

INTEGRATING BIODIVERSITY INTO EUROPEAN TRANSPORT INFRASTRUCTURES NOW AND TOMORROW: A STRATEGIC RESEARCH AGENDA FOR BIODIVERSITY-FRIENDLY INFRASTRUCTURE

POLICY BRIEF



Photo credit: Violette Le Féon

EXECUTIVE SUMMARY

To effectively integrate biodiversity considerations into transport infrastructure, the BISON project has developed a Strategic Research Agenda that promotes multidisciplinary and cross-sectoral research approaches. Currently, research efforts in this area are often fragmented, hindering a comprehensive understanding of the interactions between transport infrastructure and biodiversity.

The Strategic Research Agenda proposes various measures to enhance European research on this issue. By implementing these measures, the European Union will be better positioned to align with the Kunming-Montreal Global Biodiversity Framework, which strives to restore or maintain the integrity of all ecosystems.

KEY POLICIES RECOMMENDATIONS

The BISON project operates within a global and European framework focused on environmental transition. Europe's Strategy for biodiversity aims to protect 30% of its land and seas, while promoting eco-friendly transport systems through the reform of the Trans-European Transport Network (TEN-T). The BISON Strategic Research Agenda takes one step further by proposing transformative changes in infrastructure planning, design and management that need to be implemented across all infrastructure and all areas. The Strategic Research Agenda proposes:

- **Systemic ecological approaches:** Shifting from compartmentalised thinking to systemic ecological approaches promotes integrated vision and solutions, knowledge sharing, and international communication in transport ecology research.
- **Multidisciplinary research:** Establishing a network of diverse study areas enables collaborative research, long-term impact observation, and operational proposals for biodiversity and landscape management in transport networks.
- **Facilitating full-scale experiments** on both new infrastructure projects and existing infrastructure will enable feasibility analyses, drive practice changes and help implement practical solutions for sustainable transport systems.
- **Data sharing:** Enhancing transport ecology research through data sharing, including the sharing of biodiversity data from the mandatory monitoring of infrastructures, improves resource efficiency, enhances research outcomes and fosters collaborations.

INTRODUCTION: BIODIVERSITY CHALLENGES AND SOLUTIONS IN TRANSPORT DEVELOPMENT, THE NEED FOR A STRATEGIC RESEARCH AGENDA

The expansion of linear transport infrastructures has far-reaching consequences for biodiversity. These infrastructures create barriers, disrupt wildlife movements, cause genetic isolation and restrict access to essential resources. Direct habitat loss and degradation of adjacent areas lead to the displacement of species. Pollution from traffic, including noise and light, affect wildlife behaviour and reproduction. Traffic-induced mortality poses a direct threat to most terrestrial species. Additionally, secondary development triggered by transport infrastructure development exacerbates further degradation of natural habitats.

Overall, transport infrastructures lead to a complex and comprehensive fragmentation of the entire landscape, dividing it into smaller and more isolated remnants of land. To solve these problems, interdisciplinary research and collaboration are needed to integrate biodiversity considerations into the planning, design and decommissioning of infrastructure. This includes integrating wildlife crossings and promoting sustainable transport solutions. With these impacts in mind, the BISON project has developed a Strategic Research Agenda for guiding European research in order to provide support for the development of suitable solutions for a sustainable relationship between transport and biodiversity conservation.

MAIN FINDINGS: ENHANCING BIODIVERSITY CONSERVATION IN TRANSPORT INFRASTRUCTURE. A CALL FOR INTEGRATED RESEARCH APPROACHES

The impact of linear transport infrastructure on biodiversity is a critical issue that has not received adequate attention due to its position between the domains of transport and biodiversity, and the specific research conducted in each. The ecology of transport infrastructure presents complex interactions that demand thorough research and analysis. Currently, research is mainly organised within scientific disciplines that have limited or no exchange with one another, which hampers a comprehensive approach. Each discipline tends to focus on its specific aspects, such as technical and ecological factors or social, psychological, economic and legal aspects, but does not foster the exchange of knowledge required for a more holistic and inclusive understanding of the issue.

Rate of sharing of research questions between types of transport infrastructure (%)

Railways	96					
Airports	88	87				
Waterways	85	85	82			
Harbours	80	80	80	80		
Power lines	77	77	76	75	73	
Pipelines	74	74	74	74	73	74
	Roads	Railways	Airports	Waterways	Harbours	Power lines

Great issues and themes' occurrence among necessary research actions

IMPROVEMENT OF THE GENERAL PROCESS OF TRANSPORT INFRASTRUCTURE DEVELOPMENT	
Policy	8%
Law and regulation	4%
Planning of TI projects	5%
Assessment of realised TIs	8%
CONTRIBUTION OF STAKEHOLDERS IN PROJECTS	
Cooperation between TI stakeholders	2%
Awareness of TI stakeholders	4%
IMPROVEMENT OF THE MITIGATION HIERARCHY	
Reduction measures	16%
Compensation measures	2%
GREAT ENVIRONMENTAL CHALLENGES PROTECTING BIODIVERSITY HAS TO FACE	
Responses to effects of climate change	4%
Responses to spread of invasive species	2%
SOLVING OF SPECIFIC QUESTIONS POSED BY TRANSPORT INFRASTRUCTURES TO BIODIVERSITY	
Achieving ecological permeability of TIs	13%
Restoring and enhancing ecological networks with TIs	11%
Achieving TI network densities compatible with ecological capacities/interest	6%
Controlling the specific pressures on biodiversity created by the transport sector	11%
Developing the biodiversity care culture in the transport sector	4%

Notably, the road sector was the first to bring attention to biodiversity concerns related to transport infrastructure, and it has made significant progress in research in the field of biodiversity. The railway sector has been close behind. However, the study of biodiversity interactions with infrastructure tends to be confined to specific types of infrastructure, which creates a barrier to the efficient sharing of knowledge that could be applicable to all types of infrastructure.

To address this issue, the European Strategic Research Agenda, developed within the framework of the BISON project, promotes integrated and multidisciplinary research approaches and establishes platforms for exchanging ideas and findings between different disciplines. It also provides responses to the issue by defining and prioritising research needs and identifying the necessary resources.

Efforts and investment (time and budget) of all research actions must be clearly recognised by all stakeholders and supported until they are completed. The absence of such a guiding document in Europe has so far been a handicap for the optimal deployment of research activities on the subject of biodiversity-friendly transport infrastructure.

POLICY RECOMMENDATIONS

The BISON project is embedded in a global and European framework that is brimming with policies aimed at facilitating environmental transition. On a global scale, states have committed to following the Kunming-Montreal Global Biodiversity Framework, which calls for respect for the integrity of all ecosystems. For its part, Europe has drawn up a Biodiversity Strategy that promotes the protection of at least 30% of the EU's land and 30% of its seas. In addition, the European Union is actively encouraging environmentally-friendly transport systems to promote mobility and interconnection across Europe through the reform of the Trans-European Transport Network (TEN-T).

Given this, the BISON Strategic Research Agenda emphasises the importance of considering the impact of transport infrastructure on biodiversity within European research endeavours. It provides key recommendations and approaches to address this conflict and fully comprehend the potential consequences of developing transport infrastructures on the natural environment.

SHIFTING FROM COMPARTMENTALISED SOLUTIONS TO SYSTEMIC ECOLOGICAL APPROACHES

The "EU Biodiversity Strategy 2030 – Bringing nature back into our lives" [1] emphasises the need to systematically integrate the promotion of healthy ecosystems, green infrastructure and nature-based solutions into urban planning, including infrastructures.

To effectively address biodiversity issues associated with transport infrastructures, a shift is needed from a compartmentalised and reactive approach to a proactive and systemic ecological approach.

This shift would allow for the identification of integrated solutions on a territorial scale, avoiding contradictory measures. For research and all stakeholders, it is essential to cultivate a holistic perspective that transcends infrastructure-type approaches, promoting the sharing of knowledge and transferability of solution. Additionally, establishing an international scientific communication medium for transport ecology research is necessary to make progress in this multidisciplinary field and enhance biodiversity preservation efforts.

ORGANISE A NETWORK OF DIVERSIFIED STUDY AREAS

Establishing a network of shared study areas is vital to make progress in transport ecology research. Currently, most researchers work in isolation within their disciplines, hindered by resource availability, data and adequate tools.

This contrasts with the objective set by the Horizon Europe framework programme [2], which aims to devote 7.5% of its annual expenditure in 2024 and 10% in 2026, under the 2021- 2027 multiannual financial framework. The BISON Strategic Research Agenda proposes the creation of a European network of study areas, representing diverse landscapes, land use patterns, eco-regions and transport networks.

These multidisciplinary collaboration networks would enhance research coordination. By focusing research efforts on these study areas over an extended period, researchers can observe the long-term impacts of transport networks on a landscape scale. This includes considering different infrastructure types, densities and their effects on the environment and on human activities, and allows for experiments and implementation tests of new mitigation approaches.

Collaboration in shared study areas would facilitate knowledge exchange, fostering a European transport ecology culture. Ultimately, this approach would allow for the development of proposals for managing the complex and long-term effects of transport networks on biodiversity and landscapes.



Creating a network of diversified large-scale and long-term study areas across Europe as a multidisciplinary research tool

[1] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Biodiversity Strategy for 2030 Bringing Nature Back into Our Lives, 2020, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0380>

[2] Horizon Europe – Performance https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/horizon-europe-performance_en

ENABLING THE GENERALISATION OF FULL-SCALE EXPERIMENTS

While research and development in transport ecology face challenges due to the limited ability to conduct full-scale experiments, it is necessary to find innovative solutions to overcome these limitations. Although private sector projects can benefit from this stage, the public domain and societal innovation projects often encounter difficulties. To address this, sections of existing or new infrastructures could be designated as test sites to test hypotheses, evaluate new solutions and demonstrate feasibility to stakeholders. This would help to facilitate changes in practice and enable the adaptation of infrastructure to biodiversity requirements in the face of climate change. Introducing full-scale experimentation as a common research tool would enable multidisciplinary studies.

Collaborative projects with operators provide researchers with access to real-world testing environments, thereby fostering innovation in transport ecology. This approach paves the way for the development of practical solutions for sustainable transport systems. It aligns with the objectives outlined in Article 5 [3] of the proposed Regulation of the European Parliament and of the Council on the Union's guidelines for the development of the Trans-European Transport Network. These objectives aim to develop resource-efficient and environmentally protective, sustainable and climate-resilient infrastructure that minimises negative impacts on the health of local communities and ecosystems.

ENHANCING TRANSPORT ECOLOGY RESEARCH THROUGH DATA SHARING

Enhancing transport ecology research through data sharing is essential to improve research outcomes. The establishment of mechanisms for collecting and sharing biodiversity data obtained from mandatory infrastructure monitoring could be of great benefit to transport ecology research. This system would complement conventional research resources, reducing the time and financial burden associated with data collection. In addition, it would allow the use of territorial knowledge of biodiversity, thus improving future studies across various projects. Currently, valuable data from mandatory transport infrastructure monitoring remains untapped, resulting in missed opportunities for more in-depth analysis, large-scale assessments, improved feedback and collaboration with research projects.

To remedy this, it is crucial to make such data available to scientists by means of unified collection and sharing systems. This pursuit of efficiency in data collection would provide real added value in terms of meeting the urgent objectives of the Kunming-Montreal Global Biodiversity Framework. It also aligns closely with the research objectives outlined in Article 3.3.4 (Improving knowledge, education and skills) of "EU Biodiversity Strategy for 2030 – Bringing nature back into our lives", which emphasises the importance of enhancing research outcomes through various means, including data sharing.



Photo credit: Denis François

Both existing and new sections can offer experimentation opportunities for the improvement of infrastructures for biodiversity. For example, a forest orchard of wild species with various ecological purposes, planted in a power line right-of-way and managed by local stakeholders, instead of the routine clear-cutting by means of rotary-slashing every 3-5 years

[3] Article 5 - Resource-efficient network and environmental protection.
<https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0812>