological connectivity and the sustainable development of the whole region. A cross-border platform forum was set up for the managers of these regions to share ideas and develop solutions that can be applied within the entire region. It promoted the construction of green bridges across the motorways.[20] An Interreg project funded the joint development of strategies for transboundary river management, and pilot restoration measures on the Danube tributary rivers Fischa, Schwechat, Rudava, Mociarka and Malina.[21]

DANUBEPARKS Network

The DANUBEPARKS Association is the platform for coordinated and extensive collaboration among the protected area administrations of nearly all the Danube countries[22]. It represents the managing bodies of 20 national and nature parks, biosphere and nature reserves, represented by public authorities, public enterprises, or NGOs.

The DANUBEPARKS network's **Danube-wide Dry Habitat Corridor Initiative**[23] promotes the protection, restoration, conservation, and appropriate management of the Danube dry grasslands. It maintains a cadaster and map, networks pilot studies, and links protected areas (for example, the Donauengtal near Passau in Germany, the Wachau UNESCO site in Austria, the Danube Bend and Duna-Ipoly National Park in Hungary, Djerdap National Park in Serbia, and Iron Gate Nature Park in Romania are working on joint strategies to synergize their biodiversity conservation actions).

The **Danube Riparian Forest Corridor Initiative**[24] aims to restore the ecological network of riparian forests in the region by mapping gaps in the riparian forest corridor and synergising conservation or restoration measures across the countries.

The **Danube Wild Island Habitat Corridor** is a corridor network of 912 islands covering an area of 138 415 ha with important habitats all along the river.[25] It is being restored as an ecological corridor with the help of Interreg and LIFE funded projects.[26]

An interactive WebGis map was developed indicating the habitat suitability and corridors for bear and lynx in the Danube River Basin.[27]

Strategy of ADC (Alps-Danube-Carpathians)

The protected area networks ALPARC, DANUBEPARKS and CNPA signed a memorandum of cooperation in 2016 to work on common goals and objectives regarding the conservation of biodiversity, through activities to create and realize ecological corridors. Common objectives

[20] The project 'Alps-Carpathians Corridor' has a total eligible budget of EUR 1 852 450, with the EU's European Regional Development Fund contributing EUR 1 427 519.

[21] INTERREG Slovakia-Austria Alpine Carpathian River Corridor (AKK River) (2017-2020) – led by Donau-Auen National Park, with partners in Austria and Slovakia. https://www.viadonau.org/en/company/project-database/aktiv/alpine-carpathian-river-corridor/?backurl=32

[22] https://www.danubeparks.org/association

[23] https://www.danubeparks.org/initiatives/danube-dry-habitat-corridor

[24] https://www.danubeparks.org/initiatives/danube-riparian-forest-corridor

[25] http://wildisland.danubeparks.org/

[26] Interreg Danube Transnational Programme DanubeparksConnected (2017-2019), followed by LIFE WILDIsland (2021-2027)

[27] http://webgis.eurac.edu/bioregio/

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are also to develop a joint voice towards habitat connectivity on a political level and EU policies (e.g. Green Infrastructure) including all concerned countries of the regions; and to raise awareness of the public for the importance of large non-fragmented areas and permeable landscapes.

Transboundary protected areas in the Danube-Carpathian region

The region has adopted more than ten transboundary protected areas, including:

- East Carpathian Biosphere Reserve adopted in 1998 between Bieszczady National Park in Poland, the Poloniny National Park in Slovakia and the Uzhansky National Park in Ukraine.
- Ramsar Site Floodplains of the Morava-Dyje-Danube Confluence established in 2004 in Austria (Donau-March-Thaya-Auen and Untere Lobau), Czech Republic (Mokrady dolního Podyjí) and Slovakia (Moravské Luhy Protected Area Landscape).[28]
- Mura-Drava-Danube Transboundary Biosphere Reserve established by a joint governmental declaration between Austria, Croatia, Hungary, Serbia, and Slovenia in 2021 (after more than 15 years of negotiations).[29]
- Ramsar sites Ibisha Island, Belene Islands Complex, and Srébarna on the Danube between Bulgaria and Romania[30].
- Krkonose/Karkonosze subalpine peatbogs Transboundary Ramsar Site in the Karkonosze Mountains in Czechia and Poland established in 2009.[31]
- Ramsar site designated in 2023 in the Đerdap gorge (Iron Gate) National Park, along the Danube River, on the border between Serbia and Romania.

2.2. FUNDING FOR REGIONAL ECOLOGICAL CONNECTIVITY

The ICPDR Joint Programme of Measures for the third international Danube River Basin Management Plan (2022-2027) is supported by funding for the permanent secretariat, but implementation of the measures relies on each Danube country mobilizing the funding within their borders.

EU funding plays an important role in funding cross-border actions.

[28] https://rsis.ramsar.org/ris/604

[29] https://wwfint.awsassets.panda.org/downloads/danube_drava_mura_factsheet.pdf

[30] https://rsis.ramsar.org/

[31] https://rsis.ramsar.org/ris/637

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3. THE DANUBE-CARPATHIAN REGION – ANALYSIS BY COUNTRY

Figure 21. Nizke Tatry in the Carpathian Mountains, Slovakia. ©Rastislav Staník

Figure 22. Danube Delta, Romania. ©WWF Central and Eastern Europe.

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3.1. AUSTRIA

In Austria, most of the legislation regarding nature and landscape conservation lies within the responsibility of the federal states (Bundesländer). The Bundesländer have legislative and executive powers with regard to spatial planning, nature protection and transport and are also responsible for the administration, implementation and enforcement of certain federal laws at the lower levels of government. The nature conservation authorities of the Bundesländer are responsible for the conservation and restoration of habitats valuable for nature conservation and their re-establishment.

3.1.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 6. National and regional designation types, protection purpose and governance in Austria. Sources: (Suske and Horvath, 2023), (VDN, 2017).[32]

Designation type	Protection purpose and governance	In which federal states
Strict Nature Reserve and Wilderness Area (Wildnisgebiet)	Strictly protected primary forest under non-intervention management (corresponding to IUCN category 1b) with all extractive forms of land use completely prohibited.	Two areas have been designated: Niederösterreich - Dürrenstein-Lassingtal (2001, extended 2021) Salzburg - Sulzbachtäler (2018)
National Park (Nationalpark)	Large area protected in full compliance with IUCN category II with strictly protected core area and buffer zones. Protection goal is to protect ecosystems and intact ecosystem functions in a large natural and mostly intact area.	Designated at federal level through a national law. 6 National Parks have been designated.
Nature Park (Naturpark)	Cultural landscapes that have a high value for nature recovery or learning about nature, or that have a historical significance and that are suitable as areas of recreation and knowledge transfer. These are often traditional agricultural landscapes protected for both nature and sustainable development. Designated by the state government.	Designated by every federal state.

[32] https://www.umweltbundesamt.at/umweltthemen/naturschutz/schutzgebiete; https://www.burgenland.at/themen/natur/geschuetzte-gebiete/; https://www.ktn.gv.at/Themen-AZ/Details?thema=11&detail=1035; https://www.noe.gv.at/noe/Naturschutz/Schutzgebiete_Naturdenkmaeler.html; https://www.land-oberoesterreich.gv.at/92726.htm; https://www.salzburg.gv.at/themen/natur/naturschutzrecht-2/naturschutzrecht-salzburg/gebietsschutz; https://www.verwaltung.steiermark.at/cms/ziel/74838061/DE/; https://www.tiroler-schutzgebiete.at/; https://vorarlberg.at/-/schutzgebiete-in-vorarlberg;

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Nature Reserve (Naturschutzgebiet)	Strictly protected for the natural habitats and rare or endangered species present, or for rare or scientifically interesting minerals or fossils. The protection must guarantee the natural functions and processes. However, there is an exemption for 'customary' agricultural and forestry activities.	Designated by every federal state.
Strict Nature Reserve (Sonderschutzgebiet)	Strict prohibition of any intervention in nature. Exceptions can be given for agriculture, forestry. Fishing and hunting activities may be allowed under license. Human access is prohibited in some areas or during the breeding season. The currently designated areas all contain primary riparian forest.	Designated by Tirol.
Landscape Protection Area (Landschaftsschutzgebiet)	Landscapes with high diversity, uniqueness, and aesthetic quality. Designated for their high value for recreation and tourism or their particular historic or archaeological value. Relatively weak protection level.	Designated by every federal state.
Natural Forest Reserve (Naturwaldreservat)	Forest areas set aside for natural development, with no timber extraction, grazing, or other human intervention allowed. Hunting is allowed to control wild ungulates.	192 reserves protect 83.5 km^2 of forest.[33]
Local/regional protected areas	Designated by local/district government (Bezirksverwaltungsbehörde). Certain actions are prohibited or only allowed under licence from the local authority.	
Protected Landscape Section (geschützter Landschaftsteil)	To protect a small area of semi-natural landscape or cultural landscape that is particularly characteristic and defining in a region, that defines the diversity or structure of the landscape or place, or that is an important recreational area for the local population (e.g. urban green space).	Burgenland Oberösterreich Salzburg Steiermark Tirol Vorarlberg Wien
Protected Habitat (Geschützter Lebensraum / geschützter Biotop)	Small site designated to protect habitat(s) and/or species of EU significance, without being designated as a Natura 2000 site.	Burgenland Wien
Nature Monument (Naturdenkmal)	Natural feature that is distinguished by its uniqueness, rarity or special form, that gives the landscape a unique character or that has a special scientific or cultural and historical value. Protection of the natural feature and its immediate surroundings. Niederösterreich: sites protect, in particular, gorges, waterfalls, springs, trees, hedges, vegetated avenues, hedges and groves and rare habitats[34].	Kärnten Niederösterreich Salzburg Steiermark Wien
Protected Natural Feature with Regional Significance (Geschützte Naturgebilde von örtlicher Bedeutung)	To protect a natural feature or small area that gives the place or town a particular character, have a high aesthetic quality, or a local historical or cultural significance.	Salzburg
Protected Cave (geschützte Höhle / Naturhöhle)	To protect a cave.	Niederösterreich Steiermark

[33] BMNT (01 2019) Waldinventur des BFW - Daten und Fakten. Wien.

[34] Lower Austrian Nature Conservation Act 2000 - NÖ Naturschutzgesetz 2000 (NÖ NSchG 2000) [LGBl. 5500-0] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrNO&Gesetzesnummer=20000814

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Nature Preservation Area and Sanctuary (Ruhegebiet /Ruhezone)	Landscape dedicated to recreation and enjoyment in nature. Most are in the high mountains. Prohibition on constructions (e.g. cable cars, roads).	Tirol Vorarlberg
Plant Protection Area	To protect particular plant populations in alpine areas under high pressure from recreation and tourism. Prohibition on picking, digging up or damaging plants.	Vorarlberg
Ecological Development Zone (Ökologische Entwicklungsfläche)	To protect area important for developing and connecting green infrastructure or to support species and habitat protection programmes. Protection may be permanent or limited to a specified time period (according to article 26 of Vienna nature conservation law).	Wien

Natura 2000 network: 15.4% of terrestrial area (total); 11.2% of area as SCIs, 12.3% as SPAs. The network is considered to be complete.

Total terrestrial protected area: 29.2% of land area (Suske and Horvath, 2023), BISE, CDDA[35].

Overlaps and protection levels: In Austria, almost half of the protected areas are designated exclusively under national laws. The other half consists of Natura 2000 sites (38.2%) or areas where Natura 2000 sites overlap with national designations (47.4%) (BISE[36]). The Austrian Natura 2000 sites are all designated individually through their own legal statutes. There are some overlaps between protected area designations, but the national designations provide a substantial additional protected area coverage that complements the Natura network (Suske and Horvath, 2023). However, a large share of this additional area is made up of the Landscape Parks which have a low level of protection for habitats and species – corresponding to IUCN category V.

Transboundary protected areas: Austria's boundaries with the Czech Republic, Slovakia, Hungary, and Slovenia were part of the Iron Curtain and now form part of the trans-European Green Belt initiative. Austria therefore has many transboundary partnerships between bordering protected areas. Austria and Hungary have declared the Neusiedler See-Seewinkel – Fertö-Hanság area as a Transboundary Ramsar Site, a World Heritage Site, and a transboundary National Park. The Austro-Hungarian National Park Commission, representing the Austrian and Hungarian governmental authorities and the Park's management bodies, acts as a steering committee for the further development of the Transboundary Protected Area[37]. See the Danube-Carpathian region, Chapter 2. Descriptions of further transboundary protected areas that include Austria.

OECMs: So far, Austria has not defined any areas as OECMs.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Natura 2000 sites are designated by the nature conservation departments of the federal governments. Austria had problems completing its Natura 2000 network which led to intensive negotiations with the European Commission and two infringement proceedings for insufficient designation. The network is now considered to be complete. Natura 2000 sites are designated through site specific decrees (Europaschutzgebietsverordnung) which specify the site

[35] European Environment Agency (2022). Nationally designated areas (CDDA) for public access - version 20, Jun. 2022. https://sdi.eea.europa.eu/catalogue/srv/api/records/28a5cf37-95d5-4758-9204-9eada51ebb8a

[36] EEA BISE https://biodiversity.europa.eu/countries/austria

[37] TransNature map of transboundary protected areas, https://www.transnature.eu/map

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conservation objectives (Suske and Horvath, 2023). The majority of the sites (almost 80%) have management plans elaborated by the regional nature conservation authority or by NGOs[38]. The authorities use contracts with landowners or users to implement management.

National Parks are designated by the federal government through a national law. Most of the other protected areas are designated by the nature conservation departments of the federal governments. Some protected areas are designated by the local government. Some federal states have created additional categories of protected areas – for example, plant protection areas in Vorarlberg, and undisturbed areas in Tirol and Vorarlberg (Suske and Horvath, 2023).

The federal state Vorarlberg has designated a buffer zone around one Natura 2000 site through a local ordinance, which specifies rules for buffer zone I and buffer zone II[39]. This governance instrument has not been used for any other protected area and has not been used in the other regions.

3.1.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

There is no federal legal framework for ecological connectivity. Progress on green infrastructure and ecological networking differs between federal states.[40] In the province of Steiermark (Styria) and the district Pinzgau in the province of Salzburg, green zones and corridors are protected by decree (pers.com., Environment Agency Austria). In several other Austrian federal provinces, the theoretical and technical bases for ecological networks have been established, but they are not legally binding.

Two federal instruments require mitigation measures to maintain connectivity across the road network, and an initiative has been started to use forest management plans to define habitat corridors:

The national Ministry Directive '**Habitat connectivity for wild living animals**'[41] requires the retrofitting of 20 green bridges over the existing motorway network in Austria by 2027. This is intended to secure long-term habitat connectivity for wide ranging wildlife species. The state-owned motorway management company ASFINAG has built four in the provinces of Niederösterreich (Lower Austria) and Burgenland (Göttlesbrunn, Pöttsching, Mühlendorf, and Bergland), and is constructing two more in the province of Oberösterreich (Upper Austria) across the Linz-Passau motorway and the province of Steiermark (Styria) near Graz.

The federal government **Guidelines on Wild Animal Protection**[42] issued in 2007 regulates the construction and management of structural crossing aids in new road projects[43]. These crossing aids may include underpasses, tunnels, overpasses, amphibian tunnels and culverts.

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[38] Some plans have been developed by NGOs, for example WWF.

[39] The ordinance specifies a prohibition on construction and activities. Landesrecht konsolidiert Vorarlberg: Gesamte Rechtsvorschrift für Pufferzonen zum Schutz von Gebietsteilen außerhalb des Natura 2000 Gebietes, Fassung vom 17.10.2023. https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrVbg&Gesetzesnummer=20000509

[40] https://lebensraumvernetzung.at/

[41] Dienstanweisung Lebensraumvernetzung Wildtiere (2006) Dienstanweisung Lebensraumvernetzung Wildtiere based on the WWF implementation concept 'Strategic planning for habitat connectivity in Austria - prioritisation of retrofit proposals for green bridges over motorways and expressways' https://www.bmk.gv.at/themen/verkehr/strasse/umwelt/wildtiere.html

[42] in Guidelines and Regulations for Planning, Construction and Maintenance of Roads, Richtlinien und Vorschriften für das Straßenwesen, RSV 04.03.12. Not publicly available but can be purchased at www.fsv.at

[43] Richtlinien und Vorschriften für den Straßenbau (RVS) 04.03.14 'Schutz wildlebender Säugetiere (ausgenommen Fledermäuse) an Verkehrswegen'

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Visualization of habitat corridors in forest development plans: The forest development plans are not legally binding, but the plans are taken into consideration in environmentally relevant procedures such as Environmental Impact Assessment and Strategic Environmental Assessment. The integration of habitat corridors into the plans is being tested at the local level in three pilot communities in the provinces of Tirol (Tyrol), Salzburg and Steiermark (Styria). The corridors must be made visible; however, there is no guidance on how to manage these areas. Community representatives are asking for more action at the level of spatial planning and more communication among all stakeholders.

3.1.3. SPATIAL PLANNING

The provinces have legislative and executive powers with regard to spatial planning. The Austrian Conference on Spatial Planning (ÖROK) serves as the coordinating body at federal level and publishes the Austrian Spatial Development Concept, most recently updated in 2021. The federal strategy is specified in more detail and implemented at the regional level in partnership agreements, which can be in the form of recommendations endorsed by all partners, or projects funded and led at the federal level.[44]

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The **Ecological Network Austria** (Lebensraumvernetzung Österreich) is a standardized Austria-wide evaluation of the most important wildlife corridors for Austria. The map and assessment were first published in 2018.[45] Data were derived from several national projects and sub-strategies[46], and harmonized in 2015 to support the implementation of targets 10 and 11 of the Austrian Biodiversity Strategy 2020+. In these projects, the Austrian Environment Agency (UBA), in cooperation with the federal states, identified the most important habitat axes in Austria (Leitner et al, 2018).

The aim of this standardized evaluation is to protect the remaining open green corridors that serve as migration routes at the national scale from being lost and fragmented through building and soil sealing. The map visualizes the ecological corridors but has no legal basis. Local planning authorities should require mitigation measures to protect the corridor function whenever planning permission is given for building projects that affect corridors. The Austrian Environment Agency (UBA) recommends that the authorities can secure corridors by strategically locating the compensation areas that are required as offsets for biodiversity losses from large projects, or by making nature conservation management agreements with landowners. UBA developed a guideline for farmers on how to manage ecological corridors which has been discussed with the Chamber of Agriculture.

The online platform **Lebensraumvernetzung** (habitat connectivity) provides access to all databases, maps and visualisations. It offers the following tools for spatial planning:

- Integrated dataset of ecological corridors: line maps, nodes, polygons of minimum areas
- Assessment of quality of ecological corridors: connectivity index, index of landscape structure, index of landscape elements
- Application to establish maps of ecological corridors in forest development plan

[44] ÖREK-Partnerschaften, https://www.oerok.gv.at/raum/themen/weitere-themen.

[45] https://lebensraumvernetzung.at/

[46] 'Habitat Connectivity Austria' ('Lebensraumvernetzung Österreich: Grundlagen – Aktionsfelder – Zusammenarbeit') and 'Habitat Networking for the Protection of Biodiversity' (Lebensraumvernetzung zur Absicherung der Biodiversität)

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- Completed ecological corridor maps for forest development plans

Austria-Czechia wild animal corridors action plan: A series of projects have researched and planned the protection and restoration of the ecological corridors for large mammals across the Austria-Czech border. The work has culminated in an action plan jointly agreed between Austria and the Czech Republic (Frey-Roos et al, 2021). The action plan maps wild animal corridors of regional, trans-regional and international significance for red deer, elk, lynx, wolf and bear. It also considers the ecological corridor mapping for wild cats carried out in another project (Interreg MaGIClandscapes). Red deer are used as the umbrella species for the corridors. However, the maps are not publicly available and there is little evidence that spatial planners have used them to make legally binding restrictions on land in the corridors.

3.1.4. FUNDING

FUNDING FOR PROTECTED AREAS

The main funding source for protected area designation and management are the federal state budgets. The Austrian Federal Biodiversity Fund (partly state money, partly money from the EU Recovery and Resilience Facility) supports projects for the restoration and protection of endangered species and habitats with a special focus on habitat connectivity.

The Austrian Conference on Spatial Planning (ÖROK) is responsible for managing EU funding from the European Regional Development Fund and Interreg programmes and coordinating cross-border cooperation programmes. This funding can be used for protected area work or ecological connectivity projects. The EU Common Agricultural Policy (through EAFRD[47]) is the main funder for land management through the Austrian Programme for Environmentally Sound Agriculture (ÖPUL), which provides broad-based agricultural policy support measures for environmental policy and landscape planning, agri-environment schemes and Natura 2000 payments since 1995.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

The European Regional Development Fund and Interreg programmes have been used for ecological connectivity projects across borders, such as the projects DaRe to Connect and SaveGREEN.

The Austrian Programme for Environmentally Sound Agriculture (ÖPUL) uses the Common Agricultural Policy (EAFRD) to fund measures for the maintenance of elements that provide ecological corridors on farmland (flower strips, trees, hedges, and other landscape elements). Funding is provided through multi-year contracts with individual farmers or resource managers.

In Lower Austria (Niederösterreich), the Lower Austrian Landscape Fund (LAFO) aims to preserve and restore an ecologically intact cultural landscape with a rich variety of native animals and plants, diverse landscape elements and environmentally friendly uses, considering the effects of climate change.

The state-owned road company ASFINAG funds green bridge planning and construction from their budget.

[47] European Agricultural Fund for Rural Development

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3.2. BOSNIA AND HERZEGOVINA

Nature protection is based in the law on nature protection updated in 2013 in the Federation of Bosnia and Herzegovina, the law on nature protection updated in 2014 in the Republic of Srpska, and the law on nature protection of the Brčko district. There is currently no unified state law addressing nature protection. Environmental laws in the regions are generally similar but with some differences related to the different governance systems. The country is in the process of making changes to its nature conservation law and policy on the way to EU integration.

Environmental responsibilities are distributed across central, regional, and local authorities.[48] The Council of Ministers (the main government body) has established the Directorate for European Integration as the main operational partner of the European Commission in the EU integration process. The Directorate facilitates a coordinated approach to integration into the European Union and international policies across the government and regions.

3.2.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 7. National and regional designation types, protection purpose and governance in Bosnia and Herzegovina. FBiH = Federation of Bosnia and Herzegovina. RSp = Republic of Srpska.; Sources: Law on Nature Protection. Official Gazette of the Federation of Bosnia and Herzegovina, no. 66/13. *(Zakon o zaštiti prirode. Službene novine Federacije Bosne i Hercegovine, broj 66/13). Official Gazette of the Republic of Srpska No. 20/14.*

Designation type	Protection purpose and governance
Strict Nature Reserve (Strogi rezervat prirode)	Area strictly protected for regionally, nationally or globally prominent ecosystems, species (individual or grouped) and/or geodiversity features, which are to be maintained mostly or completely without human activities and will be degraded or destroyed even with very low human pressures. Corresponds to IUCN category Ia. Visitation, uses and impacts are strictly controlled and limited in order to ensure the protection of natural values.
Wilderness Area (Područje divljine)	Protected area that is unchanged or very little changed, that has retained its natural character and influences, in which there are no permanent or significant human settlements. The primary purpose is the long-term protection of the ecological integrity of natural areas, which are not disturbed by significant human activities, without modern infrastructure, in which natural forces and processes are dominant. Corresponds to IUCN Category Ib.
National Park (Nacionalni park)	Large natural or almost natural areas, for the protection of ecological processes of a wider scale, and relevant species and ecosystems typical for the area, which represent the basis for spiritual, scientific, educational, recreational and touristic potential, compatible with the protection of cultural and natural inheritance. The primary purpose is the protection of natural diversity together with contained ecological structures and accompanying ecological processes while promoting education and recreation. Protection corresponds to IUCN Category II. There are four national parks: Sutjeska National Park (173 km^2), Kozara National Park (34 km^2), Drina National Park (63 km^2) in the Republic of Srpska and Una National Park (198 km^2) in the Federation of Bosnia and Herzegovina.[49]

[48] https://portal.cor.europa.eu/divisionpowers/Pages/Bosnia-Herzegovina-Environment.aspx

[49] https://en.wikipedia.org/wiki/List_of_protected_areas_of_Bosnia_and_Herzegovina

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Nature Park (Park prirode)	A nature park is a large natural or partially cultivated area of land and/or sea with ecological abundance of international, federal or cantonal importance, with an accentuated landscape, visual, cultural, historical and tourist values. Private and other activities are allowed in the nature park, which do not undermine its intrinsic qualities and role. The way of enjoying private activities and the use of natural goods in the nature park shall be governed by the nature protection regulations. Large natural or partially cultivated area with ecological characteristics of international, federal or regional importance with outstanding landscape, educational, cultural-historical and tourist-recreational values. Economic and other activities and actions that do not endanger its essential characteristics and role are allowed. Protection corresponds to IUCN category IIIa in the Federation and IUCN category V in the Republic of Srpska (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023).
Monument to Nature and Natural Wealth (Spomenik prirode i prirodnih obilježja)	Area protected for specific natural features, such as special landforms, geological formations or habitats. Generally, these are smaller protected areas, often with high tourist potential. The primary purpose is to protect the specific natural features and their associated biodiversity and habitats. The protection corresponds to IUCN Category IIIb.
Habitat/Species Management Area (Područje upravljanja staništima/vrstama)	Area protected for individual species or habitats, which are a management priority. The primary objective is to maintain, preserve or recover species populations and/or habitats. Many protected areas of this category need regular interventions in order to fulfil the ecological requirements of certain species or to maintain the habitat. The protection corresponds to IUCN Category IV.
Protected Landscape (Zaštićeni pejzaž)	Area created through the interaction of people and nature over time, characterized by significant ecological, biological, cultural and aesthetic values. The primary objective is to protect and maintain important land, seascapes and nature with values created by the interaction of people and nature through traditional management practices. Preserving the interaction of people and nature is vital for the protection and sustainability of the area. The protection corresponds to IUCN Category Va.
Regional Park (Regionalni park)	Large natural or partially cultivated area with ecological features of international, federal or cantonal importance and landscape values typical for the area and its geographical location. Economic and other activities that do not endanger the essential characteristics and role of the area are permitted. The protection corresponds to IUCN Category Vb.
Protected area with sustainable use of natural resources (Zaštićena područja sa održivim korištenjem prirodnih resursa)	Area protected in order to preserve ecosystems and habitats along with associated cultural values and a system of traditional natural resource management. In general, these are large areas, with most of the land in a natural condition, and parts under sustainable management. Sustainable use of natural non-industrial resources is one of the main goals of management. The protection corresponds to IUCN Category VI.

Emerald Network / Natura 2000: No adopted sites, but 29 sites have been officially nominated as candidates for the Emerald Network covering a total area of 2504.5 km^2.[50] These sites will become Natura 2000 sites upon accession to the EU.

[50] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS. Standing Committee 43rd meeting Strasbourg, 27 November - 1st December 2022. Updated list of officially nominated candidate Emerald Network sites (December 2023). https://rm.coe.int/draft-list-of-candidate-emerald-network-sites/1680ad54a2

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Total terrestrial protected area: 4.06% of the land area covered, 2082 km² in 65 protected areas[51]. The recent proposal for the Emerald Network / Natura 2000 will increase the protected area to about 18-19% of the territory (Šobot and Lukšič, 2019).

Overlaps and protection levels: In the Republic of Srpska, nearly 60% of the protected area is in protected landscapes, with landscape protection according to IUCN Category V, and 36% of the protected area in national parks (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023).

OECM: not yet implemented.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

In the **Federation of Bosnia and Herzegovina**, the ten regional cantonal governments have established public institutions for the management of protected areas and protected natural resources[52] as part of the EU integration process (Šobot and Lukšič, 2019).

In the **Republic of Srpska**, the Republic Institute for the Protection of Cultural, Historical and Natural Heritage is responsible for protected areas. The Republic has 34 protected areas covering 730 km², consisting of two strictly protected nature reserves, three national parks, 17 natural monuments, three protected habitats, six nature parks and three areas with sustainable use of natural resources (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023). Designation has progressed from two sites in 2007 to 34 in 2023, with the area more than doubling between 2019 and 2022[53]. In 2023, a new natural monument was submitted to the declaration procedure, and the study for the declaration of a new protected habitat area is being carried out. Initiatives were also launched to establish protected areas in Gacko and Pale Municipalities. The Society for Biodiversity Research carried out research for the protection of locations in the municipality of Modriča, and the Center for the Environment did the same for the forests around the City of Banja Luka. In the municipality of Višegrad, the citizens association 'Ekocentar' launched an initiative to protect the canyon of the Rzav River.

The Directorate for European Integration is in the process of establishing the **Natura 2000 network** (Šobot and Lukšič, 2019). The country has officially nominated 29 sites as candidates to the Emerald Network under the Bern Convention[54]; if these are all adopted, the total protected area coverage will increase from 4% to 18% of the land area (Šobot and Lukšič, 2019).

The law specifies that **management plans** are to be adopted for a period of 10 years (or less if there are justified reasons). In the Republic of Srpska, 18 of the 34 protected areas have management plans or programmes in place, with two adopted in 2023 (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023). The national parks are managed by a director and board appointed by the ministry. They are expected to integrate the designation of Emerald Network / Natura 2000 sites into their management plans (Šobot and Lukšič, 2019). The Una National Park (198 km²) designated in 2008 is designed as a Natura 2000 area.

[51] https://www.protectedplanet.net/country/BIH

[52] Law on Nature Protection, 151.

[53] Figure 2 in (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023)

[54] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS. Standing Committee 43rd meeting Strasbourg, 27 November - 1st December 2022. Updated list of officially nominated candidate Emerald Network sites (December 2023). https://rm.coe.int/draft-list-of-candidate-emerald-network-sites/1680ad54a2

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Protected area managers are required to submit an annual report on the content, determination and method of implementation of management measures. Management activities should be documented in the Register of Protected Natural Resources and subjected to an expert opinion. In 2022, 18 of the 31 areas that were required to report in that period in the Republic of Srpska did so, whereas in 2021, 26 of 28 submitted a report. The institute proposed a revised format for annual reporting to get better data on the management of protected areas. In 2022, the protected area managers in the Republic of Srpska reported the lack of financing as the dominant problem in the implementation of management measures, followed by the absence of a security service, and insufficient training of personnel (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023). About a quarter of the protected areas had almost no management activities and other activities resulting from the act on protection. The national and nature parks and those in urban areas report most activity. Monitoring of natural resources was carried out in three protected areas (one national park and two nature monuments), but the planned monitoring in one national park was not completed due to a park staff strike.

The Republic of Srpska is updating its Nature Protection Information System Protected Areas module. In future it will be necessary to increase the level of quality and accuracy of the scope boundaries, to fully comply with the law. There is a need for a developed country-wide information and reporting system for protected areas (Šobot and Lukšič, 2019).

3.2.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

There is no legal framework for the protection of ecological connectivity. The Federal Environmental Strategy for 2022-2032[55], which sets priorities and measures to improve the environment, mitigate and adapt to climate change, and ensure compliance with EU regulations, seeks to integrate and protect natural habitats and ecosystems and ecological connectivity. It was developed with participation from a wide range of stakeholders including public sector representatives, academicians, civil society organizations, and the private sector[56].

There are major concerns regarding the rising number of hydroelectric power plants, as more than 300 such plants are planned, which could result in all the country's rivers being used for energy generation[57]. The Aarhus Convention right to access to justice was used for the first time in a court case opposing the construction of mini-hydro-electric plants in the Sutjeska National Park[58].

3.2.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

In the Republic of Srpska, protected areas must adopt a zoning plan in accordance with the regulations governing spatial planning and construction. Only one of the four national parks and one national monument have such valid spatial plans; a plan for the Sutjeska National Park was drawn up in the proposal phase, but it did not pass the adoption procedure in the National Assembly of the Republic of Srpska (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023).

[55] https://esap.ba/the-fbih-government-adopted-the-federal-environmental-strategy-for-2022-2032/

[56] https://www.sei.org/features/sei-supported-bih-in-developing-environmental-strategy/

[57] https://riverwatch.eu/en/balkanrivers/news/new-report-hydropower-tsunami-balkans

[58] OSCE (2020) Aarhus Centres in Bosnia and Herzegowina. Organization for Security and Cooperation in Europe Mission to Bosnia and Herzegowina. https://www.osce.org/files/f/documents/f/4/445741.pdf

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No information on spatial planning in the area of the Federation is available.

3.2.4. FUNDING

FUNDING FOR PROTECTED AREAS

Protected area managers report the lack of financing as the dominant problem in the implementation of management measures (Republic Institute for the Protection of Cultural Historical and Natural Heritage, 2023). The main source of funding for both the protected area network and for ecological corridors and connectivity in the past decade has come from the Global Environment Facility (GEF), with a United Nations Environment Programme (UNEP) project from 2016 to 2021 followed by a United Nations Development Programme (UNDP) project from 2022 to 2027:

- **GEF Sustainability of Protected Areas Project** (2022 - 2027)[59]: This UNDP project addresses the need for enhanced protection of biodiversity and ecosystem diversity in the face of increasing environmental threats. It aims to create and update management plans in 10 pilot protected areas with the findings of a comprehensive climate threat assessment. It will also develop an eco-tourism concession model and sustainable tourism products. The SPA project is funded by the GEF with a budget of USD 2.79 million. It has a comprehensive approach involving different stakeholders, including national ministries and environmental funds.
- **Biodiversity Conservation through GEF** (2016 - 2021)[60]: This UNEP project sought to build effective management capacities for biodiversity conservation in protected areas, to support the expansion of the protected area system and to address pressures from construction, deforestation, and urban expansion. The project was executed by the Federal Ministry of Environment and Tourism and the Ministry of Spatial Planning, Construction and Ecology of Republika Srpska. It was funded by GEF and co-financiers including the Federal Ministry of Environment and Tourism. The project has established special training programs for managers of protected areas[61], which provide insights into funding opportunities, project application processes, and the development of sustainable tourism in protected areas. The trainings aim to promote the preservation and enhancement of these areas through improved management and funding strategies.

A series of EU, NGO and internationally funded projects have supported the development of the Natura 2000 network and the nature protection system since 2007, for example, a project to protect the Sava River floodplains, and cross-border cooperation between Bosnia and Herzegovina and Serbia to protect the river Drina, involving the establishment of Natura 2000 areas (Šobot and Lukšič, 2019).

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no government funding available specifically for ecological corridors or connectivity. The Global Environment Facility (GEF) funding promotes some aspects of ecological connectivity.

[59] https://www.undp.org/bosnia-herzegovina/projects/spa-project and https://www.undp.org/bosnia-herzegovina/press-releases/beginning-new-undp-project-support-sustainability-protected-areas-bih

[60] https://www.thegef.org/projects-operations/projects/6990 and https://www.unep.org/regions/europe/our-projects/paving-new-paths-biodiversity-conservation

[61] https://www.undp.org/bosnia-herzegovina/press-releases/training-managers-protected-areas-grant-support-nature-protection-and-tourism-development

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3.3. BULGARIA

3.3.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 8. National and regional designation types, protection purpose and governance in Bulgaria. Source: (Barov, 2023).

Designation type	Protection purpose and governance
Reserves (IUCN category I)	Representative areas of natural ecosystems, including characteristic and/or remarkable wild plant and animal species, as well as their habitats. They are exclusively state owned and have strict protection regimes that typically only allow access to visitors on designated paths, and fire prevention activities.
National Parks (IUCN category II)	Preserve complexes of self-regulating ecosystems and their inherent species diversity, habitats of rare and endangered species and communities, characteristic and remarkable landscapes and inanimate objects that are of global importance for science and culture. They must be larger than 1 000 ha and have no human settlements; they are exclusively state property. In accordance with their goal of preserving natural processes, forest and water management is limited and tightly regulated.
Natural Phenomena (IUCN category III)	Characteristic or remarkable objects of inanimate and living nature that are small and/or occupy a single site (e.g. caves, canyons and waterfalls are typically designated under this category).
Managed (maintained) Reserves (IUCN category IV)	Preserve ecosystems including rare and/or endangered wild plant and animal species, as well as their habitats, that require some form of regular maintenance, management or restoration activities, e.g. maintenance of the water regime, traditional salt production or forest restoration activities.
Nature Parks (IUCN Category IV or V)	Large areas with diverse ecosystems, plants and animals and their habitats, characteristic remarkable landscapes, and natural and semi-natural areas shaped by traditional human activities. Nature Parks have rather weak protection regimes, seeking a balance between the protection of natural resources and economic development.
Protected Localities (IUCN category IV and/or V)	Localities that contain characteristic or remarkable landscapes and habitats of endangered, rare or vulnerable plant and animal species and communities. They are small, and their management regimes are focussed on the specific needs of the target species or habitats.

Natura 2000 network: With 194 designated SACs by November 2023, Bulgaria is close to completing the designation of its SCIs as SACs, albeit significantly behind schedule[62].

Total terrestrial protected area: Bulgaria legally protects 34.9% of its terrestrial and marine areas including Natura 2000 and other nationally designated protected areas[63]. The designation of the Natura 2000 network has increased the area of land under legal protection in Bulgaria by seven times, as the nationally protected areas covered only 5.1% of the country before Bulgaria started designating its Natura network (Barov, 2023).

[62] COMMISSION STAFF WORKING DOCUMENT Environmental Implementation Review 2022. COM(2022)438. Country Report - BULGARIA https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2022)438&lang=en

[63] personal communication WWF Bulgaria

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Overlaps and protection levels: Domestic protected areas and Natura 2000 sites overlap almost completely with the Natura network, with only a small percentage of national protected areas not designated as Natura (Barov, 2023). This does not include the State Game Husbandries (which are not regarded as protected areas).

OECM: Forests can be designated as State Game Husbandries under the forestry and hunting laws, in which commercial forestry is excluded; but they do not have the status of protected areas (Barov, 2023). In 2016, the Ministry of Agriculture and Food designated 109 000 ha of old growth forests in forests owned by the state, where logging is not allowed except in very specific cases. There is a process of designating municipally owned old-growth forests. Sanitary zones established for the protection of drinking water sources also can potentially contribute to the establishment of OECMs.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Protected Areas Act (SG No. 133/1998[64]) defines six categories of national protected areas based on, but not fully identical to, the six IUCN protected areas management categories, and regulates the ownership of protected areas (Barov, 2023). The Biological Diversity Act of 2002 added a provision for special protected areas, which allows for the designation of Natura 2000 sites (SPA and SCI/SAC). National Parks and Reserves are exclusive state property in accordance with the Constitution and any use of territory within them can only be made through an economic concession. The Protected Area Act regulates the general regimes of designation as protection, management and use and describes the responsibilities to the respective authorities. The ministry of the environment and water (MoEW) has the overall responsibility, and the National Nature Protection Service within the ministry is responsible for the protection and management of biodiversity, protected areas and the Natura 2000 network.

Management plans are obligatory for National Parks, Nature Parks, Managed Reserves and Reserves, and optional for Protected Sites and Natural Monuments since 1998. The management plans are valid for 10 years, while short-term annual activity plans and budgets are approved each year.

Although Bulgaria has designated its Natura 2000 network, it has established site-specific conservation objectives for only some of its Natura 2000 sites. Work on setting conservation objectives started only at the end of 2021 and work on the conservation measures has yet to begin. The European Commission has referred the case to the European Court of Justice (ECJ)[65].

Since 2018, the MoEW has promoted a new approach to Natura 2000 management using a project funded by the EU cohesion funds (Barov, 2023). The ministry aims to establish a new management system, to increase institutional capacity, to decentralise management responsibilities and to increase the involvement of local communities through a two-tier governance model, setting up national and regional network management authorities. Stakeholder involvement is to be promoted through a national Natura 2000 advisory board and stakeholder committees at the regional level. Management planning for Natura 2000 is to become mandatory and a four-level approach to setting conservation objectives developed: at the biogeographical level (for habitats and species under the EU Habitats Directive) or national level (birds), at the network level, at site level and at specific localities. A national document incorporating the Natura 2000 conservation objectives and 28 regional management plans (corresponding to the 28 administrative regions) is also to be developed.

[64] Protected Areas Act (SG 133/1998)

[65] European Commission press release November 2021 Nature: Commission refers BULGARIA to the Court of Justice of the European Union for failing to protect and manage its Natura 2000 sites. https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5351

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The legal framework for this new approach has not yet been agreed. In 2023, the concept changed: the 16 management plans (titled territorial plans in the law) are developed by the Regional Inspectorates of the Environment and Water (REIW); regional management bodies were established within each REIW. This approach was criticised by the nature conservation community because management plans will cover only the parts of Natura 2000 sites falling within the administrative boundaries of the REIWs. The consequence of this is that some sites will be managed with two or more management plans, with the most extreme example being the site Central Balkan Buffer, which will fall within five management plans because parts of it fall within five different REIWs. The exception here is Natura 2000 sites that are within national parks, where the management body is the national park directorate, and the management plan is for the whole Natura 2000 site. The other exception is marine Natura 2000 sites, which will all fall within the Black Sea management plan. These amendments were adopted in September 2023.

3.3.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

There are no officially mapped and approved or recognized ecological corridors in Bulgaria (Borlea et al, 2022). There are no engineering requirements and formal by-law standards for the construction and planning of defragmentation facilities to ensure the passage of wild animals. The Spatial Development Act (Jan 2001, amend. SG. 49/13 Jun 2014) contains some small provisions for the protection of the green system on the territory of municipalities.

National Ecological Network: The Law on Biological Diversity (2002) establishes the concept of a National Ecological Network including all national protected areas and Natura 2000 sites (Borlea et al, 2022). It has a provision to ensure connections between the Natura 2000 sites in the development plans, regional plans for the development of forest territories, forestry plans and programs, national and regional programs. It is intended that these include measures and activities for the protection of landscape features that, by virtue of their linear and continuous structure or connectivity function, are significant for migration, geographic distribution and genetic exchange in plant and animal populations and species. These principal features of the landscape are defined as rivers and riverbanks and water-logged old riverbeds, natural marshes, lakes, wet meadows and other wetlands, caves, rock edges, faces and dunes, valleys and other natural landforms linking separate mountains, field boundary markings, forest shelter belts, dry meadows and pastures, flood plains and riverside vegetation, and forests located at an altitude not exceeding 500 m above sea level.

Some designations of Natura 2000 sites include designation of ecological corridors or parts of them. Some of the Natura 2000 sites are designated because of their role as stepping stones. An example of such a designation is the Verila SCI, BG0000308 which protects most of the Verila Mountain that links Vitosha and Rila Mountains. This legal provision[66], however, is not linked with any control or regulatory mechanism in the law, and therefore is mainly disregarded in practice.[67]

The **National Action Plan for Conservation of Wetlands of High Significance in Bulgaria** (2013–2022) set protection, maintenance and restoration priorities as well as horizontal measures for the conservation and sustainable use of wetlands. The plan defined measures for spatial and functional re-connection of wetland habitats in line with the green infrastructure concept.

[66] Art. 30 of the Biodiversity Act, which transposes Art.10 of the Habitats Directive

[67] Personal communication with WWF-BG

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3.3.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

- The Water Act sets out objectives and measures for rivers (which we can consider as one type of ecological corridors).
- The secondary legislation for the Forest Act has a Regulation which bans logging within 15 meters along rivers in forest areas.
- The Bulgarian CAP Plan includes an ecoscheme aimed at preserving landscape elements.

There are no other instruments for integrating green infrastructure into spatial planning.

3.3.4. FUNDING

FUNDING FOR PROTECTED AREAS

The main financial sources for nature conservation in Bulgaria are the state budget, government funds established under the Environmental Protection Act and the Forestry Act, several international and bilateral donor programmes (1990–2000), pre-accession aid in the early 2000s. and EU funds since accession in 2007 (Barov, 2023). EU funding is now by far the biggest contributor.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no specific direct funding for ecological corridors. The Environment Programme 2021 – 2027, funded by the European Regional Development Fund, has an option to provide funding for the development of Natura 2000 management plans, measures for achieving favourable conservation status of species and habitat types including wetlands restoration, restoration of hydrological regimes etc.

The Bulgarian Strategic CAP plan includes an eco-scheme titled ‘Eco scheme for maintaining and improving biodiversity and ecological infrastructure’ approved with a budget of EUR 160 million. However, in December 2023, the Ministry of Agriculture and Food initiated a procedure for amending the CAP plan reducing the funding of the eco-scheme by more than EUR 120 million.

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3.4. CROATIA

3.4.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

The Nature Protection Act of the Republic of Croatia, which entered into force in July 2013, defines nine categories of protection: strict reserve, national park, special reserve, nature park, regional park, natural monument, significant landscape, park-forest and monument of park architecture. The Act distinguishes between protected areas of national significance and protected areas of local significance.

Table 9. National and regional designation types, protection purpose and governance in Croatia.
Sources: (Underwood et al, 2014) and (Radović, 2023) and (MINGOR, 2023).

Designation type	Protection purpose and governance
National Park (nacionalni park)	Large, predominantly unchanged areas of land and/or sea, with exceptional and multiple natural values, covering one or more conserved or slightly changed ecosystems. These have scientific, cultural, educational and recreational purposes. While national parks are generally identifiable with IUCN Category II, in reality some may more closely resemble special reserves due to the high percentage of actively managed semi-natural habitats such as species-rich grasslands maintained through grazing. Visitors must keep to certain zones and on marked paths and may have to pay for a permit to visit. Managed by park authority set up and at least partially funded by the state. Has to have management plan that has management objectives, activities necessary to achieve the objectives and the indicators needed to assess progress (Nature Protection Act 2008). Corresponds to IUCN Category II according to (MINGOR, 2023)
Strict nature reserve (strogi rezervat)	Areas of land and/or sea with unmodified or slightly modified nature, dedicated to the conservation of untouched natural areas, scientific research and monitoring of nature and education activities which do not disturb or interrupt the natural processes. Visitors must keep to certain zones and on marked paths. Has to have management plan that has management objectives, activities necessary to achieve the objectives and the indicators needed to assess progress (Nature Protection Act 2008). Designated by the government but managed by the county. Corresponds to IUCN Category Ia.
Special Reserve (posebni rezervat)	Protection of habitats of special importance (e.g. endangered habitats; habitats of endangered species). Visitors must keep to certain zones and on marked paths. Has to have management plan that has management objectives, activities necessary to achieve the objectives and the indicators needed to assess progress (Nature Protection Act 2008). Designated by the government but managed by the county. Corresponds to IUCN Category IV.
Nature Park (park prirode)	Protection of a large natural or semi-natural area with high biodiversity or geo-diversity, and characterised by significant landscape, educational, cultural and historical values. Economic uses are allowed if they do not threaten the key characteristics and roles of the site. Managed by park authority set up and at least partially funded by the state. Corresponds to IUCN Category V.
Regional Park (regionalni park)	Large natural or partly cultivated areas of land and/or sea with ecological characteristics of international, national or local importance, with landscape values characteristic of the region in which it is situated. Has to have management plan that has management objectives, activities necessary to achieve the objectives and the indicators needed to assess progress (Nature Protection Act 2008).

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	Corresponds to IUCN Category V.
Natural Monument (spomenik prirode)	Small strongly protected areas focussed on a particular natural feature, i.e. an individual unchanged part, or group of parts, of living or not-living nature with ecological, scientific, aesthetic or educational value. Many are smaller than 1 ha in size. Corresponds to IUCN Category III.
Significant Landscape (značajni krajobraz)	Natural or cultivated area of high landscape value and high biological diversity; or with cultural and historic values or landscape with preserved features characteristic for specific region, dedicated to leisure and recreation; or especially valuable landscapes as identified according to the Nature Conservation Law. Has to have management plan that has management objectives, activities necessary to achieve the objectives and the indicators needed to assess progress (Nature Protection Act 2008). Corresponds to IUCN Category V.

Natura 2000 network: There are 745 SCIs covering 23.72% of the total land and sea area and 38 SPAs covering 20.55%. Overall, in 2022 the network covered 36.7% of the land area (Radović, 2023).

Total terrestrial protected area: 38.1% (BISE[68]).

Overlaps and protection levels: Around 26% of Natura 2000 is protected under one of the nine categories of domestic protected areas, while 87% of all domestic protected areas are included in Natura 2000 (those which satisfied scientific criteria according to the Nature Directives) (Radović, 2023).

OECMs: OECMs are being identified and know-how is being built for use in the future, both for terrestrial and marine habitats (see below).

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Ministry of Economy and Sustainable Development and the administrative bodies of the regional self-government units (county offices) are responsible for nature protection. Public institutions, founded by the Republic of Croatia, are responsible for the management of national parks and nature parks and for the management of other protected areas and/or parts of nature whose founders are regional and local self-government units.

Legal ordinances for each site prescribe detailed rules for the protection, conservation, improvement and use of National Parks, Nature Parks, Strict Reserves and Special Reserves, enacted by the competent minister. County authorities have the power to pass ordinances with similar rules for other categories of protected area. The State has a right to expropriate, or restrict the use of, private real estate (typically land or sometimes buildings) if it is necessary for the conservation of protected parts of nature (Radović, 2023). Landowners can offer their land for sale to the state or the county or get it exchanged for equally valuable real estate. In a National Park, Strict Reserve or Special Reserve, the land must be offered to the State in the first instance, then to the respective county and finally to the local community.

All nine categories of protected areas are supposed to have adopted management plans, while for National Parks and Nature Parks spatial plans are also obligatory, adopted by the Croatian Parliament. The plans are based on expert studies and define zones according to conservation objectives and levels of use. There is a legal option to confer the care of protected areas, including Natura 2000 sites, or parts thereof, to the landowner or rights holder, or even to another person or organisation (e.g. NGO), by signing a care contract, following a public

68 https://biodiversity.europa.eu/countries/croatia

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tender. However, the county authorities have not used this mechanism, despite their low capacities (Radović, 2023).

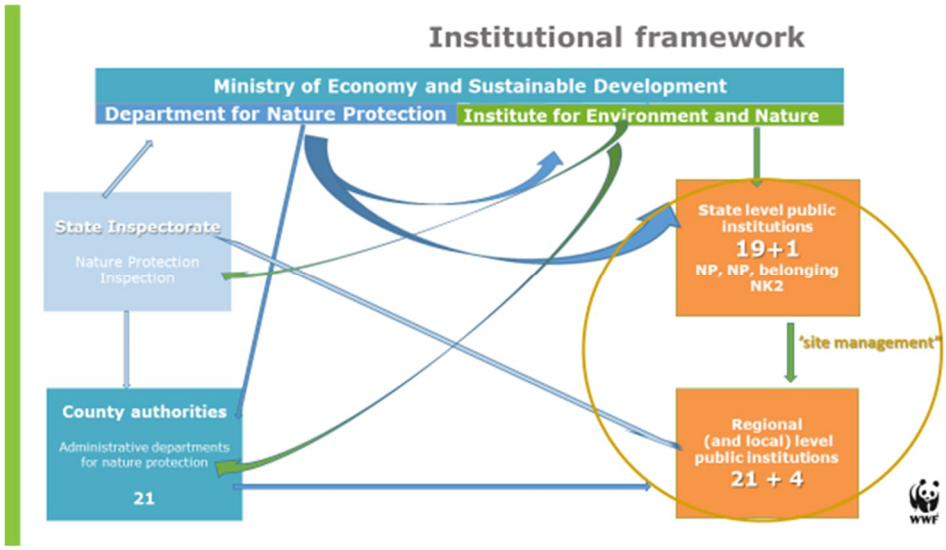

Figure 23. Institutional framework for nature conservation in Croatia, WWF Adria.

The Implementation Programme of the Ministry of Economy and Sustainable Development for the period 2021 – 2024[69] includes a measure for '*Ensuring Preconditions for Establishing a Representative and Functional Network of Areas Significant for Nature Conservation and Their Efficient Management*', which mentions the use of Other Effective Conservation Measures (OECMs). It does not, however, specify what types of areas will be considered as OECMs in Croatia.

The Croatian Agency for Nature and Environment Protection has developed a training module (MINGOR, 2023) in which participants learn to understand the definition of protected areas, categories, and types of management as defined by the IUCN standards, acquire the necessary knowledge to categorize protected areas according to the IUCN system (including areas within the ecological network), understand the difference between protected areas and OECMs, and understand the purpose and possibilities of using the IUCN standard.

3.4.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

The need for ecological connectivity varies across Croatia. Because of the density of the protected area network in Croatia, a recent author (Radović, 2023) concluded that '*overall, national protected areas and Natura 2000 comprise a functionally connected network because Natura sites are large and close to each other, or even border each other, especially in the Alpine and Mediterranean biogeographical regions. In the Continental region, which contains more densely populated and agricultural areas, the network could benefit from additional sites or corridors created through various types of green infrastructure'.*

[69] PROVEDBENI PROGRAM MINISTARSTVA GOSPODARSTVA I ODRŽIVOG RAZVOJA za razdoblje 2021. – 2024. Godine. https://mingor.gov.hr/UserDocsImages/GLAVNO%20TAJNI%C5%A0TVO/Strategija,%20planovi%20i%20ostali%20dokumenti/PROVEDBENI%20PROGRAM%20MINGOR-IZMJENE%20I%20DOPUNE-tekstualni%20dio.pdf

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LEGAL AND GOVERNANCE MECHANISMS

Croatia does not have an ecological network legislation or strategy. Some aspects of the following sectoral policies address ecological connectivity or green infrastructure directly or indirectly:

Water: Croatian Waters is responsible for the management of water bodies, which are public property. The annual maintenance plans of water bodies include nature protection requirements.

Forestry: Croatian Forests is responsible for management of state-owned forests, including forested Natura 2000 sites, which make up 81% of the forest area. It is not clear if the Croatian forest policy promotes ecological connectivity.

Transport: The Ordinance on Wildlife Crossings (based in the NPA) requires the construction of special crossings over highways ('green bridges') that connect fragmented habitats and reduce the number of animals killed by traffic. This is an important legal measure for large carnivores, and some other species that are threatened by the development of transport infrastructure (Radović, 2023). The locations in which they are required are based on EIAs and their maintenance needs are defined in the Ordinance. Regular monitoring indicates that the bridges are effective in enabling animals to cross the roads.[70]

Agriculture: Croatia has a landscape with high nature value in semi-natural grasslands and small-scale cropland mosaics, rich with hedges and tree lines (Radović, 2023). However, they are threatened due to the disappearance of traditional agricultural practices in areas being abandoned, or agricultural improvements and intensification in others. The Common Agricultural Policy Strategic Plan has designated all grasslands in Natura 2000 sites as Environmentally Sensitive Permanent Grasslands (ESPG), meaning that farmers receiving CAP payments cannot plough them and convert them. This is a significant ecological connectivity measure in Croatia as these grasslands make up a large part of the farmland area.

3.4.3. SPATIAL PLANNING

The spatial planning system is currently being changed. The State Spatial Development Plan of Croatia is being prepared, and after its adoption, the counties must create new county plans, followed by municipalities and cities. All the new plans will need to have SEAs that assess potential impacts on the Natura 2000 network. This could result in nature protection requirements being inserted into sectoral management plans and spatial plans.

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The Nature Protection Information System includes publicly available data through a web GIS-based Bioportal. A new Map of Terrestrial Non-Forest Habitats was produced at the scale 1:25 000 in 2016.

3.4.4. FUNDING

FUNDING FOR PROTECTED AREAS

The main funding mechanisms for protected areas are the state budget, county, city or municipality budgets. The Nature Protection Act also provides for income from the use of

[70] OIKON Laboratory for Monitoring and Research of Large Carnivores and Ecology of Vertebrates. https://oikon.hr/our-departments/laboratory-for-research-and-monitoring-of-large-carnivores/

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protected parts of nature, income from compensatory benefits and other established sources, and Croatian national parks charge an entry fee. The development of tourism in Croatia has increased the number of visitors to national parks and nature parks, and this increase in income enables the allocation of a significant part of these funds for nature protection activities. National and nature parks use these funds for building infrastructure, research, monitoring, etc.

The CAP plan in the previous and current period offers a series of agri-environment measures for maintaining grassland and landscape features, but the uptake by farmers is very low (Radović, 2023). The Natura 2000 payments would reach more farmers but cannot currently be used because of the lack of conservation objectives and measures for the Natura 2000 sites.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

Apart from projects funded by the EU Funds (ERDF, Interreg cross-border cooperation programmes, LIFE, etc.), there is no national fund earmarked for working on ecological connectivity.

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3.5. CZECH REPUBLIC

3.5.1. PROTECTED AREA NETWORK (TERRESTRIAL)

The Czech protected areas network is made up of the Natura 2000 network and protected areas designated based on national criteria (called specially protected areas, not to be confused with the sites designated based on the Birds Directive) – national parks, protected landscape areas, national nature reserves, nature reserves, national natural monuments, and natural monuments.

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 10. National and regional designation types, protection purpose and governance in the Czech Republic. Sources: (Knižátková and Havel, 2022), (Underwood et al, 2014), CDDA database[71]

Designation type	Protection purpose and governance
National Park	Extensive territories that are considered nationally or internationally unique, a considerable part of which consist of natural ecosystems or ecosystems little affected by human activities, in which plants, animals and inanimate nature are of exceptional scientific and educational significance (Art 15 of the Act on the Conservation of Nature and Landscape). Nature conservation authorities are required to propose and approve a management plan. Zoning is mandatory including a core area under strict protection.
Protected Landscape Area	These areas are defined as extensive territories having a harmoniously formed landscape, with a characteristic relief, a significant proportion of which consist of natural forest or grassland ecosystems, or with preserved monuments of historical settlement (Art 25 of the Act on the Conservation of Nature and Landscape). Although the designation has purposes that go beyond biodiversity conservation, the preservation of 'natural values' is one of the key aims. Nature conservation authorities are required to propose and approve a management plan. Recreational use is admissible, provided it does not damage the natural values of the area.
National Nature Reserve	These protected areas are defined as smaller territories of exceptional natural value, where the natural landscape, together with a typical geological structure, forms ecosystems which are unique and significant on a national or international scale (Art 28 of the Act on the Conservation of Nature and Landscape). Management Plans which detail proposed conservation measures (and which must therefore set out conservation goals) must be prepared for each site and approved by the national nature conservation authority (under Sec. 38 of the Nature Protection Act). Must include a 50m protective zone around the area.
Nature Reserve	Nature Reserve designated by regional authorities for its regional or local significance (Art 33 of the Act on the Conservation of Nature and Landscape). Includes 50m protective zone around area.
National Nature Monument	Smaller 'natural formations' can be designated as National Nature Monuments, in particular geological or geomorphologic formations, mineral deposits, or rare and endangered species in fragments of ecosystems that are of national or international environmental, scientific or aesthetic significance (Art 35). Management Plans which detail proposed conservation measures (and which must therefore set out conservation goals) must be prepared for each site and approved by the national nature conservation authority (under Sec. 38 of the Nature Protection Act). Alteration or damage strictly prohibited. Includes 50 m protective zone around area.
Nature Monument	Designated by regional authorities for their regional or local significance Art 36 of the Act on the Conservation of Nature and Landscape). Includes 50 m protective zone around area.

[71] https://dd.eionet.europa.eu › datasets › latest › CDDA

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Significant Landscape Element (VKP)	Includes certain habitats protected by law (ponds, lakes, water courses, peatlands, valley floodplains, forests) from harm and destruction. They shall only be used in a way that does not disturb their restoration and does not endanger or weaken their stabilizing function. There is no central registration of such elements, and they are not regarded as protected areas.
Contractually protected area	New instrument (introduced in 2006), still used almost exclusively for Natura 2000 sites - but could be applied in the non-protected landscape.

Natura 2000 network: 41 SPAs. 1113 SCIs.

Total terrestrial protected area: 21.9% of land area (BISE[72]).

Overlaps and protection levels: Slightly more than a third of the protected area network is designated exclusively under national laws; 44% consists of Natura 2000 sites; 35.4% is areas where Natura 2000 sites overlap with national designations (35.4%) (BISE[73]). Natura 2000 sites often overlap with the national parks and protected landscape areas. In some cases, the national protected area designations play a vital role in ensuring the protection regime of Natura 2000 sites (both in terms of legal limits as well as management planning and implementation).

OECMs: the concept has not been explored or systematically promoted in Czechia. Two legal tools might be used for OECMs: the significant landscape elements (VKP) and the Territorial System of Ecological Stability (TSES) (see below for description). These are both nature conservation tools that do not involve the designation of specific areas but have potential to ensure the connectivity of protected areas. However, they do not meet the OECM criteria on their own as they do not set specific conservation objectives and measures or ensure effective management and monitoring of the biodiversity in the areas.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

Designation and management of protected areas: The four national parks have their own administration body. The protected landscape areas (PLA) are managed by the Nature Conservation Agency of the Czech Republic. Regional departments (PLA Administrations) of the Nature Conservation Agency or regional authorities are responsible for the smaller protected areas and Natura 2000 sites which do not overlap with the large, protected area designations. PLA administrations are responsible for those sites that fall within protected landscape areas; and PLA administrations are also often responsible for reserves/monuments in the national category even though they are outside the PLAs, and for some Natura 2000 sites outside the PLAs.

Designation of buffer zones: If a Specially Protected Area is under threat from 'disturbing influences' from its surroundings, a protective zone may be proclaimed for this area, where it is possible to specify actions that require prior approval from nature conservation authorities. National Nature Reserves, National Nature Monuments, Nature Reserves and Nature Monuments automatically have a protective zone which extends 50 m from the border of the protected area (defined in the Nature Protection Act Sec 37).

[72] https://biodiversity.europa.eu/countries/czechia

[73] https://biodiversity.europa.eu/countries/czechia

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3.5.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Territorial System of Ecological Stability of the Landscape (TSES) constitutes an ecological network in the landscape in the Czech Republic. The legislation defines the TSES as a continuous network of areas with relatively high ecological stability (biocenters and biocorridors) for the purpose of preserving or restoring the biological diversity of the landscape and supporting the surrounding less ecologically stable parts of the landscape. The TSES consists of three basic elements – biocentres, bio-corridors and interactive elements. A biocentre is a habitat or a system of habitats which by its state and size enables permanent existence of a natural or modified, but semi-natural ecosystem. Biocentres are divided into existing and planned. A bio-corridor (biotic dispersal & migration corridors) is an area which does not enable permanent long-term existence of the critical part of organisms, but it facilitates their migration and/or dispersal between biocentres: thus, it makes a real interconnected network from isolated biocentres. The third component of TSES are interactive elements, small areas/patches/plots (often spatially isolated) that provide favourable conditions for some plants and animals significantly affecting the functioning of ecosystems in the cultural landscape.

The TSES is defined at three interconnected levels – supra-regional, regional and local. There is a dense network of local corridors (of approx. 1 km) linking local biocentres (1 to 3 hectares). The function of regional biocentres is to preserve the sub-national biodiversity. At the regional level, corridors have a width ranging from 20 to 50 metres, and a length ranging from 300 to 1000 metres. The supra-regional level includes biocentres with an area of more than 1000 hectares (Görner and Kosejk, 2011).

The habitat of specially protected large mammal species (lynx, bear, wolf and elk) was mapped in the ConnectGREEN project, as TSES does not focus on large carnivores which need large territories for migration (ConnectGREEN, 2021). This document has been integrated into the implementing regulation of the Construction Act since 2020.[74] This map level is therefore now a binding basis for all levels of land use plans.[75] A methodology for the protection of the biotope of specially protected species in spatial planning[76] was published in 2021 (Hlaváč et al, 2021). However, there has been no consultation with affected landowners or other stakeholders.

[74] Regulation 500/2006 Coll. on territorial analytical documents, 36B

[75] Action plan for habitat connectivity and linking wildlife corridors between the Czech Republic and Austria, ConnectingNature AT-CZ project. Interreg AT-CZ 2014-2020. https://2014-2020.at-cz.eu/at/ibox/pa-2-umwelt-und-ressourcen/atcz45_connat-at_cz

[76] Ochrana biotopu vybraných zvláště chráněných druhů v územním plánování

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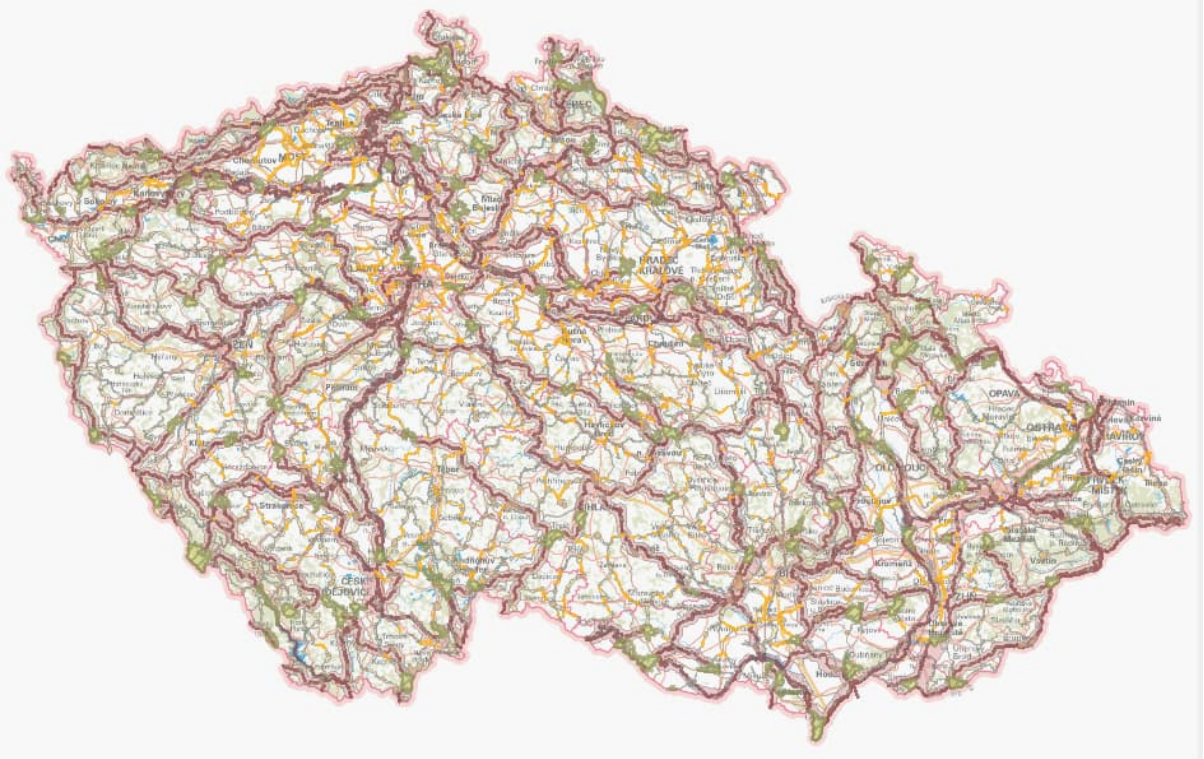

Figure 3. Territorial System of Ecological Stability (TSES) in the Czech Republic.
Source:
https://aopkcr.maps.arcgis.com/apps/webappviewer/index.html?id=399328f6b35646c2910ddbc0995b2bf6 – the interactive map of TSES is accessible on the website managed by Nature Conservation Agency.

3.5.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The TSES is integrated in the spatial planning system. The TSES on all levels (local/regional/supra-regional) must be included in land use plans of municipalities, towns, regional districts, PLAs and National Parks. It means that any intervention in the area mapped as TSES is subject to approval by the Authority. However, most parts of the TSES exist just as a plan in land use plans and the physical realization of local and regional bio-corridors and biocentres grows only very slowly.

The Czech Road Directorate is taking ecological connectivity into account in its planning of new roads and is constructing some green bridges (Chenevois, 2023).

Austria-Czechia wild animal corridors action plan: A series of projects have researched and planned the protection and restoration of the ecological corridors for large mammals across the Austria-Czech border. The work has culminated in an action plan jointly agreed between Austria and the Czech Republic in 2021 (Frey-Roos et al, 2021) The action plan maps wild animal corridors of regional, trans-regional and international significance for red deer, elk, lynx, wolf and bear. It also considers the ecological corridor mapping for wild cats carried out in another project (Interreg MaGIClandscapes). Red deer are used as the umbrella species for the corridors.

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Biotope of selected specially protected species of large mammals (lynx, wolf, bear, elk)

This biotope is provided by the Nature Conservation Agency as a GIS layer for spatial planning purposes according to the new Building Act. 283/2021, Annex 1 (methodology described in Hlaváč et al, 2021)[77].

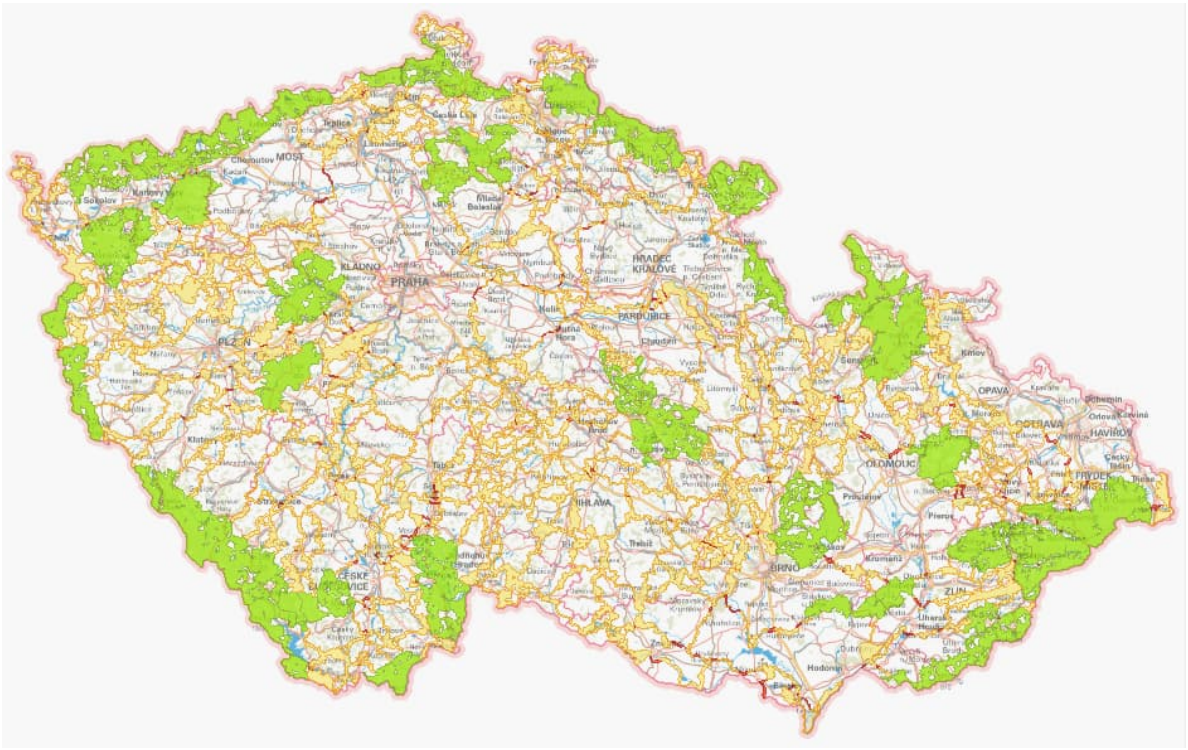

Figure 24. Interactive map of biotopes for the Czech Republic.
Source - https://aopkcr.maps.arcgis.com/apps/webappviewer/index.html?id=e07f48c384534f038cd837f7eb00d569 *– managed by Nature Conservation Agency.*

3.5.4. FUNDING

FUNDING FOR PROTECTED AREAS

Protected areas are directly financed by the Ministry of the Environment budget through the Nature Conservation Agency. There are also other national and EU funds, particularly projects in the Operational Programme Environment (ERDF and Cohesion funds) dedicated to the management of localities and other actions or activities[78].

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no special funding scheme for migration corridors or ecological connectivity. The Nature Conservation Agency of the Czech Republic has an open funding call for applicants

77 https://www.researchgate.net/publication/355809168_Ochrana_biotopu_vybranych_zvlaste_chranenych_druhu_v_uzemnim_planovani#fullTextFileContent

78 https://dotace.nature.cz/

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under the Operational Programme[79] which can be used to fund the restoration or creation of landscape and vegetation elements and structures such as small ponds and can be used for the Territorial System of Ecological Stability.

[79] Measure 1.3.1: Promoting nature-friendly measures in landscapes and settlements for renaturation / creation of small pools / creation of new and restoration of existing vegetation elements and structures (including Territorial System of Ecological Stability). https://dotace.nature.cz/-/aopk-opzp-zmv-4-vyzva

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3.6. GERMANY – national, Bavaria and Baden-Württemberg

This section provides an overview of the national framework and the situation in the two federal states that fall within the Danube River basin – Bavaria and Baden-Württemberg. The region Saxony within which lies the case study area Leipzig-Halle is presented separately in Chapter 5.1.

Germany is a federal state in which the state provides the legislative framework for nature conservation, but the laws are interpreted through the legal acts of the federal states, which may differ in their details. The federal states are responsible for the designation of protected areas and for funding incentives to promote biodiversity management.

3.6.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

The German nature conservation law (Bundesnaturschutzgesetz, BNatSchG) defines seven categories of protected area to be designated at the federal level for nature and landscape protection. The German federal states can also define and designate other protected area types if they are specified in the regional state's nature conservation law. Germany has also designated 17 UNESCO biosphere reserves. Germany also has designated wilderness areas that are not within the scope of the BNatSchG. The national parks, biosphere reserves, wilderness areas, and nature parks are classed as large, protected areas. These protected areas are jointly organised in the alliance of Nationale Naturlandschaften (in English: National Natural Landscapes).

Table 11. National designation types, protection purpose and governance in Germany. Sources: Bundesamt für Naturschutz[80]

Designation type	Protection purpose and governance
National Park[81]	Large unfragmented areas designated as a complete territory. Most of the area must meet the criteria for a nature reserve, and most of the area must be in a natural condition that is only slightly affected by human influences or have the capacity to develop into a state where natural processes and functions operate according to natural dynamics. National parks should also be designated for scientific observation, learning, and to allow the public to experience nature. (Designated according to § 24 Abs. 1 BNatSchG). Economic uses of the land (including farming, forestry, fishing and hunting) are allowed only under strict conditions. Public access and tourism can be prohibited in sensitive areas.
Nature Reserve (Naturschutzgebiet)[82]	Areas designated for the protection of nature and landscape (including geology or soil aspects) and strictly protected in all or most of their area. (Designated according to § 23 BNatSchG). Each site is protected by a statute which defines the conservation objectives and the site-specific restrictions and permitted land uses and actions. One of the oldest designation types in Germany.
Landscape Protection Area (Landschaftsschutzgebiet)[83]	Designation of landscapes for their natural heritage and/or their cultural heritage and social values and to protect the character and the uniqueness of the landscape. They can include urban areas if

[80] BfN webpage: https://www.bfn.de/schutzgebiete

[81] BfN webpage: https://www.bfn.de/nationalparke

[82] BfN webpage: https://www.bfn.de/naturschutzgebiete

[83] BfN webpage: https://www.bfn.de/landschaftsschutzgebiete

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Designation type	Protection purpose and governance
	these are considered part of the overall landscape in need of protection (e.g. farms and villages). The protection objectives are to: protect, develop or restore the natural functions and the resilience and recovery of the natural resources; to protect the unique character of the landscape; and/or because of their importance for recreation. (Designated according to § 26 Abs. 1 BNatSchG). Designated by the regional nature authority through a statute. The protection level is generally weak, corresponding to IUCN category V, but can be stricter in some cases. One important function is to protect against further development of industry or urban growth, whilst land uses such as forestry, agriculture, and hunting can continue if they do not significantly alter the landscape. They can cover large areas and make up a significant share of Germany's protected area network.
Nature Park (Naturpark)[84]	Large areas designated for the protection and maintenance of cultural landscapes with their habitat and species diversity and for their use for recreation and sustainable tourism, and to ensure a long-term sustainable land use and education for sustainable development. The nature park area should be mostly designated as either nature reserve or landscape protection area and classified for recreation in the spatial plan.
National nature monument (Nationale Naturmonumente)[85]	Area designated for its significant scientific, natural heritage, cultural, or historical value and its rarity, beauty, or uniqueness. Includes areas with geological or archaeological significance provided they also have value for nature. (Designated according to § 24 BNatschG). Added to the German system in 2010. Protection level is the same as for nature reserves. Corresponds to IUCN category III. There is no minimum or maximum size. Most sites have a high visitor pressure. Active site management, site zoning with different levels of restrictions, and site management plans are recommended.
Nature monument (Naturdenkmal)	Small area protected for a particular natural feature, protected for its natural heritage value, and for its aesthetic and scientific interest. There is a maximum size limit of 5 ha. A nature monument can be an individual tree, tree group or tree avenue, geological feature, or feature with natural and cultural heritage value.
Protected landscape element (Geschützter Landschaftsbestandteil)[86]	Small area or feature protected for a biotic or abiotic component of the landscape with a particular significance for their ecological functions (such as erosion control, air quality regulation, noise or other pollution mitigation) and/or for the character, structure or ecological connectivity of the landscape or place. They can be natural or manmade (e.g. cemeteries or parks). Elements can also be designated for their importance as habitat for species. Examples are tree avenues, village ponds, traditional fruit orchards. The designation can also be used for all the occurrences of a particular feature within a restricted area; for example, all the veteran trees in a village or town. The designation provides basic protection against the removal, destruction, damage or alteration of the landscape element, and some obligatory actions, such as replacement plantings, to maintain the ecological functions. Management actions are allowed as long as they are consistent with maintaining the characteristics of the landscape element.

[84] BfN webpage: https://www.bfn.de/naturparke

[85] BfN webpage: https://www.bfn.de/nationale-naturmonumente

[86] BfN webpage: https://www.bfn.de/geschuetzte-landschaftsbestandteile

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Designation type	Protection purpose and governance
	For example, in **Bayern** the designation includes a protection (outside the urban area) from destruction or significant damage for all hedges, living fences, tree groups, and patches of scrub, cases and underground caverns, drystone walls, ponds and other small water bodies[87].
Protected habitat (Gesetzlich geschützter Biotop)[88]	Protects a list of habitat types that are threatened. According to the law, the habitat type is protected from destruction or significant damage wherever it occurs. (Designated according to § 30 BNatSchG). The protections must be registered in a publicly accessible way (according to the legal specifics of each federal state). The list of protected habitats includes: • Natural or near-natural stretches of free-flowing rivers or standing water and their banks, regularly flooded zones, floodplains, and old meanders with natural or semi-natural vegetation. • Bogs, fens, marsh, reedbeds, sedge fens, flood meadows, springs, inland salt marshes. • Inland dunes, open natural scree or rock formations, sedimentary cliffs, heaths, Nardus grassland, dry grasslands, calaminarian grasslands, forests and scrub typical of dry and warm sites. • Natural forest types typical of alluvial, swamp, gorges, steep slopes, scree, and subalpine larch and pine forests. • Rock formations, caves or mines with natural features, alpine meadows, snow depressions, dwarf shrubs. • Coastal cliffs and rocks, coastal dunes and shingle banks, dune slacks, saltmarshes and meadows, intertidal mudflats, seagrass meadows and other marine macrophyte stands, reefs, sublittoral sandbanks, species rich seabeds with gravel, sand or fine sediments. • Lowland and mountain hay meadows according to EU Habitats Directive Annex I, orchards, stone rows, dry stone walls. The revisions of the national nature conservation law in 2009 and 2022 added more endangered habitat types to the list including orchards with non-dwarf trees. Since March 2022, these orchards are protected in whatever size or configuration, which altered the legal situation in some federal states – including Baden-Württemberg (which previously only protected orchards larger than 1500 m²), in Bayern (previously only larger than 1500 m²), and Rheinland-Pfalz (which previously did not protect the habitat type). Brandenburg and Sachsen already had the legal protection in place[89].
Wilderness area (Wildnisgebiet)[90]	The wilderness areas are also to be integrated into the transnational biotope network.

[87] Bestimmungsschlüssel für geschützte Flächen nach § 30 BNatSchG / Art. 23 BayNatSchG: https://www.lfu.bayern.de/natur/doc/kartieranleitungen/bestimmungsschluessel_30.pdf

[88] BfN webpage: https://www.bfn.de/gesetzlich-geschuetzte-biotope and BNatSchG Paragraph 30 https://www.gesetze-im-internet.de/bnatschg_2009/__30.html

[89] Naturschutz und Landschaftspflege 06/2022. https://www.nul-online.de/themen/landschaftspflege/article-7157239-201985/gesetzlicher-biotopschutz-nach-30-bnatschg-.html

[90] https://nationale-naturlandschaften.de/gebiete/kategorie/wildnisgebiete

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Natura 2000 network: In Germany, there are a total of over 4,500 Fauna and Flora Habitats and 742 Special Bird Areas, some of which overlap. In total, 15.5 % of Germany's land area is covered by Natura 2000 protected areas.

Total terrestrial protected area: The total coverage of protected areas in Germany is 37.4% of the territory. More than half of the protected areas in the terrestrial environment are designated solely under national laws. Additionally, 15.9% is covered by Natura 2000 sites and 25.4% by those areas where Natura 2000 sites overlap with national designations (BISE).

Overlaps and protection levels: As the German designations are deliberately overlapping, the total protected area is much less than the sum of the protections. Nature parks cover around 28.7% of the land area, within which just over half has another designation: around half the nature park area is Natura 2000; 5% is nature reserve; also, landscape parks. Nature reserves are the only designation that applies strict protection across the whole designated area, though it is important to note that national parks must have their core area designated as nature reserve.

OECMs: Germany has not proposed OECMs. The debate in Germany has focused on the advantages and disadvantages of marine OECM options.[91]

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The German legal framework was designed for state governance and lacks specific provisions to accommodate private protected areas. Designation is the responsibility of the regional nature conservation authorities, or the local conservation authority, depending on the designation type. Management may be transferred to another public body.

Nature reserves are designated by the federal states through site-specific statutes. Their effectiveness is related to their size: although around 15% of Germany's nature reserves are 200 ha or more in size, over half of them are smaller than 50 ha in size and are not adequately buffered against negative pressures such as drainage, eutrophication, or pollution[92]. Where the nature reserve lies inside a landscape park, this can provide a buffer function.

Nature parks have the mission to contribute to maintaining ecological connectivity and take measures to counter habitat fragmentation. There are large differences in their effectiveness between federal states, due to differences in governance and financing. In some cases, the parks are managed by the state environment ministry, in other cases associations or cooperatives have taken over the management. Management plans are only obligatory in some states. The Federal Nature Agency has published a series of guidance documents for nature park management, including how to develop and implement management planning for nature parks[93] and how to designate wilderness areas in nature parks. This identified a potential for 463 076 ha of designated wilderness in the parks, but to date only a small part of this has been realised. In 2006, the EUROPARC Federation and a national association started a campaign to improve the management of nature parks and established a method and criteria to measure and distinguish management quality.

Nature monuments and **protected landscape elements** are designated by the relevant nature conservation authority at the district or town level. Some federal states have specified that these designations should also be used to contribute to the ecological network or safeguard an ecological corridor.

[91] NABU 2022 https://www.nabu.de/natur-und-landschaft/meere/meeresschutzgebiete/32078.html

[92] https://www.bfn.de/naturschutzgebiete#anchor-3210

[93] VDN (2008) Leitfaden für die Praxis, developed by the nationally funded project Forschungs- und Entwicklungsvorhaben (F+E) 'Optimierte Umsetzung von Naturparkplänen'.

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The national nature heritage (Nationales Naturerbe) is an initiative by the federal government to turn national state-owned areas, such as military sites, into protected areas. The federal government has transferred ownership of areas with high nature conservancy value, and thus the responsibility for protection, to the federal states and to nature conservation foundations and associations. Many of the sites were obtained in the German reunification and include areas of the former inner-German border, former military training grounds, and abandoned pit mining sites. According to the German Federal Ministry of Environment (BMUV), approximately 164 000 ha were designated as national nature habitat by 2021.[94]

The **European Green Belt** runs through Germany from north to south along the old border between eastern and western Germany. The aim of the German partnership is to protect a 200-ha area on each side of the border, of which 75% should be restored to high value habitats (i.e. habitats on the German red list of habitat types). The Green Belt includes five ecological connectivity areas in Germany: Stecknitz-Delvenau-Niederung (Schleswig-Holstein), Landgraben-Dumme-Niederung (Sachsen-Anhalt), Thüringer Schiefergebirge (Thuringen), Rhön-Grabfeld (Bayern) and Innerer Bayerischer Wald (Bayern & Czech Republic).

The German federal states can also define and designate other protected area types if they are specified in the regional nature conservation law.

Bayern (Bavaria)

Bavaria has not added additional types of protected area in its Bavarian Nature Conservation Act (BayNatSchG). The Bavarian protected area network consists of two national parks, two biosphere reserves, 597 nature reserves, 699 landscape parks, 19 nature parks, 674 SCI/SACs and 74 SPAs, but as there are considerable overlaps in the designations, the actual number of protected areas on the ground is much smaller.[95]

Baden-Württemberg

The protected area network of Baden-Württemberg consists of one national park, two biosphere reserves, 1048 nature reserves, 1452 landscape parks, 7 nature parks, 6058 nature monuments, 212 SCI/SACs and 90 SPAs, but there are considerable overlaps in the designations, so the number of actual sites is much lower.[96]

3.6.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Federal Nature Conservation Act (BNatSchG)[97] mandates an ecological network for Germany – the **Biotopverbund** - that must occupy at least 10% of the land area[98]. The biotope network consists of core areas, connecting areas, and connecting elements, which are to be legally protected by suitable measures. Connecting areas and connecting elements are considered together from a technical point of view. The core areas of the network are the nature reserves, national parks, biosphere reserves, Natura 2000 sites (or parts of them), the areas of the national natural heritage and the green belt. The Bundesamt für Naturschutz issues large-scale maps of the biotope network.

The National Natural Heritage (**Nationales Naturerbe NNE**) consists of more than 180 000 ha formerly in government ownership that has been donated to various charitable recipients

94 https://www.bmuv.de/themen/naturschutz/gebietsschutz-und-vernetzung/nationales-naturerbe

95 https://www.stmuv.bayern.de/themen/naturschutz/schutzgebiete/index.htm

96 https://www.lubw.baden-wuerttemberg.de/natur-und-landschaft/schutzgebietsstatistik

97 Bundesnaturschutzgesetz 2002

98 https://www.biotopverbund.de/

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and dedicated to nature conservation in perpetuity. Only around half of the NNE areas have been protected as nature reserves and that many more have only been partially protected (Ackermann et al 2021).

Bavaria

The new Bavarian Nature Conservation Act (BayNatSchG), which was developed following a citizen's petition and referendum, specifies that the biotope network is to be expanded to at least 15% of Bavaria's open land area by 2030, with intermediate goals of 10% by 2023 and 13% by 2027[99]. The technical approach is laid down in the Bavaria Concept for Expanding the Biotope Network.[100]

Baden-Württemberg

The state has set a legal goal to realise a functional biotope network on 10 % of the state's open land by 2023, 13 % by 2027 and 15 % by 2030, similar to Bavaria.[101]

Contractual tools for land

German nature conservation associations or foundations use various legal means to gain permanent access to land of conservation interest, through leases (Pachtverträge), land swaps (Tauschvertrag), licensing agreements (Lizenzvertrag), and conservation easements (Dienstbarkeit) (Kopsieker and Disselhoff, 2024).

3.6.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The federal spatial planning law (Raumordnungsgesetz ROG) states in its principles of spatial planning the importance of intact ecosystems and the requirement to protect and restore them, the requirement to reduce land use, and to consider the requirements of ecological connectivity. The ROG also specifies when and how environmental assessment and monitoring must be integrated into spatial planning procedures.

The German planning system places emphasis on measures to reduce land take for new building and development and control urban sprawl. German planning therefore clearly distinguishes between the zones defined for human settlement (Innenbereich), which are subject to detailed spatial planning, and the rural zone (Außenbereich) in which developments are strictly limited (except certain priority activities[102]) and where land is not divided into development plan areas (see below). Each local authority area must clearly define the borders between settlement zone and rural zone in its area. Agricultural and forest areas should be included in rural zones. Developments in the rural zone are severely restricted except for a federally defined list of exemptions, such as transport corridors, energy installations (power lines, wind farms, biomass processing plants etc.). however, various arrangements allow

[99] Art. 19 Para. 1 BayNatSchG

[100] Bayrisches Landesamt für Umwelt. https://www.lfu.bayern.de/natur/bayaz/biotopverbund/konzept_ausweitung/index.htm

[101] Source: Landesanstalt für Umwelt, Baden-Württemberg. https://www.lubw.baden-wuerttemberg.de/en/natur-und-landschaft/biotopverbund

[102] These are defined in the Building Code section 35 as developments necessary to support agricultural, horticultural or forestry activities, developments associated with ensuring power supplies and telecommunications (powerlines, cables etc), or other public services (waste, heating etc), renewable energy generation, activities associated with nuclear energy, and a clause for other activities that are defined as being unsuitable to be carried out in settlement areas.

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municipalities to acquire rights to develop in the rural zone. The federal planning law (ROG) requires an environmental assessment of the spatial plans to assess the impact of the plans.

The highest binding planning level is the federal state level planning programme (landesweiter Raumordnungsplan) and (in some states) the district level regional plan (Regionalplan), sometimes also a state level plan (Landesentwicklungsplan). The community or municipality level plan[103] defines land use zones, including desired future uses, and the objectives, areas and measures for nature conservation and landscape. Local development plans - so called 'local construction development plans' or 'binding land use plans' (Bebauungsplan /verbindlicher Bauleitplan) - strictly specify land use in detail at the land parcel level, for example for a cluster of plots of land.

All regional and municipal plans are required to incorporate and illustrate all the sites that are potentially useable for offset measures, and these sites must contribute to the regional ecological network. Offset measures must be coherent with the local landscape plan[104]. However, the ecological network concept and its implementation is vaguely defined in the regulations, and in practice it is difficult to tell whether offsets are contributing to ecological coherence or not (Wende et al, 2018).

Bavaria

The biotope network is not legally secured and is not anchored in any Bavaria-wide supra-regional concept.[105] The Bayerisches Landesamt für Umwelt[106] (Bavarian State Office for the Environment) supports participation in the biotope network advice in advance on the procedures and options for restoring the areas to a good ecological condition. Landowners contribute on a voluntary basis and the land remains entirely the responsibility of the landowner, or the person authorised to use it.

Addressing defragmentation of habitats and corridors through transport infrastructure, the Bayerische Landesamt für Umwelt has drawn up the 'Concept for the conservation and restoration of important wildlife corridors on federal roads in Bavaria' with the involvement of various specialist agencies and experts in 2008. For implementation, a period of 15 years is proposed for the most important measures and 20-25 years for second priority measures. At the same time, the concept offers the opportunity to assess the potential for conflict with regard to the biotope network when planning future roads and to consider mitigation measures.

Baden-Württemberg

The specialist plan for the state-wide biotope network, including the general wildlife route plan (GWP, since 2010 §22NatSchG BW) maps out the sites and wildlife corridors of the ecological network. All public planning authorities must take the biotope network into account in their planning and measures. To implement this, the local authorities must draw up biotope network plans for their area based on the Baden-Württemberg biotope plan and wildlife route plan, or they must adapt their landscape or green space plans. Where necessary and appropriate, the biotope network must be secured under planning law within the framework of regional plans and land use plans.

[103] In the states other than Bavaria and Baden-Württemberg there are two types of local plans: the 'municipal preparatory land use plan' (Flächenutzungsplan /vorbereitender Bauleitplan) defines land use zones, including desired future uses, and the 'landscape plan' (Landschaftsplan) defines the objectives, areas and measures for nature conservation and landscape.

[104] According to article 15 of the national conservation law §15 Absatz 2 BNatSchG 2009

[105] Personal communication NABU

[106] https://www.lfu.bayern.de/natur/index.htm

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3.6.4. FUNDING

FUNDING FOR PROTECTED AREAS

Germany in general

The funding structure varies greatly between different categories of protected area. The national parks are funded through annual budgets from the federal states. For nature parks and landscape parks, there are large differences in governance and financing, from state run parks to those run by an association. Local authorities within the parks are generally significant sources of support. The association run parks may have access to a dedicated funding programme from the state, or they may rely on project funding from national or EU sources. Nature reserves and Natura 2000 sites are often managed and financed as part of a larger area designation.

Bavaria

For nature parks, the annual management payment from the state covers only a small proportion of the actual staff and maintenance costs, and the rest must be covered through project funding[107]. For example, the nature park Bayerischer Wald is mainly financed through project payments from the Bavarian state budget, complemented by the membership payments from the participating local authorities and towns, private individuals, and associations or NGOs, with a small addition of donations and project funding[108].

Baden-Württemberg

Special programme to strengthen biodiversity.

To guarantee the long-term preservation, protection and development of natural and near-natural landscape elements, habitats and the animal and plant species that need to be protected, representative areas and nature conservation projects are also financially supported. In addition to the state funding programmes - in Baden-Württemberg, PLENUM, the state's project for the conservation and development of nature and the environment, should be mentioned first and foremost. This programme is special in the sense that it also supports green economy such as ecological agriculture and tourism along with conservation and education. There are also funding programmes at federal and EU level. Nationally significant natural and cultural landscapes are supported by the Federal Ministry for the Environment as so-called large-scale nature conservation projects via the federal programmes Chance.Nature and Biological Diversity. The European programmes LIFE-Nature, LIFE+ and LIFE.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

Germany (federal level)

On the federal level, funding for ecological corridors and stepping stones is available for the areas that fall under federal responsibility. The reconnection of habitats across federal traffic infrastructure, federal roads and federal waterways is funded within the Federal Defragmentation Programme (Bundesprogramm Wiedervernetzung) to reconnect fragmented habitats across federal roads, and the Federal Blue Belt Programme (Bundesprogramm Blaues Band) to restore the federal waterways to near-natural status including ecological permeability. Both programmes are led jointly by the federal ministry of the environment and the federal ministry of traffic. While the funding of connectivity in the Federal Defragmentation Programme mainly consists of retrofitting federal traffic infrastructure, the Federal Blue Belt

[107] https://www.bundestag.de/resource/blob/559638/905a09aa298dcd323c5d5358fe341937/WD-8-040-18-pdf-data.pdf

[108] https://www.naturpark-bayer-wald.de/finanzierung.html

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Programme also includes funding of regional and local projects, for example floodplain restoration.

Bavaria

Bavaria has several state operated funding programmes that can be used to maintain, create and restore the state-wide biotope network. These programmes include funding schemes for conservation along with funding schemes for ecological connectivity:

- Contract Nature Conservation Programme (Vertragsnaturschutzprogramm, VNP),
- Contract Nature Conservation in Forests Programme (Vertragsnaturschutzprogramm Wald, VNP-Wald)
- Landscape Conservation and Nature Park Directives (Landschaftspflege- und Naturpark-Richtlinien, LNPR).

The VNPs are mainly directed at farmers and forest owners respectively but may also be nature conservation associations, that maintain the ecological management practices and ecological connectivity. The VPN is co-financed by the EU[109]. The LNPR is directed at nature protection associations to support restoration and maintenance of natural or near-natural landscapes. The LNPR funding is project based and capped to 70 % of the total project cost[110].

More explicitly dedicated to the support of ecological connectivity is the programme BayernNetzNatur. The Programme works to bring together stakeholders from different sectors on a voluntary base. The funding of projects requires at least one lead partner to take over responsibility and 10% of the project costs, the rest is funded from several programmes including the programmes VNP, VNP-Wald, LNPR, the Bavarian Cultural Landscape Programme (Bayerisches Kulturlandschaftsprogramm, KULAP), the Climate Protection Programme Bavaria (Klimaschutzprogramm Bayern, KLIP) and the Bavarian Nature Conservation Funds (Bayerischer Naturschutzfonds, BNF). For larger projects federal funding ('chance.natur – Bundesförderung Naturschutz', Federal Programme for Biodiversity) or EU funding (LIFE-Programme) and funding with donations or funds from other environment foundations is possible depending on the project[111].

Baden-Württemberg

Baden-Württemberg has several funding programmes that can be used to maintain, create and restore the state-wide biotope network:

- Landscape Conservation Directive (Landschaftspflegerichtlinie, LPR)
- CAP funding programme for agri-environment, climate protection and animal welfare (Förderprogramm für Agrarumwelt, Klimaschutz und Tierwohl, FAKT)
- Biodiversity consultancy: Land managers and land users can obtain information on suitable measures for biodiversity on their farm via the biodiversity advisory service. Advice on biodiversity is 100% subsidised.

To achieve the goals of expanding the biotope network, the state government launched a state-wide initiative in 2019 to strengthen the biotope network, which includes both financial and personnel support. As part of the Landscape Conservation Directive (LPR), the funding rate for municipal biotope network planning was increased to 90% and to 70% for measures that serve to implement the biotope network. To support and coordinate biotope network

[109] https://www.stmuv.bayern.de/themen/naturschutz/naturschutzfoerderung/vertragsnaturschutzprogramm/index.htm (in German)

[110] https://www.stmuv.bayern.de/themen/naturschutz/naturschutzfoerderung/landschaftspflege_naturparkrichtlinien/index.htm (in German)

[111] https://www.bestellen.bayern.de/application/eshop_app000006?SID=137628979&ACTIONxSESSxSHOWPIC(BILDxKEY:%27stmuv_natur_0016%27,BILDxCLASS:%27Artikel%27,BILDxTYPE:%27PDF%27) (in German)

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planning and implementation, in all the districts biotope network ambassadors have been employed by the landscape conservation associations (LEV) (or the district administrations in districts without LEV). The Ministry for the Environment, Climate Protection and the Energy Sector is responsible for overall management, with technical support from the LUBW and the State Institute for Agriculture, Food and Rural Areas (LEL). Together with the regional councils, they support local stakeholders with a large amount of specialised information and training courses. This ensures a standardised level of knowledge and a uniform approach throughout the state.

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3.7. HUNGARY

3.7.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 12. National and regional designation types, protection purpose and governance in Hungary. Sources: (Sipos, 2023), (MARI et al, 2022)

Designation type	Protection purpose and governance
National Park (nemzeti parkok)	Large unmodified area with multiple natural values and biodiversity; conservation + scientific, cultural, educational, recreational purpose.
Landscape Protection Area (tájvédelmi körzetek)	Designated for heritage, environmental education, ecotourism, local development.
Nature Conservation Area (természetvédelmi területek)	Smaller, unitary and characteristic territory.
Natural Monument (természeti emlékek)	Individual natural formation
Ex lege protected natural values qualified as nature conservation areas	Only mires and alkaline lakes not overlapping with other domestic protected areas
Ex lege protected natural values qualified as natural monuments	Kurgans, earth fortifications, springs and sinkholes
Ex lege protected natural asset	Caves
Protected natural areas of local importance = Nature Conservation Area of local importance Natural Monument of local importance	Areas of local importance can only be designated as Nature Conservation Areas or Natural Monuments.

Natura 2000 network: the network consists of 56 SPAs (13 747 km²), 479 SACs (14 442 km²) that is 525 Natura 2000 sites (19 949 km²), which cover 14.8%, 15.5% and 21.4% of the land[112].

Total terrestrial protected area: 22.2% (BISE[113]).

Overlaps and protection levels: Hungary has a total of 851 protected areas, comprising 326 sites designated under national laws and 525 recognized as Natura 2000 sites (BISE). More than half of the protected areas are designated exclusively as Natura 2000 sites. The rest consists mainly of Natura 2000 sites overlapping with national designations, with a small portion (3.6%) protected solely by national designations.

OECMs: OECMs are not used in Hungary.[114]

Transboundary protected areas: Austria and Hungary have declared the 'Neusiedler See-Seewinkel – Fertö-Hanság' area as a Transboundary Ramsar Site, a World Heritage Site, and a transboundary National Park. The Austro-Hungarian National Park Commission,

[112] https://www.eea.europa.eu/data-and-maps/dashboards/natura-2000-barometer

[113] https://biodiversity.europa.eu/countries/hungary

[114] Verbal communication with a representative of the Ministry of Agriculture, Department for Protected Areas.

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representing the Austrian and Hungarian governmental authorities and the Park's management bodies, acts as a steering committee for the further development of the Transboundary Protected Area[115]. Hungary also has transboundary Ramsar sites with Slovakia (Upper Tisza Valley, Ipoly valley and Poiplie).

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Nature Conservation Act (NCA 53/1996) defines three types of designations (Sipos, 2023). **Protected areas of national importance** (National Park, Landscape Protection Area, Nature Conservation Area and Natural Monument) are designated by the minister for nature conservation; their conservation administration lies with the county government offices, and their nature management is the responsibility of the relevant National Park Directorate. **Protected areas of local importance** are designated by a local decree and supervised by the relevant municipality which is also responsible for their management. Areas of local importance can only be designated as Nature Conservation Areas or Natural Monuments.

In all the protected areas designated according to the Nature Conservation Act, the legislation explicitly prohibits certain detrimental land uses such as the planting of invasive species, the clearcutting of forest areas of more than three hectares, and harmful infrastructure development. It also specifies authorisation procedures for potentially harmful land uses such as land transformations, the use of chemicals, collection of biomasses, and research activities (Sipos, 2023). The Act requires zonation within national parks and buffer zones around protected areas, but neither of these requirements have been enforced, except the zonation of the Hortobágy National Park in 2020. In practice, the level of protection provided by the legislation designating the national parks varies. According to MARI et al (2022), five of the ten national parks can be classified as IUCN category II, whereas five are IUCN category V. Hungary also has nature parks, but these are not designated under the act (MARI et al, 2022).

The Nature Conservation Act considers that maintenance of biodiversity and natural heritage also requires measures outside the protected areas, and it therefore introduces legal provisions for the general protection of habitats including protection from invasive alien species and protection of landscapes (Sipos, 2023) as well as provisions for the protection of protected species. **Ex lege protection** applies to the following precisely defined features of particular importance and uniqueness: mires, alkaline lakes, caves, springs, sinkholes, kurgans (burial mounds) and earth fortifications. Wherever these are discovered and meet the definition in the Act, they are given automatic and immediate protection. To register the ex lege protected features, the relevant conservation authority (currently the county government offices) must identify and designate the affected land parcels.

One challenge to management in the national parks is that forest ownership is complex, including forest land owned by the state-owned forest companies or by private persons (as well as the public land), and legal and illegal logging takes place, sometimes in contradiction to the management objectives.

3.7.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

National Ecological Network: The ecological network is a spatial planning instrument with core zones, ecological corridors, and buffer zones. The national ecological network zone includes the core areas, the buffer zones and the ecological corridors as well

[115] TransNature map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

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(ConnectGREEN, 2021). It was mapped in 2000 at a scale of 1:50 000, covering 36% of the country and comprising 55% core zones, 25% corridors and 20% buffer zones (Sipos, 2023).

3.7.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The National Land Use Framework Plan, which is renewed every six years, includes a series of thematic maps that indicate the National Ecological Network, the zone of forests and afforestation, the zone of landscape scenery protection, World Heritage Sites and candidates, and water protection areas, besides Natura 2000 sites and other protected areas (Sipos, 2023).

The County Land Use Framework Plan and the municipal land use plans (master plans) must follow the structure of the higher (spatial) level land use plans.

In the zone of core areas and ecological corridors, the rules restrict the designation of areas for development, placement of transport and energy infrastructure and new surface mines and prescribe that utility lines fit into the landscape (ConnectGREEN, 2021).

The Regulation Plans (zoning of regulation packages on a map) of the spatial plans contain the exact zoning of the National Ecological Network. The County Land Use Framework Plans, and Land Use Plans for so called priority regions (e.g. the Lake Balaton Recreational Area and the Budapest Metropolitan Region) contain regional tasks to protect the environment, landscape and nature. The National Development Concept of 2011 formulates guidelines for the development and protection for landscape areas of national importance such as Lake Balaton, the Danube region, or Lake Tisza. Guidelines for special landscape types can also be found within the frames of development plans (ConnectGREEN, 2021).

The zone of the National Ecological Network is entrenched in the municipal planning of settlements (ConnectGREEN, 2021). In the core area and ecological corridor, new areas for building cannot be designated in case the urban area is surrounded by the core area or ecological corridor. New built-up areas can be designated just in the frame of an official land-use regulation procedure.

3.7.4. FUNDING

FUNDING FOR PROTECTED AREAS

The Ministry of Agriculture does not allocate an independent budget to the Department for Nature Conservation or the Department of National Parks and Landscape Protection. Their funding is included in the overall ministry budget, which may risk a loss of resources if priorities shift. Capital, county and district government offices also receive a general budget from the Annual Budget Act, with no specified allocation for nature conservation. It is therefore difficult to assess trends in funding for nature conservation over time. National Park Directorates do, however, receive a separate budget. The budget for the National Park Directorates has increased since 2008, largely as a result of substantial revenues raised by the directorates themselves (around 60%) from environmentally friendly farming as well as ecotourism (OECD, 2018).

Nature conservation funding from the European Union has declined, but the National Park Directorates still significantly benefit from EU LIFE programme funding. The LIFE programme financed 19 projects between 2008 and 2016, providing more than EUR 1 million towards total costs of EUR 2.1 million. However, changes in budgeting in 2012 may have reduced capacity to apply for EU funding (WWF Hungary, Hungarian Birds and Nature Conservation Association and Hungarian Association of Nature Conservationists, 2015). From 2014 to 2020, the Environment and Energy Efficiency Operational Programme and the Central Hungary

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Operational Programme (EU Regional Development Fund and Cohesion Fund) provided HUF 37.8 billion for direct nature investments. These include ecological restoration projects and investments in nature management infrastructure on at least 100 000 ha of protected areas and/or Natura 2000 sites.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no funding earmarked especially for ecological corridors and stepping stones. However, they can be financed via short-term projects, mainly through the EU funding instruments.

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3.8. MOLDOVA

3.8.1. PROTECTED AREA NETWORK (TERRESTRIAL)

The main legislation (Law 1538/1998) defines seven categories of protected area (scientific reserve, national park, nature monument, nature reserve, landscape reserve, resource reserve, area with multifunctional management) which are designated nationally according to the IUCN classification, and landscape architecture monuments which are applied locally. Biosphere reserves and wetlands of international importance are designated under the respective international conventions.

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 13. National and regional designation types, protection purpose and governance in Moldova. Sources: Republic of Moldova Parliament Law No. 1538 of 25-02-1998[116]

Designation type	Protection purpose and governance
Scientific Reserve	The scientific reserve has as a priority objective the protection of the environment, the carrying out of scientific research, the education and ecological training of the population. The scientific reserve has the status of a scientific research institution and is subordinate to the central authority for the environment. On forest land, a dedicated regulation delimits the management competencies between the central authority for the environment and the central authority for forestry. The central authority for the environment and the Academy of Sciences of Moldova approve the statement of objectives.
National Park	The objective of the national park is to preserve natural complexes of particular ecological, aesthetic and cultural-historical importance in order to harmonize the geographical landscapes and their sustainable use for scientific, cultural, touristic, instructive and educational purposes. The central authority for the environment establishes the statement of objectives of each park. The national park management has the status of a public institution. Its subordination is established at the time of designation.
Nature monument	There are different classes of nature monuments: geological and paleontological, hydrological, zoological, botanical, mixed, and rare plant and animal species. Natural monuments are under the management of central or local public administration authorities. The owner of the land which is declared a natural monument is obliged: a) to ensure compliance with the protection regime of the natural monument; b) to install bollards, warning boards, signs, pedestrian tourist itineraries at the borders of the nature monument and ensure their integrity; c) to fence the protection areas of secular trees and hydrological monuments; d) to improve the living conditions of the animals, applying appropriate biotechnical methods.
Nature reserve	The objective of the nature reserve is to ensure the optimal conditions for the protection and restoration of species, plant and animal communities significant from a national point of view. Nature reserves are under the authority of the central or local public administration.

[116] https://www.legis.md/cautare/getResults?doc_id=141074&lang=ro

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Landscape reserve	The landscape reserve has as its objective the conservation of geographical landscapes of national importance, their regulated use for economic, aesthetic, cultural and recreational purposes. Landscape reserves (of geographical landscapes) are under the authority of the central or local public administration.
Resource reserve	The resource reserve has as its objective the conservation of natural resources to maintain them in their natural state for further exploitation. The resource reservation status has a provisional character, depending on its ecological and economic importance, and is evaluated by the scientific organizations and institutions of the field in agreement with the central authority for the environment. The resource reserves are under the authority of the central or local public administration, and their territories remain with the holders.
Area with multifunctional management	The area with multifunctional management has as its objective the conservation of nature and the regulated management of natural resources. Natural areas with a special protection regime within the area must be demarcated. Areas with multifunctional management are subordinated to central or local public administration authorities.
Landscape architecture monument	The landscape architecture monument aims to preserve and develop landscape architectural compositions and serve as a repository of the plant gene pool. Old parks, forest parks, alleys with historical, cultural, scientific, aesthetic, economic and recreational value are declared monuments of landscape architecture. The land is excluded from economic development, under the authority of the local public administration, but remains at the owner's disposal for allowed uses. Any work of reconstruction and restoration of the monument of landscape architecture is carried out according to a project approved by the central authority for the environment.

Emerald Network: 62 sites have been designated for the continental and the steppic biogeographical regions covering an area of 3 252 km², and the sites are now in the process of being legally established.[117]

OECMs: not applied in Moldova.

Total terrestrial protected area: protected areas in Moldova cover 1 912.7 km², which is 5.66% of the country's territory.[118]

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Ministry of the Environment (MoE) is responsible for protected area policy development and implementation. The government and ministry are in the process of reorganising the governance of the whole environmental domain, including a separation of forest management from conservation and protected area management, which means all protected areas will be governed by a single policy and administrative unit. A new Environmental Strategy 2024-2030 has been developed and is now under public consultation. A new national biodiversity strategy is also being prepared by the National Office for Environmental Project Implementation (subordinated to the MoE).

[117] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS. Standing Committee 43rd meeting Strasbourg, 27 November - 1st December 2022. Updated list of officially adopted Emerald network sites (December 2023). https://rm.coe.int/draft-list-of-adopted-emerald-network-sites/1680ad54a1

[118] pers.com., Dr. Aurel Lozan

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The land ownership in protected areas is diverse, with nearly 40% of the area, mainly forests and wetlands, owned and managed by the public forestry and hunting agency Moldsilva (subordinated to the MoE). The local public authorities and the private sector are the other main landowners, but they have only weak capacities for conservation and management. The most recent protected area established is the Lower Dniester National Park (Law 71/2022), which encompasses practically the entire Ramsar area with the same name.

3.8.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

In Moldova, the Law 'About Ecological Network' (Law 94/ 2007) provides the legal framework for ecological connectivity[119]. It has been amended several times to partially transpose provisions of the EU Habitats Directive and to include a definition of the Emerald network. The law provides the legal basis for creating and developing a national ecological network as a component of the Pan-European ecological network and establishes control and protection mechanisms for the network.

However, although the National Ecological Network is conceptualized in the law, it is almost not implemented as such. Some of its aspects are considered in various incentives, projects or policy documents. However, the network implementation needs a holistic approach and much more robust implementation on the ground[120].

3.8.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

No specific tools are available, as the national ecological network law is practically hardly implemented.

3.8.4. FUNDING

FOR PROTECTED AREAS

There is no public budget for protected areas. Some areas generate funding from their internal sources (from logging and harvesting other forest products, hunting etc.), but funding for protected areas owned by local authorities or private organisations or individuals is almost inexistent.

However, authorities are seeking for ways to sustain protected areas and support good incentives. The National Office for Environmental Project Implementation manages the National Environmental Fund, which has objectives for biodiversity conservation and area protection. The fund's focus and administrative structure was significantly changed in 2022, and it now exclusively focuses on environmental protection, climate change, and sustainable resource management, ensuring that more funding is directed toward specific environmental protection projects, including those related to ecological corridors[121]. Previously, almost all of the spending was allocated to water supply and sanitation projects. This shift in scope enables more resources to be dedicated to projects with direct environmental protection aims[122].

[119] https://cis-legislation.com/document.fwx?rgn=18399

[120] pers.com., Dr. Aurel Lozan

[121] amendments to Law 1515/1993 adopted in March 2022

[122] https://www.eu4environment.org/news/legal-reforms-of-the-national-environmental-fund-a-stepping-stone-to-environmental-protection-in-moldova/

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Various international organizations, in cooperation with local entities (NGOs, LPAs) and central authorities (Ministry of Environment, Moldsilva), are promoting initiatives aimed at enhancing biodiversity conservation and improving protected area management on the ground. Examples of cooperation between international institutions and national and local bodies are:

- Project 'Improving governance of protected areas in Moldova through institutional development, capacity development and habitat restoration' funded by the Austrian Development Agency (2023 to 2027) with a budget of €1 653 700[123]. It aims to increase the effectiveness of protected areas in reducing biodiversity loss and achieving conservation outcomes through innovative governance models and sustainable management practices. The target areas include the Codrii nature reserve, Orhei and Lower Dniester National Parks, and the focus is on integrating ecosystem services, enhancing ecological capacity, and strengthening the role of women in protected area governance.
- Global Environment Facility (GEF) funded projects aimed at improving the coverage and management effectiveness of the protected area system in Moldova. One project, which ended in 2014, sought to expand the protected area system to include under-represented ecosystems. It received a GEF Project Grant of $ 950,000 with a co-financing total of $ 1,091,670 and was implemented in partnership with the United Nations Development Programme.[124]

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no dedicated funding for the National Ecological Network.

[123] https://www.entwicklung.at/en/projects/detail-en/improving-governance-of-protected-areas-in-moldova-through-institutional-development-capacity-development-and-habitat-restoration

[124] https://www.thegef.org/projects-operations/projects/3675

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3.9. MONTENEGRO

3.9.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 14. National and regional designation types, protection purpose and governance in Montenegro. Sources: Protected Planet database (https://www.protectedplanet.net/country/MNE), The Law on the Protection of Nature.

Designation type	Protection purpose and governance
Landscape with special features (Predio Izuzetnih Odlik)	An area of exceptional characteristics on land and/or sea where the mutual influence of people and nature over time has shaped recognizable features of the locality with significant aesthetic, ecological and cultural values, accompanied by high biological diversity. It is forbidden to carry out actions, activities and activities that violate the features for which the area was declared protected.
National Park (Nacionalni Park)	A national park is a natural land and/or sea area which is designated to protect the ecological integrity of one or more ecosystems for current and future generations, in order to prevent the inappropriate use of natural resources or other harmful actions and activities and to provide spiritual, scientific, educational, recreational needs and the needs of visitors that are compatible with the preservation of the environment and culture. In the national park, it is forbidden to carry out activities and activities that threaten the integrity of nature.
Natural Monument (Spomenik Prirode)	An area of land and/or sea in which there is one or more natural or natural-cultural forms which have ecological, scientific, aesthetic, cultural or educational value. A nature monument can be in a natural, semi-natural or anthropogenically altered state. On the natural monument and in its immediate surroundings, which is an integral part of the protected natural property, it is forbidden to carry out actions, activities and activities that threaten the characteristics, values and role of the natural monument.
Nature Park (Park Prirode)	A nature park is a large natural or partially cultivated area of land and/or sea, characterized by a high level of biological diversity and/or geological values with significant regional, cultural and historical values and ecological features of national and international importance. In the nature park, it is forbidden to carry out actions, activities and activities that threaten the features, values and role of the park.
Special Nature Reserve (Posebni Rezervat Prirode)	An area of land and/or sea of particular importance due to its uniqueness, rarity or representativeness of natural values, which includes the habitat of endangered wild species of plants, animals and fungi, in which man lives in harmony with nature and which is protected for preservation of natural conditions and values. A special nature reserve can be in a natural, semi-natural or anthropogenically altered state. In the special nature reserve, it is forbidden to carry out actions and activities and to carry out activities that may damage the properties for which it was declared a protected area, namely: amelioration; drainage or other hydrological modifications which can cause changes in the structure and function of the ecosystem, i.e. irreversibly damage the land surface, change the water regime or change the relief of the terrain; construction of facilities and road infrastructure; extraction of minerals; movement of persons and driving outside marked paths for movement, except guards, forest guards and game guards, military and police personnel, inspection, firefighters, medical personnel in the performance of their duties; intentional introduction and spread of non-indigenous plant and animal species; mountaineering, use of kites, paragliders and parachutes; game breeding; harassment, capture and killing of animals; commercial fishing; mariculture; anchoring of boats;

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	construction of infrastructure in the sea; picking and collecting plants; lighting campfires in places not designated for that purpose; changing the natural values of the area. Certain actions, activities and activities can be carried out on the basis of a permit in accordance with the management plan. Visits can be made for the purposes of monitoring the state of nature, education and tourism based on the approval of the management, provided that the populations of wild species of animals are not disturbed and the habitats of wild species of plants, animals and fungi are not disturbed.
Strict Nature Reserve (Strogi Rezervat Prirode)	An area of land and/or sea with isolated or representative ecosystems, unaltered or insignificantly altered artificial nature. It is intended exclusively for the preservation and restoration of the state of nature and for scientific research, which does not alter the basic abundance and does not endanger the free unfolding of natural phenomena and processes. In a strict nature reserve, it is forbidden to carry out any work or activity, except for activities aimed at the conservation, preservation and restoration of the natural environment.

Emerald Network / Natura 2000 network: No adopted sites, but 31 sites have been officially nominated as candidates for the Emerald Network.[125] These sites will become Natura 2000 sites upon accession to the EU. The proposed sites cover around 2400 km^2.

OECMs: Not yet introduced.[126]

Total terrestrial protected area: coverage of national and local protected areas is 13.9% in 2022 according to the World Database on Protected Areas (WDPA).[127]

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The management and governance of terrestrial protected areas in Montenegro is under development, including the preparation of the Emerald Network of sites under the Bern Convention, to prepare the country for EU accession and the requirement to establish a Natura 2000 site network under the EU Habitats and Birds Directives[128]. The Ministry of Ecology, Spatial Planning and Urbanism and the Nature and Environment Protection Agency have been supported by EU pre-accession funding in this work.

A Europe-Aid funded project focused on establishing the Natura 2000 network from 2016 to 2019[129]. The project mapped and gathered data to identify key biodiversity areas and facilitated knowledge exchange between local and international experts. The Montenegro Nature and Environment Protection Agency continued the monitoring programme after the project ended. Further funding was provided in the framework of the Instrument for Pre-Accession (IPA), and a new project between 2021 and 2023 continued field work to map

[125] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS. Standing Committee 43rd meeting Strasbourg, 27 Nov - 1 Dec 2022. Updated list of officially nominated candidate Emerald Network sites (December 2023). https://rm.coe.int/draft-list-of-candidate-emerald-network-sites/1680ad54a2

[126] https://www.protectedplanet.net/country/MNE

[127] https://data.worldbank.org/indicator/ER.LND.PTLD.ZS?locations=ME&type=shaded&view=map

[128] https://www.eeas.europa.eu/node/61066_en

[129] https://www.syke.fi/en-US/Research__development/Research_and_development_projects/Projects/Montenegro__Natura_2000_Establishment_of_Natura_2000_network_ECEuropeAid_20162019/Montenegro__Natura_2000_Establishment_of(53830

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habitat types and species distributions and to map the territorial scope with precise borders (in .shp format) to occupy at least 7.33% of the state territory[130].

However, in 2018 the country reported significant challenges for protected areas arising from a low level of trust between local populations and competent authorities, conflictual situations, and excessive pressures to biodiversity.[131] The national park management authorities have not fully engaged in the Natura 2000 planning process[132]. It was assessed that measures are needed to reconcile the needs for conservation and for development by involving the stakeholders into planning and management processes, so as to achieve socio-economic progress which would have minimal impact on biodiversity.[133]

The CGIS Bioportal[134] maintained by the Nature and Environment Agency is an up-to-date source of information on Montenegro's protected areas. This publicly available online platform, launched in 2017, allows users to discover protected areas, access statistics, and download current data, including details about area, national and IUCN categories, and zoning. This portal improves data availability, national planning, priority setting, and management of protected areas and biodiversity, making the national protected area system more transparent and open to public participation[135].

3.9.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

No policy framework for ecological connectivity is available and used at the moment[136].

3.9.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The formal categorization of ecological corridors both in plans and on the ground remains uncertain and unclear. Montenegro has relevant legal frameworks for land-use/spatial planning, nature conservation, sectorial planning, as well as procedural aspects like strategic environmental assessment (SEA) and environmental impact assessment (EIA) laws. There are also legal mechanisms supporting protection, such as expropriation, and land-use permissions and the definition of public interest[137].

[130] Funded with EUR 299 926 from EuropeAid

[131] Montenegro government 6th national report to the Convention on Biological Diversity (2018). https://www.cbd.int/doc/nr/nr-06/me-nr-06-en.pdf

[132] https://www.eeas.europa.eu/node/61066_en

[133] 6th NR to CBD (see above)

[134] https://cloud.gdi.net/smartPortal/zppCG

[135] https://www.iucn.org/news/eastern-europe-and-central-asia/201706/national-portal-protected-areas-launched-montenegro

[136] personal communication from Birdlife Montenegro

[137] personal communication from Birdlife Montenegro

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3.9.4. FUNDING

FUNDING FOR PROTECTED AREAS

Montenegro receives support for its protected areas through international grants and projects. The development of the Emerald Network (and future Natura 2000 network) is being funded through the EU funds for pre-accession countries. An example:

> The 'Promoting Protected Areas management through integrated marine and coastal ecosystems protection in coastal areas of Montenegro' project is funded by the Global Environment Facility (GEF) Trust Fund and co-financed by the United Nations Environment Programme (UNEP) and Montenegro's Ministry of Ecology, Spatial Planning, and Urbanism[138]. This project aims to enhance the conservation and sustainable use of coastal and marine biodiversity through effective management of coastal and marine protected areas.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

No dedicated funding is available at the moment[139].

[138] https://www.unep.org/regions/europe/our-projects/coast-adriatic-sea-better-protected-montenegro

[139] personal communication from Birdlife Montenegro

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NATURA CONNECT

3.10. POLAND

3.10.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

The Nature Protection Act[140] defines seven types of protected area designation as well as Natura 2000 sites and international designations.

Table 15. National and regional designation types, protection purpose and governance in Poland. Sources: (Pawlaczyk, 2023)

Designation type	Protection purpose and governance
National Park	Large areas (>1 000 ha) designated for conservation of all elements of nature and the landscape. Nature conservation is their main goal, in most cases overriding all other activities (strict protection). Designation requires a decision by parliament, followed by a governmental decree to establish the park's borders. All local assemblies must agree. Must have a buffer zone. Over 85% of the land within the current parks is state-owned. Each National Park has its own directorate and specialised staff, and generally manages land owned by the state within its boundaries.
Nature Reserve	Smaller areas designated exclusively for nature or landscape conservation, with site-specific conservation objectives. Strict protection similar to national parks. Must have a buffer zone. Land is mostly privately owned. Supervised by Regional Directorates of Environment Protection (RDOŚ or RDEP). Require a management plan, but less than half of the reserves currently have one.
Landscape Park	Area designated by the regional government (Voivodship Assembly) for landscape protection with some elements of biodiversity conservation, integrated with sustainable land use. Land uses such as agriculture and forestry are still continued, and the protection is achieved mainly by land-use planning. Corresponds to IUCN category V. Some parks have a specific management body (directorate), which may supervise compliance, implement its own conservation projects, organise stakeholder collaboration for landscape care, and implement education measures. In other cases, a few parcs from the same voivodships can be summoned in a Complex of parcs, which takes care of them all jointly. Require a management plan, but less than a third of the parks currently have one.
Landscape Protection Area	Large areas designated for general landscape protection, including ecological connectivity. The protection regime is only through some general restrictions on land-use planning, which lack clear biodiversity-related objectives, measures and monitoring. Corresponds to IUCN category V.
Landscape-Nature Complex	Unique landscapes, natural and/or cultural values, designated by the local community. Protection is achieved mainly by land-use planning, usually with no limitations on forestry, farming and hunting. They vary from small areas (several hectares) to a few thousand hectares.
Ecological Area	Smaller fragments of usually unmanaged land important for biodiversity (e.g. swamps, fens, natural ponds, dunes and oxbows), designated by the local community.
Natural Monument	Protected natural features of outstanding importance (e.g. monumental trees, erratic boulders, rocks, caves, waterfalls or springs) that are designated by the local community. 94% of them are trees.

Natura 2000 network: Poland has 864 SCIs and 145 SPAs (terrestrial and marine) (end 2020). The Commission considers that Poland still has to complete its Natura 2000 network to

[140] https://leap.unep.org/en/countries/pl/national-legislation/nature-conservation-act-0

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address some insufficiencies in designating SCIs and has taken legal action to address these gaps.

OECMs: OECMs are not implemented in Poland (though they might be adopted in the future[141]).

Total terrestrial protected area: 39.6% of land area (excluding Biosphere Reserves, Natural Monuments, Ecological Areas and Nature Landscape complexes) (EEA BISE[142]).

Overlaps and protection levels: About half of the terrestrial protected areas are designated exclusively as nationally designated areas; 31.0% is covered solely by Natura 2000 sites, and the rest is covered by overlaps between the two (BISE). Most of the nationally designated area consists of Landscape Parks and Protected Landscape Areas.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

Legal protection: The Nature Conservation Act defines the national protected area system and requires the establishment of management plans and buffer zones for National Parks, Nature Reserves and Landscape Parks (Pawlaczyk, 2023). The National Parks and Nature Reserves have strict protection regimes, but this refers only to the state-owned land within them (Pawlaczyk, 2023). In Landscape Parks, Landscape Protected Areas and Nature-landscape Complexes, the general protection system is based on a list of prohibited activities, but with general derogations for sustainable land uses, including forestry, farming, hunting and fisheries. There is widespread use of these derogations and agriculture and forestry does not differ in intensity inside and outside the protected areas.

Governance: The Ministry of Climate and Environment is in charge of supervising National Parks which have their own directorates and staff. The General Directorate of Environment Protection (GDOŚ) at the national level and the 16 Regional Directorates of Environment Protection (RDOŚ) are responsible for management of Natura 2000 sites and Nature Reserves, as well as species conservation.

Regional government organisations (environmental departments) are responsible for landscape protection, such as through Landscape Parks and Protected Landscape Areas, and general landscape assessment and care. The RDOŚ supervise landscape protection, reconciling all changes in Protected Landscape Area designations as well as land-use decisions within them and their buffer zones. The Landscape Parks' management plans have no legal power to enforce any modifications, although some parks do have dedicated staff (Pawlaczyk, 2023).

Local municipalities are responsible for establishing and managing small, protected areas: Ecological Areas, Nature-landscape Complexes, and Natural Monuments. RDOŚ also supervise local nature protection (Pawlaczyk, 2023).

Natura 2000 designation and management: In the Natura 2000 network, many SCIs have not yet been designated as SAC and have no conservation objectives and measures and no list of prohibited activities. For the Natura 2000 sites that do have defined conservation objectives, the quality of these objectives is considered to be insufficient as they are often not related to the parameters used to determine the conservation condition of the habitat types and species protected on the site (e.g. in relation to area, structure and functions or populations) (Pawlaczyk, 2023).

[141] WWF Poland, written input

[142] EEA BISE https://www.eea.europa.eu/en/countries/eea-member-countries/poland

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NATURA CONNECT

3.10.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Polish Nature Conservation Act defines an ecological corridor as 'an area for the migration of animals, plants and fungi' but does not specify any legal mechanisms to designate and protect them (Chenevois, 2023). Landscape protected areas can be designated with the purpose of protecting a corridor (see table above).

The **National Spatial Development Concept 2030**, the national strategic land use planning document, includes the objective to shape spatial structures supporting the achievement and maintenance of high-quality natural environment and landscape values of Poland and emphasises the need to counteract the fragmentation of habitats and the creation of the best possible spatial ecological connections.[143] A plan for a network of ecological corridors was developed and included in the document, but there is no legally binding mechanism to implement it.

In theory, there is potential for the introduction of ecological corridors on forestland and freshwater and wetlands, as most of the Polish forests are managed by State Forests (an independent and self-financing state agency), and the state agency Polish Waters (state agency under the Ministry of Infrastructure) manages all public freshwaters since 2017.

3.10.3. SPATIAL PLANNING

Local municipalities are responsible for most aspects of spatial planning. Land-use planning in Poland has a hierarchical structure, encompassing national, regional (voivodship) and local levels, but only the local plans are legally binding.

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

Several ecological corridor projects have been carried out in Poland.

3.10.4. FUNDING

FUNDING FOR PROTECTED AREAS

The National Parks and landscape parks each get a set budget for each year from public funds overseen by Ministry of Environment. The Regional Directorates of Environment Protection, who manage the nature reserves and Natura 2000 sites, get funding mainly for their everyday work, employees and other activities, and do not or very rarely get money directly from the state budget specifically for the implementation of the management plans. The directorates, National Parks, and landscape parks are legal entities that can apply for EU funds or national funds; therefore, the employees are usually actively searching for project possibilities (mainly EU funded calls for proposals). Other protected areas do not have a set budget either. The main source of national funds is the National Fund for Environmental Protection and Water Management, which mainly is sourced from environmental fees paid by private companies.

[143] KPZK (2026) NATIONAL SPATIAL DEVELOPMENT CONCEPT 2030. https://www.kooperation-ohne-grenzen.de/wp-content/uploads/2016/05/NSDC-2030.pdf

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FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no fund for ecological corridors or stepping stones in Poland. Polish EU funding programmes had several calls for proposals connected directly with ecological corridors in the past[144].

[144] WWF Poland written input

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NATURA CONNECT

3.11. ROMANIA

3.11.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 16. National and regional designation types, protection purpose and governance in Romania. Sources: (Stanciu et al, 2023).

Designation type	Protection purpose and governance
Scientific Reserve (Rezervatie stiintifica)	Provides strict protection of natural ecosystems (0.07 % of the national protected areas, IUCN Category I
National Parks (Parc national)	National Park, aims to conserve natural ecosystems and maintain natural processes, with limited human interventions in core areas, allowing only for sustainable tourism, education and traditional use of grazing areas for local communities. Core area coverage is less than 75% in most National Parks. IUCN Category II
Natural Monuments (Monument al naturii)	Natural Monument, designated to conserve exceptional natural features (spectacular rocks, gorges, lakes, fossils sites, caves, waterfalls, etc.). IUCN Category III
Nature Reserves (Rezervatie naturala)	Nature Reserve, established for the conservation of natural and semi-natural habitats and valuable species that need active conservation management measures. This type includes marine reserves. IUCN Category IV
Natural Parks (Parc natural)	Natural Park established for the conservation of natural and cultural landscapes and to promote responsible use of natural resources for the sustainable development of local communities. IUCN Category V

Natura 2000 network: Natura 2000 sites make up 87.2 % of the total terrestrial protected area.

Total terrestrial protected area: Protected areas in Romania cover a total of 55,890 km², which is 23.4% of the national territory (BISE[145]). Many of the terrestrial protected areas of national interest overlap with the Natura 2000 sites.

OECM: Romania is implementing a project under the National Resilience and Recovery Plan that aims at developing a concept for and identifying possible OECMs (2020 to 2025)[146].

Overlaps and protection levels: The terrestrial protected area coverage is almost all due to designation as Natura 2000, with 77% of the area only designated as Natura 2000 and 20% as overlapping Natura 2000 and a national designation category (BISE[147]). Only 2.9% of the total protected area is under a national designation only.

Transboundary protected areas: Iron Gates Nature Park bordering Serbia's Djerdap National Park on the Danube. Transboundary Ramsar Sites between Romania and Bulgaria: Lake

[145] EEA BISE at https://biodiversity.europa.eu/countries/romania

[146] pers.com., Ministry of Environment, Forests and Waters

[147] EEA BISE at https://biodiversity.europa.eu/countries/romania

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Calarasi (Iezerul Calarasi) (Romania) – Srebarna (Bulgaria); Suhaia (Romania) – Belene Islands Complex (Bulgaria); and Bistret (Romania) – Ibisha Island (Bulgaria).

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Ministry of Environment, the Water and Forests Agency and the Protected Area Agency (created within the Ministry in 2016) are formally in charge of all protected areas. Their management is subcontracted mainly to the state-owned forest company RNP Romsilva which manages 22 out of the 29 national parks (Chenevois, 2023). Romsilva is therefore the biggest protected area administrating body. The Protected Area Agency is responsible for the Natura 2000 sites, some of which were managed by NGOs until a legal change in 2018 prevented this. Due to capacity constraints, it is very likely that sub-contracted custodians like NGOs will soon be managing the protected areas again (Chenevois, 2023).

The Danube Delta is a Biosphere Reserve and UNESCO site and since the early 1990s, has its own administration, the Danube Delta Biosphere Reserve Administration (DDBRA, https://ddbra.ro/). It is led by a Governor who is assimilated to a secretary of state. The administration is directly under the Ministry of Environment, Water and Forests. The budget comes from the Ministry.

The Fundatia Conservation Carpathia (https://www.carpathia.org/) is a privately managed protected area, a unique case in Romania. Since its inception in 2009, the foundation has purchased over 26 900 ha of forests and alpine meadows in the south-eastern Carpathians for restoration and full protection. The initiative aims to obtain the highest legal protection level for all acquired land, and already over 8 000 ha of forests have been declared as non-intervention zones in the Făgăraș Mountains Natura 2000 management plan or have been included as core areas of the Piatra Craiului National Park. Almost 1 000 ha of these forests are completely untouched, and part of this area has already been introduced into the National Catalogue of Virgin and Quasi-virgin Forests, in order to protect these areas in perpetuity. The presence of the Fundatia Conservation Carpathia rangers, patrolling an area of over 75 000 ha, has also led to a complete stop of illegal logging in the neighbouring forests.

3.11.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The spatial planning legislation mentions ecological corridors, but Romania does not yet have a method to officially identify and designate ecological corridors (Chenevois, 2023). Law 350/2001 on Spatial and Urban Planning specifies that territorial management aims, among other targets, to ensure the protection of natural and semi-natural landscapes, biodiversity conservation and the creation of ecological continuity.

In 2014, a working group and discussions were started to create a method and process, but they have not produced any concrete results.

The Romanian National Strategy for the conservation of biodiversity for the period 2013-2020 and Romania's Sustainable Development Strategy 2030 (Goal 14, Goal 15) refer to the need for ecological connectivity (Romania Regional Development Program, 2013).

Romania is a signatory of the **Lower Danube Green Corridor Declaration**[148].

[148] TransNature map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

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3.11.3. SPATIAL PLANNING

The Romanian spatial planning system consists of the National Spatial Plan (Planul de amenajare a teritoriului national - PATN), County Spatial Plans, and Zonal Regional Spatial Plans (ZRSP) (ConnectGREEN, 2021).

According to L350/2001-2011 (art. 41), the National Spatial Plan (NSP) has a directive character, and all its provisions are mandatory for the other spatial planning documents, which should detail its provisions for each specific territory. The national plan is composed of 8 sectoral plans, each of them adopted as laws, including Section III - Protected Areas[149], in which the natural protected areas are integrated in a protected area network. Another law delimits the biosphere reserves, national parks and nature parks and establishes their administrations[150].

The County Spatial Plans, managed by the County Council, detail long, medium and short-term measures to tackle problems and disparities identified in the county. These plans determine the core areas (10-100 km²) and connecting corridors between these areas (e.g. natural river valleys, semi-natural recreation areas for local settlements).

The Zonal Regional Spatial Plan should cover the territory of each region. It has a guiding character, coordinating the implementation of development programs and projects at regional level, in order to tackle specific sectoral problems. According to the law, the Zonal Regional Spatial Plan is initiated and elaborated by the Ministry of Rural Development and Public Administration and should substantiate the Regional Development Plans and ensure vertical coordination between the national and county plans. The Comprehensive Urban Plans determine the function of small habitats, woodlots, wetlands, grassland, patches, ponds (<10 km²) and connecting corridors (stream banks, hedgerows, field verges and ditches).

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

According to the law, protected natural areas and ecological corridors must be highlighted in national, zonal and local urban and spatial plans, in cadastral plans and land books, by the National Agency for Cadastre and Real Estate Advertising as well as by the central public authority for agriculture (ConnectGREEN, 2021). Since there is no official methodology on how to identify ecological corridors and there have been no designations, there is no implementation of this rule. The main spatial planning tool for ecological connectivity is the spatial planning system on different levels: local, regional and national. Another tool is the protected areas' network. One of our protected area forms is Protected Landscape Area, which, according to the Natura Conservation Act, may perform a role of ecological corridor or the obligation of maintaining ecological coherence of the Natura 2000 network according to Natura 2000 network.

The Interreg-funded ConnectGREEN project identified and mapped ecological corridors for large carnivores in the Carpathians that were agreed upon with national experts (ConnectGREEN, 2021). However, this map is a visualization of international and national ecological corridors that are not legally binding.

[149] approved by the Law no. 5 from 6 March 2000
[150] Government Decision no. 230 of 4 March 2003

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3.11.4. FUNDING

FUNDING FOR PROTECTED AREAS

The main funding source for protected areas is the state budget and the Romsilva budget. The protected areas managed by Romsilva and the Danube Delta Biosphere Reserve generate some income through timber production and tourism. In 2023, Romsilva paid nearly EUR 9 million for the parks they oversee, and the parks generated almost EUR 1 million[151].

Protected areas implemented projects with a total value of EUR 20 million in the 2014-2020 period[152], most of them financed by European funds (notably through the Operational Programme for Large Infrastructure funded by the ERDF and Cohesion Fund). In the 2021-2027 period, the Sustainable Development Operational Program (PODD) continues financial support for the development or updating of management plans for the Natura 2000 network, especially for those areas with infrastructure investment projects.

The National Resilience and Recovery Plan allocated EUR 370 million funding for a reform of the management system of protected natural areas, including EUR 125 million for updating management plans and identifying potential strict protection areas, and EUR 245 million for integrated investments in the restoration and conservation of species rich meadows and wetlands.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

The National Recovery and Resilience Plan includes a measure (with a funding allocation of EUR 150 million) for removing obstructions from watercourses to facilitate the restoration of the connectivity of habitats and species dependent on water, and the restoration of elements that contribute to lateral connectivity. The funded interventions must be in accordance with the protected area management plans and with the river basin management plan. Other EU funds also finance connectivity projects in Romania. No public funding from the state is available for ecological corridors management and establishment.

[151] personal communication with a Romsilva representative

[152] personal communication with a representative of the Ministry of Environment, Forest and Waters

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3.12. SERBIA

3.12.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 17. National and regional designation types, protection purpose and governance in Serbia. Sources: Law on Nature Protection issued 2009, last amendments in 2021.[153]

Designation type	Protection purpose and governance
National Park	A national park is an area with a large number of diverse natural ecosystems of national importance, with distinguished landscape characteristics and cultural heritage in which man lives in harmony with the nature, intended for conservation of the existing natural values and resources, with overall landscape, geological and biological diversity, as well as for meeting of scientific, educational, spiritual, aesthetical, cultural, touristic and health and recreational needs and other activities in accordance with the principles of nature protection and sustainable development. The forests within the national park shall be managed by the legal entity that manages the national park.
Nature Park	A Natural Park is an area of well-conserved natural values with mostly conserved natural ecosystems and picturesque landscapes, intended for conservation of the overall geological, biological and landscape diversity, as well as meeting of scientific, educational, spiritual, aesthetic, cultural, touristic, health-recreational needs and other activities harmonized with the traditional way of life and principles of sustainable development.
Strict Nature Reserve	A Strict Nature Reserve is an area of unchanged natural characteristics with representative natural ecosystems, intended exclusively for the conservation of the original nature and processes for scientific research and monitoring.
Special Nature Reserve	A Special Natural Reserve is an area of unchanged or insignificantly changed nature, of particular importance due to its uniqueness, rareness or representativeness, and which includes a habitat of an endangered wild plant, animal and fungi species, without settlements or with scarce settlements in which humans live in harmony with nature, intended for conservation of the existing nature characteristics and processes for scientific research and education, controlled visits and preservation of traditional way of life.
Natural Monument	A Natural Monument is a smaller unchanged or partially changed natural spatial entity, object or phenomenon, physically clearly distinguished, recognizable and/or unique, with representative geomorphological, geological, hydrographical, botanical and/or other characteristics, as well as a botanical value of scientific, aesthetic, cultural or educational significance, created by human labour.
Protected Habitat	A Protected Habitat is an area which includes one or more types of natural habitats that are significant for conservation of one or more populations of wild species and their communities.
Outstanding natural landscape	An outstanding natural landscape is an area of recognizable appearance with significant natural, biological-ecological, aesthetic and cultural-historical values, which developed in time as a result of interaction between the nature, natural potentials of the area and the traditional way of life of the local population.

Emerald Network/Natura 2000: No adopted sites, but 61 sites have been officially nominated as candidates for the Emerald Network.[154] These sites will become Natura 2000 sites upon

[153] Law on Nature Protection 2016. https://www.pregovarackagrupa27.gov.rs/wp-content/uploads/2021/06/LAW-ON-NATURE-PROTECTION-2016.pdf NB this is not the must up to date version of the law, but not much has changed in regards to protected areas.

[154] CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS. Standing Committee 43rd meeting Strasbourg, 27 November - 1st December 2022. Updated list of officially nominated

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accession to the EU. The total area of the proposed Emerald network in Serbia is around 10200 km^2, i.e. 11.54% of the territory of Serbia.[155]

Total terrestrial protected area covers 10.5% of land area according to one analysis[156]; covers approx. 7500 km^2 according to a national expert[157] (not including the proposed Emerald Network sites).

OECM: not in use in Serbia.

Transboundary protected areas: Djerdap National Park bordering Romania's Iron Gates Nature Park on the Danube. Part of the UNESCO Transboundary Biosphere Reserve Mura-Drava-Danube. Drina Transboundary Biosphere Reserve (TBR Drina) between Tara National Park (NP Tara) in the Republic of Serbia and Drina National Park (NP Drina) in the Republic of Srpska/Bosnia and Herzegovina.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Nature Protection Law defines three categories of institutions that designate and govern protected areas in Serbia:

- Protected areas of international, national, i.e. exceptional significance are proclaimed by the National government; the Ministry of Environment is in charge of these areas.
- Protected areas of provincial/regional, i.e. high significance are proclaimed by the Provincial government; each provincial Secretariat for the Environment has responsibility for these areas.
- Protected areas of local significance are proclaimed by the local government, which is also in charge for them.

National parks are established through a legal act passed by the Parliament. For their management, a specific public enterprise is established by the government. A National Park is required to establish a stakeholder council and a scientific board, both of which play an advisory role.

Any other category of protected area can be managed by any legal entity including public company, NGO, public utility company, church, etc. In practice, most of the protected areas in Serbia are managed by public forest companies.

The proposal for 61 Emerald Network sites is waiting for adoption by the Bern Convention. The first list of Emerald Network sites (and at the same time potential SCIs and SPAs for Natura 2000) was prepared by experts in the EU for Natura 2000 in the Serbia project in the period 2019-2021.

The Law of Nature Protection requires ten-year management plans for protected areas in Serbia (with exemptions for small, protected elements)[158]. A tool has been developed to incorporate the Natura 2000 management planning into the national protected area plans.

candidate Emerald Network sites (December 2023). https://rm.coe.int/draft-list-of-candidate-emerald-network-sites/1680ad54a2

[155] http://www.natura2000.gov.rs/en/emerald-network/

[156] Mari et al. 2022 cited by (Chenevois, 2023)

[157] Goran Sekulic, personal communication

[158] http://www.natura2000.gov.rs/en/management-plans/

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3.12.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Serbian ecological network map was created according to the Law on Nature Conservation Article 38.[159] Currently, it covers mainly larger and smaller watercourses including structural and functional connectivity and ecosystem services. The Institute for Nature Conservation of Vojvodina maintains a digital database containing the vector-displayed boundaries of Ecological Network areas and a map of ecologically important areas. However, the Law on Nature Protection (updated 2009, 2010, and 2016) does not clearly define the protection and management of ecological corridors. The Serbian Regulation on the Ecological Network established in 2010 defines the ecological network as consisting of 1) ecologically significant areas; 2) ecological corridors that connect ecologically important areas present on the national territory, as corridors of national importance and ecological corridors that enable connection with ecological networks of neighbouring countries, in accordance with international regulations and considered as ecological corridors of international importance; 3) protection zones where it is necessary to protect ecologically significant areas and ecological corridors from possible harmful external influences.[160] However, the regulation defines only basic protection measures without specified obligations or restrictions and the provisions have not been fully implemented. According to interviewees, there are not enough resources for an adequate management and functioning of the network (Chenevois, 2023). Conflicting legislation is threatening the protection and management of ecological connectivity, especially in the water sector.

3.12.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

Spatial planning practice in Serbia refers to the planning of ecological corridors. The regional spatial plans must outline spatial determinants and protection measures for the special purpose areas. The municipal spatial plans must map all levels of ecological corridors, but without established adequate measures for their protection. In reality, there are very few plans with clear spatial determinants on maps. The exceptions are spatial plans in the territory of the Autonomous Province of Vojvodina where the provincial institute holds relevant data on ecological connectivity and is engaged in spatial plan development.

The planning law provides the opportunity for stakeholders (including those from the environmental sector) to engage in public discussion in several stages of plan development. In practice, these participation processes are not very effective and are usually reduced to minimal legal requirements. They also very much depend on the initiative of the plan developers, who rarely proactively seek involvement from other stakeholders, especially non-institutional actors. There are significant issues with illegal construction in protected areas (Pantić, Zivanovic Miljkovic and Milijic, 2019).

3.12.4. FUNDING

FUNDING FOR PROTECTED AREAS

The following funds for protected areas are available:

- National, regional (provincial) or local budgets make up ca. 10% in average of the funds needed.

[159] http://www.natura2000.gov.rs/en/ecological-network-of-the-republic-of-serbia/

[160] https://www.fao.org/faolex/results/details/en/c/LEX-FAOC196060/

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- Charges for the use of protected areas are an important income source and make up approx. 50% of the total income.
- Own income, which represents mainly the income gained from forestry via state forestry companies. In many protected areas, this is the most significant source of income; in national parks, it provides over 60% of the budget.
- International and national projects that support short-time pilot activities, but not the management itself.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There are no specific funds earmarked for ecological corridors.

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3.13. SLOVAKIA

3.13.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

The national legislation distinguishes five degrees of nature protection, with increasing levels of restrictions defined:

- 5th degree: the least strict level of protection – provides general protection for nature. Applied to the whole territory of Slovakia that is not a protected area.
- 4th degree: Imposes moderate restrictions on activities, allowing sustainable human use. Corresponds to IUCN Category: V (Protected Landscape/Seascape). Applied to Protected Landscape Areas and other larger areas; protects biological diversity, ecological stability, and characteristic landscape features.
- 3rd degree: Applies stricter limitations on activities, focusing on minimal human interference, for the purpose of conservation of largely undisturbed ecosystems or biotopes of significant importance. Corresponds to aspects of multiple IUCN Categories: II (National Park), V (Protected Landscape/Seascape), VI (Protected Area with sustainable use of natural resources). Applied to nature reserves and National Parks, unless specified otherwise in the area's designation statute.
- 2nd degree: More stringent regulations confer high level of protection, limited human activities. Applied to National Parks and other designated areas.
- 1st degree: Highest level of protection, preserving critical habitats and species with minimal human impact. Restrictions are very strict, prohibiting almost all activities that could alter the natural state. Applies to small-scale protected areas referred to as (National) Nature Reserves or Monuments.
-

Table 18. National and regional designation types, protection purpose and governance in Slovakia. Sources: (Sefferova Stanova and Rybanic, 2023) & enviroportal.sk, Slovak Environmental Agency & data.sopsr.sk/chranene-objekty/ & biomonitoring.sk/

Designation type	Protection purpose and protection level
National Parks (národný park)	A large-scale protected area (VCHÚ), usually with an area of more than 10,000 ha, predominantly with ecosystems substantially unchanged by human activity or in a unique and natural landscape structure, forming the most significant natural heritage, in which nature conservation is superior to other activities. Parks are declared by the government with a regulation. The third degree of protection applies to its territory, unless defined differently in the park regulation. As of 2022, all 9 national park authorities became independent organisations separate from the Slovak National Park Administration. They manage the state forest land within the park.
Protected Landscape Areas (chránená krajinná oblasť)	A large-scale protected area (VCHÚ), usually with an area of more than 1,000 ha, with scattered ecosystems, important for the preservation of biological diversity and ecological stability, with a characteristic appearance of the landscape or with specific forms of historical settlement. Declared by the Government by regulation. The second degree of protection applies, unless otherwise provided by law.
Nature Reserves	A small, protected area (MCHÚ) or location, usually with an area of up to 1 000 ha, which represents original or little-altered by human activity

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(prírodná rezervácia)	biotopes of European or biotopes of national importance or biotopes of European species or biotopes of national importance. Declared by the government by regulation. The third or fifth degree of protection applies to its territory.
National Nature Reserves (národná prírodnú rezerváciu)	Nature reserves that are declared because they represent a supra-regional bio-centre that forms part of the most important natural heritage of the state.
Natural Monuments (prírodná pamiatka)	A small, protected area (MCHÚ), point, linear or other small-scale ecosystem, with components or elements, usually up to 50 ha, which have scientific, cultural, ecological, aesthetic or landscape significance. Declared by the government by regulation. The third or fifth degree of protection applies to its territory.
National Natural Monuments	Natural monuments that are declared because they form part of the most important natural heritage of the state. Declared by the government.
Protected Sites (chránený areál)	A small protected area (MCHÚ) or location, usually with an area of up to 500 ha, on which there are biotopes of European importance or habitats of national importance, or which is the habitat of a species of European importance or the habitat of a species of national importance and where the favourable condition of these habitats depends on human management. Declared by the government by regulation. The second, third, fourth or fifth degree of protection may apply to its territory, depending on the site designation.
Community Protected Areas (obecné chránené územie)	A small, protected area (MCHÚ) or locality, usually with an area of up to 100 ha, with cultural, scientific, ecological, aesthetic or landscape significance. Declared by the municipality by means of a generally binding regulation in which the conditions for its protection are stated.
Protected Landscape Elements (chránený krajinný prvok)	A small, protected area (MCHÚ) of landscape element that fulfils the function of a bio-centre, bio-corridor or interaction element of particular local or regional importance. Declared by the government by regulation. The second, third, fourth or fifth degree of protection applies in its territory.
Private Protected Areas (súkromné chránené územie)	The owner of such land, which meets the conditions established by Act No. 543/2003 Coll. for a protected area, nature reserve or natural monument and has not yet been declared protected, may apply to the district office in the seat of the region for the declaration of a private protected area, private nature reserve or private natural monuments. Can be in IUCN Categories II, IV or VI, depending on the degree of protection provided by the designation.
Natural Parks (prírodný park)	A large-scale protected area (VCHÚ), usually with an area of more than 500 ha, mainly with ecosystems altered by human activity, which form bio-centres of supra-regional importance, or which are important for ensuring the favourable condition of biotopes of European importance, biotopes of national importance, biotopes of species of European importance or biotopes species of national importance. It can be declared by the government. The second or third degree of protection applies to its territory, unless otherwise provided by law.

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	No protected area in this category has been declared as of December 2022.

Natura 2000 network: 29.8% of the land area (Sefferova Stanova and Rybanic, 2023). The protected bird areas (SPA - CHVÚ) represent 26.20% of the area of the Slovak Republic. The territory of European importance sites (SAC - ÚEV) represent 12.56% of the area.

Total terrestrial protected area: 37.4% of land area (EEA BISE[161])

OECMs: As of May 2021, Slovakia has no OECMs reported in the world database, but potential OECMs are under consideration. The new Biodiversa+ project 'PAREUS' has the aim of identifying potential OECMs with the Slovak Academy of Sciences as a partner.

Overlaps and protection levels: Slightly more than a third of the terrestrial protected areas are designated solely as Natura 2000 sites with further 42.4% in areas where Natura 2000 sites overlap with national designations (EEA BISE).

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The State Nature Protection legislation in the **Act No. 543/2002** on **Nature and Landscape Protection** governs the protection of the country's natural environment, establishes the Terrestrial System of Ecological Stability (TSES) of public interest, the national network of protected areas, and a European network of protected areas. The nature protection legislation has been revised several times to harmonise it with EU and international legislation. It is amended and implemented by two decrees which provide regulations for defining, designating and managing protected areas, the protection of endangered species and habitats, and the implementation of environmental impact assessments[162]. The decrees also establish a system for issuing permits and authorizations for activities that may affect the environment (Izakovičová and Świąder, 2017). The consent of nature protection authorities is required to carry out activities in protected areas (Sefferova Stanova and Rybanic, 2023).

The Slovak Republic has a high density of protected areas, but many areas were not created in accordance with international standards (especially during the communist regime) and were often created without sufficient cooperation with owners and land users.

The Ministry of the Environment has responsibility for the designation of new large-scale protected areas (National Parks, Landscape Protected Areas), except private protected areas or community protected areas. The regional environmental district office deals with new designations of small-scale sites. The State Nature Conservancy[163] usually prepares the proposal and supporting documentation for new protected areas (Sefferova Stanova and Rybanic, 2023).

The State Nature Conservancy manages the Landscape Protected Areas and the Natura 2000 sites in their area of competence, prepares legislation and does inventory work. Each of the nine national parks is managed by its own administration, which are independent of the Slovak National Park Administration since 2022. The Slovak Ministry of Agriculture and Rural Development is responsible for the management and economic use of forests outside and inside all protected areas except National Parks at the 4th and 5th levels of protection. The Institute for Environmental Policy is the state supervisory authority through which the Ministry

[161] EEA BISE: https://biodiversity.europa.eu/countries/slovakia

[162] Decree No. 24/2003 Coll. and Decree No. 492/2006 Coll.

[163] Štátna ochrana prírody Slovenskej republiky, ŠOP SR

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carries out state supervision on nature protection law compliance and imposes sanctions on natural persons, entrepreneurs and other legal persons pursuant to the Nature Protection Act[164]. The institute informs the Ministry about implementation, orders necessary corrective measures to remedy any deficiencies found and fulfils other control duties.

In 2019, the new national environment strategy to 2030 set goals for the protected area system[165]. The strategy sets the goal of reviewing and simplifying the system of protected areas and degrees of protection considering the IUCN international criteria, including goals for expanding strict protection. The re-assessed national parks that are classified under IUCN category II will have a core zone without human intervention reaching 50% of the total area of the national park by 2025 and 75% of this area by 2030. Logging will be prohibited in non-interference zones and environmentally friendly land management will be preferred in areas with active management. The reassessment will compensate landowners whose property rights are affected.

3.13.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The national ecological network known as the Territorial System of Ecological Stability (TSES or ÚSES) is a non-legally binding system with the goal of restoring and connecting natural elements in the country and maintaining or improving the ecological stability of the territory. and maps the nationally strategic corridors. The TSES as defined in the Nature and Landscape Act is a spatial structure of interconnected ecosystems, to safeguard the diversity of conditions and forms of life in the landscape. It includes bio-centres, bio-TSES corridors, interacting elements and ecostabilising measures of supra-regional (STSES or SUSES), regional (RÚSES) (district) or local importance (LTSES or MÚSES). TSES (Territorial System of Ecological Stability) is a document that defines the current state of the ecological quality of the area and represents the basis for achieving ecological stability. It is prepared at the national (state, the whole country), regional (8 regions in SK currently) and municipality levels (towns, villages). Ecological corridors are part of TSES of all levels.

The TSES, also referred to as the Regional Territorial System of Ecological Stability of the Landscape[166], was first mapped in 1985 and adopted in 1991 and has since gone through several cycles of planning. RÚSES I in the decade 2010 to 2020 established regional plans at a scale of 1:50 000 with the objectives of evaluating the state of the landscape, landscape development plans, and proposing management measures to increase ecological stability. The regional TSES documents were refined during RÚSES II (2020-2023). Funding has come from various EU operational programmes.[ii, 167]

Based on the decree of the MoE, regional and municipality TSES forms the basis for:

- the region's spatial plan and the municipality's spatial plan,
- the decision-making of nature protection authorities,
- and the practical care of specially protected parts of nature and landscape.

The Act on Territorial Planning and Construction Order (Building Act)[168] defines that the elements of TSES are obligatory regulative on all level of territorial plans. The Act on Land

[164] https://www.minzp.sk/en/iep/

[165] (2019) Greener Slovakia. Strategy of the Environmental Policy of the Slovak Republic until 2030. https://www.minzp.sk/files/iep/greener_slovakia-strategy_of_the_environmental_policy_of_the_slovak_republic_until_2030.pdf

[166] RÚSES I – Regionálnych Územných Systémov Ekologickej Stability (2010-2020)

[167] https://doi.org/10.1007/978-3-319-94018-2

[168] Act No. 50/1976 Coll. on spatial planning and building regulations (Building Act)

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Arrangement and Land Ownership (No. 331/1991) defines that the TSES is an obligatory basis of each Land Arrangement Project; in which the elements of the TSES and important landscape elements are considered as common arrangement (Izakovičová and Świąder, 2017). The need for improving the TSES function might be accepted as a legal cause for the enactment of the land arrangement procedure. Both laws specify that the TSES should be considered in matters relating to construction activity, but also in management of land by owners and users.

However, there are challenges related to the implementation, lack of compensation due to financial instruments, data accessibility, and the need for regulatory instruments to support the ecological network plans.

3.13.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The Territorial System of Ecological Stability (TSES) requires a top-down approach for achieving ecological continuity, from national to regional/county/local levels. It consists of planning documents (USES) at the supra-regional (STSES or SUSES), regional (RÚSES) (district) or local importance (LTSES or MÚSES) level.

The TSES plan at the national level is at the scale of 1:200 000 – 1:500 000 and maps the nationally strategic corridors. It was created in 1985 and adopted in 1991, together with the ecological network concept.[169]

Landscape Ecological Plans are elaborated at the regional level and the municipal level, with the focus on landscape ecological analysis, assessment and optimisation of functional use in line with landscape ecologic potentials and limitations for development. The plans are prepared by regional and local authorities cooperating with experts (planners, environmental experts). Ecological corridors should be an integral part of the regional and local master plans and the corridors that are outlined there are legally anchored, according to the Centre of Excellence in spatial planning (SPECTRA). Building activities are only allowed under strict conditions.

The local (municipal) level MÚSES documents have a scale of 1:10 000 and form the obligatory basic material for the municipal territorial plan and land consolidation projects (Miklós, Diviaková and Izakovičová, 2019).

Reportedly, there can be a disharmony between the different levels of the USES at the borders of different regions (Izakovičová and Świąder, 2017; Miklós, Diviaková and Izakovičová, 2019).

- Slovakia: Mapping and Assessment of Ecosystems and their Services

A methodology for mapping and assessment of ecosystems and their services was published in 2020[170]. It identifies individual ecosystems and their spatial distribution, status, and selected properties. Ecosystem mapping is not part of spatial planning, but it may be considered in future.

OP KŽP Green municipalities of Slovakia, National project [171] https://www.zeleneobce.sk/

The implementation of the national project will contribute to the expansion of species and the growth of biological diversity even outside protected areas. The implementation of the national project is a measure aimed at the preservation and restoration of biotopes in the territory of

[169] https://dx.doi.org/10.3390/land11071013

[170] http://www.sopsr.sk/files/hodnota-ekosys.pdf

[171] https://pmis.sazp.sk/detail-projektu/120

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the Slovak Republic, which is not directly protected through the Natura 2000 system, which will lead to the improvement of connectivity between existing protected natural areas with the aim of preventing fragmentation and increasing ecological cohesion.

- ConnectGREEN https://www.sazp.sk/projekty-eu/connectgreen

Restoration and management of biocorridors in the mountainous regions of the Danube basin.

3.13.4. FUNDING

FUNDING FOR PROTECTED AREAS

Slovakia has a National Environmental Fund. The national state budget is used for compensations to owners and farmers to secure the strictest protection in the existing protected area network (usually protection level 5). Landowners receive this funding in return for restrictions on management, especially in forest ecosystems. A certain part of the budget is also dedicated to the gradual purchase of private land in protected areas, again with priority in the higher protection levels. Once the land has been bought, it is owned and managed by the state.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

In the context of the TSES, the state budget cannot be used outside protected areas. Insufficient financing is a brake on the implementation of the TSES system (Sefferova Stanova and Rybanic, 2023).

The funding sources for ecological connectivity in Slovakia include the EU funding instruments and national funds from the State Budget, Environmental Fund, and Green Education Fund allocated for ecological connectivity projects.

Examples of EU funded ecological connectivity projects are:

- Alps-Carpathian River Corridor (ERDF funded project 2017-2020)
- ConnectGREEN is funded by European Union funds (ERDF, IPA III, ENI)
- OBWIC – Open Boarders for Wildlife in the Carpathians (HUSKROUA/1702/6.1/0010, 2019-2022)

The LIFE integrated project NATURA 2000 SVK (2021-2030)[172] is funding the implementation of the Prioritized Action Framework for Natura 2000 in Slovakia, including the goal to ensure the coherence of the Natura 2000 network through identifying ecological connectivity elements (ecological corridors, stepping stone habitats…) and applying measures for their protection through relevant policies and instruments.

[172] LIFE19 IPE/SK/000003 at https://www.prirodaprevsetkych.sk/en/home/

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3.14. SLOVENIA

3.14.1. PROTECTED AREA NETWORK (TERRESTRIAL)

The Nature Conservation Act (NCA), known as 'Zakon o ohranjanju narave', provides the legal provisions and guidelines for the establishment and management of protected areas in Slovenia[173]. The Act was adopted in 1999 and has been amended several times.[174].

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 19. National and regional designation types, protection purpose and governance in Slovenia. Source: (Skoberne, 2023)

Designation type	Protection purpose and protection level
Strict Nature Reserve	A Strict Nature Reserve is an area of naturally preserved geotopes, habitats of threatened, rare or representative plant or animal species, or an area important for biodiversity conservation where natural processes occur without human influence. All activities, including access, are prohibited. Currently there is only one very small Strict Nature Reserve in Slovenia.
Nature Reserve	Nature Reserves are areas of geotopes, habitats of threatened, rare or representative plant or animal species, or an area important for biodiversity conservation that is maintained through sustainable human activity. Only activities that maintain the character of the reserve are allowed.
Natural Monument	Natural Monuments are areas containing one or more Valuable Natural Features that have an outstanding form, size, content or location, or that are a rare example of a Valuable Natural Feature. Activities that might adversely affect the state of a Valuable Natural Feature, or reduce its aesthetic value, are prohibited. All other activities, including visits, are allowed.
National Park	A National Park is a large area possessing numerous Valuable Natural Features and high biodiversity. Nature in its near-original state, with intact ecosystems and natural processes, is present in the majority of the park (i.e. wilderness areas). Smaller areas with human influence may occur, but in harmony with nature. At least two protection zones are defined, including a core zone with no economic activities, although recreation and visitors are allowed. There is currently only one in Slovenia (Triglavski narodni park).
Regional Park	Regional Parks are extensive areas of ecosystems and landscapes characteristic of the region, with large areas in a natural state and areas of Valuable Natural Features interwoven with parts of nature where human influence is relatively substantial but in harmony with nature.
Landscape Park	Landscape Parks are areas with an emphasis on the high quality and long-term mutual interaction of people and nature and with high ecological, biotic and landscape value (cultural landscape).

Natura 2000 network: Natura 2000 sites cover about 37% of the country's territory[175].

Total terrestrial protected area covers 40.5% of land area (EEA BISE[176])

[173] Zakon o ohranjanju narave (Uradni list RS, št. 96/04 – officially consolidated text, 61/06 – ZDru-1, 8/10 – ZSKZ-B, 46/14, 21/18 – ZNOrg, 31/18, 82/20 and 3/22 - ZDeb): www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1600 ; English translation: www.pisrs.si/Pis.web/npbDocPdf?idPredpisa=ZAKO6877&idPredpisaChng=ZAKO1600&type=doc&lang=EN (last accessed 28 March 2022)

[174] WWF-Adria personal communication

[175] https://natura2000.gov.si/en/natura-2000/natura-2000-in-slovenia/

[176] https://biodiversity.europa.eu/countries/slovenia

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OECMs: No OECMs have been defined.

Overlaps and protection levels: The majority (93.3%) of terrestrial protected areas are designated both as Natura 2000 sites and under national laws, with a small portion designated solely under national laws (BISE).

Transboundary protected areas: Slovenia has two transboundary Biosphere Reserves with Italy and Austria,[177] and three Ramsar sites (8 205 ha[178]). The Triglav National Park in Slovenia and the neighbouring Natural Park of the Prealpi Giulie in Italy are recognised by the EUROPARC federation as the Julian Alps Ecoregion transboundary area and are in the process of becoming an UNESCO MAB Transboundary Biosphere Reserve.[179] In 2014, the Alpine Convention certified the parks as a pilot transborder region for ecological connectivity. Slovenia is part of the European Green Belt.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

In Slovenia, there are specific policies and strategies that significantly influence the designation of protected areas at the national, regional, and local levels. The Nature Conservation Act regulates the conservation of biodiversity and valuable natural features (e.g. geological phenomena, caves, gorges, waterfalls, lakes and exceptional trees). The act establishes the ecological network and system of protected areas.

The act also lays down the responsibilities of the state and local communities. Landowners must be able to demonstrate that required ecological and social functions (such as in forest plans) are being met on their property, including by allowing free public access.

3.14.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Nature Conservation Act defines a general obligation that biodiversity conservation measures and the system for the protection of valuable natural features are integrated into spatial planning and the use and exploitation of natural assets. This legislation serves as the basis for the establishment and management of ecological corridors to facilitate the movement of wildlife and the conservation of natural habitats. The Ministry of Natural Resources and Spatial Planning is the responsible government body.

3.14.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The long-term strategic spatial development document of the Republic of Slovenia is the Spatial Planning Strategy of Slovenia 2050, adopted by the government in June 2023, providing trends and key spatial challenges, objectives, priorities and guidelines for spatial development different topics and sectors to 2050.[180] According to the Spatial Planning Law, all spatial planning documents (regional spatial plan, municipal spatial plan, municipal detailed

[177] https://en.unesco.org/biosphere

[178] https://www.ramsar.org/country-profile/slovenia

[179] TransNature map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

[180] Resolution on Spatial Development Strategy of Slovenia (Official Gazette, 72/23, 33/): Resolucija o Strategiji prostorskega razvoja Slovenije 2050 (ReSPR50) (pisrs.si)

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spatial plan, state detailed spatial plan) and sectoral development programmes must be in line with this strategy. The strategy specifies that one of the four elements of the spatial development concept is green infrastructure and recommendations for its implementation at regional and municipal levels[181].
The ministry published a study with maps and recommendations for spatial planners to address ecological connectivity in spatial planning and management of nature and other resources.

3.14.4. FUNDING

FUNDING FOR PROTECTED AREAS

Funding for protected areas is derived from a mix of national and EU sources. EU funding plays a significant role in supporting conservation efforts and management of protected areas[182]. The state budget of EUR 8 million per year provides the core financing of the Institute for Nature Conservation, public management bodies of protected areas, and co-funding for the Natura 2000–related activities of other public bodies.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no dedicated funding stream for ecological corridors or stepping stones. Funding can be covered by the funds dedicated to nature conservation activities described above.

[181] https://www.gov.si/en/policies/environment-and-spatial-planning/prostor-2/spatial-planning/

[182] Information from WWF-Adria

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3.15. UKRAINE

3.15.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 20. National and regional designation types, protection purpose and governance in Ukraine. Sources: Internal WWF Discussion paper on PA reform in Ukraine. Protected Planet database: https://www.protectedplanet.net/country/UKR

Designation type	Protection purpose and governance
Nature Reserves (Природні заповідники)	Nature reserves are declared with the aim of preserving in their natural state typical or unique for a certain landscape zone natural complexes with all their components, studying natural processes and phenomena occurring in them, developing scientific principles of environmental protection, efficient use of natural resources and environmental safety. Land and water areas with all natural resources are completely withdrawn from economic use and are provided to nature reserves in accordance with the procedure established by Art. 15 of the Law of Ukraine 'On Nature Reserved Funds' and other acts of Ukrainian legislation. The composition of nature reserves includes integral areas that are fully represented by natural ecosystems.
Biosphere Reserves (Біосферні заповідники)	Biosphere reserves are established under the UNESCO program 'Man and the Biosphere' within the framework of the Law of Ukraine 'On NRF.' They include various land types based on functional zoning and are subject to a differentiated regime of protection, reproduction, and use. The protected area aims at conserving valuable natural complexes and gene pools, with a regime like that of nature reserves. The buffer zone prevents negative impacts on the protected area from adjacent economic activities, following protection zone requirements. The zone of anthropogenic landscapes allows traditional land use but prohibits hunting. Biosphere reserves serve three functions: biodiversity conservation, sustainable development, and the development of the material and technical base. These functions are realized in three functional zones: natural cores (protected area), buffer zone, and transit zone (zone of human economic activity). The total territory of a biosphere reserve should be large, integrative, and include various land uses. Advisory councils involving stakeholders are established for management, and management plans are developed and implemented.
Regional Landscape Parks (Регіональні ландшафтні парки)	Regional landscape parks are nature conservation and recreational institutions created to preserve in their natural state of typical or unique natural complexes and objects, as well as to provide conditions for organised recreation. Regional landscape parks are organised with or without the withdrawal of land plots, water and other natural objects from their owners or users. Regional landscape parks are analogues of national natural parks, but at the local (regional) level, and are created by decisions of regional councils. The category was first introduced in 1992 by the Law of Ukraine 'On Protected Areas'. Since then, 82 RLPs have been established in different regions.
Local Landscape Reserves (Місцеві ландшафтні заказники)	As a rule, small natural areas are declared as reserves, where individual natural complexes and objects are identified, that require protection. Reserves (except for landscape reserves) often have targeted protection regime aimed at preserving a particular species(s) of flora or fauna, natural complex, geological environment etc. At the same time, the protection regime sometimes does not provide for conservation measures aimed at the rest of the environment. However, the conservation of one component of the landscape is impossible without the others, so the best choice is to create a landscape reserve that covers the entire natural complex. The designation of nature reserves is carried out without the seizure of land plots, water and other natural objects from their owners or users in accordance with Article 25 of the Law of Ukraine 'On NRF' According to the national legislation, reserves are divided into landscape, forest, botanical,

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	general zoological, ornithological, entomological, ichthyological, hydrological, general geological, paleontological and karst and speleological. - Forest reserves include areas of forests that have environmental, scientific, aesthetic and other values and require conservation. These may be fragments of old forests, wetlands or other forests with significant biodiversity. - Botanical reserves are created to protect valuable botanical objects - populations of plant species under state protection, rare plant communities and areas of typical vegetation, preserved in their natural state. Depending on the object of protection 3. Selection of sites for potential nature reserves, they may include forest, meadow, steppe ecosystems and other areas. - Ornithological reserves provide for the protection of areas valuable for birds. These include nesting sites (colonies, individual nests of rare species and buffer zones around such nests, places of seasonal gatherings of birds during migration and wintering). - Entomological reserves include habitats of insects protected by the Red Book of Ukraine and other environmental documents, as well as habitats of natural pollinators. They include can be steppe beams, places of accumulation of old-growth trees, such as old oaks, whose wood is a place for the development of deer beetle larvae. - Ichthyological reserves are created to protect the habitats of rare fish species and integral fish communities, as well as to protect fish spawning grounds. Such areas are usually water bodies, including floodplains of rivers with oxbows, sections of the natural channel of unregulated rivers, upper reaches of rivers, and floodplains of rivers with oxbows. - General zoological reserves are created to protect faunal complexes and areas necessary for the conservation of protected animal species. protected species. The territories for the creation of such reserves can be very diverse and depend on the habitat needs of the of the species to be protected. - Hydrological reserves include water bodies (rivers, streams, lakes, swamps, marshes, floodplains and floodplains) that are of great natural value. When creating such reserves, it is desirable to include the natural complex in its entirety (for example, a river with a floodplain, a stream with a wetland from which it originates, etc.). - General geological reserves are created to protect geological formations that are valuable for science. geological formations (rocks, rock outcrops, gypsum flow formations, etc.). - Paleontological reserves are created in places where layers of earth are exposed as a result of geological processes on the surface expose layers of the earth's surface in which fossilised remains of prehistoric living organisms are found. Examples of such areas are the Druzhkivka Fossil Trees tract in Donetsk Oblast and Maryina Mountain in Luhansk Oblast, with outcrops of prints of prehistoric organisms. - Karst and speleological reserves are created to protect against damage to caves, karst formations, and their unique biodiversity. - Landscape reserves are optimal for protecting all elements of the natural landscape, flora and fauna Local landscape areas occupy 34.7% of the total area of protected areas in Ukraine and 38.5% of their number.

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Natural Monuments (Пам'ятки природи)	Natural monuments are individual unique natural formations that have special environmental protection, scientific, aesthetic, cognitive and cultural significance, with the aim of preserving them in their natural state. This status can be granted to both natural areas with a certain area, as well as individual objects, such as rocks, stones, and individual trees. Natural monuments are divided into complex, botanical, zoological, hydrological and geological. Complex natural monuments, as well as landscape reserves, include all natural, and sometimes also historical and cultural sites within their boundaries. These can include areas of natural ecosystems, ancient settlements, ramparts and mounds that are now covered with natural vegetation. Some historical and archaeological monuments are protected within natural monuments. Geological sites in geological natural monuments can be areas exposed during the development of mineral deposits and rocks that are not actually natural territory, but have an educational, scientific and aesthetic role. For example, such an object is the Basalt Pillars natural monument in Rivne region. Botanical, zoological, hydrological and geological natural monuments are created to protect individual objects: centuries-old and memorial trees, rocks, unusual geological formations, springs, trees with nests rare birds, etc. Accordingly, a natural monument is a category of protected areas that can be located both within natural landscapes and on the territory of settlements. Similarly, to nature reserves, nature monuments are a category of protected areas with so-called subject protection and protect only the main object included in their composition. The best way to preserve small natural areas is to create reserves and natural monuments of local significance under a simplified procedure for their declaration at the local (oblast) level. Because natural monuments may have a small area (or even have no area at all), there are many of them (41.7% of the total number of protected areas in Ukraine and 0.75% of their area).

Protected area network - Nature Reserve Fund (NRF): As of January 2022, the composition of the NRF is:

- Biosphere Reserves: 5 sites, covering 479 110 hectares.
- Nature Reserves (strict protection): 19 sites, encompassing 206 630 hectares.
- National Nature Parks: 53 sites, spanning 1 388 816 hectares.
- Regional Landscape Parks: 87 sites, covering 829 108 hectares.
- Other NRF Sites: A total of 8 632 sites of a lower scale and protection level.
- Botanical Gardens, Zoos, and Dendrological Parks: 28 Botanical Gardens, 13 Zoos, and 62 Dendrological Parks are also part of the NRF.

The World Database of Protected Areas (WDPA) lists a total of 5 622 protected areas registered in Ukraine; these are not aligned with Ukraine's NRF which lists 8 889 sites (MEPNR, 2023; Timmins et al, 2023).

Emerald Network: 377 sites, approximately 8 million hectares, constituting 13.42% of Ukraine's territory.[183]

Total terrestrial protected area: 10.4%.[184] Ukraine's Nature Reserve Fund (NRF; the MEPNR's system of PAs) lists 8 889 protected sites covering 4.6 million ha, including marine protected areas. Protected areas cover around 7% of the land area (MEPNR, 2023). According to 2015

[183] Internal WWF Discussion paper on PA reform in Ukraine

[184] Shared Environmental Information System website cited by Chenevois (2023)

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data, the estimated area of sites that could potentially make up the Environmental Network[185] amounts to approximately 38% of Ukraine's territory.

OECMs: not yet introduced.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The national system of Protected Areas is known as the Nature Reserve Fund (NRF). The Ministry of Environmental Protection and Natural Resources (MEPNR) is responsible for designation.

It should be noted that the NRF only loosely correspond to the International Union for Conservation of Nature (IUCN) management categories. The country's strict nature reserves, for instance, generally align with IUCN Category Ia (Strict Nature Reserve), which is focused on minimal human intervention, but the alignment is not rigid. National Nature Parks and Regional Landscape Parks, on the other hand, bear some resemblance to IUCN Category II (National Park) and V (Protected Landscape/Seascape), yet do not exactly conform to these classifications.[186] Particularly notable are the Biosphere Reserves, most of which adhere to the MaB Programme guidelines, except for the Chernobyl Reserve, which more closely represents an IUCN Category Ib Wilderness Area.

Most of the protected areas are state owned.[187]

Biosphere Reserves, Nature Reserves, and National Nature Parks are managed based on 10-year plans. These management plans require the consensus of the main landowners, land users, and local authorities within the protected area boundaries, along with approval from the Ministry of Environmental Protection and Natural Resources (MEPNR). The involvement of scientific-technical councils offers advisory support. Challenges often arise due to the lack of capacity of staff and the lack of participatory approaches in developing management plans, leading to difficulties in both their approval and effective implementation.[188]

The Russian full-scale invasion to Ukraine in February 2022 has drastically worsened the situation with protected areas regulations and management due to the lack of access to the monitoring systems, centralized power and lifted environmental regulations. As example, until 2023, the creation of new protected areas in forests was difficult due to opposition from foresters, but not impossible. With the creation of the State Enterprise ‘Forests of Ukraine’, the situation has deteriorated significantly. In nine months - from November to July 2023 - the company agreed to reserve no more than 700 hectares of forests - out of more than 36 thousand hectares proposed for protection during this period. That is, in 9 months, about 0.007% of Ukraine's forests received protected status (Hrynyk, Harbarchuk and Tiestov, 2023).

3.15.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

Under the Law on Environmental Network of Ukraine[189], the Nature Reserve Fund (NRF) sites are designated to form the core areas of an environmental network[190]. The law defines the formation, conservation, and rational sustainable use of the ecological network. This network

[185] Law of Ukraine - On the Key Principles (Strategy) of the State Environmental Policy of Ukraine for the Period till 2030 https://zakon.rada.gov.ua/laws/show/en/2697-19#Text

[186] Source: Internal WWF Discussion paper on PA reform in Ukraine

[187] *Source:* Internal WWF Discussion paper on PA reform in Ukraine

[188] Source: Internal WWF Discussion paper on PA reform in Ukraine

[189] Law of Ukraine - On Environmental Network of Ukraine https://zakon.rada.gov.ua/laws/show/en/1864-15#Text

[190] Source: Internal WWF Discussion paper on PA reform in Ukraine

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is further complemented by other protected areas, including rivers and riparian zones, reservoirs, forests, windbreaks, and grasslands. Integral to this network are the Emerald Network sites and critical parts of major eco-corridors in Ukraine – namely, the Poliskyi, Carpathian, Seashore, and Dniprovskyi corridors. These corridors facilitate the movement and genetic exchange of wildlife across different habitats, enhancing the resilience and adaptability of species. Areas earmarked for restoration with the aim of creating new eco-corridors or core areas in the future are also considered part of the network.

As of January 1, 2024, 18 regional eco-network schemes and 22 operating regional programs of the environmental network formation have been developed, and decisions of the respective level councils have been made to approve them. However, at present, the ecological network is simply a set of sites of the nature reserve fund that do not yet form ecological networks that are truly capable of stabilizing the natural environment. There is currently no monitoring of the network.

The National Environmental Network Formation Program of Ukraine for 2000-2015[191] set the objective of ensuring the integration of the national environmental network with the environmental networks of neighbouring countries that are part of the Pan-European Environmental Network by creating joint transboundary elements within natural regions and natural corridors, coordinating land management projects in border areas.

The **Lower Danube Green Corridor Declaration** is an international declaration agreed in 2000 between Bulgaria, Moldova, Romania, and Ukraine, overseen by the International Commission for the Protection of the Danube River. Through the Declaration, the four countries established the Corridor and identified specific targets in terms of wetlands protection and natural floodplains restoration[192]. The Flood Protection Expert Group of the International Commission for the Protection of the Danube River also adopted a Flood Action Programme for the Lower Danube Corridor.

3.15.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

There is a plan to amend the Law of Ukraine ‘On Regulation of Urban Planning Activities’ regarding the General Plan for the Planning of the Territory of Ukraine, to integrate the formation of the national ecological network into the General Plan for the Planning of the Territory of Ukraine for the period after 2021.[193]

Wildlife migration corridors linking the Bukovina region in Romania and the Bieszczady Mountains in Poland have been designated and formally included in spatial planning documents (Deodatus et al, 2013).

3.15.4. FUNDING

FUNDING FOR PROTECTED AREAS

The current funding system relies primarily on state and regional budgets, which often fall short, particularly in supporting vital scientific research and conservation initiatives. In 2021, only 0.55% of the State Budget of Ukraine was allocated for nature protection, including 0.45%

[191] https://zakon.rada.gov.ua/laws/show/1989-14#Text

[192] TransNature map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

[193] Source: Internal WWF Discussion paper on PA reform in Ukraine

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managed by the MEPNR.[194] This funding level is insufficient to meet the actual needs of park and reserve administrations, typically covering only half of the required amount. Consequently, most protected areas are in constant search for additional financial support through donors, grants, and visitor fees, though such funding is rarely secured.

This situation highlights the critical need to reform the funding model for protected areas in Ukraine. The chronic underfunding of protected areas results in low wages for employees, diminishing the appeal of conservation work to skilled professionals. There is a lack of appropriate equipment and insufficient funds for vital environmental protection measures, leading to reduced effectiveness of conservation efforts. Additionally, this financial shortfall creates opportunities for corruption and weakens law enforcement in protected areas. The ongoing war has further strained financial resources, diverting attention and funds away from nature conservation. Environmental issues and nature conservation receive only a small portion of national and local budgets, with few mechanisms to stimulate financial support for conservation. Innovative approaches, such as those based on payment for ecosystem services, public-private partnerships and ecotourism initiatives, could bridge some of the gaps, but stable state support is still needed.[195]

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

Financial support for the management of ecological corridors is not provided.[196]

[194] Source: Internal WWF Discussion paper on PA reform in Ukraine

[195] Internal WWF Discussion paper on PA reform in Ukraine

[196] Personal communication from PAEW, NGO Ukraine

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4. NATIONAL CASE STUDIES

FINLAND

Figure 25. Landscape in Finland. ©Mauri Rautkari

FRANCE

Figure 26. Landscape in France. ©Lee Kershaw

PORTUGAL

Figure 27. Landscape in Southern Portugal. ©Bárbara País

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4.1. FINLAND

4.1.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (EXCLUDING NATURA 2000 & INTERNATIONAL)

The designation of most protected area types is according to the **Nature Conservation Act** (NCA, Luonnonsuojelulaki renewed 1 June 2023[197] on the 1996 version, repealing the 1923 version). This Act transposes the EU Nature Directives and defines the planning, establishment and protection of habitats, landscapes and species. The revised NCA introduces aspects of connectivity (e.g. via small water courses) and new grants.

Outside the scope of the NCA, wilderness areas are designated under the **Wilderness Act** (laki Metsähallituksen erävalvonnasta, 1991), national hiking areas according to the Outdoor Recreation Act (1973), sites protected under the Land Extraction Act, and sites protected under the METSO and HELMI programmes.

Natura 2000 site designation is mostly based on the national Nature Reserves, Wilderness Reserves, National Hiking Areas and other national designations, but can also be done through a Regional Council decision.

The autonomous Åland region, the island group in the Baltic Sea, has its own legislation and government (Ålands Landskapsregering) with similar Nature Reserves, Bird Protection Areas, Natura 2000 sites and a Seal protection area.

Table 21. National and regional designation types, protection purpose and governance in Finland. Sources: (Heinonen and Juvonen, 2013; Tucker, 2023; Underwood et al, 2014; UNEP-WCMC, 2023).

Designation type	Protection purpose and governance
National Park	In addition to their conservation goals, also required to promote recreation and education. Inhabited areas are excluded. Nationally designated by site-specific statute under Domestic Legislation, on state-owned land. Proposed as IUCN II.
Strict Nature Reserve	Non-intervention area reserved mostly for scientific research, undisturbed ecosystems with their natural succession processes, and are not accessible to the public. According to the Nature Conservation Act, the general prerequisites for establishing a Nature Reserve are that it has at least one of the following attributes: - hosts an endangered or rare species, population or ecosystem, or one that is becoming scarce; - has breeding sites or resting places of species referred to in the EU Habitats Directive; - hosts a special or rare natural formation; - is of outstanding natural beauty; - hosts a type of natural heritage which is becoming scarce within the area; or; - is necessary for attaining or maintaining the favourable conservation status of a natural habitat or species. Designated by site-specific statute under Domestic Legislation, on state-owned land. Now 19 designated. Many areas still pending.
Old-growth Forest Reserve	Nationally designated reserves that protect mature, undisturbed forests with old-growth characteristics. In 2018 constituted only about 1% of the total forested area, highly fragmented. Proposed as IUCN Ib.

[197] https://www.castren.fi/blogandnews/blog-2022/nature-conservation-act-approved-after-heated-debate/

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Mire Conservation Reserves	Set up with the aim of conserving and enhancing the ecological values of mires and peatlands. Proposed as IUCN Ib.
Herb-rich Forest Reserve	Reserves that protect forests with a high abundance of herbaceous plants. Nationally designated.
Other nature reserves on state-owned land	The focus is on the protection of specific ecosystems (individual mires and forests and areas of shoreline) as well as habitats of breeding and migrating water birds. Forests purchased from private landowners through the METSO programme are designated in this category.
Privately-owned Protected Area	Private landowners can, voluntarily, protect their forests of high biodiversity value permanently but retain the ownership, with the support of the METSO programme. Most are small and from the 1970s NCA programs. Relies on interest to participate and focus is on protecting valuable land. If the landowner sells the land to the government, it falls into the category Other nature reserve on state-owned lands.
Protected Forest based on Metsähallitus decision	Protected forests designated by Metsähallitus, the Finnish Forest Administration, based on their conservation value and ecological significance. On government land and financing.
Protected area designated in land use plans, based on Regional Council decision	Regional designations include the Sites of Community Importance and Special Areas of Conservation (Habitats Directive) and the Special Protection Area (Birds Directive).
Protected Habitat Type	Protects specific habitat types listed in the NCA (NCA 64,65 § and 77 §). The law allows regional environmental administrators (ELY centres) to permanently preserve the known locations of these habitat types and species if deemed necessary for their persistence. In such cases, the ELY centre sets a permanent ban to degrade or destroy the area, even if it is privately owned. If the long-term presence of a strictly protected species is unclear in the area, the ban can be max 10 years. These are not strictly speaking protected areas but function as such, as the ban effectively prevents any construction, forestry and other major land use, in some cases even recreation if necessary.
Protected Species Type	Protects specific species listed in the NCA (NCA 64,65 § and 77 §). As above.
Wilderness Area	Designated according to Wilderness Act on state-owned land. Some human interventions are allowed, in particular to help preserve Sámi culture and sustain traditional livelihoods, particularly reindeer herding. They are not protected areas according to the Nature Conservation Act but belong to Finland's Natura 2000 network. Twelve areas are established in northern Lapland. Proposed as IUCN Ib.
National Hiking Area	Designated according to the Outdoor Recreation Act (1973), in many aspects comparable to protected areas. Proposed as IUCN II or V.

Natura 2000 network: Most of the Finnish national protected area is also designated as Natura 2000, based on the areas designated in nature conservation programmes mostly on state-owned land. New areas were added in 1999, 2002, 2004 and 2018. Finland has designated special protection areas (SPAs) classified under the Birds Directive covering 7.3% and SCIs under the Habitats Directive covering 12.5% of the Finnish territory. Overall, the Natura 2000 network covers 12.6% of the land territory (status in 2022).[198]

Total terrestrial protected area: 13.3% of land area (CDDA on BISE[199]).

[198] COMMISSION STAFF WORKING DOCUMENT Environmental Implementation Review 2022. COM(2022) 438. Country Report - FINLAND https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2022)438&lang=en

[199] Nationally designated area database (CDDA) available at: https://biodiversity.europa.eu/countries/finland

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Overlaps and protection levels: Most (74.2%) of the terrestrial protected area has overlapping national designations and Natura 2000 designation; 20.4% is designated solely as Natura 2000; only 5.4% is in sites designated only under national types (BISE[200]).

Transboundary protected areas: Finland has a transboundary protected area with Russia (Friendship Park), and one with Russia and Sweden (Pasvik-Inari Trinational Park). The Tornionjoki River Muonionjoki River Basin District is a jointly managed international river basin management district in which Finland and Sweden jointly implement the EU Water Framework Directive and the EU Floods Directive, and in which both countries protect the river Torne as Natura 2000.[201]

OECM: not applied. The definition of OECMs was under investigation at the point at which the most recent Prioritized Action Framework for Natura 2000 was finalised (Ministry of the Environment, 2021). A first assessment identified area categories that could be put forward as OECM.[202] The environment agency (SYKE) is comparing the designation of sites and defining criteria and what activities can be included.[203]

The METSO programme creates a form of temporary privately-owned protected area when forest areas are placed under a fixed-term contract (10-30 years) for biodiversity conservation but remain in private ownership. This is not technically a category of protected area.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

Designation: Legal provisions for protected areas started through the **Nature Conservation Programme** from the late 1970s to 1990s in systematic conservation planning programmes based on scientific analysis and criteria, that would best serve the conservation aims. This was possible because protected areas were initially almost all established on state-owned land or on land purchased by the state. In privately-owned protected areas, the government compensated the landowner with a lump sum for economic losses, if required. These conservation programmes were mostly completed by 2007, but some designation of protected areas on state-owned areas continues. Since 2014, in a change in the government approach, the designation of private land is only possible through voluntary protection, and two large government-funded programmes were set up for this, for specific habitats and a national evaluation: the Forest Biodiversity Programme (METSO) and the Habitats Programme (HELMI) (see the next section for more description).

The **Land Extraction Act** (Maa-aineslaki, 1981) enables the protection of nationally representative glaciofluvial esker formations and rocky areas, as well as landscapes of outstanding natural beauty.

The **Wilderness Act** (1991) establishes wilderness areas on state-owned land to preserve their unique character and allow some human interventions to help preserve Sámi culture and sustain traditional livelihoods, particularly reindeer herding. Twelve areas are established in northern Lapland. They are not protected areas according to the Nature Conservation Act but belong to Finland's Natura 2000 network.

Levels of protection: The Nature Conservation Act provides guidelines and rules for the selection criteria, spatial planning, establishment process and code of conduct for the different protected area types. The code of conduct is most restrictive in the Strict Nature Reserves where human activity is strongly prohibited, including the freedom to roam, or everyone's right.

[200] BISE country profile Finland available at: https://biodiversity.europa.eu/countries/finland

[201] TransNature project map of transboundary protected areas. https://www.transnature.eu/map (accessed 3 January 2024)

[202] https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164070/YM_2022_16.pdf

[203] Personal communication, two case study interviews

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Elsewhere, this right allows people to freely access all areas where it does not harm the environment or landowner's rights, including privately owned lands. Within it, people have the right to camp for a short time and to pick berries and mushrooms, but they are not allowed to harm animals or plants. Hunting and recreational fishing is allowed in most protected areas, but hunting is regulated through hunting rights and permits. Finland has yet to submit its pledge under the EU Biodiversity Strategy 2030. At the time of writing, the strict protection pledge includes the areas protected under the NCA (Strict Nature Reserves, National Parks, Nature Parks, Old-growth Forest Reserves, Mire Conservation Reserves, Herb-rich Forest Reserves) and Wilderness Areas (total 10.5% of terrestrial and freshwater area).[204]

Forestry activities are not allowed in protected areas designated under the Nature Conservation Act, accounting for ten per cent of Finland's forest area at the beginning of 2022, mostly in the north.[205] The **Forest Act** (Metsälaki, 1996) includes provisions for protecting and managing forests in a sustainable management practice. The focus is on small-scale areas (max. 0.5 ha) with important biodiversity features. The sites are under the responsibility of the forest owner and currently considered as potential OECMs. Biodiversity conservation sites in commercial forests covered 0.48 million ha at the start of 2022.[206] Finland is currently in the process of finalising the national criteria to identify its remaining primary and old-growth forests. Based on these criteria, all remaining primary, old-growth forest on state-owned land will be protected.[207] On privately-owned land, these areas are targeted by the METSO programme.

In the reindeer husbandry area of Finland that covers around a third of the country, reindeer are allowed to roam freely in all protected areas except strict nature reserves. The Finnish Ministry of Forestry and Agriculture sets limits to the maximum number of animals allowed within the total reindeer husbandry area and within each cooperative for 10-year periods. The current limit is valid until 2030.

Governance: The Ministry of the Environment (MoE, since 1983) manages the environmental administration, with the Finnish Environment Institute (SYKE) for research, advice and monitoring. The Parks and Wildlife Finland (a public service unit of the state-owned enterprise Metsähallitus) is responsible for the practical management of all protected areas on state-owned land, nature conservation, recreational services and cultural heritage.

The Ministry of Agriculture and Forestry (MoAF) is responsible for economically important fish, hunted species and invasive alien species. It supervises the Finnish Wildlife Agency, who manage the large carnivores and the Finnish Forest Centre (SMK).[208] MoAF is also responsible for the financial guidance of Metsähallitus and its selection of areas for transfer of control.

The 15 Regional Centres for Economic Development, Transport and Environment (ELY Centres) are responsible for biodiversity conservation both inside and outside Natura 2000 sites and for implementation of among others the water policy. The surveying and management of protected areas on private land is done and proposed through cooperation between the landowner, an ELY centre and Metsähallitus. The latter makes the priorities.

[204] Personal communication, Finland case study team

[205] LUKE Forest protection 1.1.2022. https://www.luke.fi/en/statistics/forest-protection/forest-protection-112022 (accessed 31 July 2024)

[206] LUKE Forest protection 1.1.2022. https://www.luke.fi/en/statistics/forest-protection/forest-protection-112022 (accessed 31 July 2024)

[207] Personal communication, Finland case study team

[208] https://www.metsakeskus.fi/en

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4.1.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The Finnish protected area network is most visible in the northern half, but poorly connected in the south, where pressures from fragmentation and land-use are highest (Kontula and Raunio, 2018). The connectivity between protected areas is far from optimal due to the forestry management practices that affect most of the landscape - there are 26.3 million hectares of forests in Finland. Finland's biodiversity targets and its Forest Strategy have had conflicting aims, and the connectivity is far from optimal due to the prioritisation of commercial forest management practices over protected forests.

The revised NCA 43 § on the criteria for establishing new PAs lists the area's importance for 1) maintaining favourable conservation status (e.g. population size) of species, and 2) allowing species or habitat type to adapt to climate change, as justifications. Areas crucial for movement to maintain healthy population size or to allow species to shift their ranges could be considered to meet this criterion, but it would need to be a very strong and clearly defined case.

Areas of ecological connectivity are being established through two major government-funded programmes: METSO and HELMI. HELMI and METSO are run jointly by the Ministry of Agriculture and Forestry and Ministry of the Environment and both programmes rely on voluntary conservation agreements with private landowners; there is no strict legal enforcement.

The Forest Biodiversity Programme for Southern Finland (METSO) was set up in 2008, scheduled to end in 2025. The METSO objectives are to have 96 000 hectares of forest established as permanently protected areas and to safeguard biodiversity on 82 000 hectares of commercially managed forests by means of fixed-term environmental forestry subsidy agreements and nature management projects. Private owners can offer their forests up for temporary or permanent conservation by an evaluation, and then negotiating an agreement on duration, compensation and management requirements. The implemented conservation measures will be monitored.

The HELMI programme was launched in 2019 to complement METSO by increasing conservation and restoration of open (non-forest) habitats, including mires wetlands, small water bodies and shore habitats, grassland, etc. The programme includes 'areas of concentration' - these are (currently) 10 areas across central and southern Finland where concentrated HELMI efforts are targeted and designed to complement existing protected areas and other conservation efforts.

The **Act on the Protection of Rapids** (Koskiensuojelulaki, 35/1987) protects river connectivity from power station construction. In 2020, the Finnish government committed to improving living conditions for migratory fish and river connectivity through barrier removals and commenced a national program (NOUSU) which can cover the 50% of the project cost, including the potential purchase of a hydropower facility. In December 2022 Finland revised its Water Act to enable the setting of environmental requirements for facilities that had none till then.

The **regional water protection plans** define measures to mitigate the impacts of land uses and other activities on the Natura 2000 site(s) in the catchment, such as regulating fishing in the catchment. The plans are prepared with public participation in a similar manner to the Natura 2000 management plans. The implementation of the plans is coordinated jointly by the regional ELY centres and the Finnish Forest Centre (SMK), utilizing available funds for nature conservation, river basin management, and sustainable use of forests.

Transboundary connectivity for conservation exists with Russia. Finland, Norway, Sweden and the Baltic States have collaborated with Russia to increase the cross-border connectivity in the BPAN Project. It is very relevant to ecological connectivity of terrestrial non-flying

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species since the connection of the Scandinavian Peninsula to the European mainland is only achieved through Russia.

4.1.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The **Land Use and Building Act** (Maankäyttö- ja rakennuslaki, 132/1999), with the National Land Use Guidelines (2017) sets out the framework for land use planning and zoning in Finland. It includes provisions for protecting ecological connectivity. Notably, it includes the Finnish National Urban Park (NUP) concept. The hierarchical land-use planning system has four levels; i) national land use, ii) regional planning, iii) local master plan and iv) local detailed plan.

The national and regional levels need to consider green infrastructure in planning. I.e., to avoid degrading green infrastructure and destroying important ecological connections. The regional councils are responsible for developing the regional master plans and enforcing the protection of the important areas for connectivity identified in the plans. The regional plans in theory guide the council level land use planning, but in practice councils still have a lot of independence to ignore the regional level plans when doing zoning.[209]

The **Act on Environmental Impact Assessment (EIA) Procedure** requires developers to assess environmental impacts and integrate considerations of planning and decision-making and at the same time to increase public access to information and opportunities for public participation in the procedures. In specific cases, the regional ELY centre can consider project impacts on connectivity.

Systematic conservation planning: Finland has followed systematic conservation planning processes for its protected area network for decades. The Finnish Environment Institute (SYKE), the research institute that conducts long-term monitoring and provides expert services, has developed tools and data to plan protected area designation and integrate ecological corridors into spatial planning. Tools and data include:

- **Zonation:** SYKE uses this planning software to produce 'prioritisation maps' of nature values to select complementary areas for conservation (Jalkanen, Toivonen and Moilanen, 2020). Zonation is used in METSO to guide identification and selection of sites, complementing information from field visits.[210] Software developed by the University of Helsinki.
- **Datasets:** Corine Land Cover data, mire drainage status data, Global Forest Change data and others are used in geospatial data examination (Kontula and Raunio, 2018).
- **GreenInfra GIS tool** to identify key areas for green infrastructure, developed by SYKE.
- **KOKASU GIS database and information** source that identifies thematic and regional gaps in current biodiversity protection in eight main habitats: Baltic Sea, coastal habitats, fell habitats, forests, inland waters and shores, mires, rocky habitats and seminatural grasslands. Combines information produced in earlier research and development projects and utilizes several different GIS data sources on the Finnish protected area network and known biodiversity hot spots. Developed by the KOKASU project managed by SYKE from March 2021 to April 2022.

[209] Personal communication, Finland case study team

[210] https://www.syke.fi/en-US/Research__development/Nature/Specialist_work/Zonation_in_Finland/Zonation_projects_and_research

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- **Map of floodplain forests and woodlands** that are significant in terms of diversity and operating models to improve the condition of the sites, considering the needs of water protection and flood protection. The data are being used for the Forest Biodiversity Programme for Southern Finland (METSO). Developed in the Potut project 2019–2021.[211]

Offsetting / compensation: The revised Nature Conservation Act 2023 introduced a voluntary ecological compensation procedure and offset criteria, and provisions on measurements, geographical boundaries and flexibilities are set out in a Ministry Decree of September 2023.[212] The BOOST project is conducting research to support the Ministry of the Environment in the development of national offset register, biodiversity accounting and a comprehensive offsetting system.[213] As part of the project, NNL City developed recommendations and a model for municipalities to introduce biodiversity offsetting into their land use and planning processes. It is not yet possible to say whether this new system will benefit ecological connectivity or not.

4.1.4. FUNDING

EU funding: LIFE(+) funding with national co-funding supports most of the nature conservation, with the rural development programme funded by EAFRD supporting environmental management contracts and restoration. The EU Recovery and Resilience Fund plan included EUR 53 million funding for state-owned enterprises for projects involving green areas, water services and forest conservation.[214]

National funding:[215] Compared to other member states, in Finland relatively large proportions of conservation funding come from national sources, through sectoral policies (e.g. forestry). Two national funding programmes (METSO and HELMI) function on a voluntary basis and are jointly run by the Ministry of Agriculture and Forestry and the Ministry of the Environment.

METSO: The biggest national fund METSO (I in 2002, II from 2008 to 2016) funds biodiversity conservation in commercially managed forests by means of permanent protection (through an everlasting conservation management agreement) or through fixed-term environmental forestry subsidy agreements and nature management projects. METSO is based on a voluntary approach which encourages private owners to offer their forests up for temporary or everlasting conservation management in an agreement, while selling or holding ownership. In exchange, they receive full financial compensation equivalent to the value of timber. The areas accepted to the METSO program may thus either remain under the ownership of the landowner, being protected using a fixed-term contract (10-30 years) or permanently, the latter forming a Private Nature Reserve, or it can be purchased by the state, making it a state-owned protected area. The programme includes several measures to improve ecological connectivity.

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[211] https://www.syke.fi/hankkeet/potut

[212] Ministry of the Environment https://ym.fi/en/ecological-compensation

[213] Ministry of the Environment https://boostbiodiversityoffsets.fi/en/

[214] https://valtioneuvosto.fi/en/-/10616/hallitus-paatti-vuoden-2020-neljannesta-lisatalousarvioesityksesta

[215] Sources of information for text in this section from interview and presentation by Finland case study project team

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HELMI: The HELMI program was launched in 2019 to complement the METSO program. It aims to increase the conservation and restoration of open (non-forest) habitats, including mires, wetlands, small water bodies and shore habitats, and semi-natural grasslands.

NOUSU: This national program can cover 50% of the project cost of dam removal, including the potential purchase of a hydropower facility.

The Finnish 2023 budget allotted over €43 million to 'nature conservation areas'.[216] The budget includes both the acquisition of new land and a fund to compensate economic losses caused to businesses and citizens from nature conservation, including to facilitate the uptake of METSO among forest owners, mostly through agreements between regional environmental and forest administrators. The budget also allotted over €15 million for the implementation of HELMI and METSO[217].

There is some financial support from foundations and NGOs, such as the Finnish Natural Heritage Fund that purchases old-growth forests with donation funds or support from the Kone Foundation.

[216] State budget proposals: proposal budget 2023. Line 21. Certain nature conservation expenses (transfer appropriation 3 years). https://budjetti.vm.fi/sisalto.jsp?year=2023&lang=fi&maindoc=/2023/tae/hallituksenEsitys/hallituksenEsitys.xml&opennode=0:1:149:395:1439:1451:1455:

[217] State budget proposals: proposal budget 2023. Line 21. Certain nature conservation expenses (transfer appropriation 3 years). https://budjetti.vm.fi/sisalto.jsp?year=2023&lang=fi&maindoc=/2023/tae/hallituksenEsitys/hallituksenEsitys.xml&opennode=0:1:149:395:1439:1451:1455:

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4.2. FRANCE

4.2.1. PROTECTED AREA NETWORK (TERRESTRIAL)

The French terrestrial and metropolitan protected area network consists of 15 types of protected areas under the national Environment Code law[218], as well as the Natura 2000 sites and the international designations. France also has a substantial marine protected area network, which is not covered in this review. This review also does not cover the French overseas territories, which have some specific conditions that differ from the mainland protected area designations. The French Environment Code does not apply to French Polynesia, New-Caledonia, Wallis and Futuna and Saint Barthelemy.

The French national strategy for protected areas to 2030 was published in 2021, with the headline aim to protect 30% of national natural areas by 2030, including 10% under strong protection.[219] The strategy set goals for the creation or extension of 20 national nature reserves by 2022 and gives special importance to protected area management.

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 22. National and regional designation types, protection purpose and governance in France. Sources: Ministry[220], (Commenville, 2023) and (Laslaz, Milian and Cadoret, 2023).

Designation type	Protection purpose and governance
Regulatory protection (defined in Environment Code)	
National Park (parc national) - Strict Nature Reserve within the core of a National Park (Réserve intégrale en coeur de parc national) - Cooperation area (contractual protection but linked to the core area)	Designated for biodiversity protection, management of cultural heritage and welcoming the public by a governmental decision (decree). They cover a wide range of land and sea areas. National parks consist of one or more core areas (coeur de parc national) and a cooperation area (parc national aire d'adhésion). The core area is under strict legal protection where human activities are restricted and priority is given to nature conservation. The interpretation of strict protection has shifted, as hunting is much less restricted in the core areas of the newly designated parks compared to the old parks (but hunting can be forbidden). The protection can be strengthened by designating the core area also as a strict nature reserve. The cooperation area is defined as the whole or part of the areas of the local municipalities (communes) around the park who have decided to join the park and take part in its protection goals. There is no specific regulation in the cooperation area as it is a contractual protection tool but relating to urban developments, municipalities are committed to making their urban planning document compatible with the park charter. The park charter defines the protection objectives and rules of the core area and the protection and sustainable development goals for the municipality areas included in the cooperation area[221]. It cannot define specific rules or prohibitions for the park outside the core area. The State designates a public authority to manage the park and to implement the special regulation of the core area. The new governance structure

[218] Code de l'environnement at https://www.legifrance.gouv.fr/codes/texte_lc/LEGITEXT000006074220/.

[219] https://www.ecologie.gouv.fr/sites/default/files/DP_Biotope_Ministere_strat-aires-protegees_210111_5_GSA.pdf

[220] https://www.ecologie.gouv.fr/aires-protegees-en-france

[221] Environment Code Article L331-3.

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	introduced in 2006 is composed of an administrative council, a scientific council and an economic, social and cultural council. There is no management plan in the national parks, apart from the charter.
Nature Reserve (réserve naturelle) - National - Regional - Corsican	Areas that are designated to protect, restore, understand and manage a remarkable natural heritage (biological and geological). Nature Reserves have regulations that restrict most human activities but also enable the manager to identify and carry out restoration works where necessary. All nature reserves have a management plan, which is a legal requirement for receiving state funding (it then provides its core budget). A management body is officially appointed to manage the site.
National Hunting and Wildlife Reserve (Réserve nationale de chasse et de faune sauvage)	Only national hunting and wildlife reserves are counted as protected areas, most for hunting reserves are not. Designated to protect migratory bird populations according to international commitments, ensure the protection of natural environments essential for the conservation of threatened species, promote the development of tools for the management of wildlife species and their habitats and to contribute to the sustainable development of hunting in rural areas. Hunting is prohibited, as is any other activity likely to disturb wildlife. Created by prefectoral decree on the initiative of the holder of the hunting right on the land in question. All approved communal hunting associations are required to set aside 10% of their territory as a reserve. If a hunting and wildlife reserve is of particular importance, it may be set up as a national hunting and wildlife reserve. A national reserve is designated through a ministerial decree appointing the manager, which must be a public body.
Prefectoral protection order (arrêté préfectoral de protection) - Biotope - Natural habitat - Geological interest	Designated to protect against destruction, alteration or degradation of biodiversity. Protection orders may be put on land to protect environments necessary for the survival of protected animal or plant species; protect natural habitats (without the need to establish it is also a habitat for protected species); or to protect sites of geological interest or geotopes. The order defines measures to prevent the destruction, alteration or degradation of a site or natural habitat, and may prohibit some specific activities such as the destruction of hedges or certain types of constructions that may affect the ecosystems. The Environment code does not provide for management measures or the establishment of a management body, but a consultative body may be set up to promote dialogue for the order's implementation the prefect does not delegate powers to this body but may define its tasks and composition in the order). Decision taken by the departmental (regional government) prefect.
Classified and registered site (site classé et inscrit)	Designated for landscape protection to preserve places with an exceptional character that justifies national protection: natural monuments and sites whose conservation or preservation is of general interest, aesthetic and/or cultural value. Decisions to classify or list an area are simply a declaration of recognition of the area's heritage value, and not a regulation. They do however trigger control procedures over activities that are likely to affect the area. - On a listed site, any change to the state or appearance of the site is subject to special authorisation from the prefect or minister responsible for the site. - On a registered site, applications for authorisations to carry out works that may affect the site are submitted to a state service specialised whose mission is the maintenance and conservation of protected monuments. This is one of the only protected area designations in the Environment Code that does not need to have a management plan.

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Forest Biological Reserve (réserve forestière biologique) - Managed Forest Reserve (Réserve forestière biologique dirigée) - Wilderness Forest Biological Reserve (Réserve forestière biologique intégrale)	Specific protection and management tool for the most remarkable areas of forests under the forestry regime. Reserves are either for managed or wilderness forest. Managed forest reserves concern valuable forest environments that require specific conservation management, such as interventions to create or maintain open environments, hydraulic management work (to maintain or restore wetlands), control of invasive alien species. Wilderness forest reserves are dedicated to the free evolution of forests which have representative diversity. The only possible management actions are the creation of safe paths running alongside or through the reserves, eliminating non-native plant or animal species, and regulating ungulates by hunting in the absence of predators. Created by a joint decision of the Ministries of agriculture and ecology. Managed by the Office National des Forêts (ONF). The forest reserves must have a management plan which defines the protection and management.
Contractual protection - Protection is based on a voluntary and time-limited charter, i.e. the designation is contractual and not regulatory.	
Marine Natural Park (parc naturel marin)	Contribute to protection and knowledge of marine heritage (natural and cultural) whilst fostering the sustainable development of marine-related activities. Governance: park management board made up of local stakeholders.
Regional Natural Park (parc naturel régional)	Designated for the protection and management of the heritage, promotion of the economic and social development, welcoming and education of the public by a decision of the regional council. Under the responsibility of the region; governed by a joint association of local authorities. All partners involved voluntarily commit to act in favour of the environment and its heritage within the framework of a contract (the park charter). The charter is time-limited and therefore has to be periodically renewed to maintain the protection status.
Protection through land ownership	
Land owned by the departments as Sensitive Natural Area (Espace naturel sensible)	Designation to preserve the quality of sites, landscapes, natural environments and habitats and natural flood expansion areas. The departmental council is responsible for drawing up and implementing a policy for the site protection, management and opening up to the public.
Land owned by the Coastline and Lakeshore Protection Agency (CELRL - Conservatoire du littoral et des rivages lacustres)	The Conservatoire du littoral is a public authority whose mission is to acquire coastal areas threatened by urbanisation or degradation and to restore and develop them. The land is acquired amicably, by pre-emption, and only rarely by expropriation. The agency then owns the areas which ensures its protection in perpetuity. The agency sets up management partnerships, primarily with local communities but also with regional, department or other authorities.
Land owned by the Natural Areas Conservation Society (conservatoires d'espaces naturels)	The society is dedicated to contributing to understanding, protecting, managing and enhancing natural environments and to running regional projects. Each region has its own society, represented by a federation at the national level (Fédération des conservatoires d'espaces naturels).

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Natura 2000 network: In 2022, 1 756 Natura 2000 sites covered 13% of the terrestrial metropolitan area and 35.7% of the metropolitan exclusive economic zone (EEZ) of the marine part of metropolitan France. In 2022, it included 403 SPAs, 1 341 SACs and 11 SCIs.[222]

Total terrestrial protected area: 28% (MNHN[223])

Overlaps and protection levels: about half of the terrestrial protected areas are designated exclusively under national laws; 27% consists of Natura 2000 sites; 18% of the network are areas where Natura 2000 sites overlap with national designations.[224] In 2022 the terrestrial area under strict protection in metropolitan France was 8 460 km^2; 6.44% of the terrestrial protected area, according to the national indicator.[225]

OECMs: The French strategy for protected areas *defines* OECMs as a geographically defined area other than a protected area, governed and managed to achieve positive and sustainable results for the long-term in situ conservation of biodiversity, ecosystem functions and services and, where appropriate, cultural, spiritual, socio-economic and other locally relevant values. However, there are no measures in the strategy related to OECMs and France has not yet declared any OECMs under the EU Biodiversity Strategy pledging process[226] or in the European Database of Protected Areas (CDDA).

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

Designation and governance: The French Environmental Code defines 15 categories of protected areas that can be legally designated to protect biodiversity, nature and landscapes, and where designation is based on a regulatory instrument. France also has natural parks that are under contractual protection, where protection is based on a voluntary and time-limited charter, i.e. the designation is contractual and not regulatory. Contractually protected regional natural parks are under the responsibility of the region; governed by a joint association of local authorities. There are also three categories of sites protected through land ownership instead of regulation or time-bound contract, two of which are state agencies and one of which is an NGO: land owned by the regions (departements) as Sensitive Natural Area; land owned by the Coastline and Lakeshore Protection Agency; and land owned by the Natural Areas Conservation Society (conservatoires d'espaces naturels).

The French Biodiversity Agency (Office Français de la Biodiversité) is responsible at the national level for the implementation of protected area policy, under the environment ministry. It coordinates efforts across various protected areas and supports the creation and management of ecological corridors. The agency provides scientific and technical expertise to local authorities and stakeholders.

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[222] French environment ministry November 2022. https://www.ecologie.gouv.fr/politiques-publiques/reseau-europeen-natura-2000

[223] French national statistics office February 2024. Part des terres françaises en aires terrestres protégées en France métropolitaine (objectif 30% SNAP) https://www.insee.fr/fr/statistiques/serie/010761996

[224] EEA Biodiversity Information System Europe (BISE). https://biodiversity.europa.eu/countries/france

[225] French national statistics office February 2024 Surfaces terrestres françaises classées en aires terrestres protégées en France métropolitaine (protection forte) https://www.insee.fr/fr/statistiques/serie/010596420 and Part des terres françaises en aires terrestres protégées en France (protection forte) https://www.insee.fr/fr/statistiques/serie/010761992

[226] NADEG 21th Meeting, 05 December 2023, Document N°: Doc Nadeg 23-12-03.

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Levels of protection: The core areas of the national parks, national nature reserves, regional nature reserves, and biotope protection orders have strict protection rules, currently making up 6.2% of the total land area in metropolitan France.[227] The areas designated through voluntary and time limited contractual arrangements or through public or NGO land ownership have made up a significant part of the French protected area.

Natura 2000 management: France has a standardised contractual system to secure the maintenance and management of Natura 2000 sites. Each site has an Objective Document (DOCOB) that describes the site objectives and management needs. Almost all sites have a complete Objective Document, and their preparation and revision use 20% of the annual budget dedicated to Natura 2000 (Commenville, 2023). There is also a regulatory component in the French Natura 2000 system with the appropriate impact assessment provision under article 6 of the Habitats Directive. Holders of real and personal rights over land included in a Natura 2000 site may enter into contracts with the administrative authority (Préfet). The Natura 2000 contract includes a set of commitments, in line with the guidelines defined in the objectives document, on the conservation and, where appropriate, the restoration of the natural habitats and species for which the Natura 2000 site was created. The contract defines the nature and terms of the funding provided and the services to be provided in return by the beneficiary. The contracts are funded for a minimum period of 5 years from the Ministry for Ecology and Common Agricultural Policy funding (EAFRD). There are three types of contracts: 1) forestry contract finances non-productive investments in forests and wooded areas; 2) 'neither agricultural nor forestry contract' finances non-productive investment or maintenance; 3) agricultural contract finances agri-environmental measures on agricultural plots.

Natura 2000 charter: The charter is a part of the site's DOCOB. It is a tool for declaring the signatories' adhesion to the conservation objectives of a given Natura site (as defined in the objectives document DOCOB) with a 5-year commitment. It entitles the holder to exemption from property tax on undeveloped land, and also gives access to certain forms of public aid (particularly in the forestry sector, where membership of the Natura 2000 charter is one of the guarantees of sustainable management of the woods and forests located on the site). The Natura 2000 charter is aimed at holders of real and personal rights over land present in the site. Users may also sign up to the charter to demonstrate their commitment to Natura 2000, but they are not entitled to any tax benefits. The charter is not linked to a source of funding for management, so to access management funding the landowner or manager should also sign a Natura 2000 contract. Landowners can choose to sign only a charter or only a contract or both.

4.2.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

Trame Verte et Bleue - Green and Blue Network (GBN)[228]

The Green and Blue Network (GBN) provides a legal framework for establishing a **network of terrestrial and aquatic ecological continuities, known as green and blue infrastructure.** The GNB was introduced into French law by the 'Grenelle I and II' laws in 2009 and 2010. The implementation approach is governed by the provisions of the Environment Code and the Urban Planning Code (code de l'environnement et code de l'urbanisme).

[227] https://inpn.mnhn.fr/espace/protege/indicateur/recherche.

[228] Décret nº 2012-1492, 2012; Décret n° 2014-45, 2014.

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The policy aims to integrate the challenges of maintaining and strengthening the functionality of natural environments into planning tools and development projects. It aims to curb the erosion of biodiversity resulting from soil sealing and fragmentation of habitats, by preserving and restoring ecological continuity, so that populations of animal and plant species can move around and complete their life cycle (feeding, reproduction, resting, etc.) under favourable conditions. According to the Environmental Code, the objectives of the GBN[229] are to reduce the fragmentation and vulnerability of natural habitats and species habitats and to take into account their displacement in the context of climate change; identify, preserve and link important areas for the preservation of biodiversity through ecological corridors; preserve wetlands; implement the water quality and quantity objectives set by the water development and management master plans; take into account the biology of wild species; facilitate the genetic exchanges necessary for the survival of species of wild fauna and flora; and improve the quality and diversity of landscapes. The French national strategy for biodiversity (first the 2011-2020 strategy, now the 2021-2030 strategy) describes the GBN as contributing to Natura 2000, national policies on protected areas, species protection, water quality, and impact assessment.

The GBN consists of terrestrial and aquatic **ecological continuities**[230] which must include:

- **Biodiversity reservoirs**[231]: areas in which biodiversity is richest or best represented, where species can carry out all or part of their life cycle and where natural habitats can ensure their functioning. They include all or parts of the protected area network and other natural areas that are important for the protection of biodiversity.
- **Ecological corridors**[232]: provide connections between biodiversity reservoirs, offering species favourable conditions for their movement and the completion of their life cycle. They can be linear, discontinuous or at the landscape level.
- **Watercourses and wetlands**[233]: those important for the preservation of biodiversity constitute both biodiversity reservoirs and ecological corridors.

The GBN must contribute to the favourable conservation status of natural habitats and species and to the good ecological status of water bodies[234], so the identification and delimitation of the ecological continuities must connect the populations of animal and plant species whose preservation or restoration to good status is a national or regional issue to move around to ensure their life cycle and promote their capacity to adapt. Although the GBN primarily targets ecological objectives, it also makes it possible to achieve social and economic objectives (by maintaining the ecosystem services provided by biodiversity, by making the environment more attractive to the local population).

The GBN is a **land-use planning tool**: The areas and corridors are identified in the planning documents of the State, local authorities and their groupings. The ecological continuities are identified in the regional plans for spatial planning, sustainable development and territorial equality (SRADDET)) (previously in the Regional Ecological Coherence Schemes (SRCE) and must be considered in regional projects.

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[229] Art. L.371-1 I Env code.

[230] Continuités écologiques, articles L.371-1 and R.371.19 Env code.

[231] Réservoirs de biodiversité, articles L.371-1 II and R.371-19 II Env code.

[232] Corridors écologiques, articles L.371.1 II and R.371-19 III Env code.

[233] Cours d'eau et zones humides, article L.214-17 Env code.

[234] Articles R. 371-17 of the Env code and R. 371-18 of the Env Code.

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CONTRACTUAL INSTRUMENTS

The French regions and municipalities can also use contractual instruments to dedicate land to conservation objectives and create ecological connectivity.

Conservation contracts (Obligation Réelle Environnemental ORE)[235]: The ORE is an environmental real estate bond, a voluntary contractual tool for committing land to conservation objectives for a defined period. An ORE voluntarily commits the owner to 'maintaining, conserving, managing or restoring elements of biodiversity or ecosystem services' on the land in a contract with an organisation (either a local authority, the State, an environmental protection NGO or foundation with similar goals). The landowner retains property rights, and the contract duration can be up to 99 years. The commitment is attached to the land and so transfers to the new owner when land is sold or exchanged. This is similar to a conservation easement, though they are not strictly conservation easements as they are not servitudes. Introduced in 2016 as part of the renewed French Environmental code, OREs represent a shift in France's approach to nature conservation to a bottom-up model that involves private actors. OREs are characterised by their high flexibility, adapting to the specificities of each situation: the contracts must only mention the parties' commitments, the contract duration and the possibilities for revision and termination. Landowners who sign OREs do not necessarily receive monetary compensation, but the law allows municipalities to offer an exemption from the municipal share of property tax on undeveloped land.

There is growing interest from private landowners to enter such contracts to protect their land and to receive advice and expertise on how to do so. OREs are mostly being used for contracts between private landowners and the Conservatoires d'Espaces Naturels (CENs), environmental protection NGOs managing protected areas.

Use of ORE for a Natura 2000 site in France

The Conservatoire d'espaces naturels de Savoie signed an ORE with the local authority of Yenne in 2018 for a period of 30 years to maintain, safeguard and restore the ecological functioning of the marsh of Lagneux and its biodiversity features of national value. The marsh is in a Natura 2000 site. The authority had previously bought the land parcels from 180 different owners using EU funding from the ERDF.

Source: https://www.mairie-yenne.fr/prod/wp-content/uploads/2019/04/article-accueil-marais-FEDER-1.pdf

The French regions have also developed specific contractual instruments that can be used to set conservation objectives and support conservation management on land outside designated protected areas, including the TVB continuities.

Green and blue contracts (Contrats verts et bleus) in Rhône Alpes: The region Rhône Alpes is using contracts supporting measures led by local contractors (it can be an NGO or a company or even a municipality) over the course of 5 years to maintain or restore ecological corridors on a specific territory. The contractor can receive up to €2 million in support from the region. The measures and actions are defined based on the issues identified in the regional ecological coherence scheme (SRCE), now replaced and absorbed by the SRADDET.

Nature contracts (Contrats nature) in Brittany: Brittany is using framework contracts for actions over 2 to 4 years to conserve and restore biodiversity in the region, address the priorities identified in the regional document (SRADDET), and contribute to themes outside of

[235] Article L. 132-3 Env code.

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the scope of ecological continuities. These contracts are available for territorial collectivises, public establishments, NGOs, and state services. Eligible measures include studies, the elaboration of a programme of actions and management plan, scientific monitoring, sensibilisation actions, communication support, studies prior to ecological engineering works and ecological engineering works, equipment to protect and enhance environments and land acquisition required to preserve and/or restore a natural area on a long-term basis (subject to conditions).

Offsetting and mitigation banks

The French law on biodiversity No. 2016-1087 requires that developers must offset negative impacts on protected species and wetlands. Offset can be created by the permit holder or a third-party provider. Pilot mitigation banks, called 'compensatory natural sites' or 'natural offsetting areas' have recently been introduced. Public information on biodiversity offsets has been made available through the national data platform, Géoportail (see box). The web portal is primarily intended for geolocating compensation areas to ensure their permanency and to increase public transparency.

Offset inventory: Géoportail:

The web-based portal gives the spatial location of each offset site, given either as point coordinates or line and polygon shapes. Each site has a short information summary that outlines the type of offset action (e.g., rehabilitation, restoration, change or abandonment of land use practice, establishment of nesting/roosting structures etc.), timing of approval, the permittee responsible for the offset and, in some cases, the duration of offset. It does not however contain any details about the impacted biodiversity features, approach used to estimate offset obligations, or offset outcomes (Kujala et al, 2022).

Some municipalities are using OREs to realise a compensatory measure for loss of biodiversity and ecosystem services due to a development (see Box).

Use of ORE for ecological compensation measure that benefits ecological connectivity

The organisation CDC Biodiversité signed an ORE with Messimy local authority in 2020, to implement ecological compensation measures for industrial development. They will restore and maintain hedges and open habitats for farmland birds and the local authority will support ecological management of the area for at least 15 years. The contract can be renewed after that period.

Source: *https://cemater.com/cdc-biodiversite-signe-sa-premiere-obligation-reelle-environnementale-dans-le-rhone/*

4.2.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The GBN is implemented in the following spatial policies:

- **National** orientations in a guideline document.
- **Regional** planning document which defines the objectives and measures to restore ecological continuities (see below).
- **Departmental** 'Sensitive Natural Areas' policy, the management of departmental road infrastructures, agricultural land use planning, water management policies, etc.
- **Territory/project** level implementation of pilot initiatives and contractual tools (regional natural parks, water development and management plans, etc.).

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- **Territorial Coherence Scheme** (SCoT) - urban planning documents that aim to ensure the coherence of all sectoral policies at the level of one or more municipalities. The SCoT must consider its regional SRCE and integrate ecological continuity challenges.
- **Municipal** level: allows for the operational implementation of the GBN through the local urban development plan (PLU). The PLUs can define urban development regulations that are enforceable against third parties based on recommendations defined in the regional planning document.
- **Individual** farmers and foresters take on a positive role in the maintenance of ecological continuities under land management contracts, including agri-environment measures or Natura 2000 contracts.

Regional plans for spatial planning, sustainable development and territorial equality (SRADDET) (previously in the Regional Ecological Coherence Schemes SRCE): the SRCE planning documents were introduced in 2010 to identify and protect ecological corridors, guiding regional and local planning to maintain habitat connectivity. The new SRADDET integrating planning documents are designed to integrate the mapping of regional ecological continuities.

The French regions and local governments are responsible for implementing the regional ecological coherence plan (SRADDET) and the local urban development plans (PLU).

4.2.5. FUNDING

FUNDING FOR PROTECTED AREAS

The state budget provides the core public funding for protected areas in France. The national funds mostly go to the strictly protected nature reserves and national parks. Protected areas also receive funded through taxes allocated to certain public establishments. For example, the Conservatoire du Littoral receives taxes charged on water use and boating fees. The water agencies are allocated fees from water use. The tax on built developments raised by the regions could potentially provide up to €350 million annually for protected area management, but there is a lack of accountability, each department remaining free to determine the amount going to biodiversity (Lavarde et al 2016 cited by Commenville, 2023). The hunting and fishing licences mainly fund the operations of the OFB.

The Green Fund has been set up to finance, in part, the French Biodiversity Strategy. It has been allocated €2 billion in 2023 and €2.5 billion from 2024. It is meant as a complement to other existing state resources, to create a leverage effect. It can be used to fund measures under the national strategy for protected areas, the national plan for pollinators, for species protection, for reducing threats on biodiversity, for ecological restoration, etc.

EU funds provide a significant part of the budget for protected areas, and significant co-financing has been leveraged recently in France. Funding requirements for regional nature parks are considered in the negotiations between the state and regions in the programming of EU funds. Agri-environment schemes provide a large share of financial resources for land management, with 70% going to groundwater protection areas and 30% to Natura 2000. Funds from the European Regional Development Fund (ERDF) contribute significantly to protected areas through the implementation of nature reserve management plans or restoration to improve ecological connectivity. France also relies on the LIFE programme, although less than in other member states (Commenville, p. 326).

The private sector provides some funding for protected areas through philanthropic action and funding for NGOs.

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The French strategy for protected areas provides that an analysis of the operation of protected areas and their economic models, costs and sources of funding (public and private) will be carried out, incorporating the incentive or penalty aspects of taxation to define the most appropriate public and private arrangements for financing protected areas.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no specific funding instrument for the GBN, but the following sources can be used:

EU funding

- LIFE for innovating projects
- CAP (EAFRD and EAGF) funds agricultural or forest land management through ecoschemes and agri-environment contracts for maintaining or developing environmental agricultural practices
- ERDF can provide support for investments/management actions carried out by local authorities, infrastructure managers etc. in the context of economic and regional development.

National funding

- The Green Fund has allocated 30M€ to ecological networks-related projects/issues in 2023. It can be funded by the State through the State-Region Plan contracts or through water agencies which implement restoration measures

Regional or local funding: associations can provide their own funds or mobilise relevant fiscal measures. Examples:

- Contrats de territoire corridors biologiques en Auvergne-Rhône-Alpes
- Contrats nature régionaux en Pays de la Loire

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4.3. PORTUGAL

4.3.1. PROTECTED AREA NETWORK (TERRESTRIAL)

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Protected areas are designated according to the national Decree-Law 142/2008 (24 July 2008) and classified by the national authority. New protected areas can be proposed by the national authority, by other public entities such as municipalities and regional governments, or even by private institutions.

Table 23. National and regional designation types, protection purpose and governance in Portugal.
Sources: (Ferreira and Leitao, 2023), BISE.

Designation type	Protection purpose and governance
National Park (Parque Nacional)	Large area containing mostly representative samples of typical natural regions, natural and human landscapes, biodiversity and geological elements, with scientific, ecological or educational value. Its main aim is the protection of its natural values and the integrity of ecosystems. The only Portuguese National Park in mainland Portugal is Peneda-Gerês.
Natural Park (Parque Natural) Regional Natural Park	Includes mainly natural or semi-natural ecosystems, where the long-term conservation of biodiversity might depend on human activities. 13 nationwide; 1 regional
Natural Reserve (Reserva Natural) Local Natural Reserve	An area that is not permanently or significantly inhabited and which contains ecological, physical and biological characteristics or others with scientific, ecological or educational value. 9 nationwide; 2 regional
Protected Landscape (Paisagem Protegida) Regional/local Protected Landscape	Contains landscapes resulting from a harmonious blend between human action and nature, resulting in a relevant aesthetic, ecological or cultural value. 3 nationwide; 6 regional; 5 local
Natural Monument (Monumento Natural)	Natural feature of outstanding or unique value because of its inherent rarity, representative of aesthetic qualities or ecological, scientific or cultural significance. The designation objectives are oriented primarily to the safeguarding of the geological heritage. 7 nationwide; 1 local
Private Protected Area	Area of privately-owned land, not included in any other protected area type, which hosts natural values that because of their rarity, scientific, ecological, social or scenic value require specific conservation and management activities. Faia Brava is the only Private Protected Area in the country. 4 private

Natura 2000 network: The terrestrial network consists of 82 sites (63 SCIs and 42 SPAs), covering 21% of the land area.
Overlaps and protection levels: The National Network of Protected Areas (RNAP) is made up of the 32 nationally designated areas (the national park, natural parks, nature reserves, protected landscapes, national monuments), the 14 regional/local designations of Natural Reserves, Protected Landscapes and Nature Park, and one Private Protected Area. The Natura 2000 network makes up most of the protected area coverage, outside the national designations.

OECMs: In Portugal, there is no official designation for OECMs, but discussions are taking place[236]. Some landscape management tools have the potential to be classified as OECMS when employed appropriately but some tools may not significantly contribute to conservation efforts or could even have adverse effects. Discussions centre on the Integrated Landscape Management Operations (OIGP) and the Integrated Landscape Management Areas (AIGP) aim (see below).

[236] https://www.dgterritorio.gov.pt/paisagem/ptp/oigp?language=en

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Total terrestrial protected area: protected areas cover a total of 20 547km^2 on land and 76 975km^2 at sea. Currently, 34.72% of Portugal's continental terrestrial area is designated as protected areas[237]. In 2023, the government announced that Geoparks Ramsar sites, and UNESCO Man and Biosphere Reserves would also be counted as part of the protected area network, increasing the total protected area coverage from 22.3% to 34.72%[238]. See Figure 8.

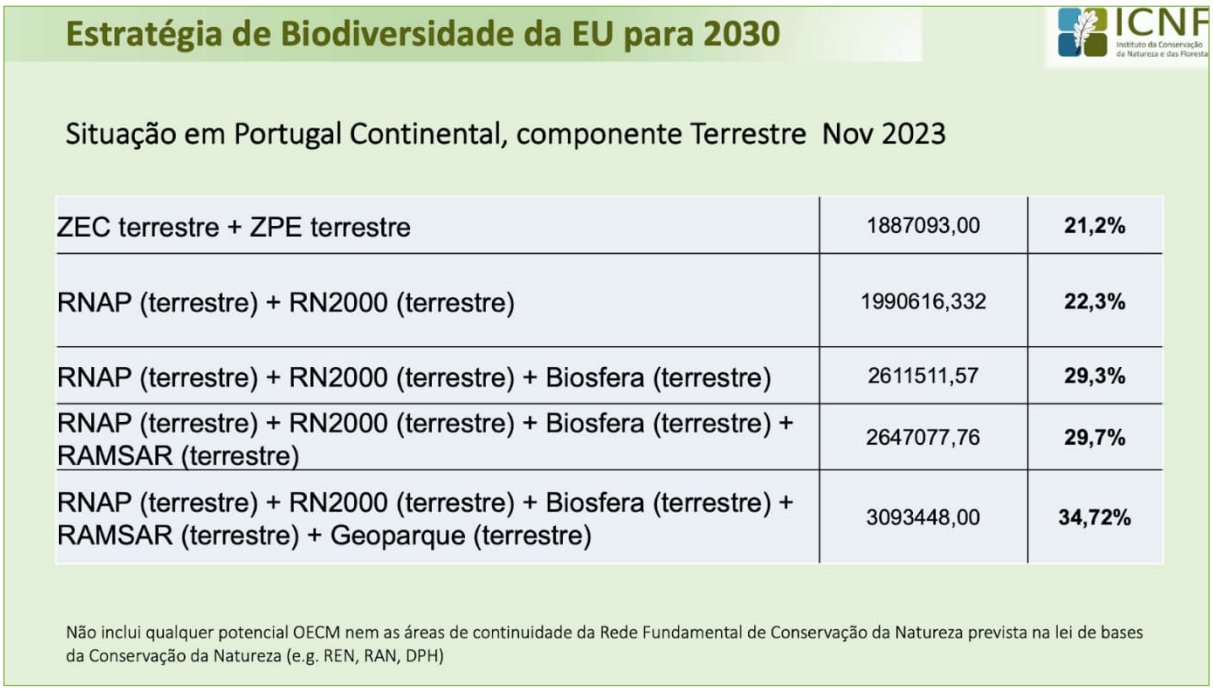

Figure 28. Protected area coverage in mainland Portugal; extracted from ICNF's presentation, during the 1st NaturaConnect Think Tank, November 2023. ©ICNF

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The Institute for Nature Conservation and Forest (Instituto da Conservação da Natureza e das Florestas, or ICNF) in Portugal is responsible for the designation and management of protected areas. ICNF is a government agency under the Ministry of the Environment and the Ministry of Agriculture and Fisheries, responsible for the conservation of nature and forests in Portugal. Its duties include the management of protected areas, wildlife conservation, forestry policies, and the promotion of sustainable land use practices.

In mainland Portugal, most protected areas are on private land, and therefore nationally designated areas (except the national monuments) are designated through a legally binding spatial plan which must include zoning into strictly protected core areas, sustainable use areas (where only low-impact activities are allowed), specific intervention areas (e.g. those requiring restoration measures), and buffer zones (Ferreira and Leitao, 2023). The National Parks, Nature Parks and Nature Reserves each have a Special Plan for Protected Area (PEAP **Programas Especiais das Áreas Protegidas**). These programmes specify the conditions of the designation (permitted, conditioned and prohibited activities and uses) and how it is

[237] https://www.portugal.gov.pt/pt/gc23/comunicacao/comunicado?i=portugal-continental-tem-348-da-superficie-terrestre-com-estatuto-de-protecao-

[238] https://www.portugal.gov.pt/pt/gc23/comunicacao/comunicado?i=portugal-continental-tem-348-da-superficie-terrestre-com-estatuto-de-protecao-

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integrated into the spatial plan. Each plan must be endorsed by a public consultation process (Ferreira and Leitao, 2023).

PEAPs are the current equivalent of the previous *Planos de Ordenamento de Áreas* Protegidas (Protected Areas Spatial Plans) in Portugal. The ICNF developed a method for converting the previous spatial plans for the national protected areas into the new PEAPs and is currently revising all the plans for the nationally designated areas. The legal regime of territorial plans foresees the monitoring and follow-up of the plans in force, to verify compliance with the measures and actions defined in the Implementation Programs and Financing Plans, as well as to monitor their effectiveness, through the analysis of the sustainability of the results obtained (Ferreira and Leitao, 2023).

The Portuguese Natura 2000 network is partly outside this system of national designations, and Natura 2000 sites do not have to have a PEAP. The latest assessment of the SCI/SAC part of the Natura 2000 network showed that there are insufficiencies in designation for several species and habitat types. The Commission launched an infringement procedure in July 2019[239]. On 16 March 2020, a regulatory decree classified the SCIs in mainland Portugal as SACs and set requirements for management plans to be prepared for them within two years, but up to January 2022 fewer than 40% of the Natura 2000 sites had management plans, and most of the existing plans were not yet fully implemented (Ferreira and Leitao, 2023). In February 2024, the Commission decided to refer Portugal back to the Court of Justice of the European Union for failure to comply with previous judgment on conservation of Natura 2000 sites. The sites (community importance) were designated but conservation objectives and management measures were not defined[240].

The Portuguese protected area system includes the designation of 'private protected areas', managed by private entities, under the terms of a management protocol signed with the ICNF[241]. Several environmental NGOs own land that is designated as a Natura 2000 site and/or a national designation.

The **National Strategy for Nature Conservation and Biodiversity (ENCNB)** is currently being reviewed by the Institute for Nature Conservation and Forests (ICNF) to incorporate the Global Biodiversity Framework (GBF) and other international commitments, and how to meet those targets. The Portuguese National Strategy for Nature Conservation and Biodiversity 2030 **(Estratégia Nacional para a Conservação da Natureza e Biodiversidade**) also sets a number of objectives important for protected areas and ecological connectivity, including:

- Understanding the Reality: This step involves mapping and identifying changes in distribution and phenology, as well as understanding the impacts on natural populations and habitats, such as climate change.
- Developing Books and/or Red Lists: The creation of these documents is essential to determine action priorities, identifying species at risk and priority conservation areas.
- Developing and Implementing Priority Action Plans: Based on the information obtained, specific action plans are developed to protect and conserve endangered species and habitats.
- Determining New Areas to Protect or Altering Existing Designations: This step involves identifying areas that need additional protection or adjusting restrictions and permissions for use in already designated areas.

[239] Commission decides to refer PORTUGAL back to the Court of Justice of the European Union for failure to comply with previous judgment on conservation of Natura 2000 sites. https://ec.europa.eu/commission/presscorner/detail/en/ip_24_268

[240] See footnote 238.

[241] https://www.icnf.pt/conservacao/rnapareasprotegidas/areasprotegidasprivadas

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- Monitoring the Implementation of Actions and Natural and Human Changes: It is essential to continuously monitor the implementation of action plans, as well as natural and human-induced changes in habitats and populations.
- Improving the National Strategy for Nature Conservation and Biodiversity (ENCNB): This management process should include the review and continuous improvement of the national strategy, based on understanding how populations and habitats evolve over time.

4.3.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The **Fundamental Network of Nature Conservation (RFCN)** is a strategic planning tool in Portugal aimed at conserving biodiversity and promoting ecological connectivity. It is part of the National Programme for Spatial Planning Policy (PNPOT) and is established under Decree-Law No. 380/99. The RFCN delineates areas of ecological importance into core areas (áreas nucleares) and connection areas (áreas de continuidade). Core areas typically include protected areas such as national parks, nature reserves, and other areas with high ecological significance. Connection areas encompass landscapes that facilitate the movement of species and ecological processes between core areas, such as ecological corridors, buffer zones, and habitats that support biodiversity. Connection areas can be Natura 2000 sites, National Ecological Reserve areas (REN), National Agricultural Reserve areas (RAN), and public water domain areas (where use restrictions apply).

The **National Ecological Reserve (Reserva Ecológica Nacional REN)** is a Portuguese public restriction which originally aimed to map and prevent development on all areas that are a high erosion risk because of their slope dynamics and instability. It designates areas with ecological importance that should be preserved from urbanization and other forms of intensive development. It has become a more comprehensive framework that protects ecological functions related to the water cycle, to avoid or aggravate soil erosion, to save the coastline ecosystems and interdicting human uses and activities both in risk areas such as flooding or landslide, as well as soil sealing in sensitive systems. There is a national REN steering committee which includes environmental NGOs and other independent organisations.

The law prohibits any uses and actions by public or private initiative in the Ecological Reserve areas that would result in subdivision operations, urbanization works, construction and expansion, communication routes, excavations and landfills and the destruction of vegetation cover. There is an exemption for actions necessary for the normal and regular development of cultural operations for the agricultural use of soil and the current operations of conducting and exploring forest areas, and for uses and actions that are compatible with the objectives of ecological and environmental protection and prevention and reduction of natural risks.

The establishment of REN was a pioneer legal instrument in 1983. However, in the current context, it falls short of ensuring mobility of species most impacted by the effects of climate change.

The methodology for defining ecological corridors aligns with the strategic orientation proposed in the Ecological Connectivity System for Mainland Portugal. Legally consolidated by the Legal Regime of Territorial Management Instruments and restricted by the National Ecological Reserve (REN), this corridor network is considered a biophysical structure integrating areas of high ecological value and sensitivity. The strategy also requires collaboration with Spain for cross-border connectivity.

Sectoral policies

Portugal has a national legal mechanism to safeguard agricultural land. Water bodies and related areas are considered public property (in contrast to most of the rest of the land which is private).

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The **National Agricultural Reserve (Reserva Agrícola Nacional RAN)** aims to safeguard agricultural activities, maintain rural landscapes, and support the agricultural sector's economic viability. The intention is to reserve the best soils for agriculture against land take to urbanization, industrialization or commerce purposes. The irrigation areas implemented by the state are included in the RAN to safeguard the investment.

Public Water Domain (DHP, Domínio Hídrico Público or DHP): The Public Water Domain includes rivers, lakes, reservoirs, estuaries, coastal areas, and other bodies of water that fall under public ownership. The Portuguese legal framework outlines the rights and responsibilities associated with the use and preservation of these water resources. The management of the Public Water Domain is typically overseen by relevant governmental agencies or bodies responsible for water resource management.

Public Maritime Domain (Domínio Público Marítimo, DPM): The public maritime domain includes the territorial areas near water bodies, particularly the beds and shores of the sea and rivers. These areas are managed and regulated by government authorities for various purposes such as navigation, conservation, economic activities, and environmental protection. Access to the maritime public domain cannot be restricted for private use.

Portuguese Landscape Transition Programme (Programa de Transformação da Paisagem PTP)

The Portuguese Ministry of Environment and Climate Action launched the PTP in 2020 in response to devastating forest fires. It is a strategic initiative aiming for a progressive transition toward green and just territories, focusing on transitioning landscapes towards a more resilient and environmentally sustainable state, in the face of challenges posed by climate change, habitat fragmentation, and ecosystem degradation[242]. The desired outcomes are to address landscape planning and management needs, increase managed forest areas to enhance resilience to wildfires, and promote the rural economy. The PTP aligns with the EU's Territorial Agenda 2030, focusing on strategic spatial planning and sectoral policy integration. The PTP prioritizes three main objectives:

- Integrating Climate Change Adaptation and Resilience: to enhance the capacity of landscapes to adapt to and mitigate the impacts of climate change, including extreme weather events and natural hazards.
- Fostering Ecosystem Services and Green Economy: to promote the sustainable use of natural resources, enhance ecosystem services, and support the development of green economic activities that contribute to landscape conservation and restoration.
- Building Innovative Governance and Stakeholder Engagement: The PTP emphasizes the importance of participatory governance processes and stakeholder engagement in landscape management. It seeks to foster collaboration and partnerships across various sectors and levels of governance to ensure effective implementation and long-term success.

The PTP has set up new mechanisms for land management[243]. The integrated landscape management areas **(áreas integradas de gestão da paisagem AIGP)** provide the spatial and organizational framework. The integrated landscape management operations **(operações integradas de gestão da paisagem OIGP)** apply a grouped management model, overseen by a management entity and funded by a long-term programme, in each AIGP. Stakeholders include local authorities, forest and agricultural producers' organizations,

[242] https://catedractv.es/wp-content/uploads/2016/10/2020-11-27-TA2030_PilotAction_LandscapeTransition_PT-Ana-Seixas.pdf

[243] https://www.dgterritorio.gov.pt/paisagem/ptp/oigp?language=en

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cooperatives, local associations, common land management entities, and collective investment organisms[244]. These OIGP groups initiate programmes for the reorganisation of land management (Programas de Reordenamento e Gestão da Paisagem PRGP). Contracts have been established between the Environmental Fund, the Directorate-General for Territory, the Institute for Nature Conservation and Forests, and promoting entities to provide technical and financial support for OIGP proposals. The government aims to complete the studies to initiate the agreement of 20 new programmes by the end of 2024[245].

In 2021, a pilot action was started to assess the effectiveness of landscape transition in promoting resilience to fires and coastal risks. Success factors included bottom-up and top-down stakeholder management and building trust among stakeholders[246].

4.3.3. SPATIAL PLANNING

The spatial planning law (Regime Jurídico da Reconversão da Paisagem RJRP)[247] has been altered several times in the last years to incorporate the landscape transition programme (Programa de Transformação da Paisagem PTP).

In Portugal, the planning system explicitly acknowledges biodiversity as a pivotal natural resource. The National Spatial Planning Policy Program (PNPOT), the reference framework for territorial programs and plans, includes ecological connectivity as a strategic objective. The incorporation of this 'new perspective' reveals a strategic approach to enhance biodiverse landscapes and bolster ecological connectivity. However, the practical translation of this commitment into applications, both in terms of instrument design and changes to territorial governance, is a complex and challenging process, as it involves the intervention of local and regional authorities that often do not have the necessary expertise to plan ecological connectivity.

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

At the **national level,** the National Spatial Planning Policy Programme (**Programa Nacional da Política do Ordenamento do Território PNPOT)**, updated in 2019, serves as the overarching framework for spatial planning in Portugal. The PNPOT establishes ecological connectivity systems as fundamental to territorial systems, including natural, social, economic, urban, and connectivity systems. The PNPOT identifies three types of ecological corridors as contributions to the Ecological Connectivity System:

- **Humid corridors**: established through the hydrographic network and associated with riparian systems, these corridors encompass marginal zones of rivers and lakes. They serve as preferential areas for biodiversity maintenance, species movement, and water cycle protection.
- **Mountain corridors**: Situated along the ridge of main mountain areas, these corridors provide refuge and movement pathways for key species. They are crucial for maintaining natural ecosystem equilibrium, air circulation, and water cycle regulation.
- **Coastal corridors**: Found along coastal and estuarine zones, these corridors safeguard coastal ecosystems' biodiversity and facilitate sea-land interconnection.

[244] https://www.dgterritorio.gov.pt/paisagem/ptp?language=en

[245] https://www.dgterritorio.gov.pt/paisagem/ptp?language=en

[246] https://catedractv.es/wp-content/uploads/2016/10/2020-11-27-TA2030_PilotAction_LandscapeTransition_PT-Ana-Seixas.pdf

[247] Decreto-Lei n.º 16/2022 de 14 de janeiro and Decreto -Lei n.º 28 -A/2020, de 26 de junho, que estabelece o regime jurídico da reconversão da paisagem (RJRP) https://files.dre.pt/1s/2022/01/01000/0018600205.pdf

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At the **local level**, the Municipal Master Plan (planos diretores municipais PDM) outlines the municipality's territorial development strategy, land use policies, and urban planning. It also defines the municipal territorial model, location options for collective facilities, and relationships with neighbouring municipalities. The PDM integrates national, regional, and intermunicipal programs' guidelines. The spatial planning law (Regime Jurídico dos Instrumentos de Gestão Territorial RJIGT) requires that the relevant content of the special plans for protected areas (Programas Especiais das Áreas Protegidas) must be transposed into the municipal master plans (Ferreira and Leitao, 2023).

The (**Política Nacional de Arquitetura e Paisagem PNAP)**, established in 2015, complements the PNPOT by focusing on landscape preservation, architectural heritage, and the promotion of sustainable land use practices. It recognizes the intrinsic value of landscapes in supporting biodiversity and ecological processes, emphasizing the need for their conservation and enhancement.

Reserva Ecológica Nacional (REN) delimitation: The land areas classified as Ecological Reserve under the REN regulations must be identified in regional and local plans. The delimitation of the REN can occur within the scope of the preparation, amendment or review of territorial plans, integrating the respective conditioning plans. The municipal authorities have the legal power to declassify REN areas in response to economic, social and cultural demands. Special committees, involving local authorities, and central and regional public agencies, manage the application of this regulation and manage conflicts. In situations where the REN delimitation, contained in a territorial management instrument, does not coincide with the delimitation operated by an autonomous act (an example of which is approvals occurring through Decree-Law no. 93/90, of March 19), its cartographic representation must be consulted with the territorially competent CCDR.

The landscape transition programme (Programa de Transformação da Paisagem PTP) and the establishment of the integrated landscape management areas (Áreas Integradas de Gestão da Paisagem AIGP) have been recently integrated into spatial planning and ecological connectivity.

Tools for ecological connectivity monitoring:

- The Ecological Reserve areas of the REN can be viewed through the territorial management system (Plataforma Colaborativa de Gestão Territorial PCGT) in the database of spatial management instruments (Instrumentos de Gestão Territorial)[248].
- The law requires the elaboration of Spatial Planning State Reports (REOT, **Relatórios do Estado do Ordenamento do Território**) at national, regional and municipal levels. These reports provide an overview of the current state of territorial planning in a specific area, typically at the national or regional level. They analyse various aspects of land use, urban development, environmental conservation, infrastructure, and socio-economic trends. REOTs are important tools for policymakers, planners, and stakeholders to understand existing challenges and opportunities in territorial planning and guide future decision-making processes.
- The OTU Observatory tracks and publishes **indicators of the connectivity corridors**, including quantification indicators (e.g., area percentage of corridors in each municipality) and quality indicators (e.g., ecological function performance evolution within the corridors. These indicators and the Spatial Planning State Report (REOT) are tools for evaluating the execution of PNPOT.
- **Cadastre of Designated Natural Values:** This is a comprehensive inventory or registry of areas that have been officially designated for their natural significance or value. It provides information about the location, extent, and characteristics of

[248] https://snit-sgt.dgterritorio.gov.pt/

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designated natural areas. It will be useful to identify areas of ecological importance to guide land use decisions, helping policymakers, planners, and stakeholders make informed decisions about land use, development, and conservation priorities. It has not been published yet.

4.3.4. FUNDING

FUNDING FOR PROTECTED AREAS

EU funding: The Portuguese **programme for the EU structural and cohesion funds** in 2014 to 2020 (POSEUR) funded a series of projects that supported the designation and management of protected areas in Portugal, including the revision of the protected area management plans of the natural parks, the designation of additional SACs, restoration projects in many of the natural parks, the reintroduction of lynx, and the Iberian wolf species protection plan. CAP instruments such as agri-environment contracts, Natura 2000 payments, and ecoschemes have limited benefits for protected areas and ecological corridors due to insufficient positive targeting of support to these areas and inadequate monitoring of impact.

National funds: The **Environmental Fund (Fundo Ambiental)** is the main finance for projects and initiatives aimed at environmental protection, sustainability, and climate action[249]. This includes funding for biodiversity conservation, ecosystem restoration, pollution control, renewable energy development, waste management, and climate change adaptation. It is primarily financed through environmental taxes and fees levied on activities that have an impact on the environment, such as pollution, waste generation, and resource extraction. In 2021, with the amendment made by Decree-Law no. 114/2021 of 15 December, the Permanent Forest Fund, the Innovation Support Fund, the Energy Efficiency Fund and the Fund for the Systemic Sustainability of the Energy Sector were abolished and added to the Environmental Fund.

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

There is no dedicated national funding. A decree passed in 2009 specifies that when Ecological Reserve areas are designated, landowners are eligible for compensatory funding[250]. However, there is no dedicated funding for this.

The Landscape Transformation Program introduces innovative mechanisms for medium to long-term financing. After the funding period of the Recovery and Resilience Plan (PRR) - investment RE-C08-i01, the Environmental Fund will provide support for 20 years through contracts with OIGP management entities.

EU funding has been the main source of funding for ecological connectivity initiatives. Portugal has had several **LIFE projects** relevant to ecological connectivity, mainly initiated by environmental NGOs:

- LIFE Eco-corridors (2015-2020): This project aims to create and manage ecological corridors in Portugal to improve connectivity between fragmented habitats.
- LIFE Rupis - Douro Natura (2015-2020): Focused on protecting threatened birds of prey like the Egyptian vulture and Bonelli's eagle in the Douro International Natural

[249] https://www.fundoambiental.pt/

[250] https://www.ccdr-lvt.pt/ordenamento-do-territorio/ren/regime-usos-e-acoes-em-areas-integradas-na-reserva-ecologica-nacional-ren/

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Park. It preserved their habitats and mitigated threats to indirectly enhance ecological connectivity.

- LIFE Saramugo - Conserving a Mediterranean Endemic Fish (2014-2019): Concentrated on conserving the Saramugo fish, an endemic species in Portugal, by restoring river habitats, enhancing water quality, and implementing conservation measures to improve ecological connectivity of freshwater ecosystems.
- LIFE WolFlux - Decreasing socio-ecological barriers to connectivity for wolves south of the Douro river (2018-2024): The project aims to promote the ecological and socio-economic conditions needed to support a viable wolf population in the south of the Douro river, including working with livestock producers, reducing and preventing coexistence conflicts and poaching, and improving genetic flux between populations.

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5. REGIONAL CASE STUDIES

GERMANY – LEIPZIG-HALLE

Figure 29. Leipzig. © Nieuwe Vecteezy Licenties

SPAIN – DOÑANA, ANDALUCÍA

Figure 30. Landscapes in the Doñana wetland, Andalucía, Spain. ©WWF-CEE

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5.1. GERMANY – LEIPZIG-HALLE IN SAXONY

This section presents the region Saxony and Saxony-Anhalt in which the case study area Leipzig-Halle is nested within. The German national framework for protected areas and ecological connectivity is described in Chapter 3.6.

5.1.1. LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

The nature conservation laws[251] of Saxony (SächsNatSchG) and Saxony-Anhalt (NatSchG LSA) specify the regulations from the federal nature conservation law in the state´s context. In addition to the national designation requirements, they add regionally specific habitats to the protected area category of protected habitat (SächsNatSchG §21, NatSchG LSA §22). They also deviate from the federal BNatSchG by listing exceptions to the permitted land-uses in the protected habitat areas. These exceptions take regional customs into account and thus apply to rock climbing and the permitted period of time for resumption of mineral extraction in protected habitat areas (SächsNatSchG §21 (2), (5)) or for maintaining the functionality of dykes and dams (NatSchG LSA §22 (2)). Both laws also implement the protection and maintenance of the European Natura 2000 Network by granting the option for executive order to put the respective areas under protection (SächsNatSchG §22, NatSchG LSA §23).

5.1.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

The SächsNatSchG states that the biotope network shall be spatially balanced and shall especially consider forest, forest edges, tree-lined avenues and rivers as possible connecting structures. In case of insufficient connectivity, long term measures are to be taken to increase the spatial dimension of these connecting elements (SächsNatSchG §21a).

The planning of ecological networks in Saxony-Anhalt is much more decentralized, although following similar objectives than in Saxony. The planning of supra-local biotope network systems in Saxony-Anhalt includes comprehensive biotope network planning at both regional and supra-regional level.[252]

The implementation of the biotope networks in both federal states is part of a broader set of instruments for the protection of species and habitats as well as conservation of the cultural landscape as detailed in the regional biodiversity strategies.[253] This program lists four instruments: ‘Agrarian Environment and Climate Measures’, Insect Protection and Biodiversity’, ‘Pond Economy and Nature Conservation’ and ‘Natural Heritage’. With respect to the Natura 2000 network, consisting of special area of conservation (Flora-fauna habitats) and special protection area (Birds Directive), both federal states require the consultation of land users, area managers and regional coordinators for the establishment of focus nature conservation stations in especially valuable areas. The federal states can obtain ecologically valuable areas in the case the measures do not bring the desired results.

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[251] SächsNatSchG as described online at https://www.natur.sachsen.de/naturschutzgebiete-7998.html and NatSchG LSA https://landesrecht.sachsen-anhalt.de/bsst/document/jlr-NatSchGST2010rahmen

[252] Ökologisches Verbundsystem (ÖVS), https://lau.sachsen-anhalt.de/naturschutz/landschaftsplanung, accessed 26.06.2024.

[253] Sachsens Biologische Vielfalt 2030 https://www.natur.sachsen.de/download/Programm_Sachsens_Biodiv_2030.pdf, Biodiversitätsstrategie des Landes Sachsen-Anhalt https://mwu.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MWU/Umwelt/Naturschutz/Biodiversitaet/Biodiversitaetsstrategie-final.pdf, accessed 26.06.2024.

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5.1.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The Spatial Planning Acts of Saxony (SächsLPlG) and Saxony-Anhalt (LEntwG LSA) do not explicitly mention ecological connectivity, but as they are guided by the principles of the federal spatial planning law (ROG), some passages address connectivity indirectly or paraphrased. In the paragraphs on the regional plans, which are the second level of spatial planning, the law regulates the necessity to develop and secure regional green corridors (SächsLPlG § 4 (2) 5, LEntwG LSA § 9 (2)). The laws explicitly state the need to consider preventive flood protection in spatial planning, however without specifying if this is to be accomplished by nature-based or engineering solutions. Then requirement for spatial planning of lignite open cast mining sites is explicitly stated, including the requirement for restoration of abandoned mining sites, this takes the substantial impact of lignite mining on the landscape into account and has special importance for the southern area of the case study region. The federal planning laws mandates the inclusion of the accepted nature conservation associations (cf. SächsNatSchG § 32, NatSchG LSA §29) as stakeholders in the spatial planning procedures (SächsLPlG § 6 (1), 4). The SächsLPlG also mandates that an environmental impact assessment (EIA) during the spatial planning process must consider compatibility with the conservation objectives of the Natura 2000 areas (SächsLPlG § 2 (2)) while in Saxony-Anhalt an EIA is required without explicitly mentioning Natura 2000 areas (UVPG LSA). The EIA environmental report is to be included in the spatial plans and has to be made publicly available during the planning process (SächsLPlG, § 6 (2), LEntwG LSA § 7 (5)).

5.1.4. FUNDING

FUNDING FOR PROTECTED AREAS

The federal state of Saxony has set up a nature protection fund to provide funding for nature conservation as well as science, education and public awareness building about nature protection issues, according to the regional nature conservation law (SächNatSchG, § 45). The fund is fed by the compensation payments that are required for environmental damage of land development, but also by donations and other payments targeted at environmental protection (SächsNatSchG, §45(2). It funds: [254]

- Projects to stimulate research and model studies in specific areas of nature conservation and to promote landscape conservation,
- Support and promotion of measures for education, training and further education,
- Securing of land by the leasing, acquisition and other lawful measures for the purposes of nature conservation and landscape management, either by itself or by local authorities or nature conservation associations,
- Maintenance and development measures of environmental conservation in protected areas or other areas that are not formally protected,
- Support of scientific and other studies and publications about nature in Saxony

Beyond small-scaled budgets many programmes for nature conservation in Saxony and Saxony-Anhalt are to a large extent co-financed by the EU, such as with funding from EAFRD, ERDF, ELER, and LIFE.

[254] Staatsmininsterium für Energie, Klimaschutz, Umwelt und Landwirtschaft (SMEKUL): https://www.natur.sachsen.de/naturschutzforderung-6926.html (accessed 26.06.2024)

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FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

The regional biodiversity strategies envision financial support to meet the requirements of ecological land use and the establishment of linear structures and structural diversity in ecological corridors, but funding needs are described only generally without stating financial volume or source[255].

Beside funding on EU and national level available to both federal states, Saxony-Anhalt supports the coordination offices of the nature conservation associations recognised under the Nature Conservation Act and active throughout the state, as well as the supporting associations of Saxony-Anhalt's nature parks. The project funding is provided to support the coordination of voluntary nature conservation work and the realisation of the nature parks' objectives.[256]

The Saxony regional government provides funding to its local authorities for spatial planning and land use planning, but the funding is not currently delivering ecological connectivity. The objective of the funding is to plan and buy land for new industrial and business parks, with the highest funding rate of 75% of total costs going to authorities that set up parks of over 50 ha in size within three years[257]. The regional government has set a requirement that developments on open land outside urban developments should only be carried out if there are no feasible options on derelict industrial land and within the urban zone and rules out funding for any developments on flood prone areas, but there is no explicit condition that requires the consideration of ecological connectivity. There is also no condition that encourages the inclusion of such measures in the funding, though in justified cases the funding can also cover costs related to the basic services of the landscape and green space plan delivered by architects and engineers[258].

[255] https://www.natur.sachsen.de/download/natur/Programm_Sachsens_Biodiv_2030.pdf., p.19, 20, accessed 26.06.2024

[256] Naturschutzförderung in Sachsen-Anhalt https://mwu.sachsen-anhalt.de/umwelt/naturschutz/foerderung-naturschutz#c293258, accessed 26.06.2024.

[257] Sächsisches Staatsministerium für Regionalentwicklung. 'Freistaat unterstützt Planung von Gewerbegebieten für Industrieansiedlungen'. Press release 10.01.2023. Sächsische Staatskanzlei. https://www.medienservice.sachsen.de/medien/news/1060772

[258] https://www.gesetze-im-internet.de/hoai_2013/anlage_5.html (in German)

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5.2. SPAIN – DOÑANA IN ANDALUCIA

As a federal country, in Spain the national government provides the legal framework for nature conservation, but the competence lies mostly with the regions. For marine areas, the authority rests with the central government (currently the Ministry for Ecological Transition and Demographic Challenge - MITERD - through the Directorate General for Biodiversity, Forests, and Desertification, pending the approval of the MITERD's structural Royal Decree).

The regions or autonomous communities (Communidades Autonomas) are responsible for implementing national policy into their regional laws and can also generate their own regional nature conservation legislation. They assume responsibility for managing the natural environment, particularly the terrestrial Natura 2000 protected areas. Marine Natura 2000 protected areas may also fall under the jurisdiction of regional governments when ecological continuity with the corresponding territory is recognized. The competencies of Public Administrations regarding marine biodiversity are determined by Article 6 of Law 42/2007, of December 13, on Natural Heritage and Biodiversity. The Autonomous Communities and Cities declare and manage Natura 2000 sites within their territorial scope. They report these actions to the Ministry for Ecological Transition and Demographic Challenge for official communication to the European Commission.

5.2.1. PROTECTED AREA NETWORK (TERRESTRIAL)

The national law defines the categories of protected areas. As the autonomous communities have their own legislation on protected areas, there are currently over 40 different designations of protected areas in Spain. Some of these are recognized as equivalent to national categories, and these designations are grouped in Spanish statistics into a central network of protected areas. Regional legislation is not defined by national categories and not related to any IUCN protection categories.

TYPES OF DESIGNATED PROTECTED AREAS (NOT INCLUDING NATURA 2000 & INTERNATIONAL)

Table 24. National and regional designation types, protection purpose and governance in Spain. Sources: (Underwood et al, 2014), (EUROPARC-España, 2024), Environment Ministry MITERD[259]

National protected area designation types	Designation purpose and governance
Park (National and Natural)	These are large areas of high ecological and cultural value, characterized by their high naturalness and lack of modification by human activities. Their representation of ecosystems makes their preservation a national priority, where the uniqueness of flora, fauna, geology, or geomorphology holds ecological, aesthetic, cultural, educational, and scientific value, justifying preferential protection.
Nature Reserve	This designation aims to protect ecosystems, plant and animal communities, or other biological elements important for their rarity, fragility, ecological importance, and/or uniqueness. It includes areas designated for minimal intervention (known as 'integrated') and areas

[259] https://www.miteco.gob.es/es/biodiversidad/temas/espacios-protegidos/espacios-naturales-protegidos/enp_categorias.html

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	requiring management to maintain their natural value (known as 'managed').
Natural Monument	These are natural areas with unique, rare, and beautiful characteristics deserving special protection due to their scientific, cultural, and/or landscape value. This may include individual trees, geological features including type sites, fossil or mineral deposits, and other special landscape features.
Protected Landscape	Areas of protected landscape due to their natural, aesthetic, and cultural characteristics, in accordance with the European Landscape Convention.
Marine Protected Area	Designated natural spaces for the protection of ecosystems, communities, or biological or geological elements of the marine environment, including intertidal and subtidal zones, which, due to their rarity, fragility, importance, or uniqueness, deserve special protection.
Regional protected area designations in Andalucía	
Protected areas defined by the autonomous communities	Concerted Nature Reserve, Wild Fauna Reserve, Managed Nature Reserve, Special Nature Reserve, Integral Nature Reserve, Partial Nature Reserve, Fauna Reserve, Fauna Refuge, Integral Reserve, Marine Reserve.

Natura 2000 Network: The Natura 2000 network covers 27.39% of the terrestrial area, with 1 468 SCI/SACs and 662 SPAs (EUROPARC-España, 2024). Many sites are designated under both directives (i.e. both SCI and SPA).

OECMs: The following areas have been proposed as OECMs, of which over half are not considered to be protected areas under Law 42/2007 (Rodríguez-Rodríguez, Sánchez-Espinosa and Abdul Malak, 2021):

- Spanish Wetlands Inventory
- Marine reserves for the protection of fishery resources
- River reserves - rivers or sections of river that retain their natural structure and dynamics
- Hunting reserves
- Public Utility Forests and Protective Forests (private)
- Critical areas for species

Overlaps and protection levels: Nearly half (47%) of the Natura 2000 sites also have other national or regional designation(s) (parks, reserves, monuments, landscapes, and marine areas) (EUROPARC-España, 2024).

Total protected area coverage: Spain has secured protection for 36.7% of its land and 12.3% of its oceanic regions. In 2023, Spain had a total of 1 840 national protected areas, over 1 857 spaces recognized as Natura 2000 sites, and approximately 170 areas protected by international instruments (EUROPARC-España, 2024).

Transboundary protected areas:

- The Gerês-Xurés Transboundary Biosphere Reserve, spanning the Peneda-Gerês National Park in Portugal and the Baixa Limia-Serra do Xurés Natural Park in Spain,

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is a vital area for biodiversity, encompassing diverse ecosystems such as forests, wetlands, and high-altitude grasslands.

- Pyrenees-Mont Perdu World Heritage Site: Although not strictly a Transboundary Protected Areas in the conventional sense, the Pyrenees-Mont Perdu is a transboundary World Heritage Site located in the Pyrenees mountains between France and Spain.

LEGAL AND GOVERNANCE MECHANISMS FOR PROTECTED AREAS

In 2023, there were 16 national parks, 154 natural parks, 294 nature reserves, 367 natural monuments, 67 protected landscapes, and 2 marine protected areas declared, along with the Natura 2000 network and over 800 spaces with other designations developed by the autonomous communities (EUROPARC-España, 2024). The Spanish terrestrial protected areas also include many protected by international instruments: Internationally Important Wetlands under the Ramsar Convention (76); Natural sites on the World Heritage List under the Convention concerning the Protection of the World Cultural and Natural Heritage (6); Geoparks designated by UNESCO (15); Biosphere Reserves declared by UNESCO (53); Biogenetic Reserves of the Council of Europe.

Most of the protected terrestrial area is privately owned.

Management planning: Spanish law defines two types of management plan for protected areas: the natural resources management plan (PORN) and the management and use plan (PRUG). [260]

PORN: A National Park or Nature Reserve can only be designated once its natural resources management plan has been approved. This plan defines the site objectives and conservation measures. The law states that objectives and measures should go beyond the borders of the protected area, to set objectives for the ecological connectivity of the site. Some protected areas are also required to develop a public access plan.

PRUG: These plans must be developed within two years and expire every ten years. They define the spatial planning (opportunities, what can and cannot be done).

Progress has been made with management planning but there are still deficiencies, and many sites still follow an outdated and expired management plan. During the 2022-2023 period, four PORNs and three PRUGs were approved and one PRUG was modified. As of 2023, 81% of national parks and 58% of natural parks have an approved PRUG (EUROPARC-España, 2024).

The Governing Boards and Boards of Trustees (Las Juntas Rectoras y los Patronatos) are management and participation bodies for protected natural areas, representing institutions and groups directly involved in the management of the protected area. Natural Parks have Governing Boards, while National Parks, Natural Landscapes, and internationally important Nature Reserves have Boards of Trustees. This is an area where entities can interact with the managers of protected areas, providing advice on the space.

Natura 2000: as of December 2023, management instruments for nearly 90% of Natura 2000 sites have been approved, with an additional 4% currently in the process of being processed (EUROPARC-España, 2024). This is a significant improvement on the situation in 2022, when 176 SCIs had not yet been designated as SACs and therefore, site specific conservation objectives and measures had not been established for these SCIs.[261] However, in 12 of the

[260] Ley 42/2007 del Patrimonio Natural y la Biodiversidad, modified by Ley 33/2015

[261] COMMISSION STAFF WORKING DOCUMENT Environmental Implementation Review 2022. COM(2022)438. Country Report – SPAIN https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2022)438&lang=en

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regions, the quality of the conservation objectives is considered insufficient, and some experts consider there is still a need to designate more sites for birds to protect all areas currently designated as Important Bird Area (Naumann et al, 2022).

5.2.2. ECOLOGICAL CONNECTIVITY STRATEGY / LEGAL FRAMEWORK

LEGAL AND GOVERNANCE MECHANISMS

National strategy for green infrastructure and ecological restoration: Spanish law has set the legal basis for a national green infrastructure strategy for green infrastructure and ecological restoration and connectivity since 2007.[262] In the 2015 revision of the national nature conservation law, the government was required to publish a national green infrastructure and nature restoration strategy within three years. [263] The National Strategy for Green Infrastructure and Ecological Connectivity and Restoration (2022-2024), produced by the National Commission on Natural Heritage and Biodiversity, was approved by the Spanish government on 9 July 2021 (MITERD, 2021). The ministry has also published a guidance document on how to identify green infrastructure in Spain.[264] According to the national law, the 17 Spanish regions must produce their own regional strategy following the national strategy's directives within three years, i.e. by July 2024. The government must evaluate its impacts in 2030, 2040 and 2050. In January 2024, the government convened the First Work Programme of the General State Administration of the strategy, outlining the objectives to be achieved over a three-year period.

The strategy does not define the legal basis for the ecological network designation, and it recognises that any legal basis would have to be embedded in the regional legislations, including the sectoral legislative frameworks for transport, urban development, energy, water, forestry and agriculture. It also recognises that there is a need to achieve the recognition of green infrastructure management and restoration needs in impact assessments (EIA and SEA[265]).

The national strategy defines three general objectives, 8 aims, and 50 lines of action (MITERD, 2021). The first aim is to define a basic national ecological network. The network should consist of:

- **Nuclear areas** – areas where biodiversity protection is the priority objective: any kind of protected area; other well-conserved habitats or ecosystems or areas of high ecological value outside protected areas; systems and areas with high nature value because of sustainable agricultural practices.
- **Ecological corridors** – physical links between nuclear areas which maintain ecological connectivity. The Spanish law provides a definition of ecological corridors.
- **Multifunctional elements** – area under sustainable management or ecological restoration which maintains or restores ecosystem services.
- **Buffer zones** – transition area with compatible land uses that protects the ecological network from pressures.

[262] Article 15 of Ley 42/2007 del Patrimonio Natural y la Biodiversidad, modified by Ley 33/2015

[263] Ley 42/2007 del Patrimonio Natural y la Biodiversidad, modified by Ley 33/2015

[264] AGE (2021) Guía metodológica para la identificación de la infraestructura verde en Espana. Administración General del Estado. MITECO, Madrid. https://www.miteco.gob.es/es/biodiversidad/temas/ecosistemas-y-conectividad/infraestructura-verde/iv_guia_metodologica.html

[265] Environmental Impact Assessment (Evaluación Ambiental de Planes, Proyectos y Programas) and Strategic Environmental Assessment (Evaluación Ambiental Estratégica)

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- **Urban green areas and elements** – e.g. parks, gardens, recreational areas, reservoirs and canals, green roofs and walls.

The elements of the basic network should be declared formally by the public administrations.[266] The declaration must include: 1) spatial delineation, 2) identification of spatial and ecological characteristics and functions that make it a green infrastructure element, 3) indicators that measure each of the defining characteristics and functions, 4) objectives to be achieved, 5) administrative authority responsible for designation and management, 5) any other relevant information. The strategy also requires a process of evaluation of the conservation status, connectivity contribution, and restoration needs of all the integral elements, and a process to increase knowledge. The network elements can be either declared for protection because of their existing value for biodiversity conservation and/or ecosystem services (level 1 - IVC) or for ecological restoration to improve their value (level 2 - IVR).[267]

Several Autonomous Communities (CC.AA.) in Spain incorporate elements of ecological connectivity into their planning processes (MITERD, 2021). Territorial planning in regions like the Basque Country, Catalonia, Navarra, Murcia, Galicia, Valencia, Balearic Islands, Aragon, and Canary Islands includes these elements, with Catalonia detailing partial territorial plans that outline corridors. Specific connectivity promotion plans, such as the Master Plan for Improving Ecological Connectivity by the Junta de Andalucía, also exist. Additionally, sectoral plans, particularly in forestry, address connectivity. The Spanish Forest Plan mentions connectivity specifically regarding the National Livestock Routes Network, which is reflected in regional forest plans in Cantabria, Madrid, Extremadura, Canary Islands, Basque Country, Aragon, Andalusia, and Catalonia, some of which further promote, define, and restore ecological corridors.

Management and planning of protected areas can also incorporate connectivity goals and measures to ensure functional links between different ecosystems. Examples include the PORN of Montgró (Alicante), the Natura 2000 Management Plan for Sierra de Cantabria and the Southern Sierras of Álava, the PORN of Los Alcornocales (Cádiz), and the PORN and PRUG of Doñana Natural Space. At the municipal level, urban and peri-urban natural environments are managed to protect connectivity, with local instruments like the Special Plan for the Protection of Natural Heritage in Granollers, the Green Ring of Terrassa, and the Green Infrastructure and Biodiversity Plan of Madrid, among others.

State Strategic Plan for Natural Heritage and Biodiversity 2030 (approved in 2022)[268]

One of the strategy's main objectives is to develop a well-managed, ecologically representative network of protected areas that support natural processes and conserve habitats, geological heritage, and wildlife. In line with the Government's Climate and Environmental Emergency Declaration, new marine protected areas will be established to protect 30% of marine areas by 2030, with eight new sites added to the Natura 2000 network by early 2024 and additional proposals to achieve at least 18% marine protection by 2024. Following the EU's 2030 Biodiversity Strategy, which targets 30% protection of terrestrial and marine areas with one-third under strict protection, new strictly protected areas will be designated, or existing protections revised, to achieve 10% strict protection in the EU by 2030.

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[266] Pp 21-22 in (MITERD, 2021).

[267] The value is measured on a scale of three for the two axes biodiversity conservation and ecosystem services. Those areas that are assessed with the top value for both criteria or either are assigned to conservation; those areas that are assessed as of middle value for both or one of the criteria and lower value for the other are for restoration. Areas assessed with low values for both are not included in the network.

[268] Real Decreto 1057/2022 at https://www.boe.es/eli/es/rd/2022/12/27/1057/con

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Strategy for the Defragmentation of Transport Infrastructures ('Estrategia de Desfragmentación infraestructuras de transporte')[269]

It aims at mitigating habitat fragmentation caused by transport infrastructures. It facilitates wildlife movement, reduces accident risks, and enhances Green Infrastructure. Key measures include improving signage, adjusting speeds in high-risk areas, and installing fencing to prevent unsuitable crossings. For over 20 years, the Ministry for Ecological Transition and Demographic Challenge has coordinated efforts involving regional and state experts. This strategy sets national goals and actions to address fragmentation, ensuring ecosystem conservation and biodiversity. Its approval is imminent, marking a significant step forward in national conservation efforts.

Andalucía Directive Plan for Improving Ecological Connectivity[270]

The region of Andalucía published a plan for improving ecological connectivity in 2018. The plan presents a method for identifying and mapping strategic areas for ecological connectivity, including an index of connectivity. It identifies four types of area:

- Landscapes of value for ecological connectivity[271]: defined according to national strategy.
- Priority areas for intervention[272]: defined according to national strategy.
- Areas of reinforcement[273]: with lower priority for connectivity but support function and maintain integrity of the landscapes and priority areas.
- Pilot areas[274]: areas for restoration of capacities to deliver ecological connectivity.

Each identified area is described in a fiche that identifies the protected areas present, the ecological functions and structures, and the barriers and fragmentation caused by rural land use change, electricity infrastructure, and transport.

Doñana, the NaturaConnect case-study, falls within the Doñana-Sierra Morena priority zone API01.

Priority zone API01 Doñana-Sierra Morena[275]

The Framework for Priority Action (API) defines the needs for preserving and strengthening ecological connectivity between the ecosystems of the Doñana region, the Guadalquivir estuary, and the western coast of Huelva, as well as between these areas and the forested ecosystems of Andévalo and Sierra Morena. The API addresses challenges posed by landscape simplification and the loss of natural and forested areas, which have hindered ecological flows over the years. It promotes habitat conservation and restoration efforts, including the protection of native plant species and the management of invasive species and waste. Additionally, the API supports monitoring initiatives for avifauna and encourages citizen involvement in conservation activities. While facing obstacles such as intensive agriculture and road infrastructure development, the API's actions aim to improve ecological connectivity, benefiting emblematic species and a variety of native flora and fauna. Through collaboration with local communities and stakeholders, as well as regional lynx

[269] https://www.miteco.gob.es/es/biodiversidad/temas/ecosistemas-y-conectividad/conectividad-fragmentacion-de-habitats-y-restauracion/fragm-documentos-grupo-trabajo.html

[270] Junta de Andalucía (2018) Plan Director para la Mejora de la Conectividad Ecológica at https://www.juntadeandalucia.es/sites/default/files/2021-06/PDMCEA_areas_estrategicas_2018.pdf

[271] Paisajes de interes para la conectividad ecologica

[272] Areas Prioritarias de Intervencion

[273] Areas de Refuerzo

[274] Areas Piloto

[275] Pp79-90 in Junta de Andalucia (2018) ibid

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conservation programs, the API works to enhance organism mobility along the coastal axis and between coastal and forested areas.

Land stewardship agreements for nature protection (Acuerdos de Custodia del Territorio)

Spanish law provides a legal framework for land stewardship agreements, which are voluntary agreements between landowners and public or private stewardship entities, made up of a diverse range of civil society agents. Spanish law does not define a minimum length for agreements nor whether the agreement goes with the land (an easement) or is ended when the land changes ownership. In most cases, the landowner continues to use the land under the agreement in a way that is compatible with the conservation objectives, but in some cases the agreement involves the stewardship entity obtaining the land rights and taking over land management. The ministry maintains a registry of all agreements including their geographical location.

The Forum of Stewardship Networks and Entities (FRECT) has been created to represent the stewardship entities, led by the Biodiversity Foundation. In 2023, the Biodiversity Foundation presented the 2023-2027 Strategy of the Land Stewardship Platform, a framework of shared work and strategic objectives aimed at addressing the emerging demands identified in the field of land stewardship in Spain (EUROPARC-España, 2024).

Up until 2019, 3 100 agreements had been signed by 218 entities to protect nearly 578 000 hectares of land across Spain, in addition to 123 hunting agreements with 27 entities (Prada, Fundación Biodiversidad and MITERD, 2019). Slightly less than half of these agreements cover lands within a Natura 2000 site, or land partially within and partially outside the network. Around two-thirds of the agreements concern private lands. The rest are on public lands: 16% are on lands owned by municipalities; and 4% are on public domain lands. More than half (56%) are written agreements; 11% are territorial agreements; 9% are verbal agreements; and 8% are agreements to cease land use for a specified period. A third of the agreements cover forest land; most of the rest are on agricultural lands; rough grazing lands; or riparian areas or wetlands. The conservation objective of the agreement is conservation of animal species on 69%, restoration of habitats on 8%, and conservation of habitats on 3% of the total area under agreement in 2019.[276]

In **Doñana**, the SEO/BirdLife's ‘Alzando El Vuelo’ project involves a land stewardship agreement.

Custodio del Territorio in Doñana

SEO/BirdLife and the Guadalquivir Hydrographic Confederation (CHG) have collaborated on a land stewardship agreement concerning the El Partido stream in Almonte, Huelva.[277] The agreement[278] incorporates approximately 3 000 hectares of CHG-owned land within the Doñana Natural Space. This area boasts significant natural value, hosting diverse fauna and flora of conservation importance and serving as a potential ecological corridor. The agreement focuses on conservation efforts to enhance biodiversity, particularly by increasing the presence of key species and indicators of ecosystem health. Additionally, it aims to restore habitats through native plant conservation, reforestation, invasive species management, and waste removal. Monitoring of avifauna, including census-taking and scientific ringing campaigns, will be conducted. The agreement also promotes citizen involvement, emphasizing outreach, awareness-raising activities, and citizen science

[276] Examples are the Lurgaia Foundation's work in the recovery and restoration of Atlantic forests, the environmental organization GOB Menorca in the agricultural sector, and the Galician Land Stewardship Association (ACGT) from ‘Terra Cha’ to the Ancares region.

[277] Resolución de 20 de diciembre de 2023, de la Confederación Hidrográfica del Guadalquivir, O.A., por la que se publica el Convenio con la Sociedad Española de Ornitología, para la custodia del territorio en fincas situadas en El Arroyo del Partido, en Almonte (Huelva).

[278] detailed in the Official State Gazette (BOE) (No. 309, December 27, 2023)

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initiatives within SEO/BirdLife's Doñana programs. Furthermore, an international volunteering program is in place, enabling youth from across Europe to participate in various activities during extended stays. A Monitoring Committee, comprising representatives from CHG and SEO/BirdLife, will oversee the agreement's implementation. Initially set for four years, the agreement may be renewed in accordance with legislation.

5.2.3. SPATIAL PLANNING

SPATIAL PLANNING TOOLS FOR ECOLOGICAL CONNECTIVITY

The national law requires the property registers to include information considered important for green infrastructure.

The national strategy foresees the development of processes of participation in the identification of green infrastructure that should include the active intervention of affected or interested experts, organisations, sectors and social agents. It also specifies that all information should be accessible to the public. It does not however define how the regional authorities should do this.

Water sector: The river reserves (Reserva fluvial) - designated to retain the natural structure and dynamics of the river - have a high potential to contribute to ecological connectivity (Lázaro et al, 2021). These areas overlap with protected areas but also cover unprotected areas that are still in a natural or semi-natural environment, and so play a critical role in freshwater connectivity. They are managed by the river basin authority. In contrast, potential flood risk areas are not managed with a focus on nature conservation objectives and some interventions to reduce flood risk can have negative impacts on biodiversity.

An example of a project financed by the PIMA Adapta program to improve hydrological connectivity and habitat quality in the meanders of the lower Arga River. It aims to restore natural processes, enhance habitat for aquatic species, and adapt water management practices to climate change. Activities include channel restoration, riparian buffer creation, and sustainable water management. The project enhances habitat and resilience to climate change while promoting integrated water management approaches. The Environmental Impulse Plans (PIMAs) serve as a tool for implementing measures to combat climate change, aiming to improve the environment, stimulate economic development, and promote job creation. They incentivize low-carbon economic activity and strengthen the resilience of intervened systems (MITERD, 2020c).

Transport sector: The environment ministry (MITERD) working group on fragmentation of habitats by transport infrastructure[279] has published a series of guidance documents to aid local authorities to take measures to reduce road fragmentation: The effects of edge and margin effects of transportation infrastructures and mitigation of their impact on biodiversity, published in 2019. Technical specifications for effective monitoring of mitigation measures for the barrier effect of transportation infrastructures (design, documentation, and environmental monitoring tracking), published in 2020.

WWF, in collaboration with the Universidad Politécnica de Madrid, authored a report on ecological connectivity in the Iberian Peninsula, advocating for the establishment of ecological corridors to connect areas within the Natura 2000 Network. The findings offer vital information to inform environmental and sectorial policies, including land planning, agriculture, and transportation, thus aiding Spain in fulfilling its biodiversity conservation obligations. This comprehensive perspective also holds promise for fostering ecological connectivity across

[279] Grupo de Trabajo sobre fragmentación de hábitats causada por infraestructuras de transporte at https://www.miteco.gob.es/es/biodiversidad/temas/ecosistemas-y-conectividad/conectividad-fragmentacion-de-habitats-y-restauracion/fragm-documentos-grupo-trabajo.html

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European nations. Within the study, 12 ecological corridors and 17 critical areas for connectivity were identified.

The integration of protected areas into Catalonia's strategic green infrastructure planning (EUROPARC-Spain, 2024). The Generalitat de Cataluña is working on planning green infrastructure in line with the mandate of Law 42/2007 on Natural Heritage and Biodiversity. This involves identifying areas with significant biodiversity and ecosystem services, as well as those crucial for ecological connectivity. As a result of the analysis work, several cartographic products on ecological connectivity have been generated for Catalonia. These include an Ecological Connectivity Index (ECI) with a pixel resolution of 20 meters, a map illustrating the main and complementary terrestrial and riverine connectors concerning protected areas, identification of critical points for ecological connectivity within the defined connectors, and delineation of areas of interest for terrestrial and marine-terrestrial-riverine connectivity.

The Methodological Guide for the Identification of Green Infrastructure Elements in Spain (GMIVE) offers unified methodologies for identifying and mapping territorial elements for the Green Infrastructure network. This dynamic guide includes methodologies for evaluating ecosystem services and ecological connectivity. It focuses on integrating areas with high ecosystem service provision and key biodiversity conservation areas, analysing both terrestrial and fluvial connectivity. The guide aims to establish a Green Infrastructure network that supports biodiversity conservation and ecosystem service provision, classifying elements for either conservation or restoration.

5.2.4. FUNDING

FUNDING FOR PROTECTED AREAS

The Ecological Restoration and Resilience Fund (Fondo de Restauración Ecológica y Resiliencia) was created in 2021 from the Spanish Recovery and Resilience Facility of the NextGenerationEU funds.[280] The fund is managed by the Environment Ministry (Ministerio para la Transición Ecológica y el Reto Demográfico). It has broad environmental funding objectives including nature conservation, coastal protection, and climate change adaptation[281].

FUNDING FOR ECOLOGICAL CORRIDORS OR STEPPING STONES

In Spain, applicable European funds include the European Regional Development Fund (FEDER), the European Social Fund (ESF), the European Maritime and Fisheries Fund (EMFF), and the European Agricultural Fund for Rural Development (EAFRD). LIFE projects, European Territorial Cooperation (Interreg), and Horizon projects are also relevant.

EU funded projects that have contributed to ecological connectivity in Spain include:

- LIFE Zaragoza Natural - Creation, Management, and Promotion of Zaragoza's Green Infrastructure (LIFE12 ENV/ES/000567)
- LIFE CAÑADAS - Conservation and Restoration of Livestock Routes to improve biodiversity and connectivity of Natura 2000 sites in Spain
- INTERREG project 'Development of Green Infrastructure in the cities of central Portugal and Castilla y Leon as a strategy for climate change adaptation' (INTERREG POCTEP: 0485_CIUDADES_VERDES_CENCYL_3_E)

[280] https://www.cetenma.es/espana-aprueba-el-fondo-de-restauracion-ecologica-y-resiliencia-dotado-con-200-millones-de-euros/

[281] Real Decreto 690/2021 at https://www.boe.es/boe/dias/2021/08/04/pdfs/BOE-A-2021-13267.pdf

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National funding lines aimed at broader objectives such as protected area conservation, ecological improvement of the environment, or climate change adaptation could potentially contribute to improving ecological connectivity through green infrastructure. A project is currently developing a national funding guide for green infrastructure projects (see box below).

Private landowners and companies can contribute to green infrastructure financing through land stewardship agreements (see above).

PROCONECTA 212 project [PROCONECTA 21. Integración de las áreas protegidas en el territorio: alianzas, conectividad ecológica e infraestructura verde]

The PROCONECTA 212 project aims to provide guidance and clarify the conceptual framework for green infrastructure in response to the European Biodiversity Strategy 2020, which emphasized ecosystem maintenance and the restoration of degraded ecosystems. The project is carried out by the Fernando González Bernáldez Foundation and EUROPARC Spain with support from the Biodiversity Fund of the Spanish environment ministry (Ministerio para la Transición Ecológica y el Reto Demográfico). This project seeks to address questions arising from the growing interest in green infrastructure and the proliferation of related initiatives across various disciplines, sectors, and entities. It builds on the National Strategy for Green Infrastructure, Connectivity, and Ecological Restoration, approved in Spain in 2020, which requires autonomous communities to develop their own strategies for ecological connectivity and ecosystem functionality within three years. The report offers a comprehensive overview of various public and private funding sources that can be utilized to develop the integrated approach to green infrastructure throughout the territory.

Sources: PROCONECTA 21. Integración de las áreas protegidas en el territorio: alianzas, conectividad ecológica e infraestructura verde DOCUMENTO DE ORIENTACIONES June 2021. https://fungobe.org/wp-content/uploads/2022/04/Documento_orientaciones_PROCONECTA21_Junio2021.pdf

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Appendix 2: Literature review indicators table

Review indicator category	Corresponding research question	(Example) field values
Paper/Source	Identification of records	Authors, title, DOI, (citation)
Date published	When were the sources published, are there trends in publication numbers?	Year of publication
Type of source /	How is the subject ecological connectivity/ green infrastructure covered in different categories of literature sources?	Peer-reviewed papers, 'grey' literature, book(chapters)
Publisher	In which journals are the topics of interest covered?	Name of the journal/ publisher
'Type' of paper	What proportion of the published papers builds on original research?	Research paper, review paper
Context [ecology, planning, politics, …]	In addition to ecology (cf. ecology-oriented search strings), what contexts is the research about?	Urban ecology, Planning, Administration, Politics, ...
Governance impact reported in paper	What is the focus of the paper, governance impacts of connectivity implementation/planning or fragmentation?	Governance impact on connectivity or fragmentation?
Barriers	Is any barrier for implementing an ecologically representative, resilient and well-connected TEN-N mentioned in the paper?	Lack of funding, lack of legislation, lack of coordination, …
Drivers	Is any driver for implementing an ecologically representative, resilient and well-connected TEN-N mentioned in the paper?	Land abandonment, urban renewal, agricultural change, …
Types of connectivity	What type of connectivity is the paper analysing?	Corridors, stepping stones, …
Best practices in policies and governance frameworks	Which best practices (if any) are mentioned in the paper?	Stakeholder engagement, legal tools, financial tools, …
Countries/regions/areas of connectivity/fragmentation studies	In which countries and regions are connectivity/ fragmentation researched?	Country, region, city
Spatial scale	On what spatial scale is connectivity/ fragmentation analysed?	City districts, urban area, field scale, local, regional, national, supra-national scale

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Search string for the literature review:

(all ‘spatial*’ OR ‘plan*’ OR ‘poli*’ OR ‘govern*’ AND (‘infrastructur*’ W/5 ‘green’ OR ‘infrastructur*’ W/5 ‘blue’) AND (‘habitat’ W/5 ‘connect*’ OR ‘habitat’ W/5 ‘fragment*’) OR (‘species’ W/5 ‘turn*over’) OR (‘species’ W/5 ‘move*’ OR ‘isolat*’) AND PUBYEAR > 2010 AND PUBYEAR < 2023) OR (ALL (‘connectiv*’ OR ‘fragment*’ OR ‘species’ w/5 ‘turn*over’ OR ‘move*’ OR ‘isolat*’) AND (‘infrastructure’ w/5 ‘green’) OR (‘infrastructure’ W/5 ‘blue’) AND (‘poli*’ OR ‘govern*’ OR ‘admin*’) OR (‘spatial*’ OR ‘plan*’) AND PUBYEAR > 2010 AND PUBYEAR < 2023) AND (LIMIT-TO (AFFILCOUNTRY,’Germany’) OR LIMIT-TO (AFFILCOUNTRY,’France’) OR LIMIT-TO (AFFILCOUNTRY,’Italy’) OR LIMIT-TO (AFFILCOUNTRY,’Sweden’) OR LIMIT-TO (AFFILCOUNTRY,’Spain’) OR LIMIT-TO (AFFILCOUNTRY,’Portugal’) OR LIMIT-TO (AFFILCOUNTRY,’Netherlands’) OR LIMIT-TO (AFFILCOUNTRY,’Poland’) OR LIMIT-TO (AFFILCOUNTRY,’Belgium’) OR LIMIT-TO (AFFILCOUNTRY,’Denmark’) OR LIMIT-TO (AFFILCOUNTRY,’Finland’) OR LIMIT-TO (AFFILCOUNTRY,’Austria’) OR LIMIT-TO (AFFILCOUNTRY,’Hungary’) OR LIMIT-TO (AFFILCOUNTRY,’Czech Republic’) OR LIMIT-TO (AFFILCOUNTRY,’Greece’) OR LIMIT-TO (AFFILCOUNTRY,’Romania’) OR LIMIT-TO (AFFILCOUNTRY,’Ireland’) OR LIMIT-TO (AFFILCOUNTRY,’Serbia’) OR LIMIT-TO (AFFILCOUNTRY,’Latvia’) OR LIMIT-TO (AFFILCOUNTRY,’Slovakia’) OR LIMIT-TO (AFFILCOUNTRY,’Undefined’) OR LIMIT-TO (AFFILCOUNTRY,’Bosnia and Herzegovina’) OR LIMIT-TO (AFFILCOUNTRY,’Lithuania’) OR LIMIT-TO (AFFILCOUNTRY,’Slovenia’) OR LIMIT-TO (AFFILCOUNTRY,’Ukraine’) OR LIMIT-TO (AFFILCOUNTRY,’Croatia’) OR LIMIT-TO (AFFILCOUNTRY,’Cyprus’) OR LIMIT-TO (AFFILCOUNTRY,’Estonia’))

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Appendix 3: Breakdown of interviews according to stakeholders' type

Country	Number of interviews	Stakeholders
Austria	3	Ministry Government Agency NGO
Bosnia and Herzegovina	2	Ministry NGO
Bulgaria	3	Ministry NGO
Croatia	2	Ministry NGO
Czech Republic	3	Ministry Government Agency NGO
Finland	2	Ministry Government Agency Academia
France	3	Ministry Academia NGO
Germany – Leipzig-Halle case study	12	Government Agency NGO City Administration Science Project Citizen Science Project
Germany – Danube-Carpathian case study	2	Government Agency NGO
Hungary	2	Ministry NGO
Moldova	4	Government Consultant Academia NGO
Montenegro	3	Ministry NGO
Poland	1	NGO
Portugal	4	Government Agency Academia NGO
Romania	3	Ministry NGO
Serbia	2	Government Agency NGO
Slovakia	3	Ministry Government Agency NGO
Slovenia	3	Ministry Government Agency NGO
Spain	3	Regional Government

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		Academia NGO
Ukraine	3	Ministry Professional Association NGO
Transnational organisations	4	Intergovernmental Organizations NGO
TOTAL	**67**	

(w) means the answers to the questions in written form (n=7)

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Appendix 4: Interview questions

General

1. What are the key elements of the governance and financing model for Natura2000 in your case study? If not yet available, are you planning to develop such an overview or do you know papers that tackle this topic?

Governance

2. Do you have specific policies and/or strategies which influence the designation of protected areas in your case study (national, regional and local levels)?
3. Does your country or region have a strategy or policy to ensure ecological connectivity between protected areas?
4. What are the main barriers (socio-economic, legislative gaps) for the implementation of a well-connected protected area network in your case study? Do you have any ideas or good examples of projects or programmes on how to overcome them?

Ecological connectivity

5. Are there any initiatives for ecological connectivity between protected areas covering the following ecosystems in place in your country/region?

- Rivers and floodplains (Yes/No/Don't know)
- Peatlands (Yes/No/Don't know)
- Farmland (Yes/No/Don't know)
- Woodland and forests (Yes/No/Don't know)
- Coasts (Yes/No/Don't know)
- Seabed (Yes/No/Don't know)
- Mountains (Yes/No/Don't know)
- Nature in and around cities (Yes/No/Don't know)
- Other ecosystems (short-answer text)

Finance

6. Are the following sources of funding used for designating and managing Natura 2000 sites or other protected areas in your case study?

- EU funds for projects – LIFE, Interreg, European cohesion and structural funds
- Common Agricultural Policy
- National and/or regional funds
- NGOs and/or private or philanthropic funds
- Biodiversity offsets or compensation measures
- We have no funding

If yes, are they working properly? Are there major or minor problems?

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If not, do you think the use of funding should be integrated in your case study, through WP2 for example?

7. Are the following sources of funding used for ecological connectivity in your case study?

-
  - EU funds for projects – LIFE, Interreg, European cohesion and structural funds
  - Common Agricultural Policy
  - National and/or regional funds
  - NGOs and/or private or philanthropic funds
  - Biodiversity offsets or compensation measures
  - We have no funding

If yes, are they working properly? Are there major or minor problems?

If not, do you think the use of funding should be integrated in your case study, through WP2 for example?

8. We aim to produce factsheets detailing both public (EU) and private financing instruments, how to access them and the challenges and barriers to access them.

Do you think that in the implementation of TEN-N lack of knowledge about available financial instruments is a key problem?

Would you be happy to review the factsheets once they are ready?

Stakeholder mapping

9. Have you already conducted, or do you plan to conduct a stakeholder analysis regarding the implementation of TEN-N* in your case study?

Do you already have a (rough) list of relevant stakeholders regarding the expansion of protected areas, expansion of strict protection and ensuring ecological connectivity?

* With implementation of TEN-N we are referring to the design of the network (if any) and the specific challenges in expanding the protected areas / strict protection and ensuring ecological connectivity between protected areas.

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Appendix 5: Survey questions for the nature conservation sector

The survey targeted professionals within the nature conservation sector to assess policies, strategies, and practices related to ecological connectivity between protected areas. Below are the questions included in the survey:

1. Affiliation:
2. Country (and sub-national region, if relevant):
3. Position:
4. Does your country have a national strategy or policy to ensure ecological connectivity between protected areas?
    a. If yes, please provide a link.
5. Does the strategy identify corridors for habitats or species?
6. Are there any initiatives for ecological connectivity between protected areas covering the following ecosystems in place in your country/region?
    a. Rivers and floodplains
    b. Peatlands
    c. Farmland
    d. Woodland and forests
    e. Coasts
    f. Seabed
    g. Mountains
    h. Nature in and around cities
    i. Other
7. Do you have a particularly successful example of connecting protected areas in your country?
    a. If yes, please provide a weblink or short description.
    b. If yes, which of the following factors would you consider critical in its success?
        i. Planning and design
        ii. Funding
        iii. Stakeholder engagement
        iv. Tenure rights
        v. Financial incentives for landowners
        vi. Subsequent management
        vii. Cross-border cooperation
        viii. All of the above
8. Is there a designated administrative body in charge of ensuring the ecological connectivity of protected areas?
    a. If possible, kindly provide the link.
9. Is ecological connectivity reflected in the following sectoral planning instruments in your country?
    a. Transport policy
    b. Renewable energy and electricity grid policy
    c. Urban planning
    d. Spatial planning
    e. Water policy
    f. Agricultural policy
    g. Forestry policy
    h. Marine spatial planning
    i. From the above list, do you have a particularly economic sector in your country that was particularly successful in integrating ecological connectivity in their planning?
        i. If yes, please provide a weblink or a short description.

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10. What are the main enablers for the implementation of a well-connected Protected Areas (PA) network?
    a. legislative changes
    b. cross-sectoral collaboration
    c. compensation measures
    d. cross-border cooperation
    e. other
11. What are the main barriers for the implementation of a well-connected PA network?
    a. Lack of funding
    b. Lack of legislation/legal status
    c. Lack of coordination between authorities/ no functional administrative authorities
    d. Intensive agriculture/primacy of agricultural profits
    e. Presence of Linear infrastructure
    f. Lack of data/Lack of monitoring
    g. Non-secure tenure rights for connectivity
    h. Land abandonment and vegetation succession
    i. Lack of awareness
    j. Other
12. In case of barriers, do you have any suggestions on how to overcome them?
13. Can you think of any other policy (not necessarily related to Protected Areas) that we could learn from to enable better ecological connectivity across Protected Areas?
14. Does your country have a legal or policy mechanism to protect privately owned land outside protected areas? For example, through a stewardship agreement, conservation easement, tax break, or any other designation for privately protected areas.
    a. If yes, what is it? Is it being used successfully?
15. What is the main source of funding for ecological connectivity in your country?
    a. EU funds for projects – LIFE, Interreg, European cohesion and structural funds
    b. Common Agricultural Policy
    c. National and/or regional funds
    d. NGOs and/or private or philanthropic funds
    e. Biodiversity offsets or compensation measures
    f. We have no funding
16. We are planning to conduct a follow-up on our research. Could we contact you again if we have further questions to you?
    a. If yes, please, add your email below.
17. Would you like to receive information and updates from NaturaConnect?
18. If you agree to receive information and updates from NaturaConnect, we will include your information in the project's contact list, so that you can always be kept up to date. You can unsubscribe at any time.
    a. If yes, please, add your email below.

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Appendix 6: Survey questions for other sectors than nature conservation

The survey targeted professionals from multiple public sectors to assess how ecological connectivity, including the Trans-European Nature Network (TEN-N) and its integration under the EU Water Framework Directive, is reflected in sector-specific strategies and projects. Below is a generalized format of the questions included in the survey:

1. Country:
2. Affiliation:
3. Position:
4. Please, select your sector:
    a. Agriculture
    b. Forestry
    c. Water management
    d. Spatial planning and urban spatial planning
    e. Transport infrastructure
    f. Energy sector (renewables, electricity grids etc.)

General Survey Questions (Adapted for Each Sector):

5. Does your country or region integrate protected areas and/or ecological connectivity and/or TEN-N in [sector] strategies or projects?
    a. If yes, please give more details.
6. Does ecological connectivity/TEN-N appear in [related sector] management plans?
7. Could you provide us the documents even in national language (link or name of the document)?
8. From your point of view, what are the biggest enablers for integrating ecological connectivity in the [related sector] planning and strategies of your country or region?
    a. Legislative changes
    b. Compensation measures
    c. Cross-sectoral collaboration
    d. Cross-border collaboration
    e. Other
9. Do you know of any formal or informal structures of cross-sectoral cooperation in the planning of [related sector] or other activities that facilitate the integration of ecological connectivity/TEN-N at the national level?
    a. If yes, can you give an example (link or text)?
10. Do you know of any formal or informal structures of cross-border cooperation in the planning of [related sector] or other activities that facilitate the integration of ecological connectivity, both at national and transnational level?
    a. If yes, can you give an example?
11. Do you know of any plans for legislative changes to better integrate ecological connectivity/TEN-N into [related sector] planning in your country?
    a. If yes, can you give an example?
12. Do you know of any compensation measures to maintain/protect/create ecological connectivity in [related sector] planning in your country?
    a. If yes, can you give an example?
13. From your point of view, what are the biggest barriers for integrating ecological connectivity/TEN-N into [related sector] planning and strategies of your country or region?
    a. Lack of funding
    b. Lack of legislation/legal status
    c. Lack of coordination between authorities/ no functional administrative authorities
    d. Intensive agriculture/primacy of agricultural profits

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e. Presence of linear infrastructure
f. Lack of data/lack of monitoring
g. Non-secure tenure rights for connectivity
h. Land abandonment and vegetation succession
i. Lack of awareness
j. Other

14. How do you think the situation can be improved?
15. We are planning to conduct a follow-up on our research. Could we contact you again if we have further questions to you?
    a. If yes, please add your email below.
16. Would you like to receive information and updates from NaturaConnect in the form of a newsletter?
    a. If you agree, we will include your information in the project's newsletter contact list, so that you can always be kept up to date. You can unsubscribe at any time.
    b. If yes, please add your email below.

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Appendix 7: Workshop details

In total, five workshops were held as part of the analysis, with the main objective to introduce the project to the participants and gather opinions and ideas around the implementation of TEN-N, barriers and enabler including financing. Each workshop was designed to foster collaborative engagement and in-depth discussions among the participants. To ensure a comprehensive exploration of challenges for connectivity in Europe and identify best practices and governance tools, a structured format was employed. In all workshops, participants worked together in small groups of around 5 persons and each session carefully designed to encourage diverse group discussions and the exchange of ideas. Some workshops used the Appreciative Inquiry (AI) method (Cooperrider, D.L. and Whitney, D., 1999), which focused on identifying and building on existing successes rather than just discussing problems. This approach encouraged positive, strengths-based discussions.

Participants were encouraged to share best practices from their experiences in nature conservation and deliberate on the most effective governance tools that could facilitate the establishment of a Trans-European Nature Network. Participants included representatives from governmental bodies, environmental organisations, academic institutions, local communities, and other relevant sectors were invited to provide a holistic perspective on the challenges and strategies.

Additionally, the workshops were adapted as needed based on factors such as the number of participants, time constraints, and participant demographics. The format emphasized group discussions and brainstorming, and the structure of the workshops aimed to be flexible to accommodate varying workshop goals, objectives, or topics. The participation list can be found in the NaturaConnect stakeholder analysis here.

NaturaConnect session at the BirdLife International (BLI) Partnership meeting (Edinburgh, UK, 17 May 2023)

This workshop took place during the Nature and Climate Task Force (NCTF) a permanent working group within the BirdLife Europe and Central Asia Partnership aiming to actively solicit feedback from 36 participants representing 22 countries. The primary focus of the workshop was to gather knowledge on key governance challenges related to connectivity in Europe.

Three structured discussion rounds were conducted: In identifying challenges, participants identified primary governance challenges for connectivity. In exploring Solutions, solutions to address the challenges and successful examples were discussed. The last round was focused on envisioning necessary steps, and participants deliberated on the required actions by BirdLife and civil society to actualise solutions. This approach facilitated in-depth discussions and enabled the gathering of diverse perspectives on connectivity governance, contributing valuable insights to this deliverable.

NaturaConnect workshop at the EUROPARC conference (Leeuwarden, the Netherlands, 4 October 2023)

This three-hour workshop aimed to identify enabling factors for effective protected area governance and explore innovative funding opportunities to improve connectivity. Approximately 20 participants attended, including 10 protected area managers, NGOs involved in protected area management, and representatives from regional and national governments. The workshop commenced with group discussions focusing on barriers related to governance and funding, drawing upon examples from participants' experiences. Subsequently, discussions centred on potential solutions in governance and funding, further enriched by participant examples.

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IEEP (Institute for European Environmental Policy) presented ecological networks in Flanders and France, along with their associated funding mechanisms, as a basis for breakout group discussions on policy improvements and ecological network implementation.

NaturaConnect Doñana stakeholder workshop (Sevilla, Spain, 1 December 2023)

SBE led a stakeholder workshop in collaboration with CSIC together with 19 participants (7 externals) from public administrations, the private sector, universities and NGOs. The workshop began with the identification of barriers to establishing a coherent nature network around Doñana. The discussion then expanded to understanding the enablers and barriers of connectivity within the region, addressing governance challenges, and exploring potential solutions. Participants engaged in identifying necessary steps to overcome these challenges, focusing on strategies to enhance collaboration and ensure the long-term sustainability of the nature network.

Danube-Carpathian region

In the frame of the Carpathian Convention, the project organised two workshops, which brought together ministerial representatives of the seven Carpathian countries, representatives of the Convention on Biological Biodiversity, IUCN, and UNEP as well as observers working in science or on related projects, NGOs, consultants and others. Altogether we engaged approximately 70 people from 13 countries.

Both events had the same structure. First, we created the context, presented the project to the participants and led a Q&A session. Second, we divided the participants into smaller groups of 5-10 people and discussed and collected ideas and opinions on flipcharts.

NaturaConnect workshop at the 14th Meeting of the Carpathian Convention Working Group of Biodiversity (Vsetín, Czech Republic, 22-24 May 2023)

A one-and-a-half-hour workshop on the NaturaConnect project was held at the 14th Meeting of the Biodiversity Working Group of the Carpathian Convention (Vsetín, Czech Republic, 22-24 May 2023, 30 participants).

The Carpathian Convention Working Group on Biodiversity and its observers discussed the following:

- *What are the main **barriers** (socio-economic, legislative gaps, sectors) and **enablers** for the implementation of a well-connected protected areas network in and between the countries of the region?*
- *Are you aware of **good practices** in particular to stakeholder engagement for the implementation of a well-connected protected area network between the countries of the region? How do these countries work together and how is this work **financed**?*

NaturaConnect stakeholder session at the 7th Carpathian Convention Conference of the Parties (Belgrade, Serbia, 11 October 2023)

The one-and-a-half-hour stakeholder consultation at the 7th Carpathian Convention Conference of the Parties (Belgrade, Serbia, 11-13 October 2023) brought together 50 participants from national authorities, public institutions, research entities, NGOs and the private sector.

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WWF-CEE, together with IIASA, conducted consultation session during this high-level event, discussing in small groups how the Carpathian Convention can foster collaboration on the implementation of the ecological network based on the Carpathian Biodiversity Framework.

The participants at the COP7 Stakeholder Consultation discussed the following:

- *What are the needs of the Parties to the Carpathian Convention to foster the development of a functional ecological network in the regional context?*
- *How can we use the Carpathian Convention cooperation mechanisms such as working groups to contribute to filling in the gaps?*

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More information about the project:

NaturaConnect has 22 partner institutions: International Institute for Applied System Analysis (project lead; Austria); German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig (project co-lead; Germany); Associacao Biopolis (Portugal); BirdLife Europe (Netherlands); Birdlife International (United Kingdom); Centre National De La Recherche Scientifique (France); Doñana Research Station - Agencia Estatal Consejo Superior De Ivestigaciones Cientificas (Spain); EUROPARC Federation (Germany); Finnish Environment Institute (Finland); Humboldt-University of Berlin (Germany); Institute for European Environmental Policy (Belgium); Netherlands Environmental Assessment Agency (Netherlands); Rewilding Europe (Netherlands); University of Evora (Portugal); University of Helsinki (Finland); University of Natural Resources and Life Sciences, Vienna (Austria); University of Rome La Sapienza (Italy); University of Warsaw (Poland); Vrie University of Amsterdam (Netherlands); WWF Central and Eastern Europe (Austria); WWF Romania and WWF Hungary.

NaturaConnect aims to design and develop a blueprint for a truly coherent **Trans-European Nature Network** (TEN-N) of conserved areas that protect at least 30% of land in the European Union, with at least one third of it under strict protection. Our project unites universities and research institutes, government bodies and non-governmental organizations, working together with key stakeholders to create targeted knowledge and tools, and build the capacity needed to support European Union Member States in realizing an ecologically representative, resilient and well-connected network of conserved areas across Europe.

www.naturaconnect.eu

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