



Recommendations for policy/strategy harmonization

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TABLE OF ACRONYMS

AA:	Appropriate Assessment
ACLIE:	African Conference for Linear Infrastructure and Ecology
ANET:	Australasian Network for Ecology & Transportation
CBD:	Convention on Biological Diversity
CEDR:	Conference of European Road Directors
COP:	Conference of the Parties
DTP:	Interreg Danube Transnational Programme
EEC:	European Economic Community
EEA:	European Environmental Agency
EIA:	Environmental Impact Assessments
EU:	European Union
GI:	Green Infrastructure
GIB:	Global Infrastructure Basel
ICOET:	International conference on Energy and Transport
IENE:	Infrastructure and Ecology Network Europe
IPBES:	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN:	International Organizations on Nature Conservation
LTI:	Linear Transport Infrastructure
MS:	Members States
OECD:	Organisation for Economic Co-operation and Development
PIANC:	World Association for Waterborne Transport Infrastructure
PIARC:	World Road Association
SDG:	Sustainable Development Goal
SEA:	Strategic Environmental Assessments
SGI:	Strategy for Green Infrastructure
SRDA:	Strategic Research and Deployment Agenda
TEN-G:	Trans-European Network of Green Infrastructure
TEN-N:	Trans-European Nature Network
TEN-T:	Trans-European Transport Network
UIC:	International Union of Railways
UNEP:	United Nations Environment Program
WP:	Working Package
WWF:	World Wildlife Fund

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EXECUTIVE SUMMARY

The BISON project, works as an active platform to support Biodiversity and Infrastructure Synergies and Opportunities for European Transport Network in the framework of Horizon 2020 Programme. BISON is an urgent respond of a consortium of 45 European members and associated countries to the need of making transport infrastructure more sustainable taking into account biodiversity issues, while ensuring their reliability and efficiency. BISON is a Horizon 2020 project aiming to tackle the integration of biodiversity with the development of infrastructure, including roads, railways, waterways, airports, ports, or energy transport networks.

The current report explores **the policy/strategy alignment and implementation maturity in reconciliation with the European Union Strategy for Green Infrastructure (EU SGI) for ensuring ecological connectivity in infrastructure development, and the proposed recommendations for addressing the different levels of maturity**. This report is a deliverable of the Working Package (WP) 5 linked to the previous Deliverable of Task 5.1 of BISON project, D5.1 “*Status of national policy, legislation and implementation tools and recommendations for the integration of the EU SGI into transport infrastructure development*” and will feed into the Strategic Research and Deployment Agenda (SRDA).

Within the BISON project, WP5 aims -among other- to set the ground for the necessary actions and innovative solutions to take place, in order to mainstream Green within Grey infrastructure across the EU Member States and across the different transport modes. Within this scope of WP5, Task 5.1 aimed to identify the level of integration of the provisions set by the EU SGI, as these are also supported by actions under target 2 of the EU Biodiversity Strategy, and by the transport policy and legislative framework of the EU Member States. More specifically, an alignment assessment of national transport policies with the EU SGI has taken place in the context of T5.1, identifying gaps and barriers for the EU Member States and considering all transport modes. Additionally, a review took place on how EU SGI & Biodiversity Strategy are integrated into the National Transport Master Plans and how biodiversity & ecological connectivity are addressed in the Strategic Environmental Assessments (SEAs).

The content of Deliverable 5.2 has been based upon the outcomes of D5.1, and more specifically the initial recommendations on improving policies and legislation status from both EU level and Member States (national) level for their implementation at local/regional level and what specific processes are foreseen towards ecological connectivity. Deliverable D5.2 is a result of integrating feedback and input on the findings also by external stakeholders (in a dedicated consultation process) and other projects and actions that are relevant with policies and strategies on harmonization of EU SGI ensuring ecological connectivity in transport infrastructure development. More specifically, the set of derived recommendations is based upon exploitation of the results of the previous report of WP5, namely D5.1, successive survey questionnaires, consulting of experts, workshops, as well as interpretation of results from other projects and institutions.

The final 46 recommendations are formulized in a framework of five distinctive categories:

1. International and National Policy level – Policy and Strategies documents;
2. National Planning level;
3. Legal framework and instruments;
4. Regional Strategies and instruments;
5. Follow up process in national and regional level.

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1 INTRODUCTION

1.1 Objectives

1.1.1 The BISON project

The BISON project, **B**iodiversity and **I**nfrastructure **S**ynergies and **O**pportunities for European Transport **N**etwork, consisted of a consortium of 45 European members and associated countries to the need of making infrastructure more sustainable for biodiversity while ensuring their reliability and efficiency. BISON implemented in the framework of Horizon 2020 framework EU Programme aiming to tackle the integration of biodiversity with the development of infrastructure, including roads, railways, waterways, airports, ports, or energy transport networks and strengthened the relevant European Research Area.

The BISON project meets the above aim through the specific objectives below:

- To identify future research and innovation needs for a better integration of biodiversity with infrastructure.
- To identify the construction, maintenance and inspection methods and materials which are long-lasting and resilient and can be used by different transport modes to mitigate pressure on biodiversity.
- Support European Member States to fulfil their international commitments by engaging all stakeholders into biodiversity mainstreaming for infrastructure planning and development.
- Support European Member States to become political leaders through collaboration and support of European research.

BISON is structured in 5 Work Packages:

WP1: Project Management

WP2: Communication, Dissemination and Exploitation to Strengthen Partnerships

WP3: Existing and future synergy between Infrastructure and Biodiversity

WP4: Towards a Research Agenda for Europe

WP5: Towards Deployment

WP6: Ethics requirements

1.1.2 The Working Package 5: Toward developing a Strategic Research and Deployment Agenda

The main aim of the Work Package 5 (WP5) is to produce the deployment side of the BISON Strategic Research and Deployment Agenda (SRDA), setting the ground for the necessary actions and innovative solutions to take place, for mainstreaming Green & Grey infrastructure across the EU Member States and across the different transport modes. WP5 identifies the critical topics for potential cooperation of European stakeholders in transferring good practices at policy, legislative and implementation levels.

WP5 has the following objectives:

- Assess the maturity level, gaps and needs of the EU Member States in policy, legislative and implementation levels on integrating the provisions of the EU Strategy for Green Infrastructure (EU SGI) into transport infrastructure development for all transport modes.
- Provide concrete innovative instruments and visual tools (i.e., map) for the planning and design stage of the infrastructure life-cycle.
- Define respective indicators for identifying conflict points and design solutions on how to avoid and/ or compensate for existing fragmentation caused by transport infrastructure and on how to avoid future fragmentation by new constructions and upgrading of infrastructure.

Moreover, key topics, processes and tools to foster the deployment of the recommended practices have been identified for the different transport modes. For this identification, special consideration took place on the entire active life-cycle of a transport infrastructure project (i.e., scoping, planning, designing, constructing, adapting, operating & maintaining, decommissioning). In this regard, WP5 has also **the following additional objectives**:

- Prepare for the future the most suitable/promising innovative solutions that would address the stakeholders' needs and requirements, based on WP4 outcomes. In order to derive these solutions special consideration has been focused on emerging trends and uncertainties (WP3), while a framework of plausible scenarios developed for the deployment of the proposed innovation and research initiatives.
- Identify EU funding sources and possibility for cross-thematic/cross-sectoral funding for sourcing the necessary financial resources towards the deployment of the recommended policies and practices at EU level.

1.1.3 Interrelation with other WPs

In an overall approach, all WPs are interrelated each other and multiple interconnections of deliverables and meetings between all working groups have taken place. Additionally, and in order to finalize the D.5.2 there is a special interrelation with the WP3 and the Task 3.1 on identification of good practices per transport mode in order to create State of Play of good practices as “best practices”. In this task, principles and criteria developed in order to support the co-existence of Green and Grey Infrastructure and contribute to biodiversity restoration. Finally, an analysis on the gaps and barriers that create difficulties for the application of these practices conducted in order to provide solutions based on research and transfer technology. The gaps and barriers derived from this task are taken into account in the overall process of the finalization of the D5.2 in order to identify recommendations to overcome critical obstacles on mainstreaming Green Infrastructure and biodiversity in policy and strategies of transport development.

1.1.4 Aim and structure of Deliverable 5.2

As crucial part of WP5 the current report D5.2, aims at exploring **the policy/strategy alignment and implementation maturity in reconciliation with the European Union (EU) Strategy for Green Infrastructure (SGI) for ensuring ecological connectivity in infrastructure development, and providing recommendations for further harmonization.** The recommendations emerging from D5.2 are linked with the outcome of BISON T5.1, D5.1 “Status

of national policy, legislation and implementation tools and recommendations for the integration of the EU SGI into transport infrastructure development” (Loukea et al., 2022).

The pre-existing information on how European strategies are implemented today across countries relatively to transport infrastructure is very limited, as presented in **Section 2** of the current report. To overcome this weakness, the work that has been carried out within the D5.1 Report provides information on how well the EU strategies (especially EU SGI) are known by actors and whether (and how) they are applied in different countries.

For assessing the alignment of national transport policies with the EU SGI, D5.1 looked at how EU SGI & Biodiversity Strategy are integrated in the National Transport Master Plans and how biodiversity & ecological connectivity are addressed in SEAs. Defining and using specific criteria, it looked at how the alignment of national transport policies with the EU SGI is achieved and is translated into implementation at local/regional level and what specific processes are foreseen towards ecological connectivity. The method was based on the Interreg project HARMON (Mot et al, 2019) and the D5.1 presents the current status and gaps for aligning the national transport policies with the EU SGI. All the aforementioned are detailed in **Section 3** of the current report.

The framework of D5.2 is also integrating further input of other resources and feedback of other BISON activities, as international workshops and debate with international experts, as well as input from other relevant projects and international activities of IENE (Infrastructure and Ecology Network Europe), as presented in **Section 3** of the current report.

The work that has been realized during this period in order to update them and end up with the final recommendation is reported in **Section 4**. In **Section 5** the main conclusions of the executed work of D5.2 and the recommendations are presented which will feed the SRDA in multiple scales, either within the EU research framework program, or by other regional, national or local programs, in order to improve the knowledge-base on infrastructure and biodiversity.

1.2 Targets audience of BISON recommendations on policy and legislation

The current report aims to support the process of policies’ production and promote the strategic planning, in order to make right decisions on development of transport infrastructure in the best sustainable way, maximizing the avoidance of environmental impacts and the fragmentation of landscapes and ecosystems, following:

- a) the proactive approach of the current recommendations that they have to have,
- b) the fact that BISON as IENE most actions has European focus but international exposure and
- c) the analysis of stakeholders needed to be engaged on decision making from the international to the local regional level according the Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure (Georgiadis et al., 2020).

The spectrum of the target audience can include the stakeholders listed below, grouped in three levels:

A. International policy and strategy level

1. EU as the first audience, but other interested Intergovernmental Regional “Unions” as well, as African Union, Organization of American States and Union of South American Nations etc.
2. UNEP (United Nations Environment Program) and International or Regional Conventions e.g., Convention on Biological Diversity, Bonn Convention, Bern Convention, European Landscape Convention, Carpathian Convention, Alpine Convention.
3. International Forums e.g., High-level Political Forum on Sustainable Development, G20, G7, World Economic Forum, Belt and Road Forum for International Cooperation, OECD (Organisation for Economic Co-operation and Development).
4. International Organizations for infrastructure development e.g., World Road Association (PIARC), World Association for Waterborne Transport Infrastructure (PIANC), International Union of Railways (UIC), the Global Infrastructure Basel (GIB).
5. Continental Organizations for infrastructure development e.g., CEDR (Conference of European Road Directors) in Europe.
6. International Organizations on Nature Conservation (IUCN, WWF-International) and continental networks and conferences on infrastructure and ecology with international activities as IENE (Infrastructure and ecology network Europe) (ICOET-International conference on Energy and Transport, ANET- Australasian Network for Ecology & Transportation, ACLIE- African Conference for Linear Infrastructure and Ecology).

B. National policy and strategy level

1. Governments and Ministries responsible for transport, infrastructure, environment, development, economy, spatial planning, energy, agriculture, forestry, tourism, water management or other sector involved on harmonizing transport infrastructure with Green Infrastructure and ecological corridors.
2. Agencies which support Governments policy, strategic planning and designing and operation of transport infrastructure e.g., Research Institutes, Environmental, Transport and Energy Agencies, Water Management Agencies, Agencies for Development.

C. Local regional policy and strategy level

1. Local Regional authorities e.g., regions (or counties and provinces), municipalities, protected areas authorities.
2. Local Regional services e.g., services for sectors as spatial design, water management, forestry, tourism and energy.

2 BACKGROUND ON TRANSPORT AND BIODIVERSITY POLICIES

2.1 The need to align Green and Grey Infrastructure Strategies

The European Commission defines green infrastructure as natural or semi-natural areas used to address economic, social and environmental problems¹. Addressing these problems is based on ecosystem services which are defined as ecological characteristics, functions, or processes that directly or indirectly contribute to human wellbeing and can be grouped in four categories of services that the natural capital can provide: provisioning, regulating, cultural and supporting (Costanza et al., 1997 and Millennium Ecosystem Assessment - MEA 2005 in Costanza et al., 2017). These functions can be environmental, such as adaptation to climate change, social, by improving the quality of life (improving air quality, mitigating the effects of urban thermal islands, etc.), or economic, by creating jobs. The objective is therefore to exploit the natural capital of the water or land maintaining the quality and quantity of provided ecosystem services without any loss of biodiversity, rather than to destroy or artificialize it. These solutions appear unavoidable at a time when environmental problems and natural disasters could tend to multiply with climate change.

Green infrastructure are proposed as alternatives to grey, artificial, less sustainable and generally more expensive infrastructure. The European Commission's Green Infrastructure Strategy aims to encourage the deployment of this type of infrastructure in the Member States in a comprehensive approach (European Commission 2013a).

However, the fact that this concept is relatively recent leads to strong differences in definitions around this term. According the results of the D5.1, each country has its own definition of green infrastructure, different from that given by the European Commission, and considers them more or less broadly. Often, this question is primarily considered around the issues of biodiversity, which corresponds to the diversity of animal and plant species living in an environment (Loukea et al., 2022).

2.2 The need to mainstream biodiversity to transport policies and practices

Transport networks are considered to be a common place of the European landscape that facilitate the connection of people, their provision of access to key services, while they also facilitate and promote economic activity. However, transport networks usually also influence the environment around them and they often introduce barriers between natural areas, as they accommodate the spread of urban areas into the relatively rural and less populated European areas, putting pressure on natural habitats. Transport infrastructure often comes with negative impacts on biodiversity, disconnecting ecosystems and landscapes, while the emission of pollutants and the introduction of non-local species, pose also additional burdens to ecosystems (EEA, 2016).

¹ https://ec.europa.eu/environment/nature/ecosystems/index_en.htm

Transport infrastructure has both primary and secondary effects on nature (Van der Ree et al., 2015; Iuell et al., 2003). According to the IENE “European Handbook for Identifying Conflicts and Designing Solutions”² (Iuell et al., 2003; Rosell et al., 2022), five major categories of primary ecological effects (**Table 1**) have been distinguished, namely the following:

1. Loss of wildlife habitat.
2. Barrier effects.
3. Fauna casualties - collisions between transport and wildlife.
4. Disturbance and pollution.
5. Ecological function of verges (edges of infrastructure development which can be refuge for wildlife, but traps as well).

Basic secondary effects are connected with the landscape changes with negative ecology perspectives over extended periods and broader geographical scales determining an overall future framework of irreversible impacts (Georgiadis et al., 2020).

Table 1: Primary and secondary effects on biodiversity due to LTI

Primary effects on biodiversity	
1	<u>Loss of wildlife habitats</u> , as considerable surface areas are occupied by LTI structures. Parallel supportive infrastructure (such as operation facilities and logistics) further creates a wider zone of occupation in natural areas. For several threatened species, and especially those with small populations, the combination of habitat fragmentation and loss is a main cause for their decline.
2	<u>Barrier effects</u> for both local and migratory species populations negatively influence their natural movements. This increases genetic isolation, and can contribute to extinction of endangered species.
3	<u>Faunal casualties</u> resulting from collisions between vehicles and wildlife, electrocutions related to electrical infrastructure and bird collisions with overhead lines. This has multiple costs, primarily to humans (deaths and injuries, damage to vehicles and hardware, medical treatment, policy, and patrol maintenance) as well as impacts on animal populations.
4	<u>Disturbance and loss of habitat quality due to noise, light and pollution</u> resulting from LTI and its associated users influence zones on a wider scale than the land they occupy.
5	<u>The ecological function and the value of habitats related to infrastructure such as verges, green or drainage areas</u> , is rarely considered. These habitats are important refuges for numerous flora and fauna species; however, they can be ecological traps and be causes for roadkill, or also spread of Invasive Alien Species.

² <https://handbookwildlifetraffic.info/ch-3-effects-of-infrastructure-on-nature/3-2-ecological-effects-of-transport-infrastructure/>

Secondary effects on biodiversity	
1	<u>Resulting changes in the landscape</u> are often not addressed with the development of a LTI; for example, with a new road, urbanisation, human settlements, local access roads are often secondary developments. These are major land use changes.
2	LTI, whilst improving access and improved livelihoods, often create <u>disturbance</u> to areas previously inaccessible. Hunting, poaching and tourism are examples of activities that access otherwise undisturbed wildlife habitats.
3	<u>Negative landscape ecology perspectives</u> over extended periods and broader geographical scales require permanent LTI interventions, especially in sensitive, natural landscapes; this can determine an overall future framework of irreversible impacts.

On practical point of view, all the above impacts normally interact and may altogether build their adverse consequence through synergistic and cumulative impacts. The results of weakening natural life territory, boundary impacts, segregation, and aggravation can be summed up by the term of “fragmentation”. Fragmentation of natural ecosystems is one of the primary impacts (Van der Ree et al., 2015; Forman et al., 2003; Sherwood et al., 2003, Trocmé et al., 2002, Canters et al., 1997) which influences biodiversity decline and species evolutionary perspectives worldwide (Brady & Richardson, 2017). As transport and other linear infrastructure provide crucial services for people’s mobility needs and the transportation of energy and goods, correspondingly, the dispersal of organisms considered the most important aspect of life after survival and reproduction of species (Hamblen, 2004), while the same time, nature has the right to be protected (Chapron et al., 2019).

According the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (IPBES, 2019), the transport sector is closely connected, directly or indirectly, to the five main direct drivers of biodiversity loss (Figure 1) (Jaureguiberry et al., 2022):

- i. **Land-use and sea-use change**, by irreversibly fragmenting habitats and populations and by increasing wildlife mortality risks, changing the structure and functionality of ecosystems and generating a cascade of changes at landscape levels;
- ii. **Direct exploitation of organisms**, by facilitating access to previously remote natural areas / road-less areas and overexploitation, of animals, plants and other organisms, mainly via gathering, logging, hunting and fishing;
- iii. **Climate change**, by increasing green-house gas emissions during the construction and use of the infrastructure;
- iv. **Pollution from all sources**, emitted during the construction and use of the infrastructure; and
- v. **Invasive alien species**, facilitating their introduction and spread.

As these drivers are reinforced by underlying causes, such as the lack of consistency across sectoral policies, subsidies, and between regulations, there is a strong and urgent need for integrated sustainable approaches and an adequate and effective governance.

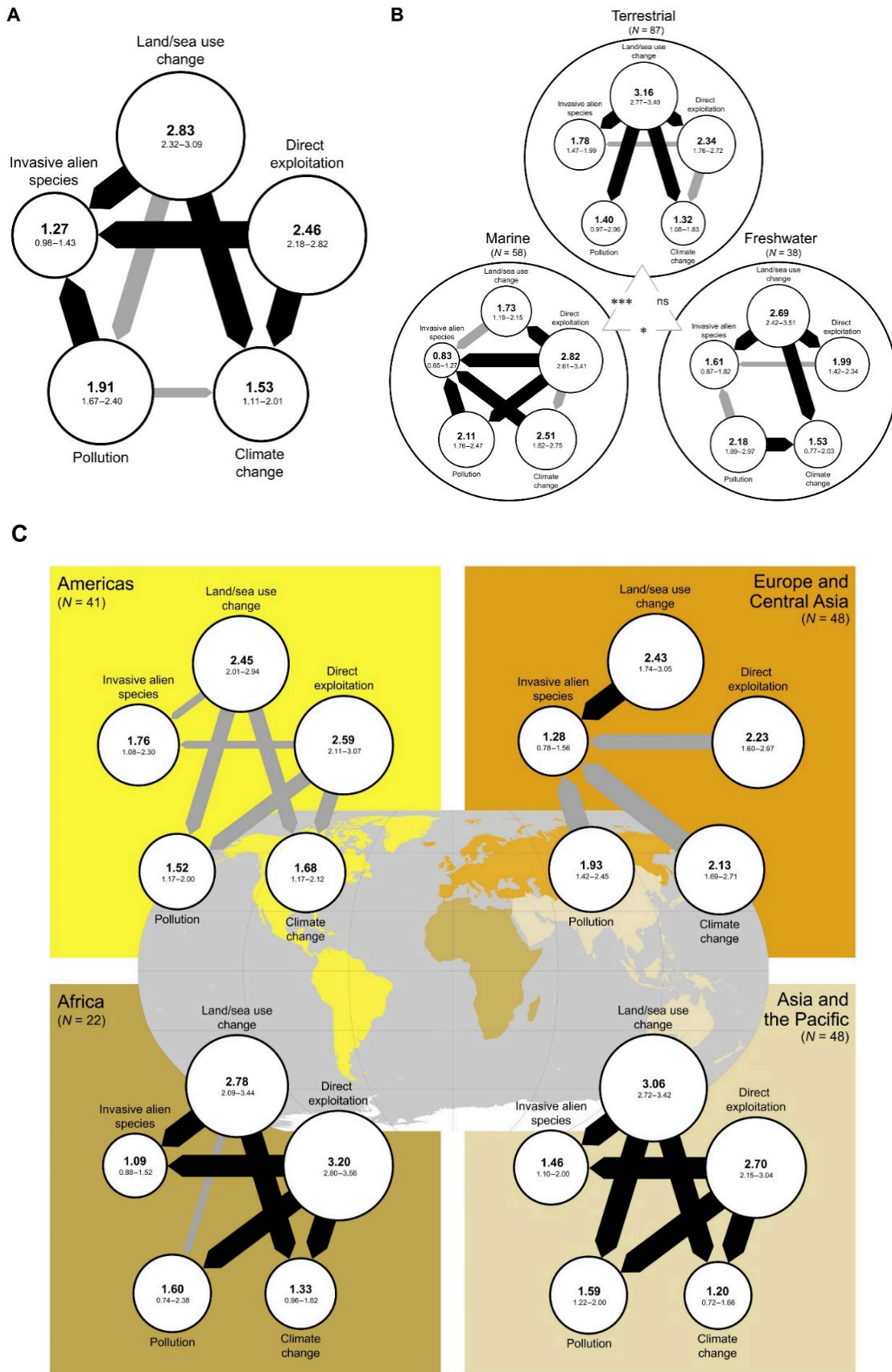


Figure 1. Main 5 interconnected drives (A, B) for biodiversity loss per internationally regional scale (C)

The loss of biodiversity, its impact on the delivery of ecosystem services, as well as on the whole society and economy, has become one of the main environmental challenges and together with

the need for action on climate change are widely recognised across Europe and around the world in order to achieve the global Sustainable Development Goals (SDGs) (United Nations, 2015, European Commission 2013a). Additionally, in order to achieve sustainable transport infrastructure development it's essential to assess the reversibility of environmental impacts of project as fourth pillar of sustainability except of the pillars of economy, society and environment (Joumard & Nicolas, 2010). To make progress towards addressing those challenges, adapting to climate change, and reducing the loss of biodiversity and the defragmentation of ecosystems, it is crucial to fully integrate these issues in the plans, policies, legislation, programmes and projects implemented across Europe. For an effective response on these challenges in order to tackle these global threats, it's necessary to employ all available tools in a most effective way. For example, Environmental Impact Assessments (EIAs), Strategic Environmental Assessments (SEAs) and Appropriate Assessment (AA) procedures³ are legally required and are considered as tools, well suited to systematically tackle such problems⁴. In international policy level, mainstreaming of biodiversity in infrastructure and other sectors was decided with the Decision 14/3 of 14th Conference of the Parties (COP) of Convention on Biological Diversity (CBD) (Convention on Biological Diversity, 2018).

2.3 The European policies and legal status to mainstream biodiversity to transport policies and practices

The protection of biodiversity has been at the heart of European policies since the beginning of the European Union's intervention in environmental matters. The EU actions mainly through the EU Biodiversity Strategy have aimed both to protect the elements of biodiversity, such as ecosystems, and to reduce the nuisances that impact the environment (European Commission, 2011; European Commission, 2020). However, even though these pieces of EU policy and legislation have brought positive developments, biodiversity losses continue to increase and to be recorded. The main cause of biodiversity loss is human activity, both directly and indirectly (climate change) and in this respect, the development of transport infrastructures has a particular impact on the protection of biodiversity in several respects (Jaureguiberry et al., 2022).

All man-made infrastructure networks, such as road, rail and inland water channels, are designed and structured to connect urban areas, rural areas and people. They aim to stimulate/ develop human and economic activities in the areas they connect, creating/ increasing local environmental pressures. At the same time, they also create barriers, dividing the natural landscape into smaller areas. Especially fences around transport networks are a serious barrier driver and often isolate the population of a particular species such limiting their genetic pool and making them more vulnerable to diseases, and ultimately dying out. Better connectivity through dedicated wildlife crossing structures, tunnels or bridges would certainly reduce the pressure on Europe's biodiversity and ecosystems. In fact, these initiatives could be better planned on a much wider scale than a single infrastructure project, involving different stakeholders (e.g., planners, investors, citizens, public authorities etc.) (EEA, 2016, in Loukea et al., 2020).

3

https://ec.europa.eu/inea/sites/default/files/download/events/2014/may_ENER_info_day/cef_2352014_hab_dir_art_6_aa_env_extra.pdf

⁴ <https://ec.europa.eu/environment/eia/pdf/SEA%20Guidance.pdf>

In the context of Natura 2000 network, except of the needs of the protection and conservation of species inside the network, the article 10 of Habitat Directive (92/43/EEC) states the need to ensure the ecological coherence of the biggest protected network globally (Council of the European Communities, 1992; The European Parliament and the Council of the European Union, 2009). This means that when the Mitigation Hierarchy is implemented and “avoidance” of a transport infrastructure alignment in a Natura 2000 site is selected, “mitigation” or/and “compensation” has to be implemented on the final alignment outside of the Natura 2000 site. With this way, ecological connectivity is secured as essential driver for the migration, dispersal and genetic exchange of wild species. Addressing the protection and conservation of biodiversity outside protected areas while developing transport and other linear infrastructure has to be highlighted all over Europe including not EU countries as well. This challenge has to be noticed under the press of demanding more and faster development of transport infrastructure in these countries. In those countries the status of the implementation of Bern Convention provisions and the development of the Emerald Network and its cohesion has to be considered in combination with the Recommendation No 25 (1991) of the Bern Convention on the conservation of natural areas outside protected areas of the Emerald Network (Bern Convention 1991).

In the context of the Green Deal (European Commission, 2019), the European Union has strengthened its will to fight against the loss of biodiversity by adopting EU Biodiversity Strategy for 2030 (European Commission, 2020). Green Deal sets objectives to stop the loss of biodiversity, aiming in particular to increase the surface of protected areas, to increase the protection of forests, and to strengthen the legal rules. Special topic of Green Deal, as well of the UN current policy is the restoration of ecosystems in order to reverse the existed negative impacts, especially focus on the running decade highlighted as the “Decade of Ecosystems Restoration” (United Nations, 2020). At this stage, even if the main lines of action have been defined, the concrete actions are still being defined.

Recently, the European Commission technical guidance on the application of “do no significant harm” under the Recovery and Resilience Facility Regulation, (European Commission, 2021) includes the protection and restoration of biodiversity and ecosystems as one of the six environmental objectives that have to not be significantly harmed (European Commission, 2021). Consequently, the integration of these objectives into transport policies, particularly when they are implemented at national level, is first and foremost a matter for the classic legal instruments of European Union law, which relate to the development of protected areas and the implementation of environmental assessment (Loukea et al., 2020).

The mobilisation of environmental law, in the context of transport infrastructure development, aims firstly to impose taking into account of biodiversity conservation objectives, but also aims to offer ways of reconciling the development of human activities with the imperative of protecting the environment, particularly biodiversity. These instruments lead to the establishment of obligations that shall be complied while assessing transport infrastructure, and more specifically at the decisive moment when decisions are made on whether or not to authorise such projects (Loukea et al., 2020). Such cases are developed in order to plan and implement national defragmentation projects in Western Europe as the 15 years defragmentation project of the Netherlands⁵. It should be noted that there are no specific rules applicable to transport, and projects concerning it are therefore subject to general rules. Moreover, in the texts relating to transport, particularly in the

⁵ <https://www.mjpo.nl>

context of the promotion of mobility, biodiversity and the need to protect it are not mentioned. Thus, the requirements relating to the protection of biodiversity are imposed on transport infrastructure projects mainly by virtue of the obligations relating to environmental assessment (The European Parliament and the Council of the European Union, 2001; 2011) obligations that are reinforced when projects have an impact on protected area or species (Council of the European Communities, 1992; The European Parliament and the Council of the European Union, 2009).

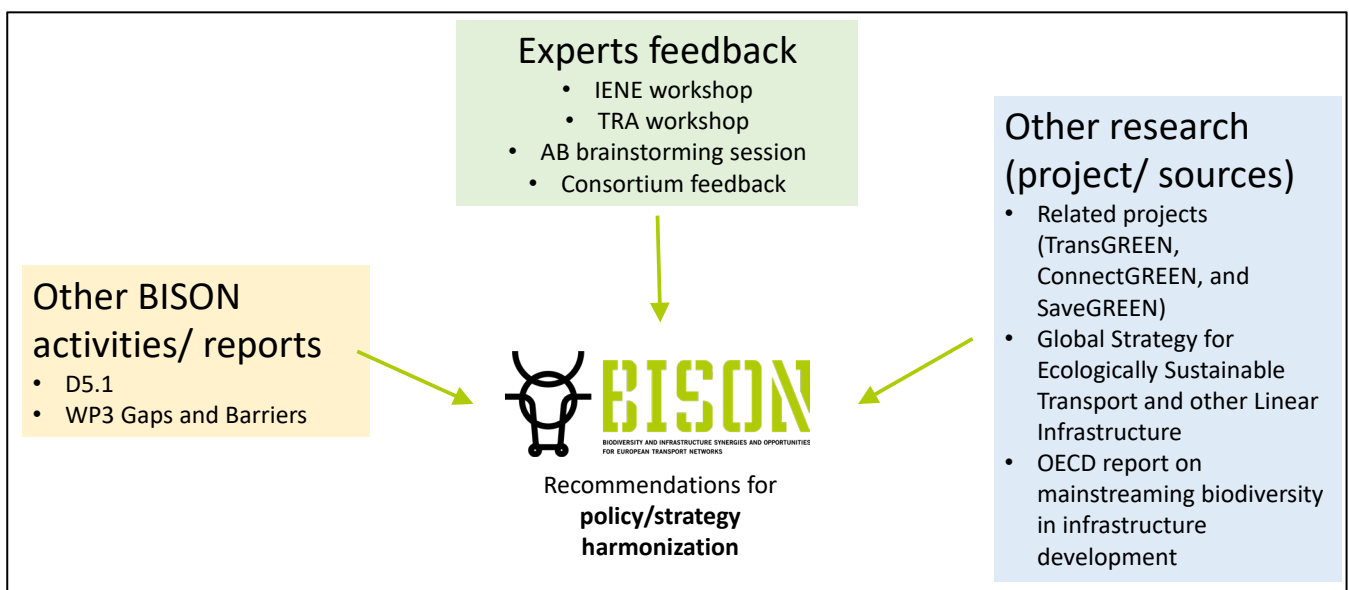
It is therefore questionable whether these instruments, as defined by European legislation, interpreted by the European Court of Justice and implemented by national administrative authorities, allow the objectives of the European Biodiversity Strategy to be integrated, and if so to what degree and quality (Loukea et al., 2020). In this respect, particular attention should be paid to the way in which these instruments can promote green infrastructure (European Commission, 2013b). A “Green Infrastructure” consists of a strategically planned network of high-quality green spaces. It requires a wider look at all green spaces in remote, rural and urban areas, and beyond national borders connects between them, so as to facilitate movement of species. To this end, the European Union adopted the Green Infrastructure Strategy (European Commission, 2013b) aimed at providing a vision for a Trans-European Network of Green Infrastructure (TEN-G), in parallel with TEN-T, (the Trans-European Transport Network), as well as facilitating coordination among stakeholders, and exchange of ideas and information. In the framework of the Green Deal of EU a special Trans-European Nature Network is mentioned as TEN-N. Better ecological connectivity is not the only positive outcome of green infrastructure. In addition to improving public health, it is increasingly seen as a cost-efficient way of reducing current (or future) weather and climate-related natural hazards.

3 METHODOLOGY AND RECOMMENDATIONS DEPLOYMENT

3.1 BISON recommendations' extraction methodology and its deployment

The set of derived recommendations has been based upon several sources, namely:

- Other BISON activities
 - initial data delivered from previous BISON task reported in the D5.1 and the feedback of the BISON questionnaires and the legislation survey
 - identification of Gaps and Barriers to mainstream biodiversity in transport infrastructure as a final result of the WP3
- Consulting of experts and workshops
 - special workshop of WP5 – Task 5.1 “Mapping the mainstreaming of Green and Grey Infrastructure” organized in the framework of BISON project at IENE 2022 international conference (Cluj – Napoca, Romania) on 23rd September 2022
 - online workshop with members of the Advisory Group of BISON organized online on 26th of October 2022 by CERTH and IENE secretariat.
 - special BISON workshop organized in the framework of the Transport Research Arena (TRA) Conference in Lisbon, Portugal on 14-17 November 2022.
 - Feedback from the Consortium experts.
- Interpretation of results from other projects and institutions.
 - Results on recommendations for harmonizing Green transport Infrastructure and other sectors development, as well as securing ecological connectivity, from other projects and the IENE international conferences Declarations.
 - The use of the Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure.
 - The OECD report on mainstreaming biodiversity in infrastructure development



3.2 Feedback from other BISON activities

3.2.1 BISON policies alignment questionnaires from D5.1

For a thorough analysis to be achieved and in order to present a comprehensive representation of the alignment status in the EU Members States to the EU relevant strategies, the preparation work of D5.1 Report has been divided into 2 different parts:

- The first part concerns the integration of the **biodiversity-related policies of EU** (with focus on the European Biodiversity Strategy and the Green Infrastructure Strategy) **in the transport policies and strategies** of the different EU Members States and
- The second part concerns the **legislation alignment** of the EU Members States **to those EU Strategies** and the respective legislative actions.

These two parts are considered to be interdependent and complementary, so they are both required to provide a good overview of the alignment level of the EU Members States to the EU relevant strategies in total.

The first step for collecting the necessary information on the alignment of the national transport with the policies with the EU Strategies for Green Infrastructure and Biodiversity, has been the development of the BISON questionnaire (<https://bison-transport.eu/questionnaire/>). This questionnaire combined both strategic and technical questions, according to the expertise and the experience of each respondent and fed into the different needs of the project. It has been uploaded to the BISON website for 5 months (March 2021 – May 2021) and it had been widely disseminated by the project's dissemination team in general but also by the different involved partners towards more dedicated and relevant audiences, depending on the varying needs of the different WPs and Tasks.

The assessing of national policies in alignment with the EU Strategies for Green Infrastructure and Biodiversity took place in two steps:

- Through the general BISON questionnaire (March 2021 – May 2021),
- Through a special second complementary questionnaire (March 2022 – April 2022)

Additionally, in order to provide a holistic overview of the integration level of the provisions set by the EU SGI, and the EU Biodiversity Strategy to the transport policy and legislative framework of the EU Member States, emphasis has been provided to both the analysis of relevant literature sources but also to the consultation of relevant experts both from the transport and also the environmental and biodiversity sectors (Loukea et al., 2022).

For the analysis of the input collected by all the sources mentioned at the Section above, and mainly by the second questionnaire, and in order to achieve a homogeneity of the outcomes, specific criteria have been defined and further analysed into parameters and questions (Loukea et al., 2022).

To analyse and define the framework of the final criteria the following methodology adopted in four steps:

1. An initial set of criteria created based on the respective work that took place within the HARMON (Harmonization of Green and Grey Infrastructure in Danube Region) project

(Mot et al., 2019)⁶ based on parameters that have been set up and analysed during the HARMON project,

2. The initial draft framework of the criteria was shared to BISON partners and experts for further analysis, discussion and receiving important input and feedback.
3. The second round of consultation based on the final feedback of the BISON partners with some predefined (optional) possibilities of each answer per, criterion, which have been also suggested.
4. The final criteria defined having in mind and evaluating all the spectrum of the received input and feedback.

More specifically, the defined criteria and their analysis, which have been also used for the development of the second -brief- questionnaire, are presented in the table 1 of D5.1 (Loukea et al., 2022).

Both the surveys were intended to try to compensate for the lack of pre-existing information on the situation in the different European countries. The results of consultations are by nature dependent on the free participation of people and their level of knowledge, so the result is indicative of the situation, in its diversity. The overview of the results of the assessment of the alignment of National Transport Policies with the EU SGI and the Biodiversity Strategy with the two questionnaires can be described in the following points per the eight criteria (C1 to C8) and parameters as are presented in table 1 of D5.1 (Loukea et al., 2022).

C1: "Integration" of EU SGI in the National strategic planning for transports

A. Response based on answers of 20 countries of the first questionnaire

- 33,3% answered "Yes",
- 38,9% answered "No", while:
 - ✓ 87,5% have neither launched a process towards their integration the next 1-2 years
 - ✓ 57,4% stated that there is no legal obligation to integrate EU-SGI in their Transport Development at national level
- 27,8% answered "I don't know"

B. Response based on answers of 13 countries of the second questionnaire

- 27% answered "Yes",
- 27% answered that "the integration is still in progress"
- 37% stated that no relevant action has been taken so far
- 9% answered "I don't know"

⁶ HARMON project aimed to support the governance and implementation of the EU Strategy for the Danube Region (EUSDR), as well as improve the governance system and the capabilities and capacities of public institutions and key actors involved in complex transnational project development to implement the EUSDR in a more effective way.

Conclusion for Criterion 1:

- **1/3 of the countries have achieved the “integration” of the EU SGI in the national strategic planning for transport.**
- **1/3 of the countries not achieved the “integration” or they are in progress⁷.**
- **1/3 of the countries have unknown level of “integration”**

C2: Inclusion of ecological connectivity-related targets in national Transport Master Plans (or similar strategic transport documents) and their SEAs (based on 20 answers of the first questionnaire).

A. Response based on answers of 20 countries of the first questionnaire

- In 78% of the countries, a SEA has been already implemented within their National/Regional Master Plan(s), or relevant documents,
- 86% of the countries have also integrated the special topics of biodiversity, ecological connectivity and Green Infrastructure in to their SEAs,
- In 62% of the countries the integration has been also translated into regional policies, strategies and action plans.

B. Response based on answers of 13 countries of the second questionnaire

- 25% of countries have set the precise target-based requirements within their Transport Master Plan (or similar strategic transport document) and SEA,
- 58% of countries are in progress for setting the precise target-based requirements within their Transport Master Plan (or similar strategic transport document) and SEA.

Conclusion for Criterion 2:

- **Most of the countries have included ecological connectivity-related targets in Transport Master Plans or their SEAs**

C3: Identification and detailed mapping of Green and Grey Infrastructure conflict points at national and regional level.

A. Response based on answers of 13 countries of the second questionnaire

- In 46,15% of the countries Green and Grey Infrastructure maps are available in order to support harmonized decision-making at the national and regional levels in useful formats (i.e., GIS shape files), or that all structures (drainages, under or overpasses) on linear transport infrastructure are being considered and adapted as potential wildlife crossing structure.
- For the rest 53,85% of the countries this is an on-going process.

⁷ The survey was not able to specify the way ahead to achieve integration, nor its speed of progress

Conclusion for Criterion 3:

- **Half of the countries have identified and mapped detailed Green and Grey Infrastructure conflict points at national and regional level**

C4: Efficient involvement of the key-stakeholders and communication (based on 13 answers of the first questionnaire).

A. Response based on answers of 13 countries of the second questionnaire

- 44% of the countries have already established a process ensuring the efficient participatory engagement of the key- stakeholders and outreach to the general public during all phases of the transport project development,
- In 56% of the countries efficient engagement of key stakeholders is still in process encouraged by authorities/official responsible bodies by setting up open consultation committees / working groups.

Conclusion for Criterion 4:

- **Half of the countries have efficient involvement of the key-stakeholders and communication**

C5: Enforcement of the mitigation hierarchy on selection of linear transport infrastructure alignments in relationship with natural protected areas and ecological corridors.

- No feedback for this criterion

C6: Provision of clear biodiversity-related objectives and appropriate tools and processes to be used during the whole life cycle of transport infrastructure.

- No feedback for this criterion

C7: Environmental evaluation of the Transport Master Plans in the form of monitoring their impacts on biodiversity, according to the SEA Directive.

A. Response based on answers of 13 countries of the second questionnaire

- 50% of the participating countries are currently developing an environmental monitoring of the National Transport Plan, based on relevant parameters related with biodiversity, ecological connectivity and Green Infrastructure status
- 50% of the countries stated they don't have such a procedure

Conclusion for Criterion 7:

- **Half of the countries are currently developing an environmental monitoring of the National Transport Plans**

C8: Established follow-up process to support the improvement of Transport Master Plans, based on evaluation of a long-term monitoring data.

A. *Response based on answers of 13 countries of the second questionnaire*

- Most countries were mentioned to be in progress of developing a follow-up process (including, Austria, Czech Republic, France, Germany, Spain, Switzerland), mainly based on the evaluation and recording of lessons learned that are being made available to key-stakeholders, facilitating knowledge transfer by responsible bodies/authorities.

Conclusion for Criterion 8:

- **There is no country with established process of follow-up process to support the environmental improvement of Transport Master Plans, based on evaluation of a long-term monitoring data.**
- **Most of the countries are currently developing an environmental monitoring of the National Transport Plans.**

3.2.2 BISON legislation alignment survey from D5.1

Within Task 5.1 an analysis of the relevant European and national legislation that took place, describing –among others- how green infrastructure and biodiversity issues are taken into consideration in infrastructure legislation and also to which extent are biodiversity regulations applicable to infrastructure projects.

In addition, a second analysis of national systems was also carried out, through the feedback of a comparative questionnaire that consisted by the 3 main sections:

- a) Description of the national background of the examined countries,
- b) Description of the national transport infrastructure policy in comparison to the EU environmental requirements and
- c) A juridical review.

For this comparative law study, 7 countries were studied: Belgium, Bulgaria, France, Germany, Italy, Spain, and Sweden. This selection provides a broad overview, with countries with different state and economic structures. Structural differences necessarily have a strong influence on how green infrastructure is taken into account in legal and political terms, the powers and competences are not distributed in the same way at the territorial level according to the organizations. Depending on whether the countries are organised in a federal (Germany, Belgium), regional (Italy, Spain) or unitary (Bulgaria, France) way, decentralization is more or less strong, legislative and political competences being more or less distributed between national and local levels. Depending on the type of organization, the regions are more or less autonomous and therefore have more or less prerogatives in terms of the environment and transport in relation to the States. For example, in Italy, some regions and cities have much more integrated green infrastructure than others, while in Bulgaria the consideration of green infrastructure is much more uniform (Loukea et al., 2022).

The overall view of the results of the assessing the legal alignment of the National Transport Policies with the EU SGI and the Biodiversity Strategy can be summarized in the following points:

1. **The definition of Green Infrastructure varies** greatly from country to country as in general, is viewed much more narrowly in national definitions than the broader European Commission's approach.
2. **Despite** the fact that **most of the countries have included ecological connectivity-related targets in Transport Master Plans or their SEAs:**
 - **Half of the countries have identified and mapped detailed Green and Grey Infrastructure conflict points at national and regional level.**
 - **Half of the countries currently developing an environmental monitoring of the National Transport Plans.**
3. The creation of **green transport infrastructure is slowed down because the distinction between environmental and transport bodies** since transport departments do not always have the same issues to deal with as environmental departments.
4. Where **there are disputes over transport and environmental matters**, they are dealt with in all countries by the administrative court.
5. Although legislation generally frames the balancing between transport and environment, it is often the economic interests that take precedence, **direct economic benefits being valued more highly than potential long-term benefits.**
6. In recent years, in a number of the countries studied, **environmental issues are increasingly taken into account in the decisions of judges.**
7. Regarding the application of European environmental law, most of the **countries studied have difficulties in ensuring the proper application of green infrastructure legal framework**, with wide disparities between countries.
8. **Regarding the specific application of green infrastructure standards**, it is the proper application of environmental law that is the problem, with varying degrees of **implementation difficulties from country to country.**
9. Sometimes, the **problem is the transposition of the norms and rules about green infrastructure**, which is carried out without any real and substantial thought, and thus **poorly adapted and adaptable to the economic and social realities of the countries.**
10. In several cases, **environmental standards conflict with each other**, eg. climate change versus biodiversity.
11. **On the transport issue, the integration of environmental considerations is mainly based on the environmental impact assessment** and impact assessment procedures (which take different names from country to country) of plans and projects.
12. **The environmental impact assessment studies sometimes have a limited consideration of biodiversity.** However, the fact that an area is classified as Natura 2000 is very binding for the authorization of a project.
13. **Faster procedures result in less consideration of environmental considerations** than in conventional procedures. Such perfunctory cases are under high juridical risk which leads in longer delayed processes of the projects implementation.

14. **There are many gaps in the implementation of impact studies**, which are sometimes **characterized by poor quality**, and which therefore take little account of the potential damage to the environment caused by the projects.
15. **The green infrastructure requirements have not been fully integrated in most of the countries studied**. This integration is underway, or has been achieved through guidelines or "secondary legislation"⁸, **which are not legally binding**. This type of integration is problematic because it severely limits the potential development of green infrastructure in member countries.
16. Problematic integration means that **there are a number of legal decisions that were unfavourable to biodiversity when creating or expanding transport infrastructure, with sometimes irreversible damage to the environment**.
17. **There are good initiatives, such as in Sweden (Reference), where the implementation of internal regulations to address biodiversity adaptation needs has improved impact assessments**, and thus the consideration of the environment.
18. Concluding in an overall view, **the European legislation on green infrastructure is being gradually taken into account, but indirectly**.

3.2.3 BISON Work Package 3 on gaps and barriers

The work that has been done from early in the project in WP3 has also been taken into account in developing the BISON recommendations on policy and strategy harmonization. Especially after the workshop of WP3 at IENE 2022 conference, where feedback from external experts has been selected and the gaps and barriers went to an "almost final" format (see "Appendix II. Gaps and Barriers for the BISON Workshop of WP3 in IENE International Conference 2022"), the list has been thoroughly examined and taken as much as possible into account in our recommendations list.

⁸ Secondary legislation is a collective term used to describe all the various types of law the European institutions can make: Regulations, directives, decisions (binding), as listed in Article 288 of the Treaty on the Functioning of the EU); "soft laws" (non-binding) such as communications, opinions, recommendations, white and green papers; Delegated Acts and Implementing Acts. Available at: <https://www.eui.eu/Research/Library/ResearchGuides/EuropeanInformation/EU-Legislation>



Figure 3. Photo of the BISON D3.1 Workshop on gaps and barriers in IENE 2022 International Conference in Cluj-Napoca, Romania (© Radu Mot)

The groups of gaps and barriers that were considered as critical and have been taken into account at the recommendations are the following:

- Group A #1 – LEGISLATION/ FUNDING (Policies, Strategies, Plans, Laws, Budgets...)
- Group B #2 –GOVERNANCE/ COMMUNICATION/ COOPERATION (Awareness, training seminars, stakeholder cooperation...)
- Group D – TOOLS/ PROCEDURES (Guidelines, handbook, standards, monitoring, methods, databases...)

3.3 Feedback from experts

3.3.1 BISON WP5 workshop at IENE conference

The draft recommendations presented at the D5.2 workshop in IENE 2022 Conference in Cluj – Napoca, Romania in 23th of September 2022 and discussed with 35 experts from all over Europe receiving comments in form of questions, needs for clarifications, additions and changes on the expressions and structure of the recommendations.



Figure 4 Photo of the BISON D5.2 Workshop in IENE 2022 International Conference in Cluj-Napoca, Romania (© Radu Mot)

One main and general comment was to define the language used throughout the document according to whom this document is targeting to. As mentioned in beginning of this chapter the regrouping of the recommendations was based on this concern. For the same reason, an introductory section regarding the audience of the report assumed important and included explaining the audience targeted based on the Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure.

3.3.2 Getting feedback from the BISON Advisory group and BISON experts

Policy Recommendations were also presented and discussed with BISON Advisory Group members in an online workshop held on 26th October 2022. Several comments received in the workshop and important points of some recommendations discussed and clarified. In a parallel way comments were received from Advisory Group members that didn't attend the online workshop as well as from BISON experts involved in several tasks of the project. A general concern about ranking and prioritizing of the recommendations has been expressed as several are of the same level of importance or are not comparable. Also except of the avoidance of ranking, important comments were received considering the fact that several recommendations are interconnected and complementary each other

3.3.3 BISON workshop at Transport Research Arena (TRA) 2022 Conference

TRA (Transport Research Arena), is the largest European research and technology conference on transport and mobility. TRA is the foremost European transport event that covers all transport modes and all aspects of mobility. In 2022, TRA took place in Lisbon, Portugal on 14-17 November. Themed "Moving together – reimagining mobility worldwide", TRA 2022 brought together experts from around the world to discuss the

newest innovations and future of mobility and transport, building also on the Portuguese historical legacy and linked to overseas transport professionals.

In the framework of the TRA a special Workshop was organized on 16th of November, inviting experts, institutions and organizations from the transport sector and related with the crucial thematic fields of BISON project. In the framework of the BISON workshop in TRA a special debate organized for the D5.2 Recommendations on policy/strategy harmonization and important input received and it was integrated in the final list of BISON recommendations.

9 people with high expertise in transport issues participated at the Special Session of BISON at TRA conference and 7 out of them had already used or are aware of tools towards developing sustainable transport of other linear infrastructure. These experts were asked what would be to one thing that they would recommend for mainstreaming biodiversity into transport and their feedback was taken into account in our recommendations.

3.4 Feedback from relative research (projects/ sources)

3.4.1 Inputs from other international projects on infrastructure and biodiversity

In the Carpathians and surrounded area of Danube River and with cooperation with the Carpathian Convention, three important projects have been implemented on ecological connectivity in relation with transport and other development sectors in rural and nature landscapes. The projects were funded by the Interreg Danube Transnational Programme. Each of the project has produced a list of deliverables like Guidelines, Methodologies, Case Studies, Pilot actions and Policy Recommendations. Based on this experience their Policy Recommendations have been taken into account in order to update the D5.2. Below, the basic characteristics of each project are described providing the links of their policy recommendation for any further information or interest.

3.4.1.1 The TransGREEN project

The TransGREEN project (2017-2019) aims on integrated transport and Green Infrastructure planning in the Danube-Carpathian Region for the benefit of people and nature in the Carpathians. TransGREEN aimed to contribute to safer and environmentally-friendly road and rail networks in mountainous regions of the Danube Basin with a special focus on the Carpathian Mountains. It did so by improving planning frameworks and developing concrete environmentally-friendly and safe road and rail transport solutions taking into account elements of Green Infrastructure, in particular ecological corridors (<https://www.interreg-danube.eu/approved-projects/transgreen>).

The final deliverables of the project included important guidelines and tools (<https://www.interreg-danube.eu/approved-projects/transgreen/outputs>) as the “*Wildlife and Traffic in the Carpathians: Guidelines how to minimize the impact of transport infrastructure development on nature in the Carpathian countries*”, the “*Tool for registering animal-vehicle collisions*”, the “*EIA Training Package*”, the “*Public Participation Scheme*” and a catalogue of measures for each pilot area.

Additionally, several policy/strategy deliverables were produced which considered and integrated in D5.2. Such deliverables are the “TransGREEN Policy Recommendations”, the “*Draft Action Plan of Carpathian Convention*” (For the Implementation of the Protocol on Sustainable Transport (Mikulov, 2014) to the Framework Convention on the Protection and Sustainable Development of the Carpathians (Kyiv, 2003), and the “TransGREEN Final Conference Declaration – Bucharest, June 25th 2019.

3.4.1.2 *The ConnectGREEN project*

The ConnectGREEN project (2018-2021) aimed on Restoring and managing ecological corridors in mountains as the green infrastructure in the Danube basin (<https://www.interreg-danube.eu/approved-projects/connectgreen>). Through ConnectGREEN project, partners from different countries and various fields of activity (spatial planning, research, government, biodiversity conservation) joined forces to increase the capacity of ecological corridors identification and management and to overcome the conflict between infrastructure development and wildlife conservation. Valuable knowledge and experience will be made available to spatial planners and vice versa for finding the best ways to develop infrastructure and other plans in order to secure ecological connectivity in the Carpathians.

The final deliverables of the project (<https://www.interreg-danube.eu/approved-projects/connectgreen/outputs>) included important methodologies and tools as the “*Methodology for identification of ecological corridors*”, the “*International Action Plan on conservation of Large Carnivores and ensuring ecological connectivity in the Carpathians*”, the “*Guidelines on how to use spatial planning tools in integrative management of ecological corridors*” and the “*Set of Recommendations developed together with spatial planners to avoid/minimize fragmentation of ecological corridors and Natura 2000 sites*”. Elements of the above deliverables have been integrated in D5.2 and especially from the “*Set of Recommendations developed together with spatial planners to avoid/minimize fragmentation of ecological corridors and Natura 2000 sites*”.

3.4.1.3 *The SaveGREEN and the Declaration of Carpathian Convention on ecological connectivity*

The SaveGREEN project (2020-2022) was focused on Safeguarding the functionality of transnational important ecological corridors in the Danube basin (<https://www.interreg-danube.eu/approved-projects/savegreen#!>). SaveGREEN aimed to demonstrate ways of designing appropriate mitigation measures and maintaining or improving the functionality of ecological corridors through integrated planning. It builds on key results of the Interreg Danube Transnational Programme (DTP) projects TransGREEN, ConnectGREEN and HARMON, highlighting the necessity of monitoring the impact of such measures, the lessons’ learned, as well as the proper recommendations for follow-up action and policy design.

The basic deliverable of the project related to D5.2 is the “*Local cross-sectoral operational plans (CSOPs) for the 7 pilot areas including concrete measures to safeguard, enhance, restore the functionality of ecological connectivity in the pilot areas*”. Additionally, two policy/strategy deliverables considered and integrated in the next draft of the D5.2, the “*Recommendations towards integration of mitigation measures into the national and EU level policy processes including programming process of EU funds*” and the high-level political declaration on maintaining and restoring ecological corridors/green infrastructure in the frame of the Carpathian Convention and the EU Strategy for the Danube Region with the title “*Achieving functional biodiversity in the Danube-Carpathian Region by mainstreaming ecological connectivity*” (<https://www.interreg-danube.eu/approved-projects/savegreen/outputs>).

3.4.2 Mainstreaming biodiversity in policies according OECD

The national level entry point for biodiversity mainstreaming in policies is an important challenge as it is most often at this level that long-term strategies are developed, while it is also at this level that politics should be captured and presented. According to a special report of policy highlights of OECD on mainstreaming biodiversity for sustainable development (OECD, 2018), important features to help the promotion of this mainstreaming and enable its implementation in practice include:

- a) mainstreaming biodiversity across relevant national plans and strategies;
- b) ensuring coordination and coherence across institutions and clearly defining respective roles and responsibilities;
- c) generating the evidence-base needed for informed decision-making (e.g., with respect to legislative and policy frameworks) and
- d) mainstreaming biodiversity in national budgets.

Moreover, the need to monitor and evaluate mainstreaming efforts cannot be underestimated, in order to achieve desired objectives, with the use of indicators being a key component of this. On the other hand, using the appropriate indicators is essential for a follow up process which has to be established in order to create a permanent supervising system which will be constantly improved in order to translate policy decisions in effective actions in practice. Additionally, for biodiversity mainstreaming to be achieved, all levels of government should be involved and all relevant stakeholders should be included in four group of interest: informative, consultancy, involvement and fundamentally collaborated (Georgiadis et al., 2020).

3.4.3 Inputs from the IENE international conferences on infrastructure and ecology Declarations

Since 2012, a Declaration is produced in each IENE conference focusing in a topic that requires particular attention from transport and nature stakeholders. The message is agreed among all participants and addressed to decision makers, planners, technicians and researchers as well as the general public, and claim for actions that contribute to find solutions to old or emerging conflicts, to gap lacks of knowledge and to reduce the pressures that transport infrastructure exerts on nature.

The Declarations used for integrating their recommendations to the D5.2 Policy Recommendations are those of:

- The IENE 2012 Conference in Germany and the Potsdam Declaration titled “*Overcome Barriers – Europe-wide and now. Life Needs Mobility*” highlighting the need to develop an integrative European Defragmentation Programme (<https://www.iene.info/international-conferences/iene-2012/>).
- The IENE 2018 Conference in the Netherlands and the Eindhoven Declaration titled “*Building bridges and crossing borders for the defragmentation of Europe*” celebrating the finalization of the National 15 years long Defragmentation Programme and highlighting the need to cross border cooperation on development the EU Trans European Transport Network (TEN-T) in harmonization of the EU TEN-G Strategy (<https://www.iene.info/international-conferences/iene-2018/>).

- The IENE 2022 Conference in Romania and the Cluj-Napoca Declaration titled “*Connecting people, connecting landscapes*” highlighting the different level of fragmentation of landscapes and ecosystems between Western and Eastern Europe and based on lessons learned in Western Europe to develop strategies towards avoiding fragmentation in Eastern Europe (<https://www.iene.info/news/connecting-people-connecting-landscapes/>).

3.4.4 Inputs from the Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure

The Global Strategy for Ecologically Sustainable Transport and other Linear Infrastructure (LTI) has been developed by an international working group coordinated by IENE and supported by an international coalition formed from the international conferences on transport and ecology and conservation organisations as IENE, ICOET⁹, ANET¹⁰, ACLIE¹¹, WWF¹² and IUCN¹³. The working group is drawn from global experts in transport and ecology and aims to work towards finding a ‘win-win’ solution for securing mainstreaming biodiversity and ecological connectivity and avoiding, mitigating, or compensating ecosystems’ fragmentation during transport infrastructure development or adaptation (Georgiadis et al., 2020).

Basic elements that used and integrated in the D5.2 are:

1. The basic concepts as main challenges need to address in ecologically sustainable LTI as are described in the **table 2** (adapted from Georgiadis et al., 2018);
2. The definition of the Sustainable LTI;
3. The basic principles of Sustainable LTI as are described in the **table 3** (adapted from Georgiadis et al., 2018) ;
4. The basic steps on mapping and engaging the appropriate stakeholders;
5. The Action Plan of the Global Strategy.

Table 2 Basic concepts of ecological connectivity in relation with the transport infrastructure

	Ecological connectivity related concepts	Main logical framework concepts	Description
	<i>Genetic isolation and wildlife mortality</i>	<i>Problem</i>	The main environmental challenges related to LTI development are: genetic isolation, wildlife mortality and the loss of ecosystem functions which can cause significant changes in habitats, thus making it impossible for the original community of species to persist.

⁹ International Conference on Ecology and Transportation (USA/North America)

¹⁰ Australasian Network of Ecology and Transportation

¹¹ African Conference on Linear Infrastructure and Ecology

¹² World Wildlife Fund

¹³ International Union for Conservation of Nature

	Ecological connectivity related concepts	Main logical framework concepts	Description
	Habitat fragmentation	Cause of the problems	The lack of genetic exchange is caused by the habitat fragmentation on both terrestrial and aquatic ecosystems.
	Securing the ecological connectivity	Aim	The main aim is to secure the ecological connectivity in important natural landscapes , as species' basic habitats or ecological corridors when they are intersected by LTI.
	Sustainability	Objective	Sustainability and quality must be achieved for three different perspectives: Social, Environmental and Economic.
	Green and Grey Infrastructure	Crossing point and conflict areas	Adopting the concepts of Green Infrastructure, the Natural Capital and the Ecosystem Services and identifying the conflicts in the main “crossing points” that Grey - Infrastructure such as LTI pass through Green Infrastructure/natural areas.
	The hierarchy of priorities: Avoidance - Mitigation – Compensation	Solution	The achievement of sustainable coexistence of Green and Grey Infrastructure must focus on resolving conflict through specific measures following the hierarchy of priorities of Avoidance - Mitigation – Compensation.

Table 3 International Principles for Sustainable LTI

International Principles for Sustainable LTI	
1	Strong policy and legal framework: Safeguarding landscape connectivity as a primary concern for any project scale, establishment and strengthening of a policy and legal framework of regulatory requirements for sustainable LTI development is necessary.
2	Strategic planning: Any major LTI should be based on an overall strategic plan, and designed and developed to guarantee ecological fluxes and well-connected wildlife populations before any implementation and funding decision is made. The “Mitigation Hierarchy” of ‘Avoidance – Mitigation – Compensation’ should also be implemented.
3	Ecosystem approach: LTI projects should combine habitat quality with healthy ecosystem functioning based on the “Precautionary Principle ^{14, 15, 16} ”. The value of Natural Capital and ecosystems services should be included along with projects that acknowledge cultural diversity, as an integral component of ecosystems (www.cbd.int).

¹⁴ <http://www.precautionaryprinciple.eu/>

¹⁵ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0001:FIN:EN:PDF>

¹⁶ <https://unesdoc.unesco.org/ark:/48223/pf0000139578>

International Principles for Sustainable LTI	
4	Any case is a unique case: Each LTI project is site-and species-specific and is therefore unique. Mitigation should be based on scientific and best available local knowledge without “copy and paste” from other projects.
5	Multi-disciplinary and cross-sector cooperation: To ensure integration and coordination, the establishment of multi-level governance and stakeholder engagement, with multi-disciplinary co-operation amongst different professionals (such as engineers, policy makers, economists, ecologists and environmentalists) as well as cross-ministerial agencies (such as, nature conservation, transportation, finances) should be applied.
6	Stakeholder involvement and public participation: Involvement of civil society and all the relevant stakeholders in the development of LTI projects.
7	Responsible polluter pays principle: Implementation of the “polluter pays principle” where the integration of environmental consideration is responsible for LTI investments, after clarifying the ethical and transparency concerns; this should include concrete mitigation measures from the onset of the LTI planning phase, until the tendering and contracting, and finally to the building and operating phases.
8	Long life effective maintenance: Inclusion of LTI maintaining mitigation measures in the budget for the life-cycle of the operation.
9	Resilience to climate change: LTI should be planned or adapted with consideration for their resilience to natural disasters and risks, associated with extreme weather events and climate change. This is especially the case for TIL, where responses to stronger and intense precipitation with larger bridges and culverts servicing both hydraulic and ecological connectivity purposes is a critical requirement.
10	Adaptable infrastructure habitats: Habitats related to LTI should be planned and managed in a manner that fulfils their potential as positive biodiversity refuges and ecological corridors.
11	Environmental supervision: Inclusion of environmental supervision that monitors the effectiveness of LTI features and the habitat and wildlife populations in all phases of programmes, plans and projects; this is within the Strategic Environmental Assessment, Environmental Impact Assessment to the design of full operation and maintenance.
12	Culture of learning: Establishment of a culture of learning to develop and support continuous evaluation and exchange of knowledge and experience between the interested, relevant and authorised organisations and state services.

4 BISON RECOMMENDATIONS ON POLICY/ STRATEGY OF HARMONIZATION OF GREY AND GREEN INFRASTRUCTURE

4.1 Definition of thematic fields

The overall framework of the Recommendations had to be structured in separated thematic fields to achieve a clear format and understanding of the recommendations. The need of categorisation of the recommendations was covered by the identification of specific thematic fields that were defined in order to cover the great variety of the defined recommendations. The recommendations were assigned to each specific thematic field based upon the special needs and characteristics of each one. The thematic fields defined tried to cover all the aspects of the recommendations, nevertheless some recommendations may exist in more than one thematic fields. The five policy and administrative thematic fields defined are the following:

1. International and National Policy– Policy and Strategies, where:
 - The basic concepts of ecological connectivity in relation with the transport infrastructure have to be recognized,
 - These main concerns have to be expressed in a political will,
 - The critical environmental challenges have to be translated on appropriate political decisions.
2. National Planning where:
 - Plans are based on relative data for biodiversity, green infrastructure, ecosystem services and landscape),
 - Data are evidence and scientific based,
 - Decisions determine the future of the landscape and aim to keep the impacts of transport infrastructure on biodiversity and landscapes reversible.
3. Legal framework and instruments which:
 - Determine procedures of decision making, screening, design, implementing and environmental monitoring of transport infrastructure projects,
 - Provide the appropriate tools and guidelines to be used for planning, constructing and operating and maintain transport infrastructure in the most sustainable way,
 - Support transparency and stakeholders' engagement,
 - Secure funding of concrete mitigation measures from the onset of the transport infrastructure planning phase, until the tendering and contracting, and finally to the building and operating phases.
4. Regional Strategies and instruments which:
 - Transform the global thinking to local acting,
 - Unite the national planning to local needs,
 - Support the participation of local societies,
 - Create the field on experience and evolution of good practices.
5. Follow up process in national and regional level, in which:
 - Monitoring and environmental supervising is essential,
 - Mistakes are recognized and good practices are highlighted,

- Data are used for updates, improvements and better future design and planning,
- Culture of learning is established with exchange of knowledge and experience between the interested, relevant and authorised organisations and state services.

4.2 BISON recommendations list

In the **Appendix I** a synthetic matrix creates a background for analysis and combination of the conclusions and results of both the questionnaires and the legislation research in order to create a framework of initial framework of recommendations based of the predefined criteria of table 1 of D5.1 (Loukea et al., 2022).

BISON Recommendations, as they have been developed in D5.2 are presented below for each of the five policy and administrative levels.

4.2.1 Field 1: International and National Policy I – Policy and Strategies documents

The recommendations in the policy and administrative field1 on international and national policy are described below:

- 1.1 Support the appropriate political will joining the international and European policies with decisions on strategies and action plans on national level based on criteria of the four pillars of sustainability (society, environment, economy and reversibility of impacts) and biodiversity conservation needs.
- 1.2 Provision of clear definition* of Green Infrastructure with concrete management directions for Transport Policy and Strategies documents as well for other sectors (i.e., agriculture policy) considering their cumulative impacts on GI identifying and ensuring the functionality of ecological corridors.

*Green infrastructure definition should be done in EU level including transport sector examples and then each country should handle a proper translation of this definition.

**The general aim for Green Infrastructure from a biodiversity conservation perspective should be to contribute to the conservation of relevant species, habitats and ecosystems. Ratification of International Conventions and agreements with concrete National Action Plans transposed them to the national legal and institutional system.

- 1.3 Mainstreaming of biodiversity and ecological connectivity in national transport policies and strategies integrating the following basic concepts:
 - The problem: Genetic isolation and wildlife mortality;
 - The cause: Habitat fragmentation and land degradation;
 - The aim: Ecological and landscape connectivity;
 - The objective: Sustainability;
 - The Conflict: Green and grey Infrastructure, and,
 - Solution: Avoidance and mitigation as the main solutions

- 1.4 Mainstreaming of biodiversity in the EU programmes funding and national budgeting for transport and all other sectors over the years.
- 1.5 Implement the “responsible polluter pays” principle not only from the pollution perspective, but also taking into consideration the impacts on biodiversity and ecological connectivity as well as ethical and transparency concerns.
- 1.6 Define entry points for mainstreaming biodiversity in all development sectors in national level. Such entry points can be:
 - National level policies and plans;
 - Sectoral level
 - Development co-operation programmes
 - Local/regional level (development plans and actions)
 - Projects’ level

4.2.2 Field 2: National Planning

The recommendations in the policy and administrative field 2 on national planning are described below:

- 2.1 Enforce the identification and detailed mapping of Green and Grey Infrastructure conflict points, including current and future infrastructure for transport and energy and involving local stakeholder for the appropriate mapping. Future TEN-T plans and policies should assess and integrate the impact on the ecological connectivity and especially on Natura 2000 network and other protected areas and their coherence upfront in a transparent manner.
- 2.2 Aim to effective protection of remaining large un-fragmented and road less areas both in and outside protected areas, through:
 - Promoting proactive approaches for minimizing negative impacts during the planning and construction stages of new infrastructure;
 - Preventing further increase of the density of the transportation network;
 - Restoring connectivity across existing transportation and other infrastructure implementing defragmentation practices;
 - Decommissioning and remove existing non efficient transportation and other infrastructure.
- 2.3 Strengthen interdisciplinary cooperation and setting up of cross-sectoral and interagency Working Groups (including internationally/cross-border) for sharing and exchange information, methodological developments, analysis of results and trade-off discussions; ensure that relevant staff is tasked to participate regularly, and meetings are prepared and moderated effectively. Ensure coordination and coherence across institutions and clearly defining respective roles and responsibilities.
- 2.4 Support the completion of the European Defragmentation Map and the establishment of cross-sectoral cooperation and common methodologies technics and tools on mapping corridors and crucial Green Infrastructure and biodiversity elements for SEA.

2.5 Ensure that biodiversity is integrated as an equivalent steering mechanism in the planning phases of national Transport Master Plans (or similar strategic transport documents) and programs and their SEAs and achieving the goals in practice: Ecological connectivity-related targets; A holistic - ecosystem approach based on the “Precautionary Principle” respecting the value of natural capital and ecosystem functions; Ecosystem services embracing dynamism of ecosystems over short and long-time scales; Resilience and adaptation of climate change. Assuming reversibility of impacts considering decommissioning scenarios; Establishing criteria with the appropriate weigh value for each environmental factor avoiding conflicts between environmental fields e.g., biodiversity vs climate change

2.6 Ensure that the mitigation hierarchy is applied and fully respected during strategic planning on selection of linear transport infrastructure alignments based on quantity and quality of biodiversity data and green infrastructure elements and the reversibility of impacts in relationship with:

- Protected areas;
- Ecological corridors;
- Areas of high importance in biodiversity.

2.7 Include reversibility of environmental impacts on infrastructure planning as key sustainability criterion for decision making. Impacts of human activities on the environment have to be reversible.

2.8 Define common international / national guidelines for the appropriate mitigation and compensation measures and the cost-benefit analysis of transport programmes and projects which fully reflect environmental costs and benefits.

2.9 Plan and manage adaptable Habitats related to Transport Infrastructure (HTI) to fulfil their potential as positive biodiversity refuges and ecological corridors but avoiding to function as traps for wildlife and dispersal corridors for alien species.

2.10 Include long life appropriate maintenance of infrastructure and sufficient monitoring of its effectiveness on wildlife permeability and biodiversity in all planning and budgeting of transport and other developing projects.

2.11 Periodically monitor and assess the impact of transport master plans implementation in order to support the follow up process.

2.12 Design and finance capacity building measures and empower stakeholders to participate effectively in transport planning processes with transparency. Further, design and finance capacity-building measures for infrastructure planners and policy-makers on how to properly define the objectives) of the impact assessments, supervise the development and conclude on results such as adapting the siting and design of infrastructure.

4.2.3 Field 3: Legal framework and instruments

The recommendations in the policy and administrative level 3 of legal framework and instruments are described below:

3.1 Create a clear legal, funding and regulatory framework with integrating green infrastructure, biodiversity and ecological connectivity in environmental supervising of the whole life cycle of transport infrastructure projects and the effectiveness of the mitigation and compensation measures.

- 3.2 Create a concrete and clear legal framework in both EU and national level for integrate green infrastructure and biodiversity in transport and other development sectors. Mitigation measures on/under linear infrastructure (as wildlife crossings) should be assessed as critical part of green infrastructure.
- 3.3 Harmonize and coordinate, based on use of international criteria and existing lessons learned (from Directives, research, etc.) and their evaluation, the alignment on legislation within countries with federal governments and administrations.
- 3.4 Create a spatial planning Directive (including maritime spatial planning) considering the need of coordination between national level and federal states.
- 3.5 Give the appropriate time on the assessment of the environmental impacts to obtain both quantity and quality of evidenced information and data as a baseline for the final decisions. Avoid faster procedures on environmental assessment and evaluation of alternative solutions considering that:
 - the more extensive a SEA is on identifying conflicts points, the faster and sufficient will be the EIA.
 - the more extensive an EIA is on identifying concrete problems the more effective and less costly the operation and maintenance will be in a full life cycle timeline of the infrastructure.
- 3.6 Amend infrastructure planning legislation so as to systematically require that technical feasibility studies, costs and revenue forecasts (conducted in the project planning phase) consider mitigation measures. This is particularly important for the coherence of protected areas and landscapes outside of the protected areas that provide critical ecosystem services, especially under current climate change effects.
- 3.7 Development or used pre-defined methodologies and tools (guidelines, standards, indicators) to refine the cumulative impact analysis and measuring the impacts on biodiversity and landscape.
- 3.8 Establish internal and legal regulations to address biodiversity adaptation needs on impact assessments and the consideration of the environment on transport planning:
 - Laws;
 - Ministerial decisions;
 - Regulations.
- 3.9 Establish a clear legal framework on environmental evaluation of the Transport Master Plans in the form of monitoring their impacts on biodiversity, according to the SEA Directive.
- 3.10 Strong enforcement of the existing laws on including biodiversity and habitats in environmental impact assessment studies (SEA or EIA), regardless whether the transport infrastructure is connected or not with the Natura 2000 network or a wildlife corridor.
- 3.11 Deepening or adopting transversal European legislation regulating the protection of specific elements of biodiversity, following the example of the Water Framework Directive.
- 3.12 Simplification and clarification of public construction permitting legislation and respective policy.

- 3.13 Upgrade laws and policies on public procurement, public–private partnerships, power purchase agreements and concession agreements to seek best results according to the four pillars of sustainability across the infrastructure life cycle.

4.2.4 Field 4: Regional strategies and instruments

The recommendations in the policy and administrative level 4 on regional strategies and instruments are described below.

- 4.1 Integrate biodiversity and ecological connectivity in Regional Transport and GI-Biodiversity Strategies, Plans and Programs and their SEA and projects EIA at different levels: Regional, landscape and site level.
- 4.2 Establish complete framework of environmental criteria with the appropriate weight value for each environmental factor avoiding unfounded conflicts/competition between environmental fields e.g., climate change versus biodiversity.
- 4.3 Support the engagement of key stakeholders, public awareness, citizen science and the communication with the local societies.
- 4.4 Build the necessary partnerships and encouraging collaboration between the partners to overcome imminent (and delayed?) conflicts.
- 4.5 Develop and implement tools to follow the projects' results implementation and environmental supervision (guidelines, Standards, national–regional data Tools and bases).
- 4.6 Production of updated and available open evidence based good practices and guidelines, accessible to all, the comparability of projects, and thus contribute to the emergence of common understandings on appropriate maintenance of existing infrastructure and better planning and design of future project.
- 4.7 Mainstreaming of biodiversity in regional budgeting for transport and all other sectors and also in the budgeting of project implementation in regional level.
- 4.8 Consider that any case is a unique case. Each project is site-and species-specific and therefore unique. Mitigation should be based on scientific and best available local knowledge without “copy paste” from other projects and cumulative impacts of other local projects should be taken in to account.

4.2.5 Field 5: Follow up process in national and regional level

The recommendations in the policy and administrative field 5 in follow up process are described below:

- 5.1 Support the creation and operate of permanent high-quality data bases with updated available information of biodiversity (populations, landscapes, ecosystem services, ecological connectivity, cumulative impacts, wildlife mortality) and ecosystem services on an inter-ministerial platform in order to promote the mainstreaming of biodiversity conservation in infrastructure deployment.
- 5.2 Established standardized follow-up processes to support the improvement of Transport Master Plans and the functionality of ecological corridors, based on evaluation of a long-

term monitoring data and thinking of “alive networks” especially considering climate change. Evaluate actions and adapt management in the light of results, to achieve long-term aims at local and national scales.

- 5.3 Establish independent environmental supervising of the necessary assessments (e.g., Strategic Environmental Assessments, Environmental Impact Assessments, Appropriate Assessments, Climate Change, or Water Framework Directive Assessments) by independent scientific expertise.
- 5.4 Monitoring of landscape fragmentation as an essential indicator of threats to biodiversity, to the sustainability of human land use, and to landscape quality. Tracking the changes in landscape fragmentation on a regular basis is a precondition for being able to diagnose the rate of increase and changes in trends.
- 5.5 Monitoring of status of ecological connectivity of wildlife corridors intersect by linear transport infrastructure with standardized methodologies, ensuring that the designed structural connectivity and applied measures is followed by evidence based functional connectivity.
- 5.6 Promote a culture of learning to develop continuous evaluation and exchange of knowledge and experience. Proactively produce and use the scientific and practical knowledge to promote innovative and sound evidence-based sustainable solutions.

All the aforementioned recommendation have the possibility to be applied in all transport modes that BISON is addressing, namely road, rail, inland waterways, ports, airports and powering transport system - electrical networks, as they are or with minor changes.

5 CONCLUSIONS

The current report explores **the policy/strategy alignment and implementation maturity in reconciliation with the European Union Strategy for Green Infrastructure (EU SGI) for ensuring ecological connectivity in infrastructure development, and the proposed recommendations for addressing the different levels of maturity.** The content of Deliverable 5.2 has been based upon the outcomes of D5.1, and more specifically the initial recommendations on improving policies and legislation status from both EU level and Member States (national) level for their implementation at local/regional level and what specific processes are foreseen towards ecological connectivity. The fact that the subject under research is rapidly evolving and there is conflicting demand for infrastructure development, especially when considering that the situation is very heterogeneous depending on the country, the challenge of a coordinated European approach to this issue is very ambitious and the national and even sub-national difficulties are major. Significant lessons can be learned from the questionnaires phase of D5.1 in combination with the overall documents and projects exploitation phase of the D5.2 and they are related with difficulties of implementation decision of national level in local and project implementation level. This weakness is especially due to lack of synergies between different sectors or lack of continuity between of different administrative levels, especially in countries with federal structure and lack of balance between national and regional/county laws.

Deliverable D5.2 is a result of integrating feedback and input on the findings also by external stakeholders (in a dedicated consultation process) and other projects and actions that are relevant with policies and strategies on harmonization of EU SGI ensuring ecological connectivity in transport infrastructure development. More specifically, the set of derived recommendations is based upon exploitation of the results of the previous report of WP5, namely D5.1, successive survey questionnaires, consulting of experts, workshops, as well as interpretation of results from other projects and institutions.

The recommendations expressed in this report are important as they aim to fill gaps. Some can be treated directly on the operational ground and deployment of actions. Some others may call some research, and thus confirm or complement some research needs identified elsewhere in BISON as in WP3. Also, there are recommendations of **legal** measures and recommendations of **technical** measures. In general, towards implementing technical measures in practice, legal measures and political decisions are needed in order to foresee and request the measures legally. In this respect and in order to support the development of the Strategic Research Deployment Agenda, except of the research on technical aspects, constant research on political and legal aspects has to be promoted and supported for the future.

The final 46 recommendations are formulized in a framework of five distinctive categories:

1. International and National Policy level – Policy and Strategies documents;
2. National Planning level;
3. Legal framework and instruments;
4. Regional Strategies and instruments;
5. Follow up process in national and regional level.

Despite the fact that the overall spectrum of the proposed recommendations is quite wide, they can't be separated from each other. They might have been categorised into 5 different clusters

but they have to be taken in to account as a single matrix of interconnected parameters and factors in a united system.

The recommendations that have been emerged from the work of WP5, have to be handled as baseline framework to update international, national and local policies and strategies on harmonization of Green Infrastructure and Biodiversity with Transport Infrastructure development, especially as urgent need to take the appropriate decision for update policies the soonest under the massive press for infrastructure development and also to support the development of Strategic Research Deployment Agenda of BISON project

Finally, establishing a follow up process for the recommendations, using the appropriate indicators, is essential in order to create a permanent supervising system which will be constantly improved in order to transform policy decisions and strategies in effective actions in practice on the harmonization of convenient transport corridors with permeable wildlife corridors and functional green infrastructure networks.

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APPENDICES



Appendix I. A first framework of indicative recommendations as a matrix of the conclusions and results of both the questionnaires and the legislation research

Criteria	Conclusions of Q	Results of legislation research	Recommendations
1. Integration of EU SGI in the National strategic planning for transports.	<ul style="list-style-type: none"> • 1/3 of the countries have achieved the “integration”. • 1/3 of the countries not achieved the “integration” or they are in progress. • 1/3 of the countries have unknown level of “integration” 	<ul style="list-style-type: none"> • The definition of Green Infrastructure varies greatly from country to country as in general, is viewed much more narrowly in national definitions than the broader European Commission’s approach. • The creation of green transport infrastructure is slowed down because the distinction between environmental and transport bodies since transport departments do not always have the same issues to deal with as environmental departments. • Regarding the application of European environmental law, most of the countries studied have difficulties in ensuring the proper application of green infrastructure legal framework, with wide disparities between countries. • The green infrastructure requirements have not been fully integrated in most of the countries studied. This integration is underway, or has 	<ul style="list-style-type: none"> • Provision of clear definition of Green Infrastructure with concrete management directions for each development sector. • Established cross-sector working groups for developing Transport Plans and Programmes based on consultation with experts and National Agencies. • Create a concrete and clear legal framework for integrate green infrastructure and biodiversity in transport and other development sectors. • Include reversibility of environmental impacts on infrastructure planning.as key criterion of sustainability base for decision making.

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Criteria	Conclusions of Q	Results of legislation research	Recommendations
		<p>been achieved through guidelines or “soft law”, which are not legally binding. This type of integration is problematic because it severely limits the potential development of green infrastructure in member countries.</p> <ul style="list-style-type: none"> • Problematic integration means that there are a number of legal decisions that were unfavourable to biodiversity when creating or expanding transport infrastructure, with sometimes irreversible damage to the environment. • the European legislation on green infrastructure is being gradually taken into account, but indirectly. 	
2. Inclusion of ecological connectivity-related targets in national Transport Master Plans (or similar strategic transport documents) and their SEAs	<ul style="list-style-type: none"> • Most of the countries have included ecological connectivity-related targets in Transport Master Plans or their SEAs 		<ul style="list-style-type: none"> • Enforce the inclusion of ecological connectivity-related targets in national Transport Master Plans (or similar strategic transport documents) and their SEAs • Include reversibility of environmental impacts on infrastructure planning as key criterion of sustainability base for decision making.
3. Identification and detailed mapping of Green and Grey Infrastructure conflict	<ul style="list-style-type: none"> • Half of the countries have identified and mapped detailed Green and Grey Infrastructure conflict points at national and regional level 		<ul style="list-style-type: none"> • Enforce the Identification and detailed mapping of Green and Grey Infrastructure conflict points. • Support the completion of the European Defragmentation Map and the establishment of common methodologies technics and tools on

Criteria	Conclusions of Q	Results of legislation research	Recommendations
			mapping corridors and crucial GI and biodiversity elements.
4. Efficient involvement of the key-stakeholders and communication.	<ul style="list-style-type: none"> • Half of the countries have efficient involvement of the key-stakeholders and communication 	<ul style="list-style-type: none"> • Sometimes, the problem is the transposition of the norms, which is carried out without any real thought, and thus poorly adapted and adaptable to the economic and social realities of the countries. 	<ul style="list-style-type: none"> • Support the engagement of key stakeholders and the communication with the local societies. • Simplification and clarification of public construction permitting legislation and respective policy
5. Enforcement of the mitigation hierarchy on selection of linear transport infrastructure alignments in relationship with natural protected areas and ecological corridors.	<ul style="list-style-type: none"> • No feedback for this criterion? 	<ul style="list-style-type: none"> • The environmental impact assessment studies sometimes have a limited consideration of biodiversity, even if generally the fact that an area is classified as Natura 2000 is very binding for the authorization of a project. • Faster procedures result in less consideration of environmental considerations than in conventional procedures. • There are many gaps in the implementation of impact studies, which are sometimes characterized by poor quality, and which therefore take little account the potential damage to the environment caused by the projects concerned. • There are good initiatives, such as in Sweden, where the implementation of internal regulations to address biodiversity adaptation needs has improved impact assessments, and thus the consideration of the environment. 	<ul style="list-style-type: none"> • Include biodiversity and especially priority species and habitats in environmental impact assessment studies, independently if the transport connected or not with the Natura 2000 network. • Development of methodologies and tools to refine the impact analysis and measuring the impacts. • Give the appropriate time on the assessment of the environmental impacts to obtain both quantity and quality of evidenced information and data as a baseline for the final decisions. Avoid faster procedures on environmental assessment and evaluation of alternative solutions. • Enforce the mitigation hierarchy on selection of linear transport infrastructure alignments in relationship with natural protected areas and ecological corridors based on quantity and

Criteria	Conclusions of Q	Results of legislation research	Recommendations
		<ul style="list-style-type: none"> • Where there are disputes over transport and environmental matters, they are dealt with in all countries by the administrative court. • In recent years, in a number of the countries studied environmental issues are increasingly taken into account in the decisions of judges 	<ul style="list-style-type: none"> quality of biodiversity data and green infrastructure elements. • Deepening of the regulation of the use of compensation and the evaluation of its real scope. • Establish internal and legal regulations to address biodiversity adaptation needs on impact assessments and the consideration of the environment on transport planning. • Adopt proactive policies on evaluating environmental demands on real ground in order to obtain sustainable solution without losing considerable and crucial time. • Deepening or adopting transversal European legislation regulating the protection of specific elements of biodiversity, following the example of the Water Framework Directive.
<p>6. Provision of clear biodiversity-related objectives and appropriate tools and processes to be used during the whole life cycle of transport infrastructure.</p>	<ul style="list-style-type: none"> • No feedback for this criterion? 	<ul style="list-style-type: none"> • Although legislation generally frames the balancing between transport and environment, it is often in the economic interests that take precedence, direct economic benefits being valued more highly than potential long-term benefits. • Regarding the specific application of green infrastructure standards, it is the proper application of environmental law that is the problem with the implementation difficulties to 	<ul style="list-style-type: none"> • Create a clear legal and regulatory framework with integrating green infrastructure, biodiversity and ecological connectivity in environmental supervising of the whole life cycle of transport infrastructure. • Production of updated and available open data ensuring greater effectiveness of the exchange of practices, the comparability of projects, and thus contribute to the emergence of common understandings.

Criteria	Conclusions of Q	Results of legislation research	Recommendations
		<p>differ between countries, with different levels of intensity.</p> <ul style="list-style-type: none"> • In several cases, environmental standards conflict with each other. 	<ul style="list-style-type: none"> • Establish criteria on social, environmental and economical sustainability with the appropriate weigh value in areas with environmental interest. • Establish complete framework of environmental criteria with the appropriate weigh value for each environmental factor avoiding conflicts between environmental field e.g., climate change versus biodiversity.
<p>7. Environmental evaluation of the Transport Master Plans in the form of monitoring their impacts on biodiversity, according to the SEA Directive.</p>	<ul style="list-style-type: none"> • Half of the countries currently developing an environmental monitoring of the National Transport Plans 		<ul style="list-style-type: none"> • Establish a clear legal framework on environmental evaluation of the Transport Master Plans in the form of monitoring their impacts on biodiversity, according to the SEA Directive.
<p>8. Established follow-up process to support the improvement of Transport Master Plans, based on evaluation of a long-term monitoring data.</p>	<ul style="list-style-type: none"> • There is no country with established process of follow-up process to support the environmental improvement of Transport Master Plans, based on evaluation of a long-term monitoring data. • Most (half?) of the countries currently developing an environmental monitoring of the National Transport Plans. 		<ul style="list-style-type: none"> • Established follow-up processes to support the improvement of Transport Master Plans, based on evaluation of a long-term monitoring data. • Support the creation and operate of permanent data bases with updated available information of biodiversity.

Appendix II. Gaps and Barriers for the BISON Workshop of WP3 in IENE International Conference 2022

<i>Group A #1 – LEGISLATION/FUNDING (Policies, Strategies, Plans, Laws, Budgets...)</i>	
Code	Gap/Barrier
L1	Lack of EU policies/guidelines to standardize compensation measures and connectivity restoration after decommissioning
L2	Lack of policy, standards and regulations on ecologically sustainable and biodiversity friendly Transport
L3	Lack of official approval for official guidelines even if they are agreed among the relevant ministries
L4	Incomplete integration of EU SGI and EU BS2030 into Transport National policies
L5	Lack of alignment on legislation within countries with federal administrations
L6	Lack of funding (often but not only due to low priority of ecology)
T6	Lack of standard methodology to measure TI impacts on biodiversity
L7	Personal data rights use on automatic animal detection devices registering cars and their passengers
L8	Lack of legal repositories/databases of biodiversity raw data
L9	Neglecting available knowledge regarding ecological corridors due to contradictions between different corridor approaches and/or planning levels
L10	Lack of EU legislation on cross-cutting topics, such as soil artificialization, forest protection...
T14	Management and maintenance policies and plans to enhance biodiversity on verges and other HTI
<i>Group B #2 –GOVERNANCE/ COMMUNICATION/ COOPERATION (Awareness, training seminars, stakeholder cooperation...)</i>	
Code	Gap/Barrier
G1	Lack of effective communication of available knowledge to decision-makers, engineers, field crews... Need to share both successes and failures
G2	Lack of capacity/understanding between TI developers and other stakeholders. Capacity building is considered a crucial cross-sector

	issue.
G3	Lack of awareness/willingness about biodiversity Strategies among policy-makers particularly from transport sector
G4	Lack of awareness of citizens, including children education (needed to influence decision makers, policies etc.)
G5	Weak coordination/cooperation between Ministries/regional/local governments. Within and among countries (trans-border cooperation)
G6	Lobbying of infrastructure 'industry' (manufacturers and others) to keep business as usual'
G7	Unwillingness of actors for changing traditional solutions ('fear of failure', 'aversion to risk', 'fear of legal consequences')
G8	Lack of education of transport technical staff about potential solutions and actions to mainstream biodiversity. Need for Training seminars, special courses, hybrid training
G9	Weak coordination/cooperation between biodiversity/transportation/spatial planning administrations
G10	Political demands for fast project implementation in contrast with long-term required to develop infrastructure
G11	Lack of specialists in key positions with decision and cooperation capacity
G12	Lack of knowledge about cost of biodiversity loss, collisions with vehicles, etc. 'What is the cost of no action?', 'How a sustainable infrastructure should be?'
G13	Lack of multistakeholder governance approach and stakeholder/citizen involvement
G14	Lack on the strategic level implementation
G15	Lack of awareness and knowledge from technical staff, particularly but not only at the design phase. Knowledge transfer to practitioners into practical guidelines.
G16	Understanding the importance of biodiversity protection and safeguarding ecological connectivity
G17	Lack of continuation
G18	Gap between the objectives of the policy and the local actions
G19	Need for psychological science to help the collaboration
G20	Lack of resources (time notably) and pressures on biodiversity/technical staff

G21	Private ownership of adjacent land limits measures to apply
G22	Lack of opportunities to try and apply innovative solutions
Group C # 3 – KNOWLEDGE/ RESEARCH/ INNOVATION (Maps on ecological data, technical solutions, research needs, innovation needs...)	
Code	Gap/Barrier
K1	Deficits in the knowledge and baseline data at large scale (populations, landscapes, ecosystem services, ecological connectivity, cumulative impacts...) or in the access to this knowledge
K2	Lack of long-term monitoring and dissemination of the results about effectiveness of mitigation and compensation measures (include also information about failures)
K3	Inappropriate impact indicators or inappropriate methods for data gathering (neglecting small and non-endangered species; use vs effectiveness, etc)
K4	Knowledge on how to adapt transversal structures to face climate change and increase permeability at the same time. Need to anticipate CC effects when designing mitigation measures and reassess over time due to changing conditions.
K5	Lack of definitions and criteria for 'biodiversity-friendly' TI by transport mode. Including materials for new TI.
K6	Lack of research on cost-effectiveness analyses to communicate better with decision-makers
K7	Comprehensive inventories of crossing structures (databases, maps) identifying their ecological role
K8	Need for research specifically on effects of disturbances (noise, light, chemical pollution, dust...) and their cumulative effects
K9	Lack of information (or access to it) regarding areas to defragment, for compensation, ecological corridors... (databases, maps...)
K10	Lack of R+D and Innovation programs to promote and fund new technologies in the scenario of global change need
K11	Lack of information regarding animal mortality due to TI, ecological corridors...
K12	Lack of criteria for fauna passages establishment

K13	Accurate knowledge on species distribution and dispersal versus TI
K14	Insect mark-capture-recapture surveys
K15	Special research is needed e. g. for the assessment of the impact of stepping stone biotope topology and for barrier impacts of different land use
K16	Guidelines for the delineation of impact areas of barrier effects and “parity GI concepts”
K17	Research on biodiversity reaction to artificial light in fauna passages
K18	Understand importance of secondary roads
K19	Transversal research and publications (not only transversal management teams)
K20	Include urban areas to evaluate biodiversity
K21	Research on Climate Change effects in TI/biodiversity: floods, fire...
Group D – TOOLS/ PROCEDURES (Guidelines, handbook, standards, monitoring, methods, databases...)	
Code	Gap/Barrier
T1	Difficult access to biodiversity information and data: defragmentation, compensation, road mortality, ecological corridors, ecological assets management...
T2	Lack of standardize methodologies: to collect information AVC, evaluate TI impacts, mitigation measures effectiveness, identification of areas to defragment; CC risk evaluation...
T3	Need to improve EIA method to better evaluate TI impacts on biodiversity. Including: fragmentation, ecosystem services, dynamic modelling, multispecies connectivity, cumulative impacts...
T4	Need of an integrated platform (formal and informal) addressed to both sector and at different levels (from policy-makers to TI users) for an effective communication among them (regarding impacts, solutions...)
T5	Biodiversity should be more highlighted when talking about Climate Change
T6	Lack of clear guidelines and technical prescriptions to apply measures at different levels of mitigation hierarchy

T7	Lack of environmental monitoring programs in National Transport Plans
T8	Fragmentation and defragmentation concerns have to be better assessed and complementary avoided/mitigated
T9	Management and maintenance policies and plans to enhance biodiversity on verges and other HTI
T10	Environmental externalities are not sufficiently integrated into decision-making process
T11	Lack of control (about biodiversity issues) on infrastructure managers in the operational phase
T12	Lack of appropriate methodological tools to integrate TI into the landscape
T13	Neglecting available knowledge regarding ecological corridors due to difficult acquisition procedures for GIS-data for existing concepts
T14	For scales > 1:50.000: Special developed parity GI concepts should be part of any TI development
T15	Guidelines for plausibility checks of existent GI concepts and for TI-specific parity GI-concepts should be developed
T16	Inappropriate definition of the impact areas for fragmentation assessment (in scoping procedures)
T17	Neglecting impact reduction by lower velocity standards. Their effects have always to be compared as an obligatory alternative in SEA and EIA
T18	Neglecting the role of soil management for optimizing habitats and minimizing maintenance (and construction) costs
T19	Consideration of climate change in environmental evaluation of transportation projects
T20	Absence of a Climate Change adaptation plan incorporating biodiversity concerns
T21	Lack of systematic adaptation of drainages to face climate change and improve ecological connectivity