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TRANSGREEN. Integrated planning for transport and green infrastructure in the Danube-Carpathian Region to the benefit of people and nature

Using EIA to develop an environmentally-friendly transport infrastructure

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Good morning! Welcome!

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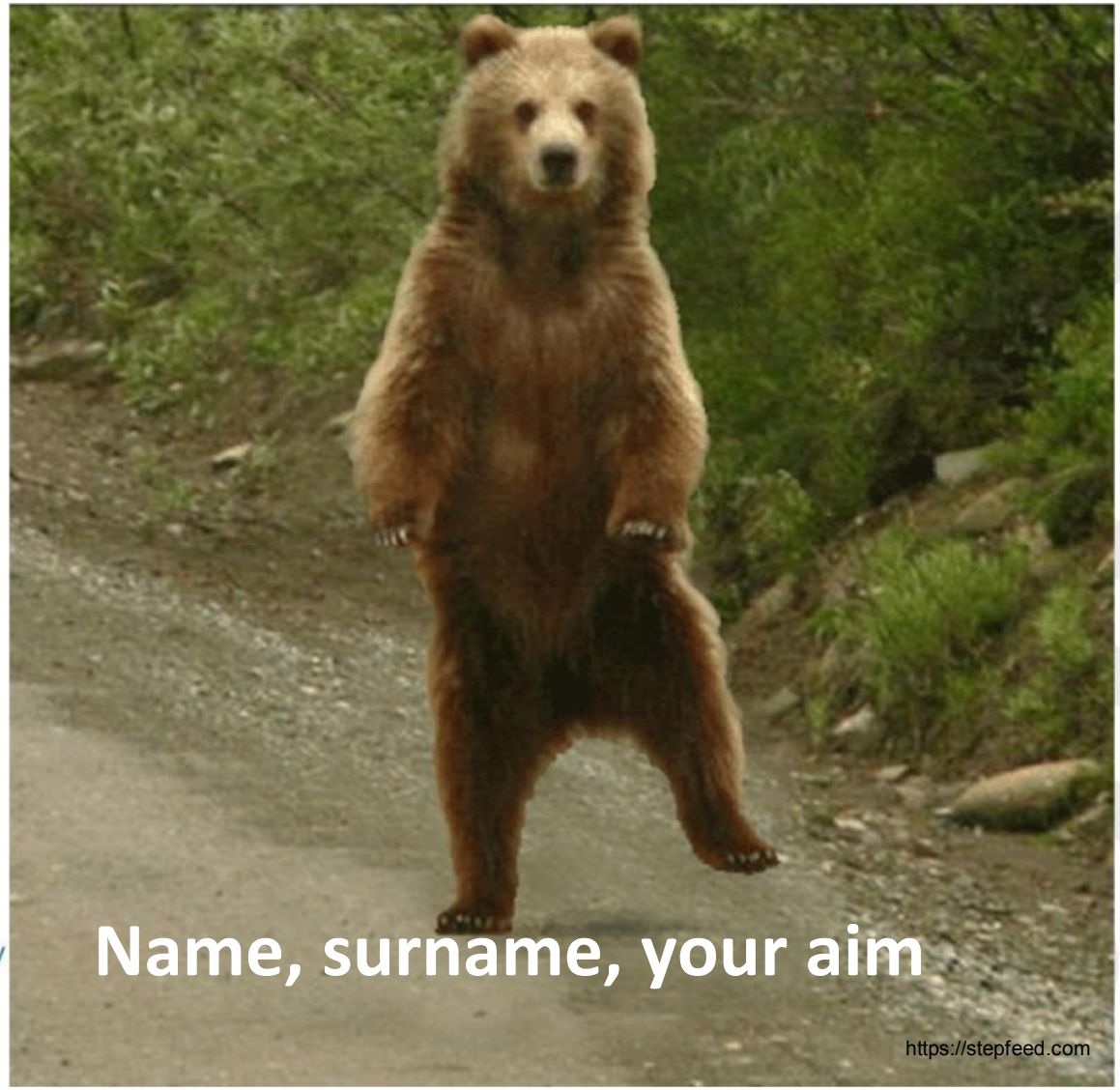

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Debate topics:

- ➢ **Green Infrastructure**
- ➢ **Ecological connectivity**
- ➢ SEA/EA/EIA
- ➢ **Permeability**
- ➢ **Significant impact**
- ➢ **Assessing the quality of** environmental impact studies
- ➢ Field **data collection**
- ➢ Measures to **avoid** / **reduce** / trade-offs

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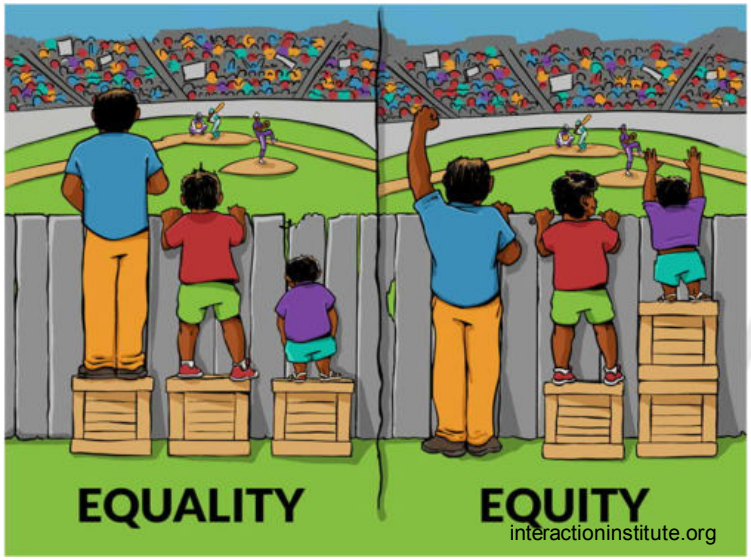
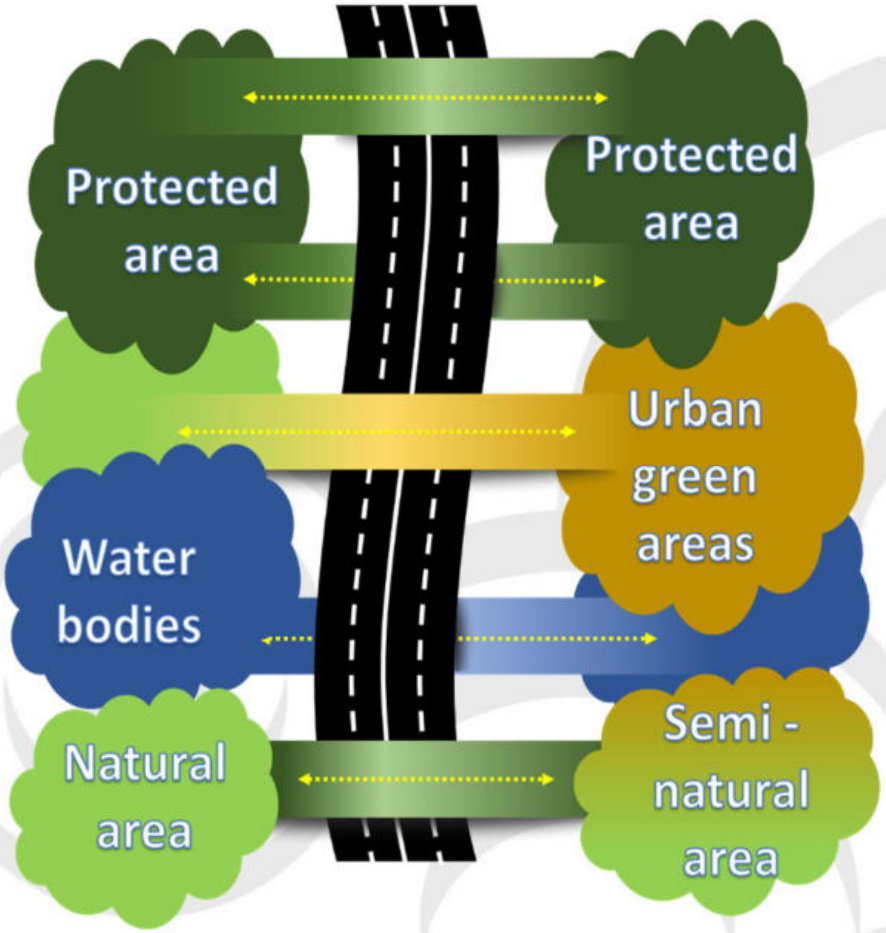
How do we address the problem of ecological connectivity?





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WHAT IS GREEN INFRASTRUCTURE?

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The European Commission defines **GI** (**Green Infrastructure**) as:

A strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services.

GI incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings.

Source: Green Infrastructure (GI) – Enhancing Europe's Natural Capital, EU Communication 6.5.2013

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A simple definition:

Green infrastructure includes everything which is not part of the Grey (or built) Infrastructure

Source: European Commission, Towards a Green Infrastructure for Europe, Developing new concepts for integration of Natura 2000 network into a broader countryside

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Key characteristics of GI, as emphasized by various definitions:

- **Critical mass** – the components of green infrastructure normally have some degree of scale, critical mass and/or connectivity;
- **Benefits to people** – their contribution to the delivery of ecosystem services;
- **Multi-functionality** – GI is normally recognised as serving a variety of functions for both people and nature;
- **Substitutability with grey infrastructure** – GI has the potential to replace some of the functions that would otherwise be served by man-made or "grey infrastructure" (e.g., flood defences, water treatment, pollution control, recreational infrastructure);
- **Co-ordinated interventions** – GI is often defined by human interventions which aim to identify map, protect, restore, enhance or maintain it.

Naumann, Sandra, McKenna Davis, Timo Kaphengst, Mav Pieterse and Matt Rayment, 2011, Design, implementation and cost elements of Green Infrastructure projects. Final report to the European Commission, DG Environment

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GI's **constituents** are those physical features features in which and through which natural functions and processes are sustained:

- On **local scale**: biodiversity-rich parks, gardens, green roofs, ponds, streams, woods, hedgerows, meadows, restored brownfield sites, coastal sand-dunes and other features if they deliver multiple ecosystem services, or connecting elements like green bridges and fish ladders;
- On **regional / national scale**: large protected natural areas, large lakes, river basins, high-nature value forests, extensive pasture, low-intensity agricultural areas, extensive dune systems, coastal lagoons etc;
- On **EU scale**: trans-boundary features such as international river basins, forests and mountain ranges.

Technical information on Green Infrastructure (GI), Accompanying the EU Communication 6.5.2013

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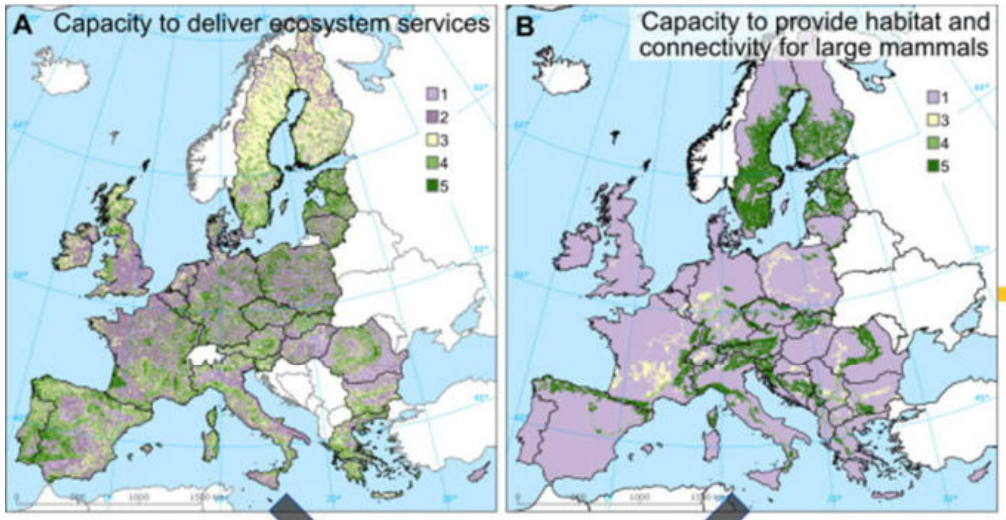

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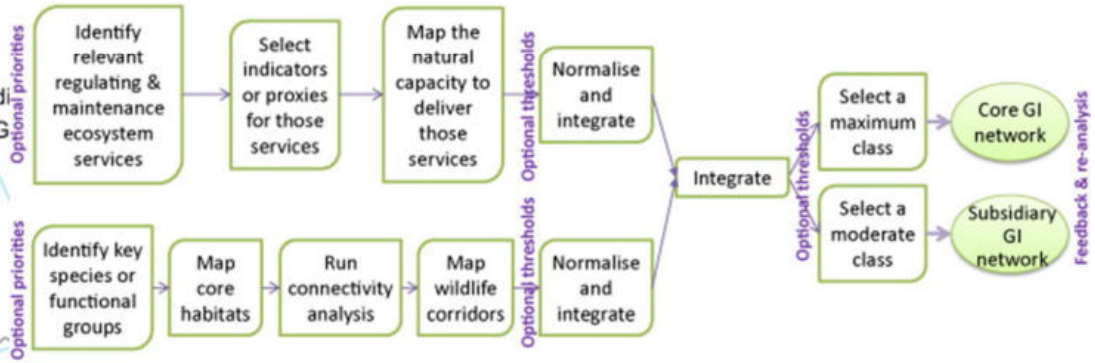
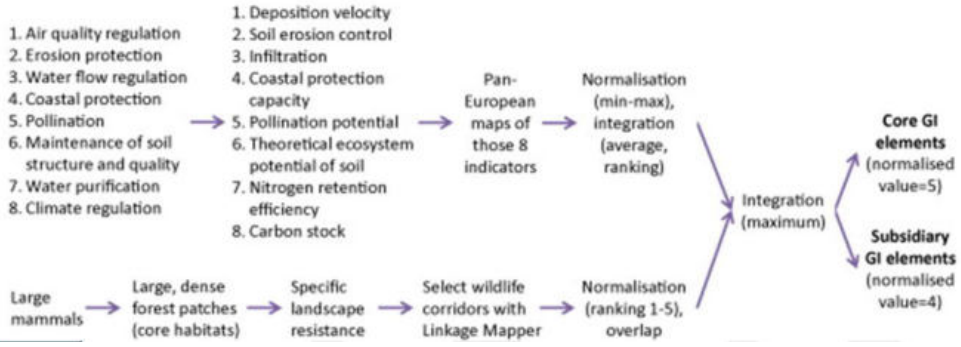
General methodology:



Application in the Pan-European case study:



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WHAT IS ECOLOGICAL CONNECTIVITY?

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There are **two** perspectives on connectivity :

- **Structural connectivity or habitat connectivity** – which refers to the spatial relation and consists of maintaining the contiguity or connectedness between patches of suitable habitats;
- **Functional connectivity –** represents habitats' capacity to satisfy species' ecological needs.

Tischendorf and Fahring, 2000

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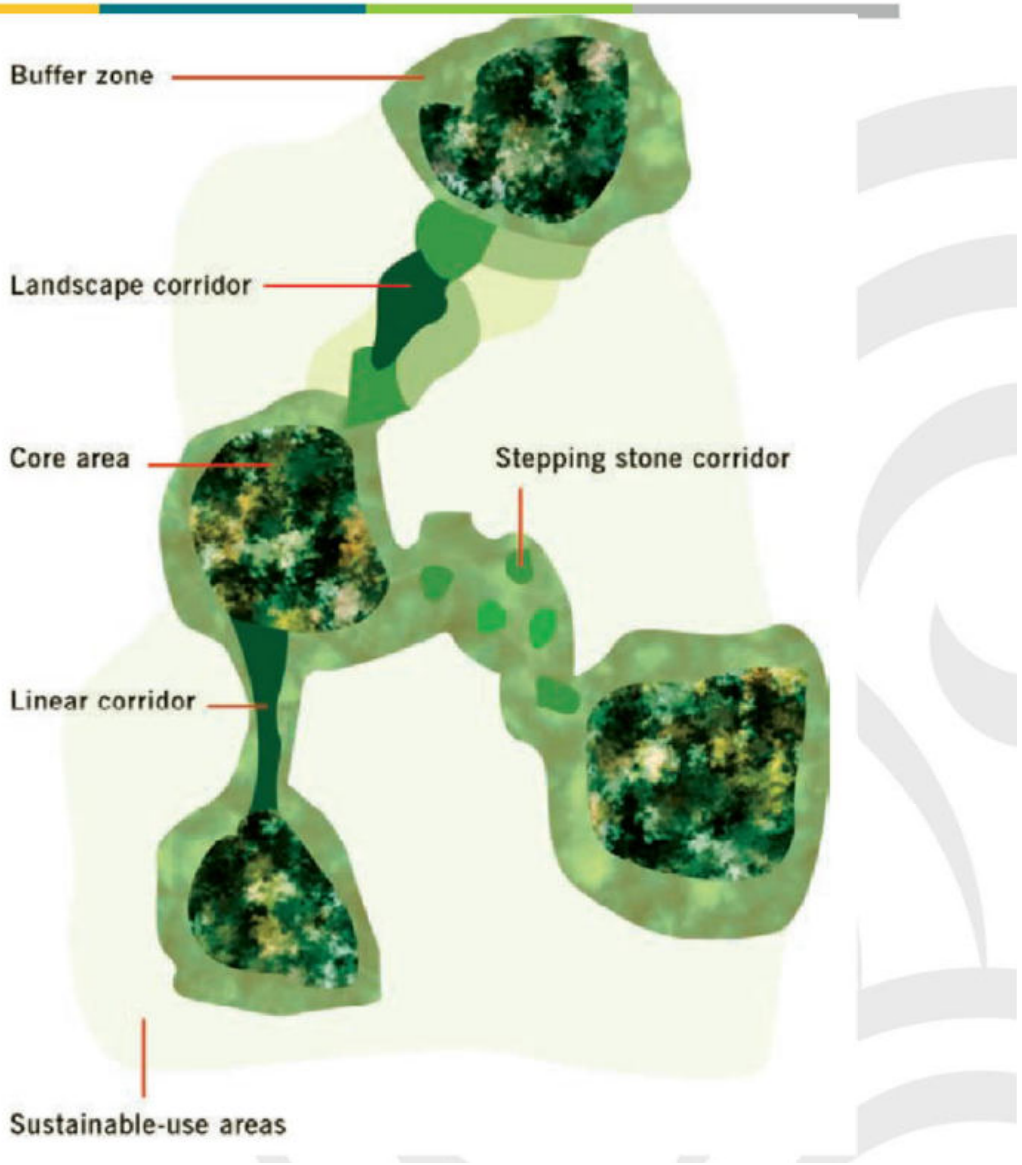
The spatial configuration of an ecological network

Bennett & Mulongoy, 2006



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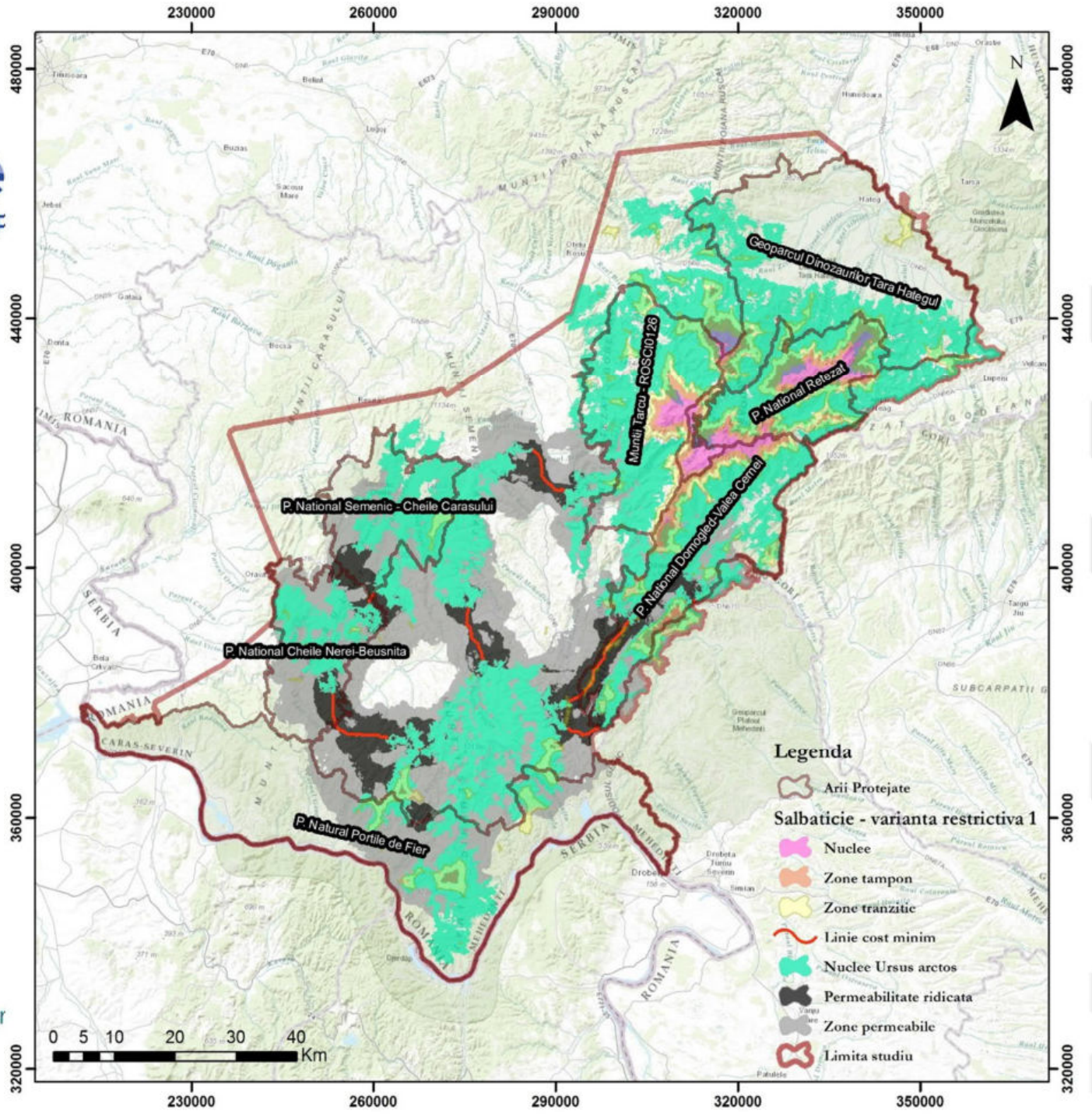
South Western Carpathians' Ecological Network



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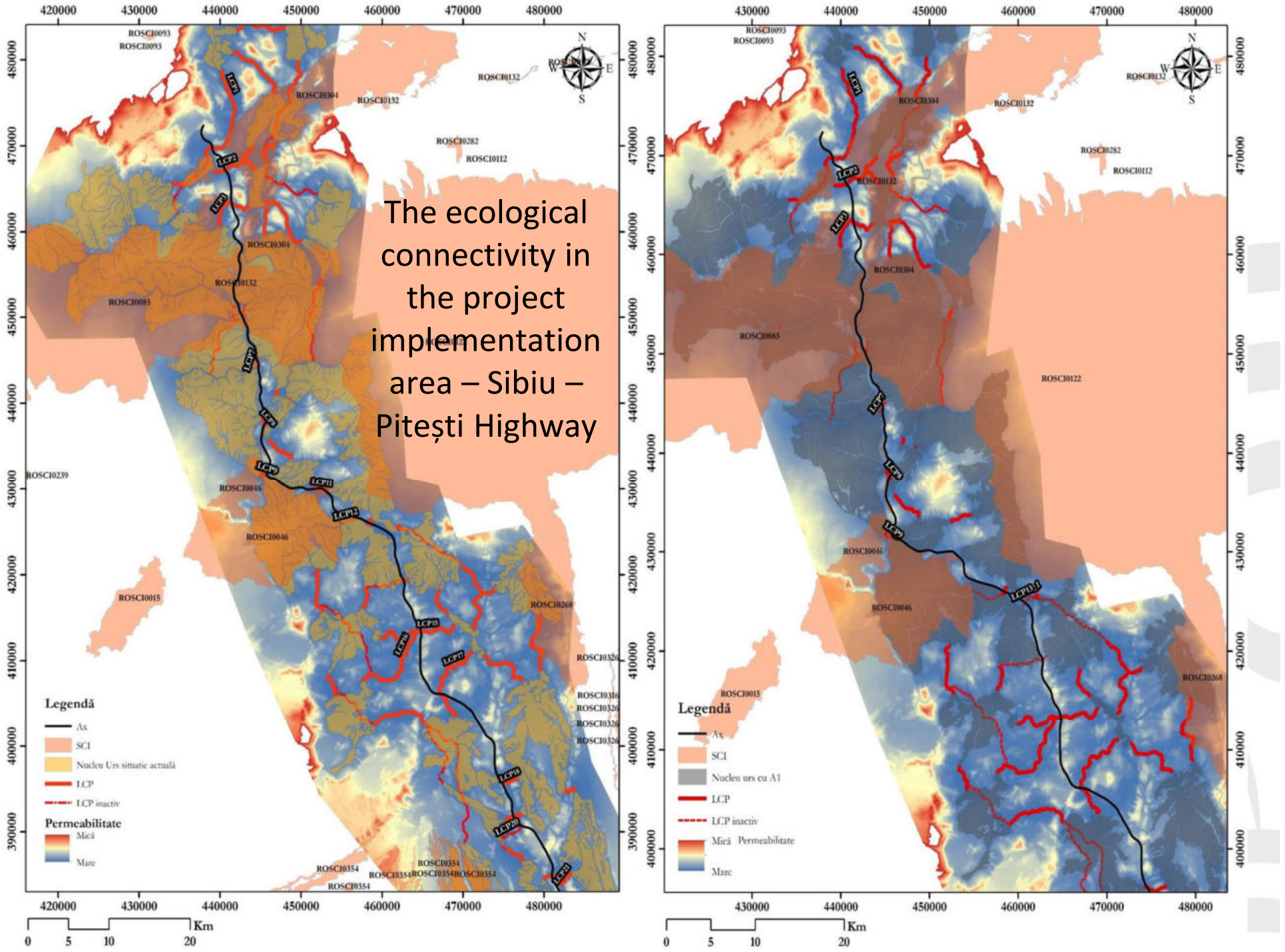
The ecological connectivity in the project implementation area – Sibiu – Pitești Highway
Legendă
Ax
SCI
Nucleu Urs situatie actuală
LCP
LCP inactiv
Permeabilitate
Mică
Mare
Km
0 5 10 20
Legendă
Ax
SCI
Nucleu urs cu A1
LCP
LCP inactiv
Permeabilitate
Mică
Mare
Km
0 5 10 20

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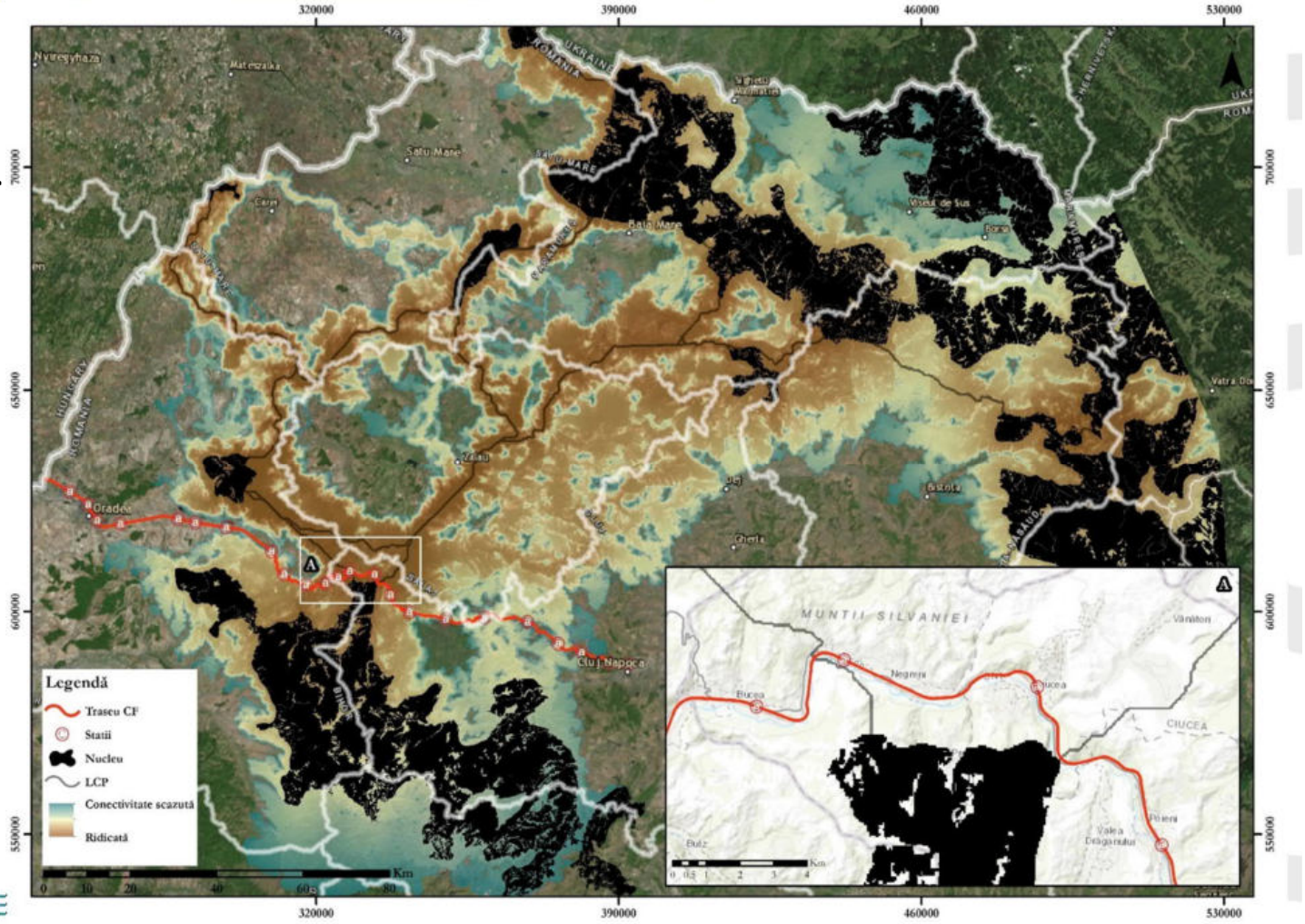
Connectivity map for *Ursus arctos* in a railroad development area – core areas, crossing areas with minimal costs (LCP) and and resistance to displacement



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http://webgis.eurac.edu/bioregio/

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http://geoportal.ccibis.org

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Practical application
Example

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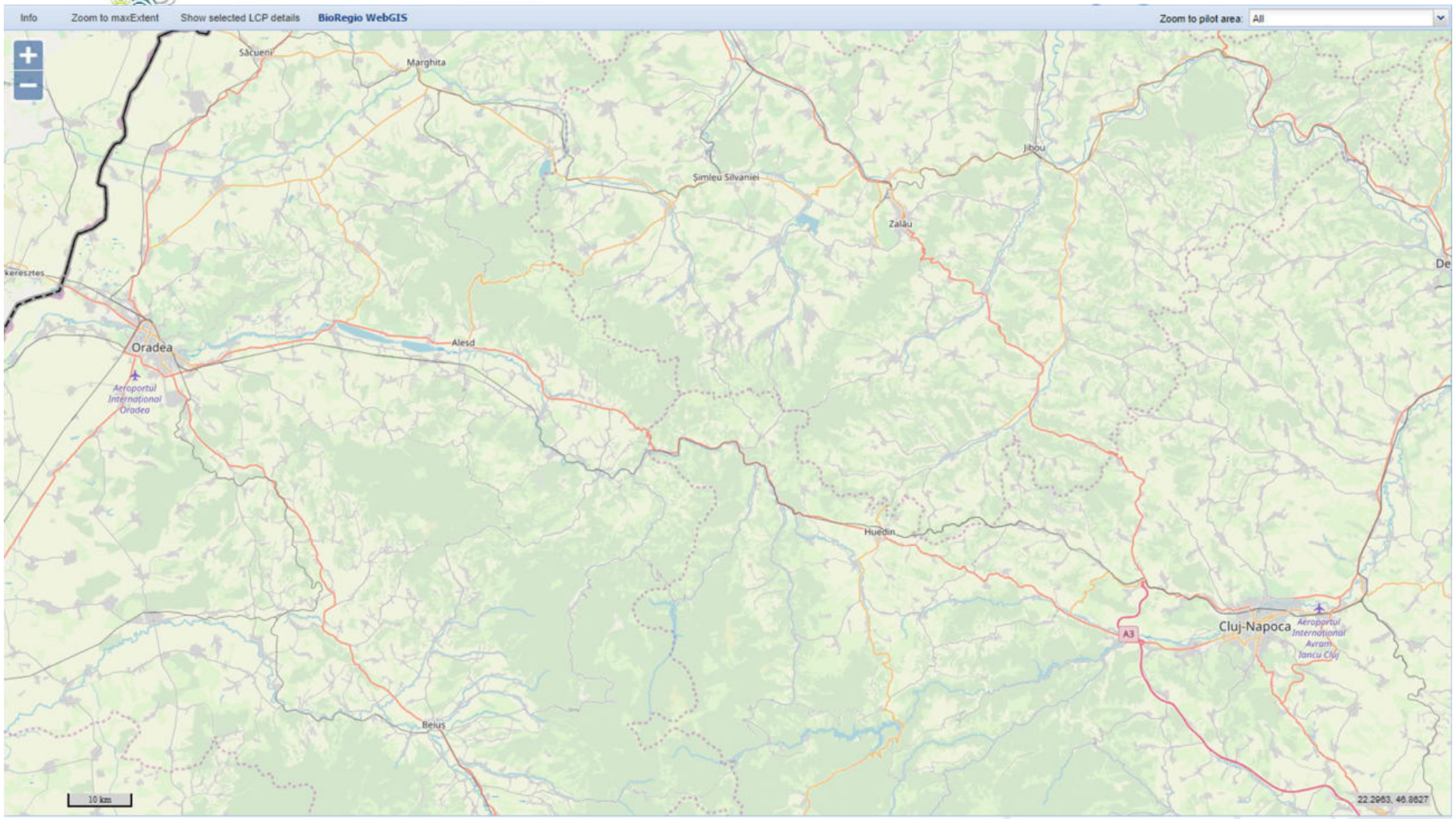

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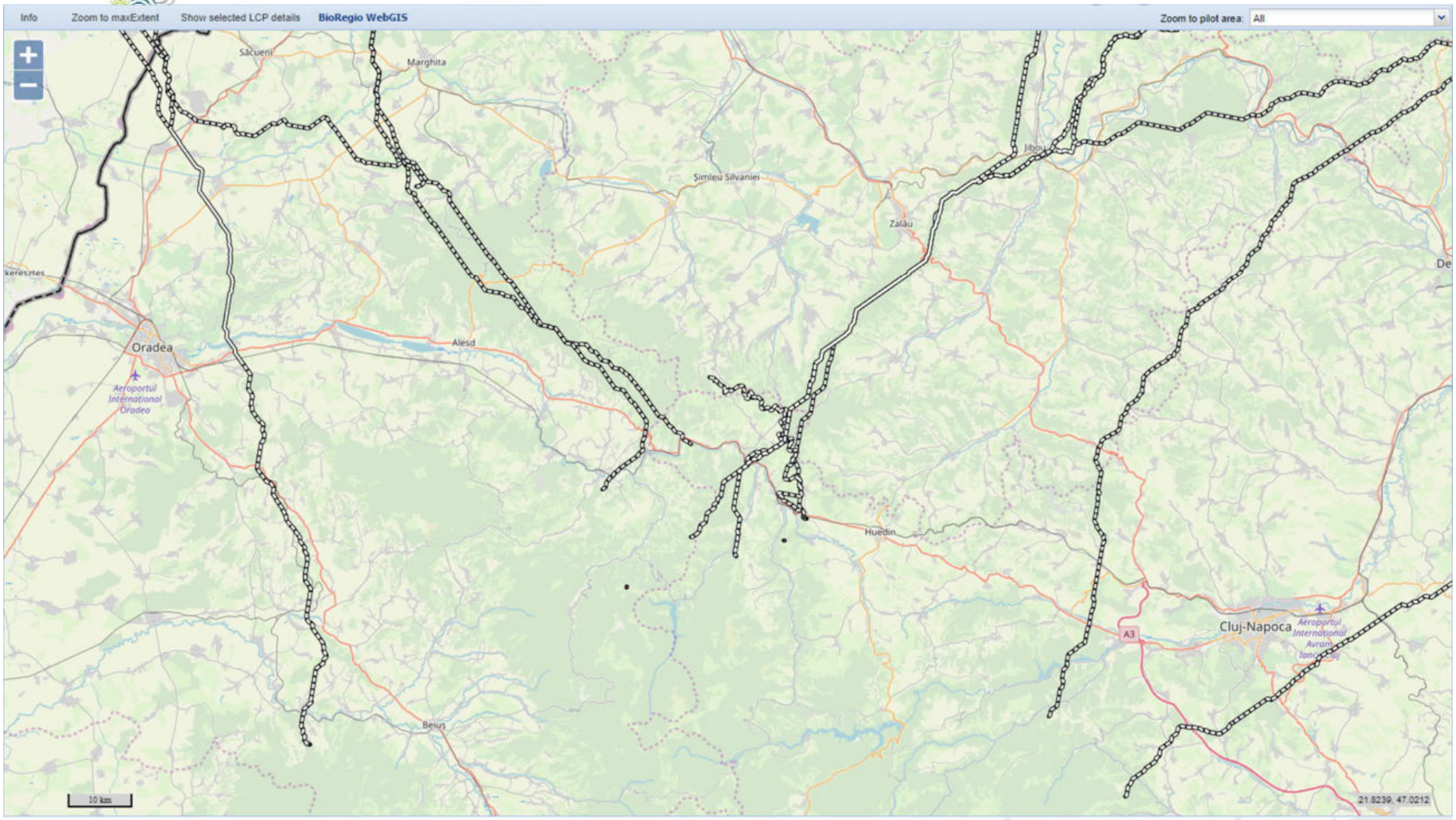

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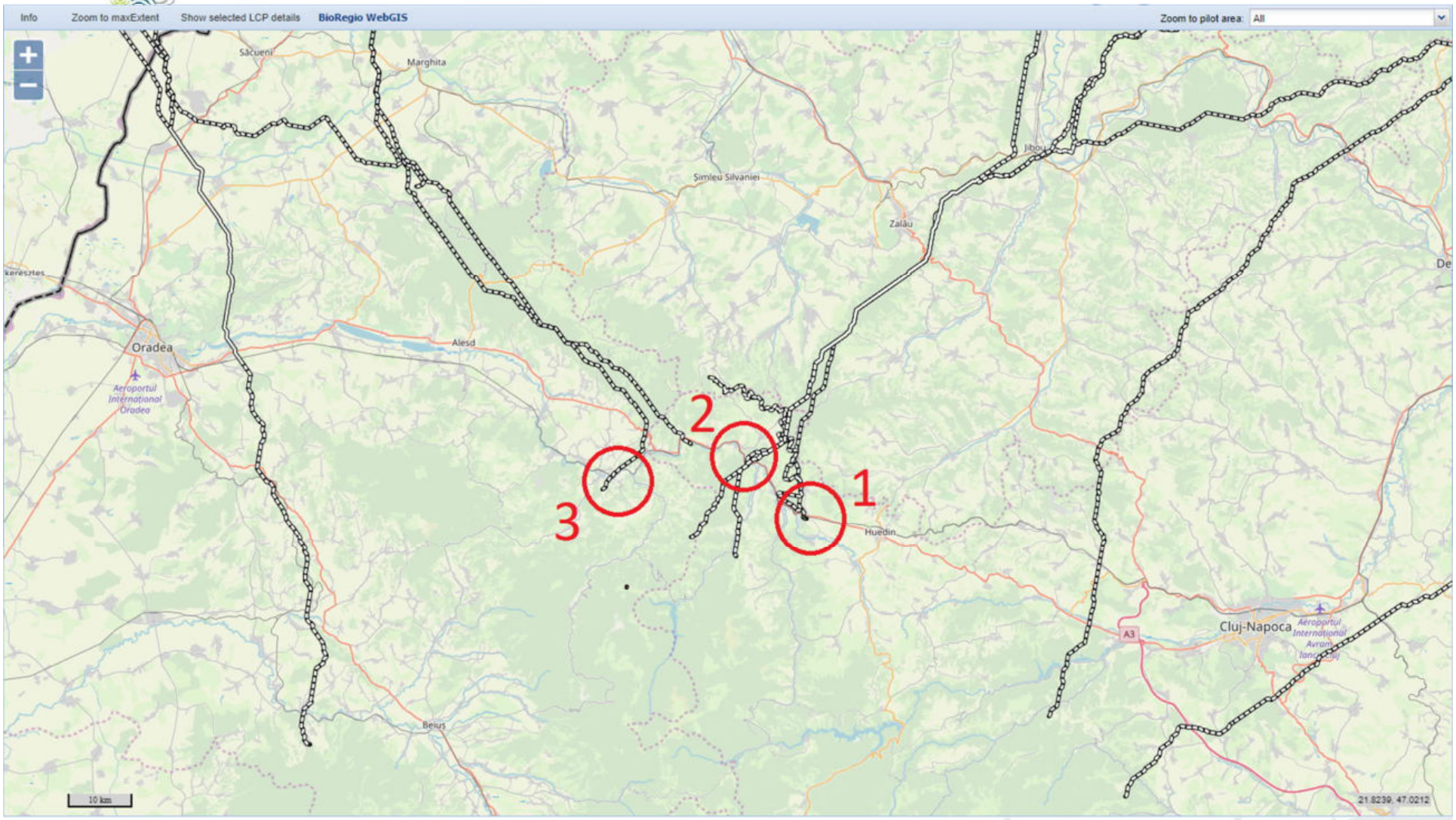

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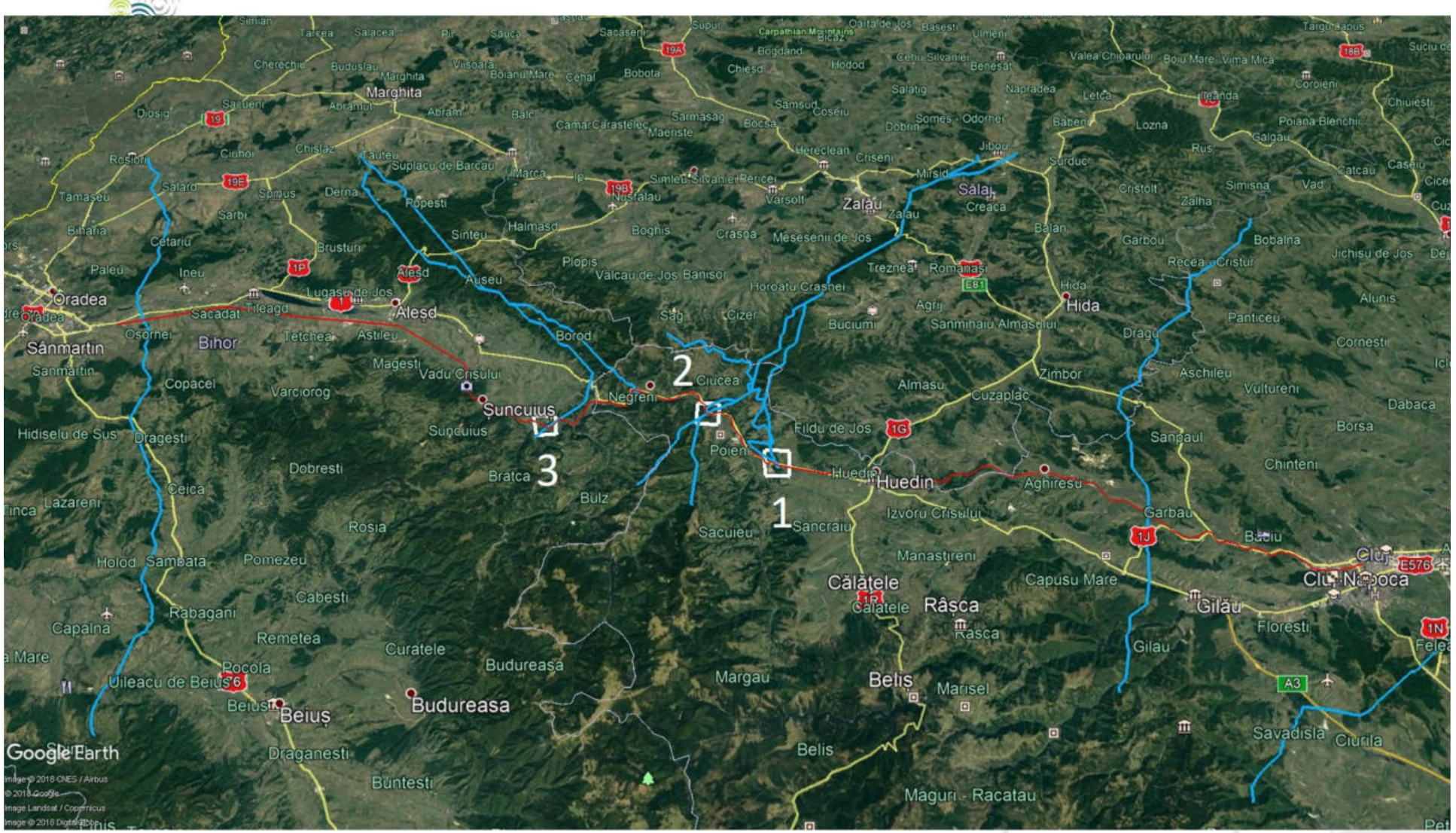

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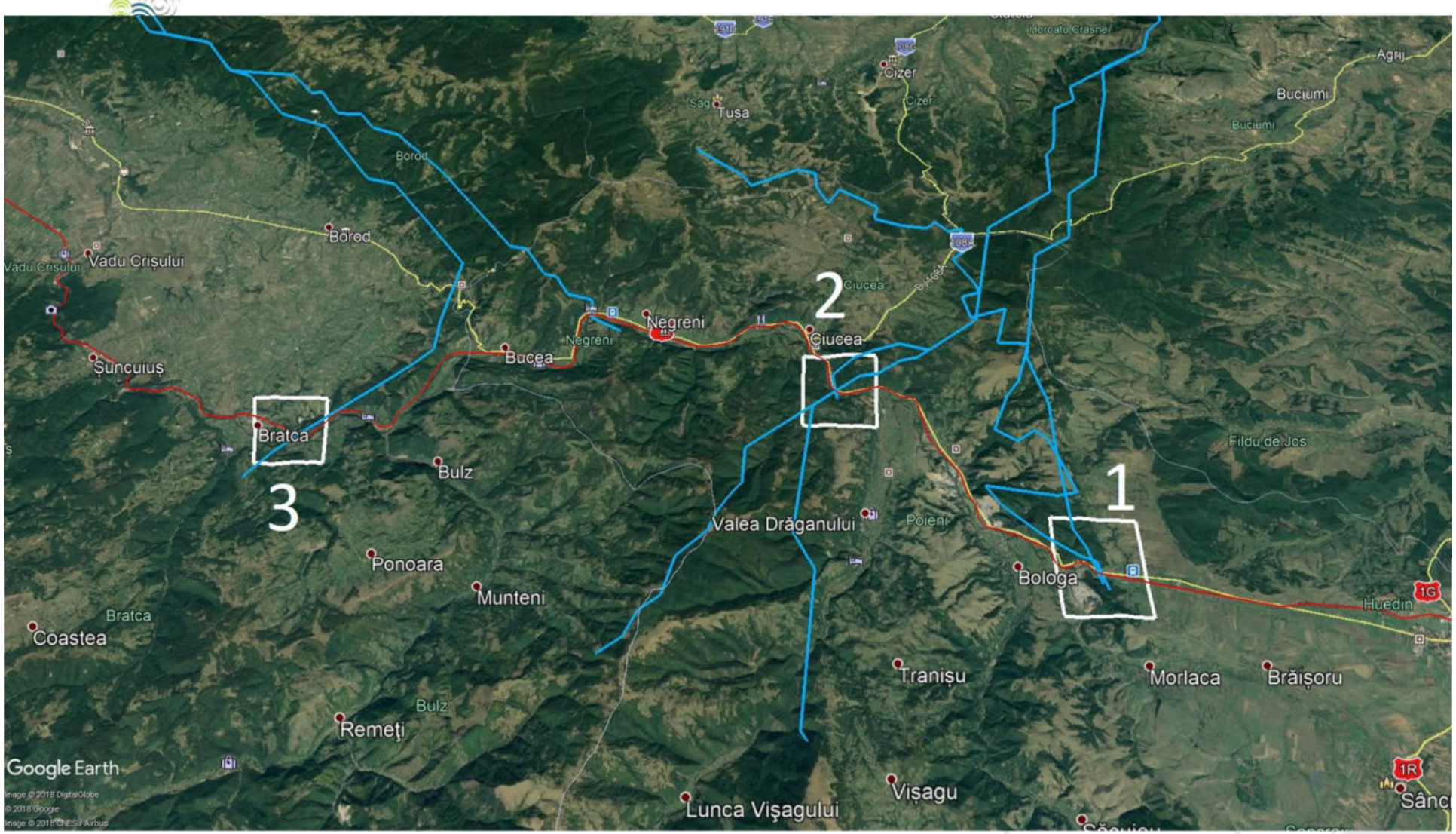

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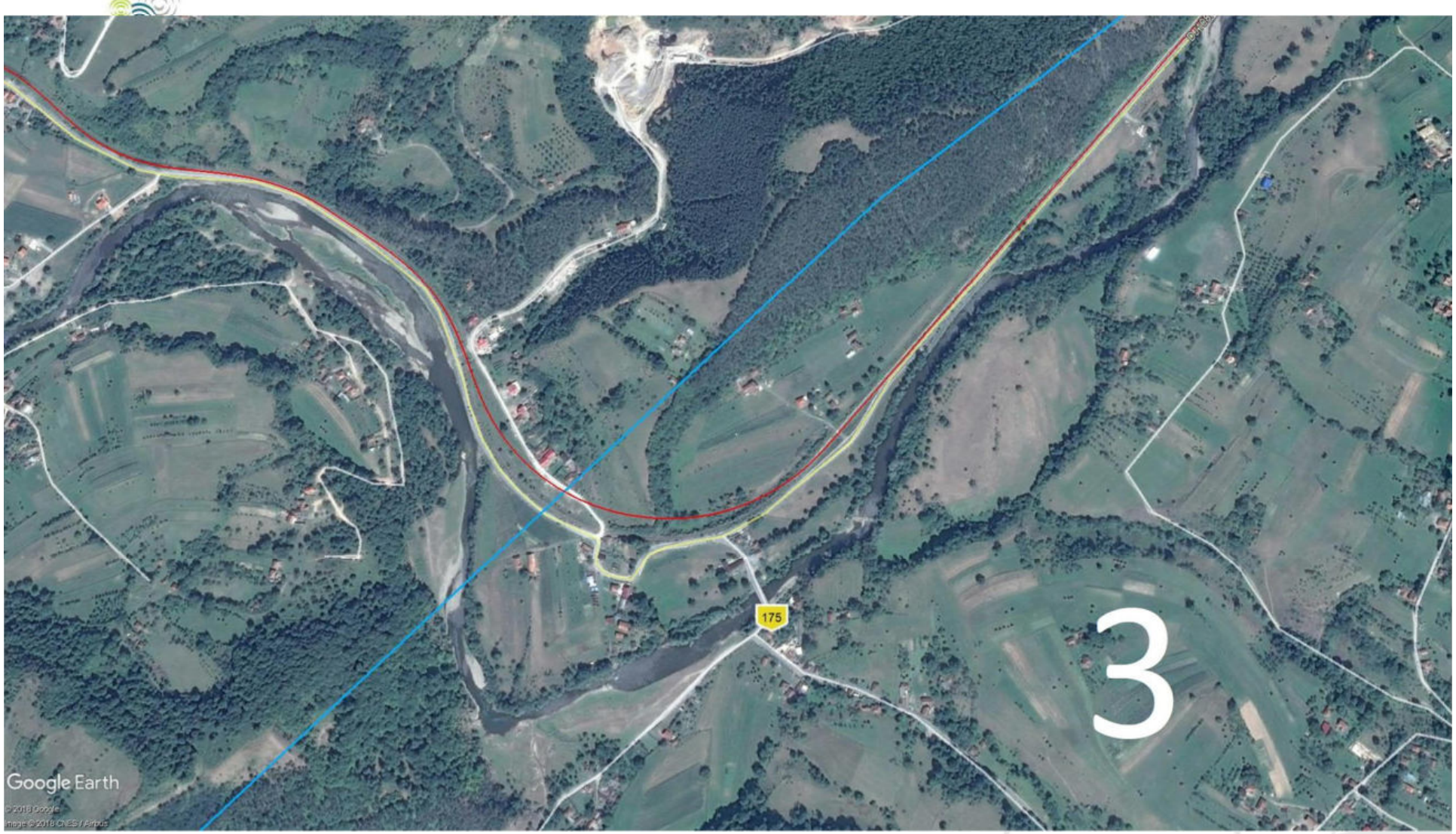

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SEA / EA / EIA

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Environmental assessment - a procedure that ensures that the environmental implications of decisions are taken into account before the decisions are made.

Environmental assessment can be undertaken for:

- **Strategies, plans or public programs,** on the basis of Directive 2001/42/EC (known as "Strategic Environmental Assessment" – **SEA Directive**);
- **Individual projects**, such as a dam, motorway, airport or factory, on the basis of Directive 2011/92/EU (known as "Environmental Impact Assessment" – **EIA Directive**).

A common principle of both Directives: to ensure that plans, programmes and projects likely to have significant effects on the environment are made subject to an environmental assessment, prior to their approval.

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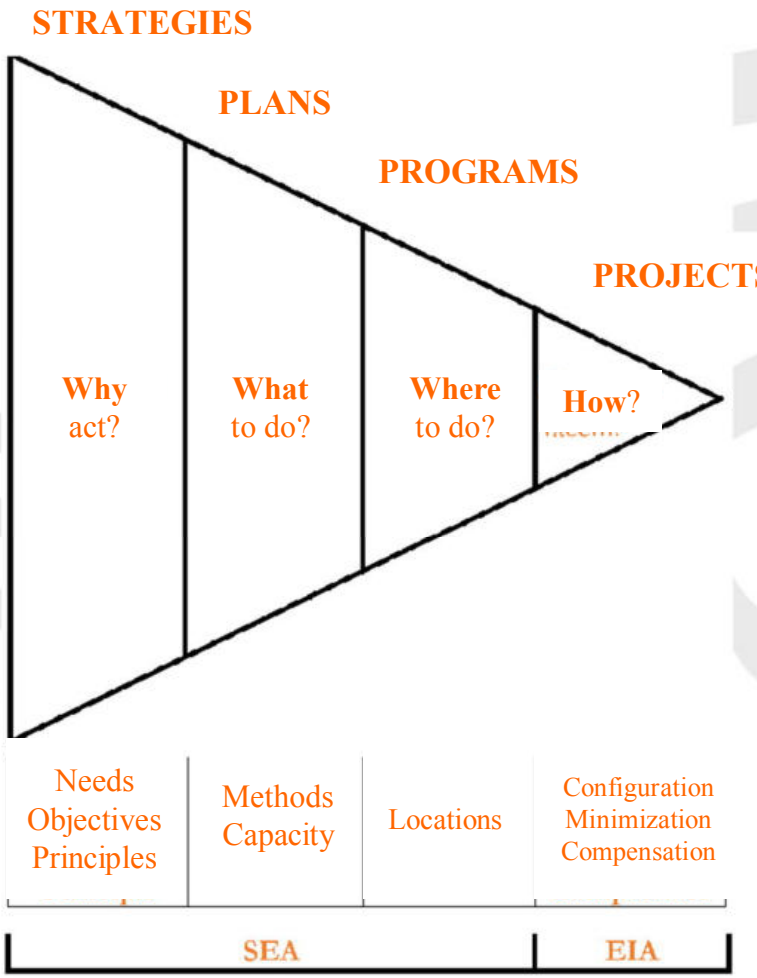
The level of details for SEA and EIA procedures

Adapted after Partidario, 2003



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Directives' Aim: to provide a high level of environmental protection and to contribute to the integration of environmental considerations into the preparation of projects, plans and programmes, thus reducing their environmental impact.

Any plan or project which doesn't have a direct link or is not needed for a protected area of community interest (**Natura 2000**), but which could affect significantly the area, salone or in combination with other plans or projects, is subject to an **appropriate assessment (AA)** of its potential impacts on the natural sites of community interest, considering its **conservation objectives**.

Public consultation – key to environmental assessment procedures.

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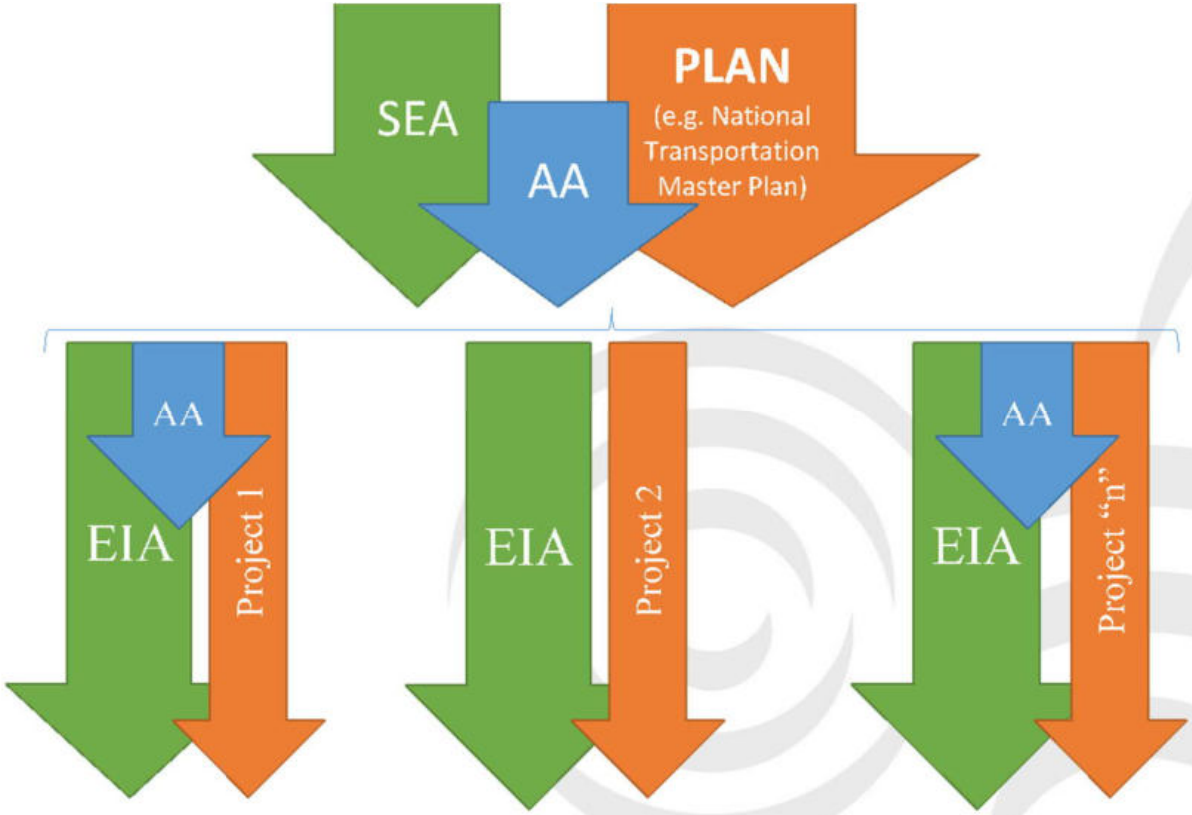

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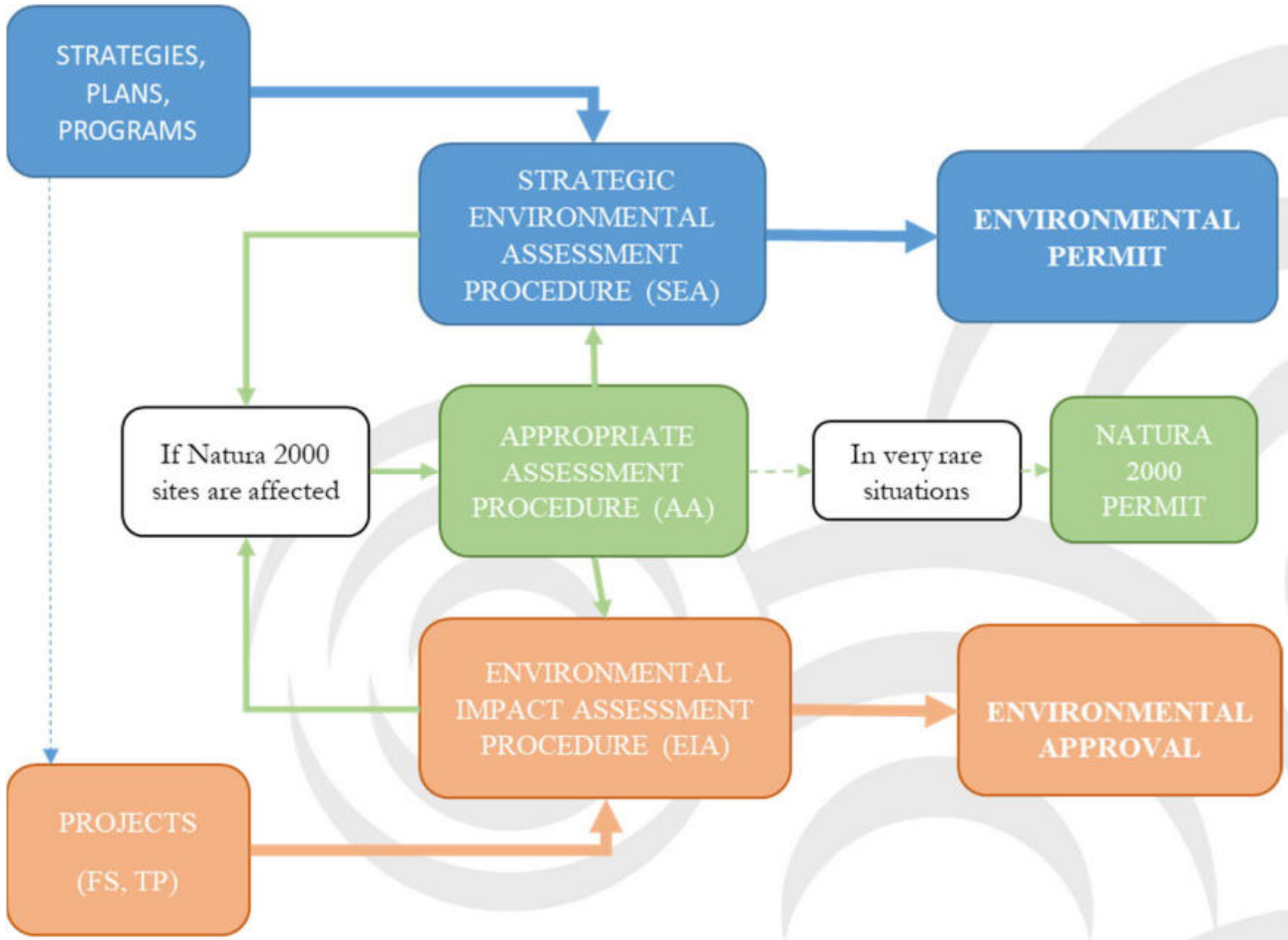

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Stage	Planning		Project design	
Environmental assessment process	**SEA**	**AA**	**AA**	**EIA**
Subject of assessment	Plans, Programs, Strategies		Feasibility studies, Technical projects	
Perspective	Long term		Short & medium term	
Adaptive management	≈ 4-6 years or more		Preferably yearly	
Uncertainty	Large	Average	Low	
Main source of data	Statistics, State of Environment Reports	EU/national data on N2k network	N2k Management Plans + field data collection for the project	Literature, State of Environment Reports + field data collection for the project
Filed data collection	Not necessary	Not necessary / difficult or impossible depending on the plan's scale	Essential (preferably minimum 4 consecutive seasons)	
Main output	Environmental Report	AA Report	AA Report	EIA/ESIA Report
Main focus	Achieving environmental objectives by avoiding significant effects	Coherence of Natura 2000 network	Maintain conservation status of N2k habitats & species	Avoid / reduce significant impacts
Keywords	Alternatives, avoidance of effects /impacts	Alternatives, avoidance of effects /impacts on N2k	Mitigation and compensation measures	Mitigation of impacts
Assessment of effects and impacts	Qualitatively	Mainly qualitatively	Quantitative	Mainly quantitative
Impact significance	Thresholds related to environmental objectives	Thresholds related to N2k management objectives	Thresholds relates to the deterioration of conservation status of N2k habitats & species	Thresholds defined by environment sensitivity and magnitude of changes. Often rely on legislation and norms
Monitoring	Statistics and subsequent projects' generated data	EU/national data on N2k network	Field data monitoring (project's impact area) + data provided by N2k sites	Field data monitoring (project's impact area) + data provided by competent authorities

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Why are SEA and EIA key to maintaining ecological connectivity?

The main principles of using SEA and EIA to warrant ecological connectivity:

- **Apply Ecosystem Based Management: a correct assessment of impacts should rely on the identification of ecosystems and their key processes**. The intent is to maintain those spatial and temporal characteristics of ecosystems such that component species and ecological processes can be sustained, and human wellbeing supported and improved (*Coast Information Team, 2004, Ecosystem-Based Management Framework, https://www.for.gov.bc.ca/tasb/slrp/citbc/c-ebmf-fin-03May04.pdf*);

- **No-net-loss of biodiversity and ecosystem services.** The principle requires that damages resulting from human activities must be balanced by at least equivalent gains;

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- **Assure interpenetration of grey and green infrastructure:** development of grey infrastructure should not interrupt the connectivity of GI;
- **Apply hierarchy of interventions**: avoidance is preferable to mitigation and compensation is the last option. Avoidance of significant impacts cannot be achieved without taking in consideration all feasible alternatives of a plan/project;
- **Apply adaptive management**. As a formal response to the presence of uncertainty and risk, adaptive management is a systematic learning process that formally plans and monitors the outcomes of decisions to improve our ability to better manage natural resources given uncertainty (*Vold, T. and D.A. Buffett (eds.), 2008, Ecological Concepts, Principles and Applications to Conservation, BC. 36 pp. Available at: www.biodiversitybc.org*).

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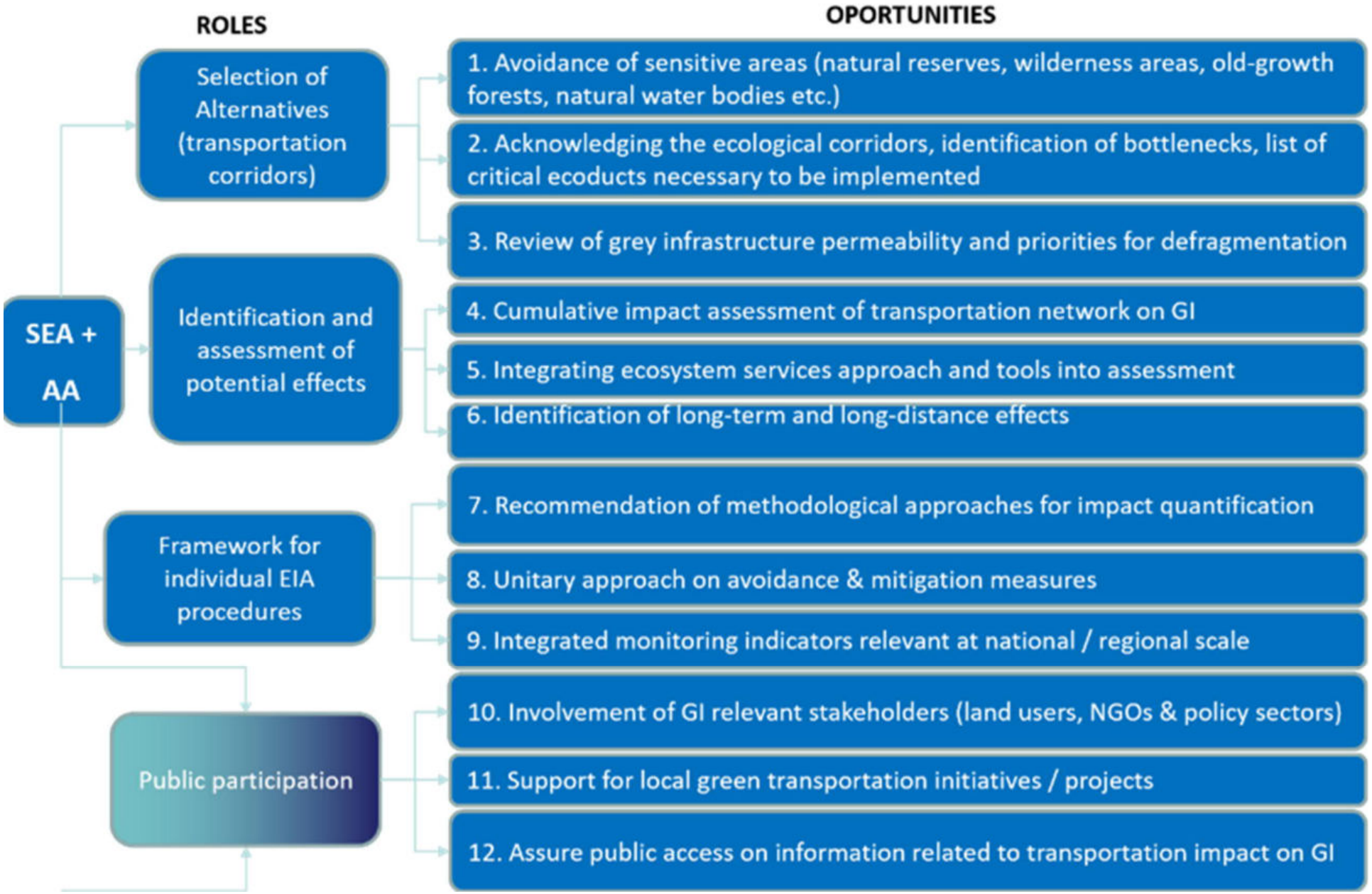
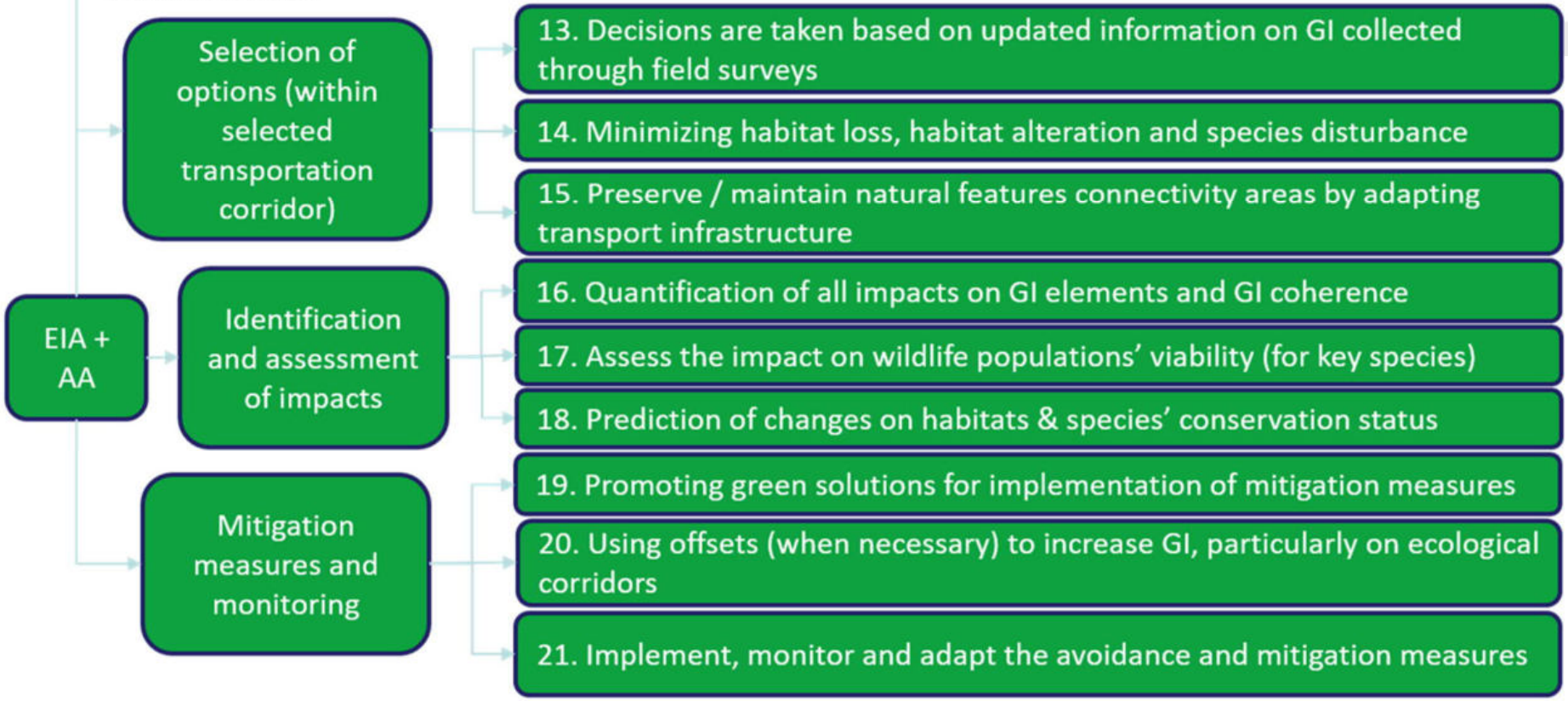

ROLES
OPORTUNITIES
SEA + AA
Selection of Alternatives (transportation corridors)
Identification and assessment of potential effects
Framework for individual EIA procedures
Public participation
1. Avoidance of sensitive areas (natural reserves, wilderness areas, old-growth forests, natural water bodies etc.)
2. Acknowledging the ecological corridors, identification of bottlenecks, list of critical ecoducts necessary to be implemented
3. Review of grey infrastructure permeability and priorities for defragmentation
4. Cumulative impact assessment of transportation network on GI
5. Integrating ecosystem services approach and tools into assessment
6. Identification of long-term and long-distance effects
7. Recommendation of methodological approaches for impact quantification
8. Unitary approach on avoidance & mitigation measures
9. Integrated monitoring indicators relevant at national / regional scale
10. Involvement of GI relevant stakeholders (land users, NGOs & policy sectors)
11. Support for local green transportation initiatives / projects
12. Assure public access on information related to transportation impact on GI



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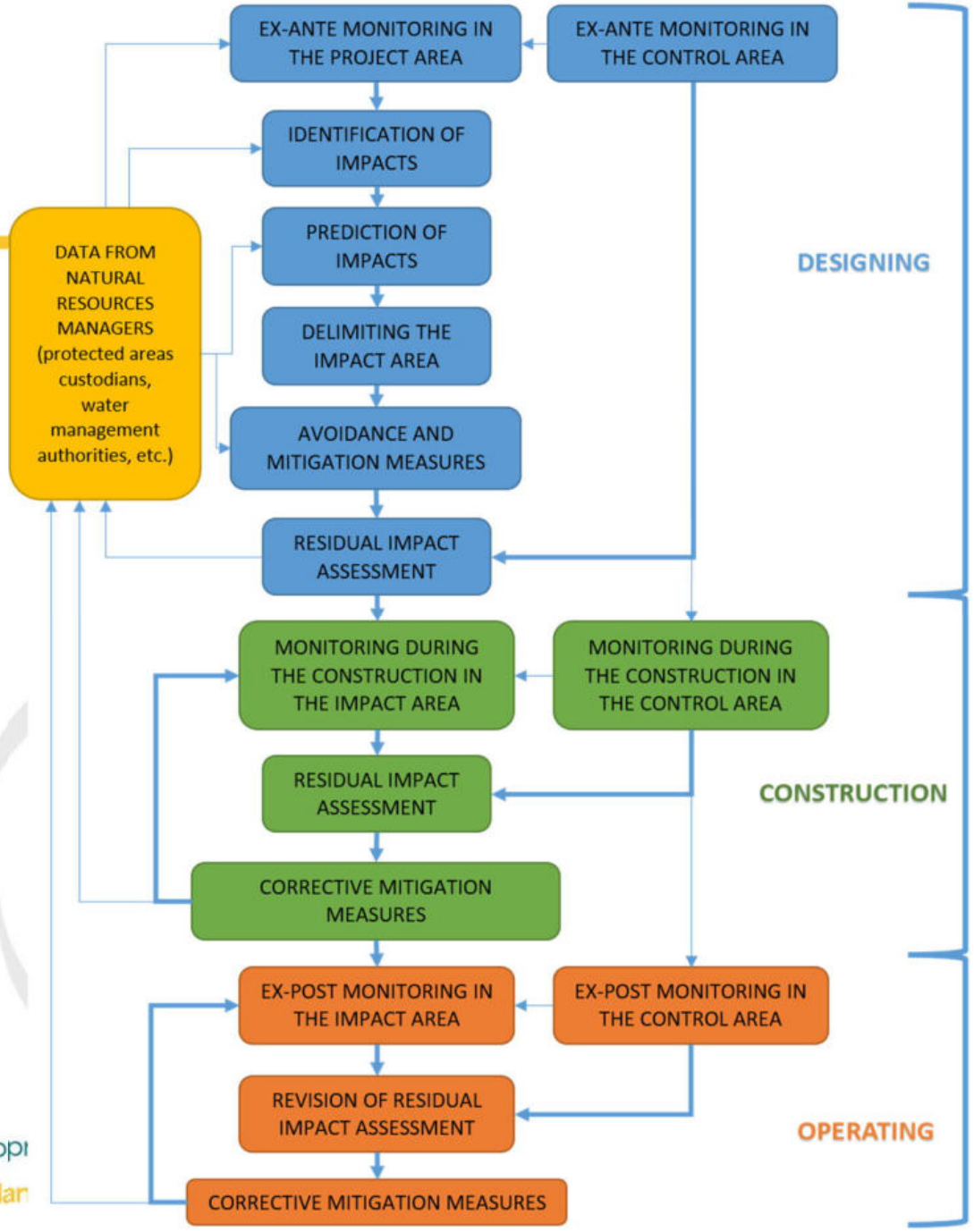
„**BACI** – before-after control-impact.

BACI Method (Steward-Oaten, 1986 in Smith et al., 1991, 2002) involves collecting of data from the impact area, as well as from a reference area, several times before and after the occurrence of impacts.

Right: The main components of BACI in impact assessment



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WHAT IS PERMEABILITY?

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Permeability, as a landscape feature indicates the degree to which the wild fauna can move within a territory.

Urban and infrastructure development can reduce landscape's permeability.

Habitat fragmentation is indirectly correlated with landscape's level of permeability.

Not only physical barriers can reduce permeability, but also behavioural barriers. For the latter, the parameter which best indicates its effects on permeability is **traffic density**.

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The relation between traffic density and permeability for the mammal species

Nr.	Traffic density	Permeability
1	Roads with less than 1.000 vehicles/day	Adequate permeability for the majority of wild species
2	Roads with 1.000-4.000 vehicles/day	Permeability for some species, but avoidance for sensitive species
3	Roads with 4.000-10.000 vehicles/day	Strong barrier, noise and traffic chases away most species. Individual who try to cross the road become victims, being killed in the collision.
4	Roads with more than 10.000 vehicles/day	Impermeability for the majority of species.

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Example of forest habitat fragmentation (site: Bucureşti-Ploieşti Highway, Source Google Earth)

Big structures (bridges, tunnels) can maintain the permeability for the wild fauna (site: Transilvania Highway)

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The analysis of permeability for the wild fauna – aims to reduce the negative effects of artificial barriers generated to the wild species of fauna.

The analysis is needed to **develop a permeable infrastructure** by chosing the best options to the selected alternative, thus **avoiding a high degree of fragmentation**, by proposing passages, respectively adapting the technical solutions and the management of traffic (Iuell et al., 2003, Anděl et al., 2010).

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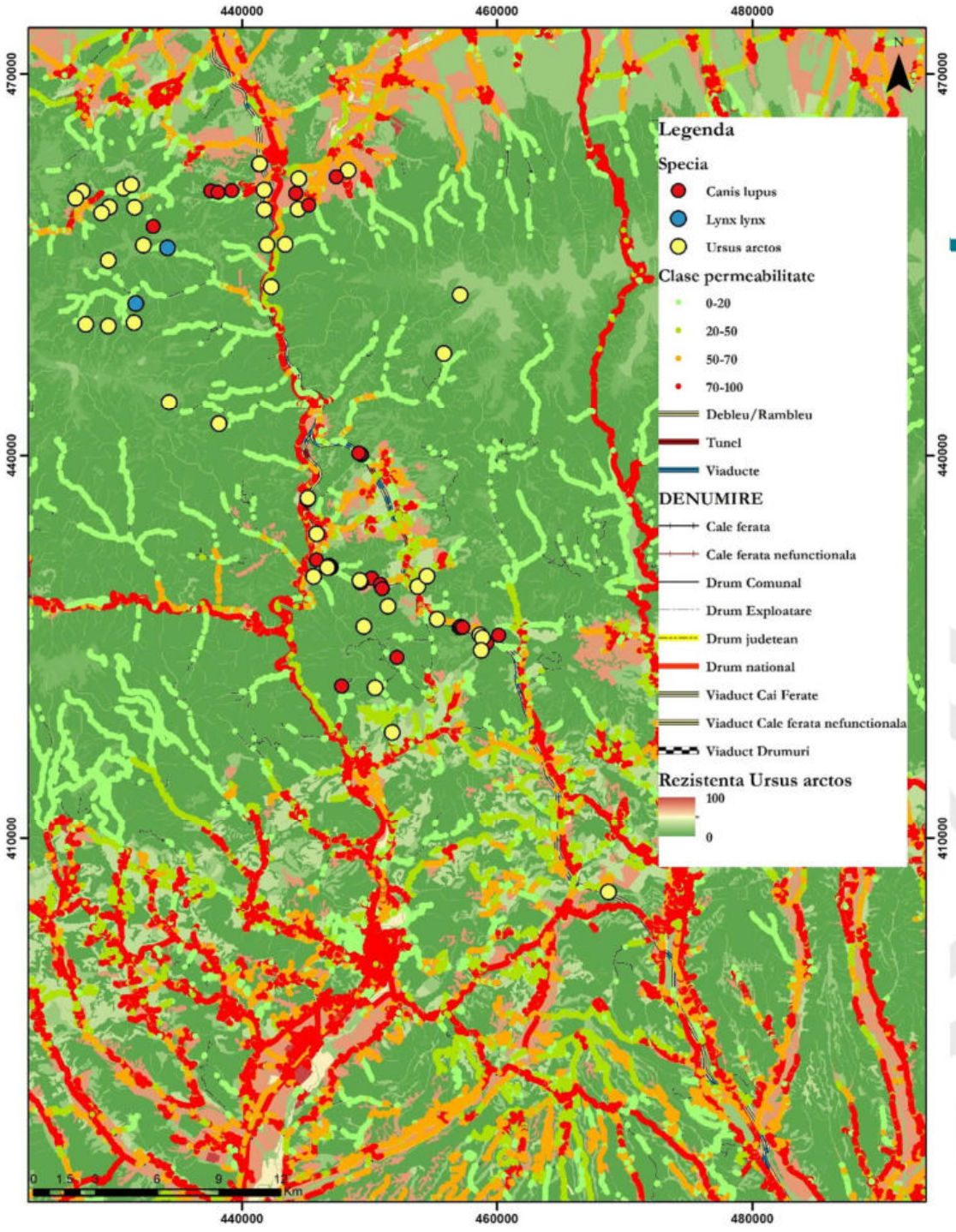
The analysis of permeability needs to include **maps:**

• **For the species of animals with conservative value** identified in the project area;

• For the **initial conditions** and for the **conditions resulting from the project implementation**;

• Based on which to be able to identify the crossing areas which are not affected by the proposed project, as well as the areas where interventions are needed to maintain the connectivity of habitats for the species.

The maps have to include the graphic representation of the degrees of permeability/the categories of importance in the target area: areas of exceptional importance, areas of high importance, areas of medium importance, areas of low importance and areas of no importance.



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The analysis of permeability – Initial conditions

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When assessing the permeability as well as in other stages of impact analysis, one needs to consider the projects which are being implemented or planned to be implemented with the goal of reintroducing the species, ecological reconstruction or habitat conservation. The areas targeted by such projects need to be considered of *exceptional importance*.

Besides the **spatial analysis** it is recommended to use **matrixes and diagrams** of permeability to identify the supplementary passages needed to assure an optimal level of connectivity for the fauna. These will include a details analysys (kilometer by kilometer) identifying the background conditions (the importance of the areas crossed by the project) and the permeability of the structures to be put in place by the project.

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When additionally to the new structures to be put in place by the project there are other impermeable or less permeable infrastructures (e.g. the existing railroad), all the structures need to be considered together when assessing the impact.

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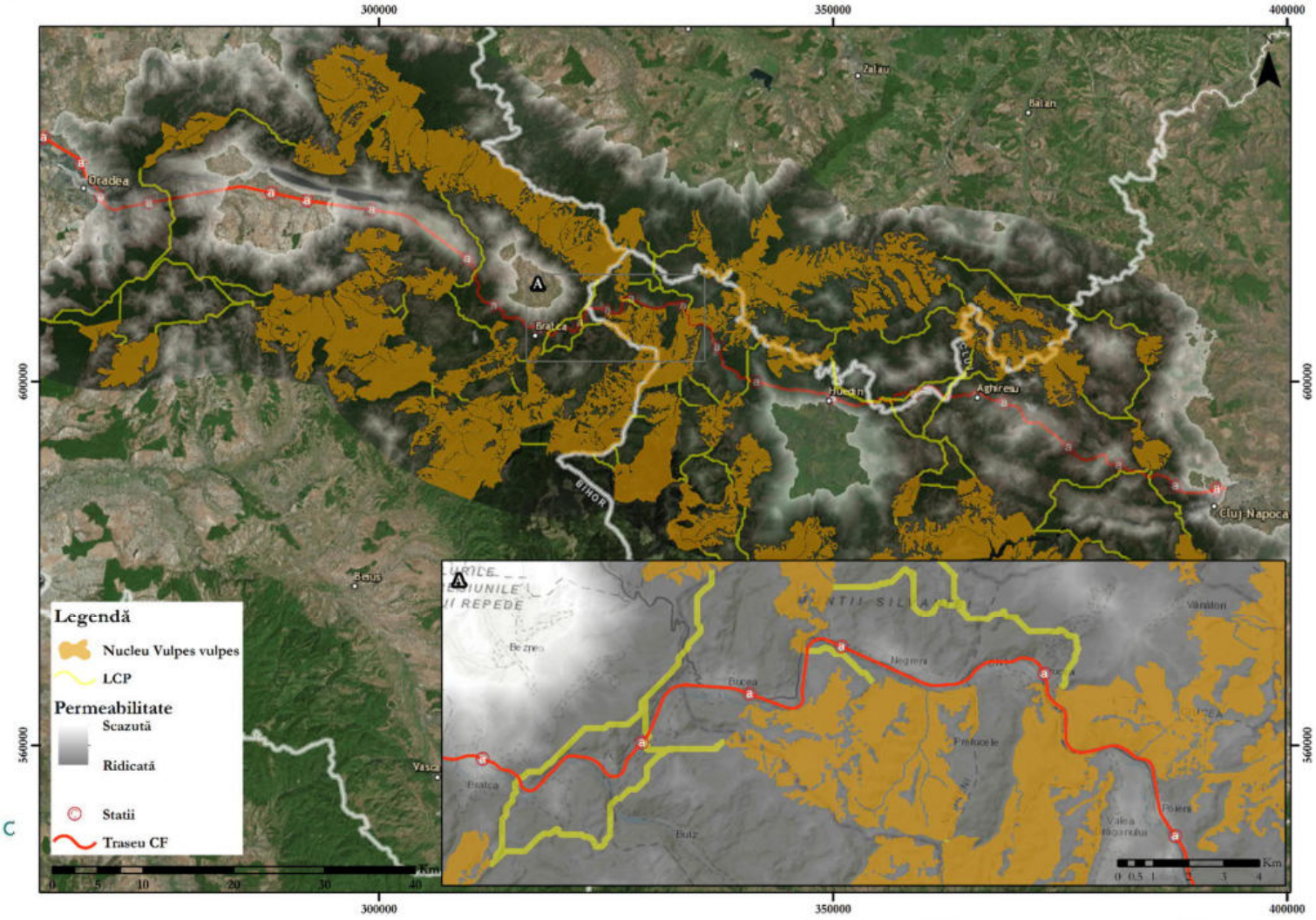

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An example of how to assess permeability

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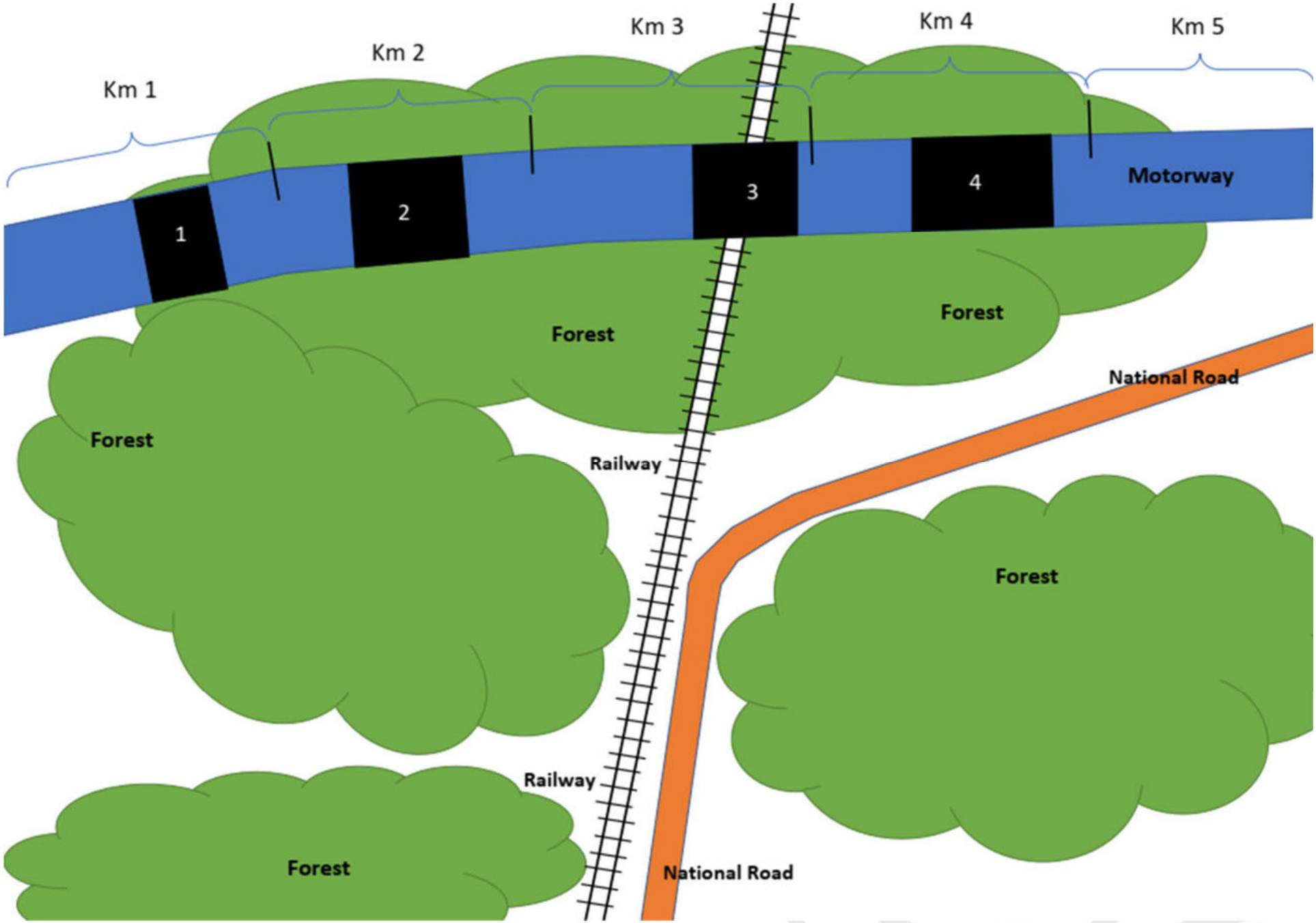
Km 1
Km 2
Km 3
Km 4
Km 5
1
2
3
4
Motorway
Forest
Forest
Forest
Forest
Forest
Railway
Railway
National Road
National Road

					Functionality for						Fulfillment of conditions regarding the structure frequency (Yes / No)		
Structure	Length (m)	Height (m)	Width (m)	Openness (IO)	Large mammals	Medium mammals	Small mammals	Distance form the last structure (km)	Distance to the next structure (km)	Structure frequency (km)	Large mammals	Medium mammals	Small mammals
Bridge 1	100	1.5	28					800	200				
Bridge 2	300	3	28						1200				
Bridge 3	250	5	28						500				
Bridge 4	450	10	28						1050				

Where

IO = Length * Height / Width (referring to each structure)

Minimum IO values

		Large mammals	Medium mammals	Small mammals
Functionality	No functionality	0	0	0
	Minimal	1.7	0.65	0.09
	Medium	4	1.5	0.2
	High	8	7	0.96
	Very high	40	30	4.15

Structure frequency

	Maximum values for the "very high" sensitivity category	
Large mammals	3 - 5	km
Medium mammals	1.5 - 2.5	km
Small mammals	1	km

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WHAT DOES SIGNIFICANT IMPACT MEAN?

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Habitat alteration; Perturbing species' activity

Losing habitats

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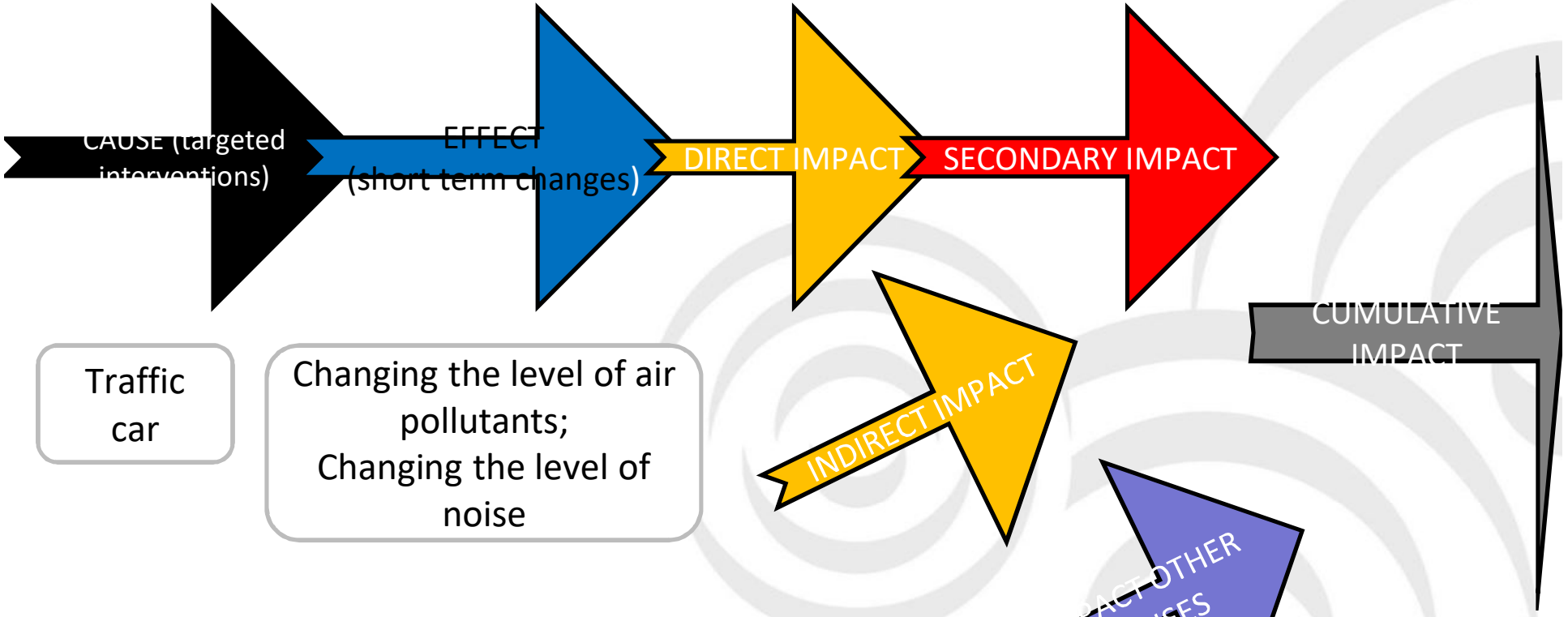
Changing conservation status



Traffic car

Changing the level of air pollutants; Changing the level of noise

Ex: Mortality

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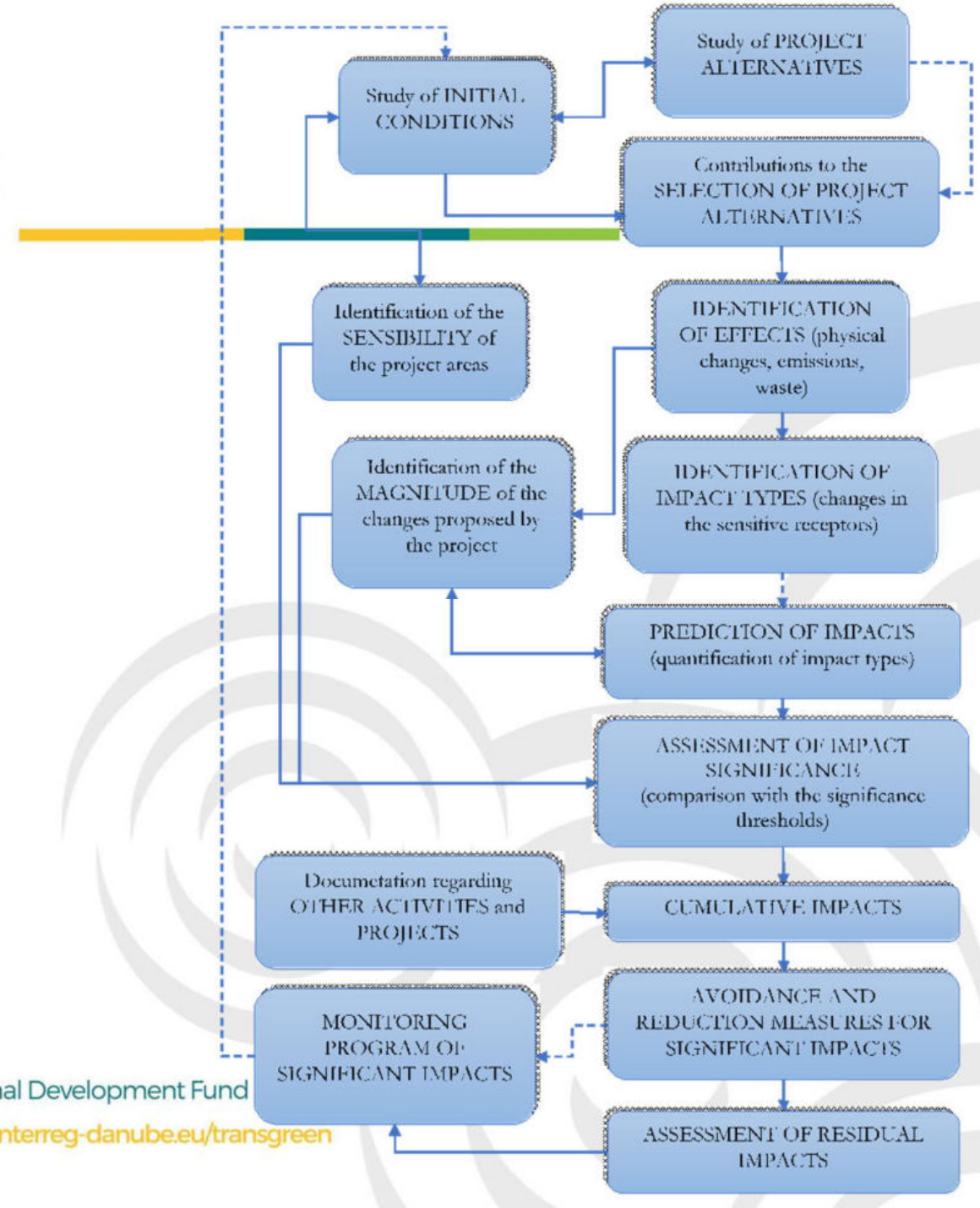
The conceptual framework for the environmental impact assessment



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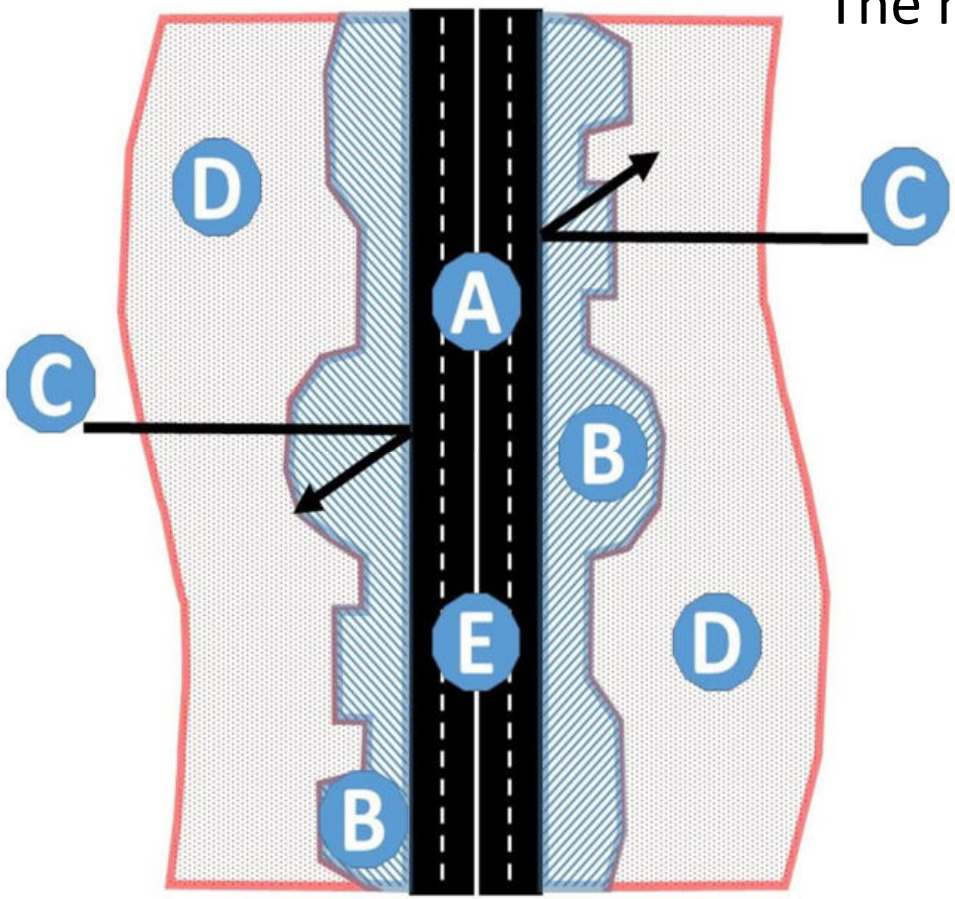
The main forms of impact on biodiversity – simplified scheme



A. Habitat loss;
B. Habitat alteration;
C. Habitat fragmentation;
D. Disturbance of wild fauna;
E. Decreasing populations due to increased mortality.

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The impact assessment matrix

Significance of impact		Magnitude of change										
		Negative very large	Negative large	Negative moderate	Negative low	Negative very low	No change	Positive very low	Positive low	Positive moderate	Positive large	Positive very large
Sensitivity of area	Very large	Significantly negative	Significantly negative	Significantly negative	Moderately negative	Moderately negative	No impact	Moderately positive	Moderately positive	Significantly positive	Significantly positive	Significantly positive
	Large	Significantly negative	Significantly negative	Moderately negative	Moderately negative	Low negative	No impact	Low positive	Moderately positive	Moderately positive	Significantly positive	Significantly positive
	Moderate	Significantly negative	Moderately negative	Moderately negative	Low negative	Low negative	No impact	Low positive	Low positive	Moderately positive	Moderately positive	Significantly positive
	Low	Moderately negative	Moderately negative	Low negative	Low negative	Low negative	No impact	Low positive	Low positive	Low positive	Moderately positive	Moderately positive
	Very low	Moderately negative	Low negative	Low negative	Low negative	Low negative	No impact	Low positive	Low positive	Low positive	Low positive	Moderately positive

Where,

Colour code	Significance of impact	Necessary measures
	Significantly negative impact	If efficient reduction measures cannot be found (so as the residual impact to be not significant) impact avoidance measures (change of the proposed location, change of the proposed technical/technological solution, etc.) or, depending on the case, compensation measures must be taken.
	Moderately negative impact	Impact reduction measures are necessary.
	Low negative impact	Impact avoidance / reduction measures are not necessary, but some measures can be taken for ensuring the maintenance of the negative impact at a minimum level.
	No impact	Measures not necessary.
	Low positive impact	Any measure that can lead to the extension / multiplication of the effects.
	Moderately positive impact	
	Significantly positive impact	

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Requirements to assess impacts' significance:

1. **Quantifying** the existing situation (baseline);
2. **Quantifying** the effects;
3. **Quantifying** the forms of impact;
4. Defining on some **thresholds of significance**;
5. **Prognosis** of if the thresholds will be exceeded (or not).

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Significance thresholds:

1. The habitat / specie(s)' conservation status gets worse (e.g.: shifts from favourable to unfavourable – inadequate conservation status);
2. Deteriorating the water body;
3. Any other thresholds which would lead to losing a resource / component or irreversible affecting it (e.g.: the abandonment of > 50% of the total number of households in a village).

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The impact on the conservation status of species:

Parameters	Current status	Reference status	Changes generated by the project	Significant impact?
The population of the target species	Favourable - 100 ind. (Unfavourable – inadequate = 50 ind; Unfavourable – bad = 25 ind)	120 ind	- 5 ind / year	Yes, In around 10 years conservation status worsens
The area of species' habitat	...	...	...	...
The future perspectives for the target species	...	...	...	...

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Example SEICA Sibiu - Pitesti

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FIELD DATA COLLECTION

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"...and we can save 700 lira by not taking soil tests."

Minimum recommended durations – reflects the length of time required to collect data and information for the field concerning the presence and dynamic of the relevant biodiversity elements

Component	Stages of environmental assessment	The structure of environmental impact assessment	Recommended duration
Selecting the alternative	MCA (multi-criteria analysis)	Field data collection	6 months – 1 year
		MCA: Stage 1 + 2	
Feasibility study	EIA	Field data	Minimum 1 year
		Environmental impact assessment study	~ 6 months
		Environmental accord	
Technical project	Revising EIA (is necessary)	Field data (if necessary)	Minimum 6 months
		Revising the impact study (if necessary)	
		Revised accord (if necessary)	

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Project managers need to make sure that the elaboration of a feasibility study and the environmental assessment studies have allocated sufficient time and budgets, so that the project is sustainable.

Field data collection - minimum 12 months needed to observe all the phaenological details from species' development cycle.

To be noted! If between the data collection and the beginning of construction work there are more than 2 years, it is recommended to undertake a supplementary inventory (at least one summer season).

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Stages for field data collection:

- Data from the literature;
- Data from the stakeholder consultation(s) (e.g.: Forest Management Units, Game management, Protected Area Managers, NGOs, local communities);
- Data from previous projects;
- Data collected from the field.

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Guidelines published by the Institute of Biology in Bucureşti:

- Synthetic guidelines for the monitoring of reptilian and amphibian species of community importance in Romania;
- Synthetic guidelines for the monitoring of mammal species of community importance in Romania;
- ….

http://www.ibiol.ro/posmediu/rezultate.htm

Standard guidelines for the monitoring of bird species of community importance in Romania (under the scientific coordination of Societatea Ornitologică Română/BirdLife România and Asociaţia pentru Protecția Păsărilor și a Naturii „Grupul Milvus”)

http://monitorizareapasarilor.cndd.ro/documents/Ghid-standard-de-monitorizare-pasari-2014.pdf

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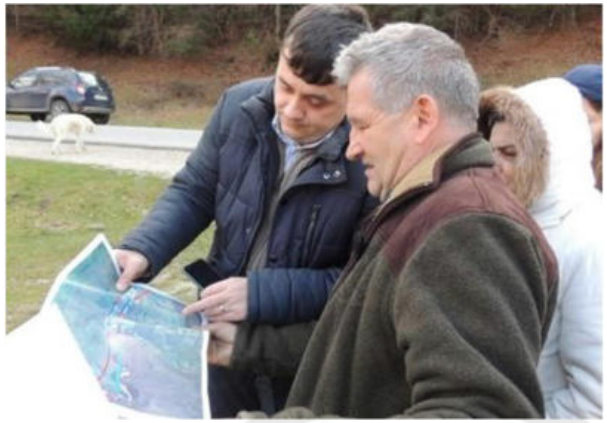

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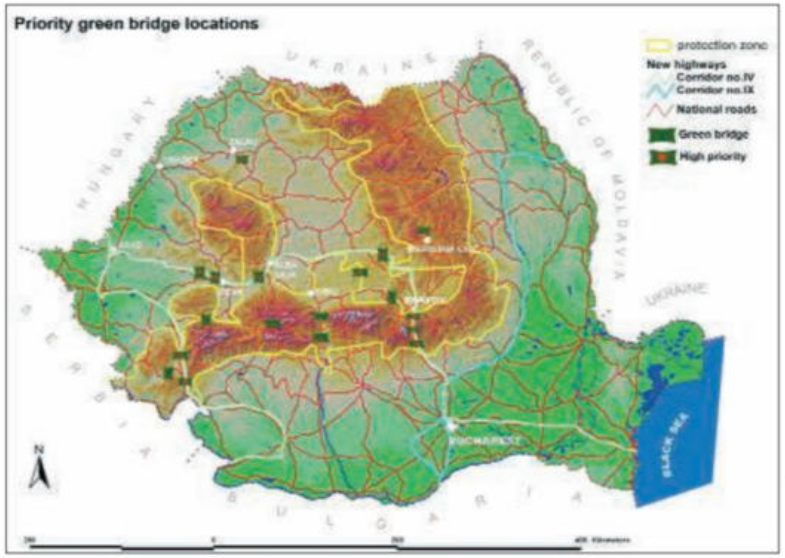
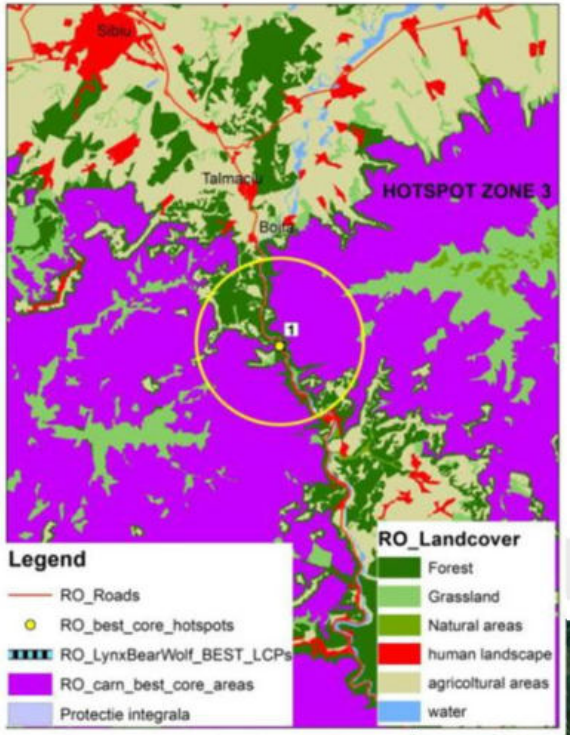
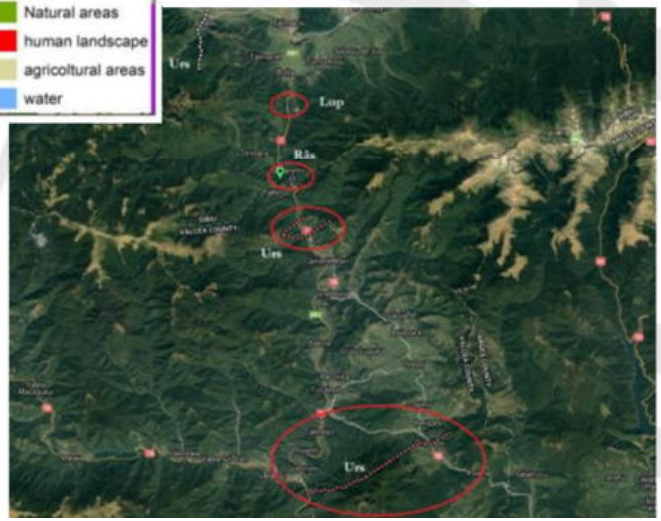


The map of priority locations for ecoducts (Maanen et al. 2002)



Priority locations for the proposed eco-ducts, as from BioREGIO – EURAC Project



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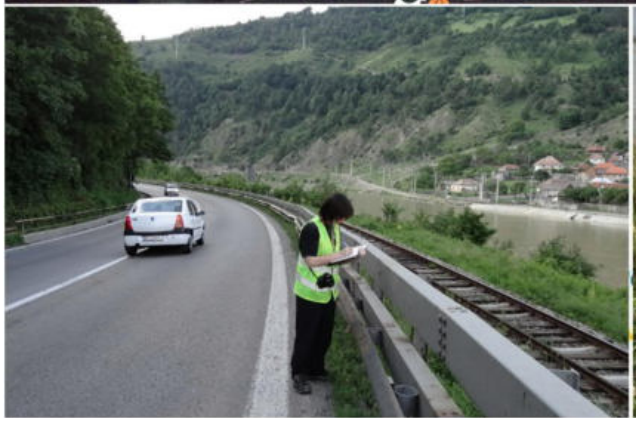

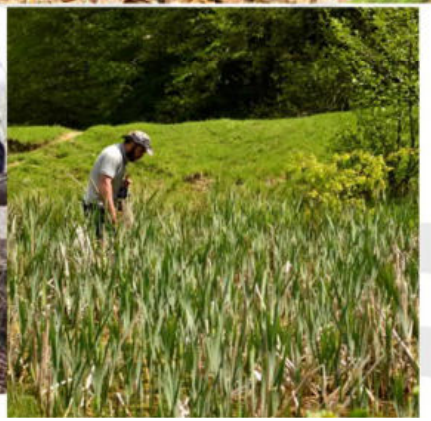

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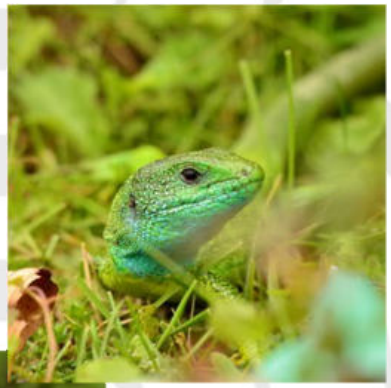


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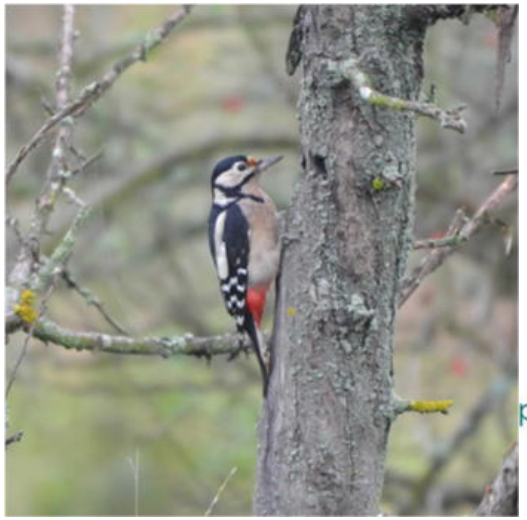
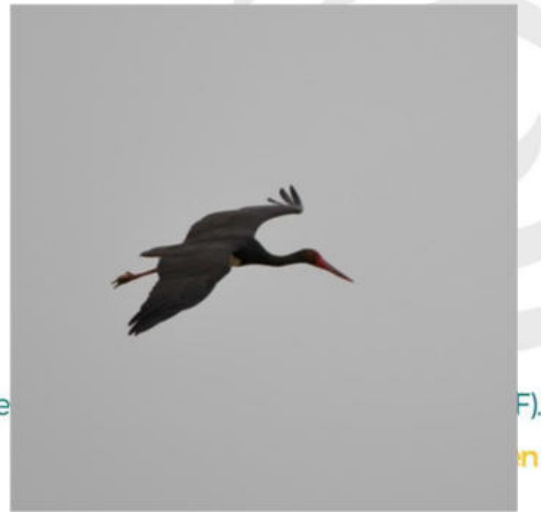


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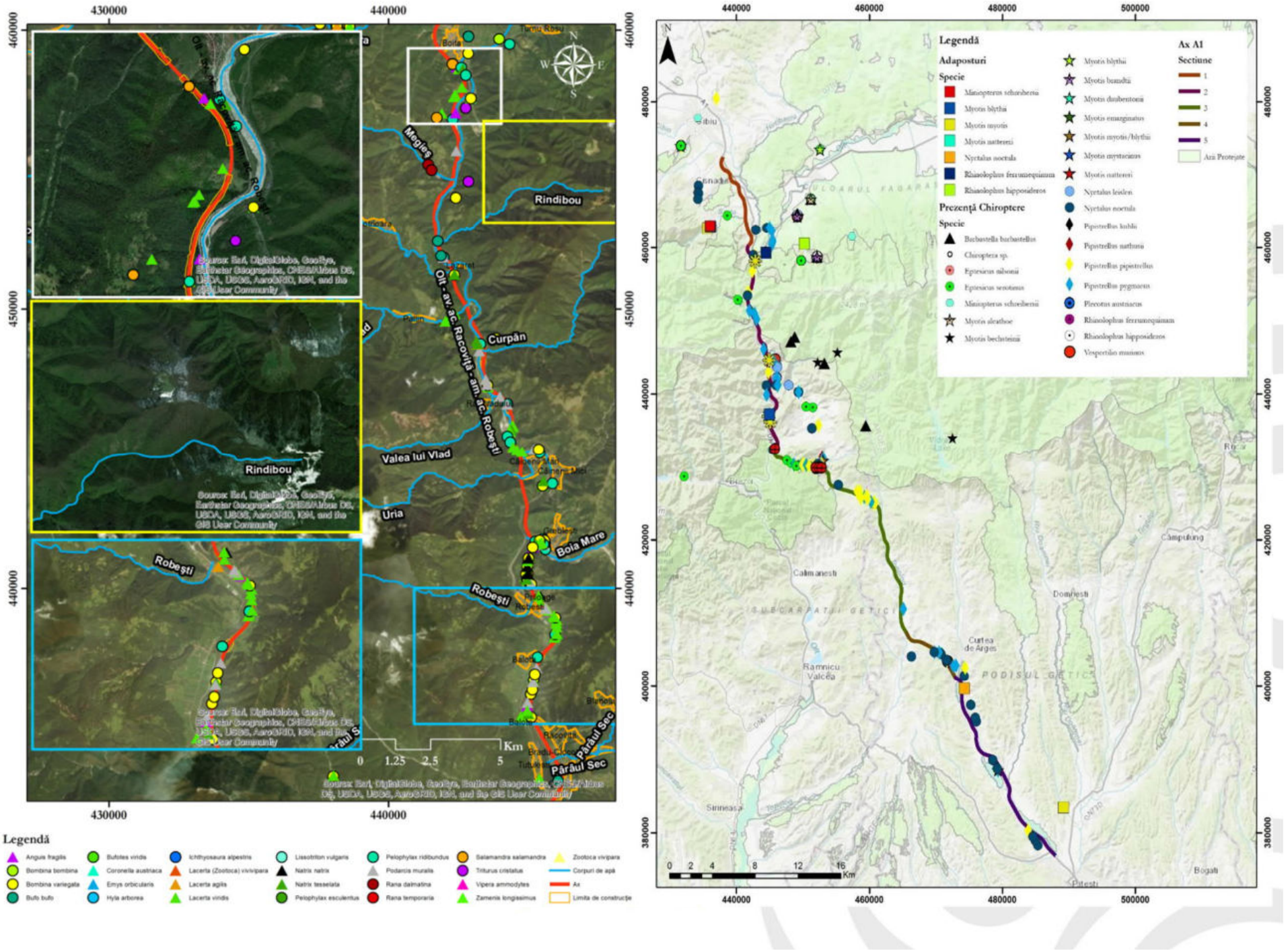
Legendă
Adaposturi
Specie
Miniopterus schreibersii
Myotis blythii
Myotis myotis
Myotis nattereri
Nyctalus noctula
Rhinolophus ferrumequinum
Rhinolophus hipposideros
Prezenţă Chiroptere
Specie
Barbastella barbastellus
Chiroptera sp.
Eptesicus nilssonii
Eptesicus serotinus
Miniopterus schreibersii
Myotis alcathoe
Myotis bechsteinii
Myotis blythii
Myotis brandtii
Myotis daubentonii
Myotis emarginatus
Myotis myotis/blythii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Nyctalus noctula
Pipistrellus kuhlii
Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus austriacus
Rhinolophus ferrumequinum
Rhinolophus hipposideros
Vespertilio murinus
Ax A1
Sectiune
1
2
3
4
5
Arii Protejate
Olt - av. ac. Racoviţă - am. ac. Robeşti
Megieş
Rindibou
Curpăn
Valea lui Vlad
Uria
Boia Mare
Robeşti
Părâul Sec
Sibiu
Râmnicu Valcea
Curtea de Argeş
Câmpulung
Piteşti
Bogaţi
Km
Legendă
Angus fragilis
Bombina bombina
Bombina variegata
Bufo bufo
Bufotes viridis
Coronella austriaca
Emys orbicularis
Hyla arborea
Ichthyosaura alpestris
Lacerta (Zootoca) vivipara
Lacerta agilis
Lacerta viridis
Lissotriton vulgaris
Natrix natrix
Natrix tesselata
Pelophylax esculentus
Pelophylax ridibundus
Podarcis muralis
Rana dalmatina
Rana temporaria
Salamandra salamandra
Triturus cristatus
Vipera ammodytes
Zamenis longissimus
Zootoca vivipara
Corpuri de apă
Ax
Limita de construcţie

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AVOIDANCE/ REDUCTION / COMPENSATION MEASURES

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Impact avoidance measures - those which, through implementation, ensure that an impact identified in the assessment will no longer occur over the life cycle of the project.

Example of avoidance measures:

- **changing the site** (e.g. selecting a route that does not intersect protected natural areas);

- **changing the technical solution** (e.g. choosing a solution that does not lead to fragmentation of the habitat - building a tunnel or which allows maintaining connectivity - building a viaduct).

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Impact mitigation measures – proposals that are strictly related to the proposed project and that address directly the identified impacts and risks, which will lead to reduction of anticipated effects and thus contribute to impact mitigation.

Examples of mitigation measures:

- **Installing panels** to reduce the level of noise in the vicinity of road infrastructure;
- **Placing fences** to reduce the risk of collision between animals and the auto traffic;

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Impact avoidance and mitigation measures can address only one or several components of interest (species, habitat).

For all the components affected and for each form of significant or moderate impact, avoidance or reduction measures need to be identified and adopted.

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If the planning stage is not followed and the avoidance or reduction measures are not effective enough to guarantee that the negative and significant impacts on the environmental components will not be recorded, the procedure needs to include an adequate impact assessment stage with **alternative solutions**, and, if necessary, **compensation measures**.

The need to formulate compensatory measures – the failure to propose a technical alternative with no/less impact on the environment or major constraints to the project, from a geographical point of view (e.g.: no technical solutions are possible/available in sensitive areas from Natura 2000 sites).

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Favorable structures for different animals

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Tabelul nr. 8-1 Favorabilitatea diferitelor structuri de trecere pentru unele speciile de faună

	Ecoducte	Pasaje faună	Pasaje multi-funcționale	Pasaje între arbori	Poduri și viaducte	Subtraversări pentru animale mari și medii	Subtraversări multi-funcționale	Subtraversări pentru animale mici	Canale modificate	Pasaje pentru pești prin canale și conducte	Tuneluri pentru amfibieni
Ungulate											
Cerb	●	●	–	–	●	○	–	–	–	–	–
Căprior	●	●	○	–	●	●	○	–	–	–	–
Mistreț	●	●	○	–	●	●	○	–	–	–	–
Carnivore											
Urs	●	●	○	–	●	○	○	–	–	–	–
Râs	●	●	○	–	●	●	○	–	–	–	–
Lup	●	●	●	–	●	●	●	–	–	–	–
Șacal	●	●	●	–	●	●	●	○	–	–	–
Vulpe	●	●	●	–	●	●	●	●	○	–	–
Bursuc	●	●	●	–	●	●	●	●	●	–	–
Vidră	○	○	○	–	●	●	●	●	●	○	–
Jder	●	●	●	?	●	●	●	●	●	–	–
Mustelide mici	●	●	●		●	●	●	●	●		
Insectivore											
Arici	●	●	●		●	●	●	●	–	–	–
Cârtiță	●	●	●	–	●	●	●	●	○	–	○
Rozătoare											
Iepure	●	●	○	–	●	●	●	●		–	–
Veveriță	●	●	●	●	●	●	●	–	–	–	–
Pârș	●	●	○	?	○	–	–	–	–	–	–
Șoareci	●	●	●	–	●	●	●	●	○	–	–
Castor	–	–	–	–	●	●	○	○	○	?	?
Reptile											
Șerpi	●	●	○	–	●	●	○	●	○	–	○
Șopârle	●	●	○	–	●	●	○	●	○	–	○
Țestoase	●	●	○	–	●	●	○	●	–	–	○
Amfibieni	●	○	○	–	●	●	○	●	○	–	●
Pești	–	–	–	–	–	–	–	–	–	●	–
Nevertebrate											
Specii de habitate uscate	●	●	●	–	●	○	○	○	–	–	–
Specii de habitate umede	○	○	○	–	●	○	○	○	○	–	○

● - soluție optimă; ○ - poate fi utilizată cu unele adaptări la condițiile locale; – - nefavorabil; ? – necunoscută, sunt necesare observații suplimentare

Overpasses:

- **Tunnels**;

- **Eco-ducts** ("green bridges"): big structures, integrated in the landscape, specially designed to reduce the impact of habitat fragmentation, which can ensure connectivity between ecosystems. Their width should be of minimum 100 m (EuroNatur, 2010);

- **Passages for the fauna** – special structures built to reduce the impact of habitat fragmentation, whose width is less than 100 m;

- **Multifunctional passages** – structures which are adapted (by changing existing ones) or build with the aim to be used both by the wild fauna and people.

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Example - tunnel

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Example - tunnel

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Example – green bridge

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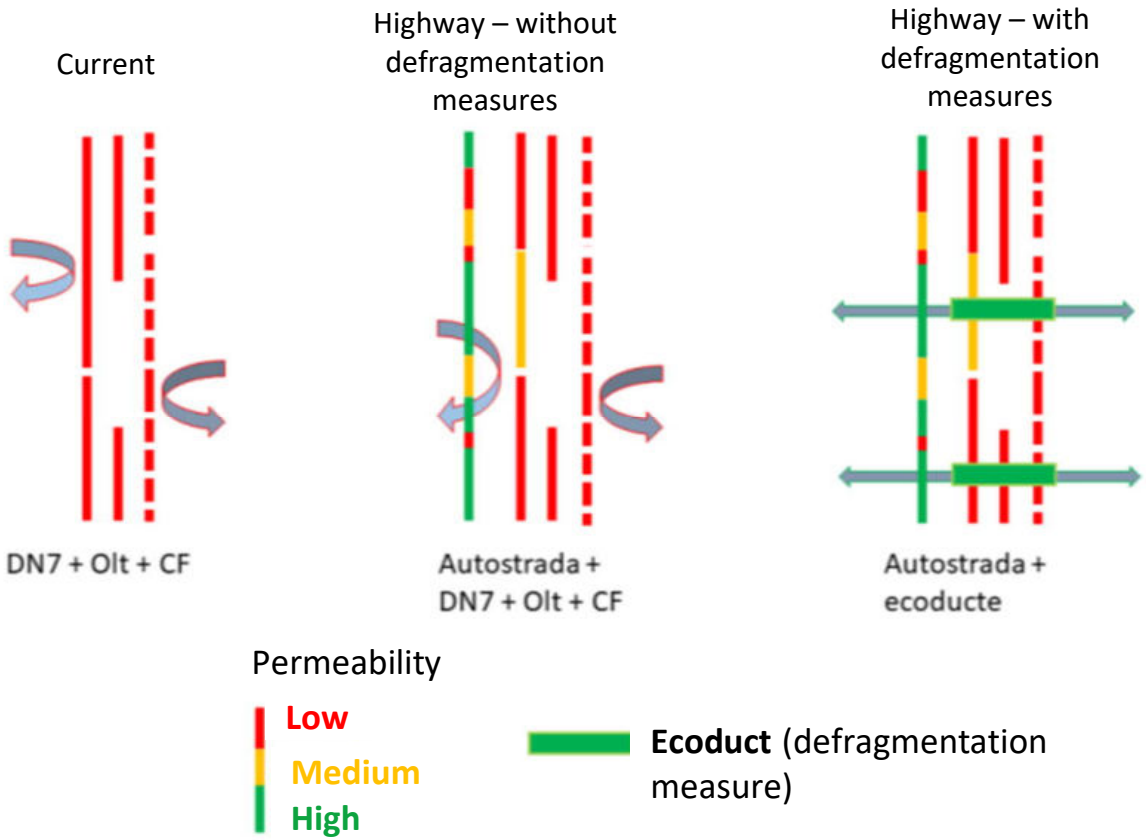
Example of the cumulative effects of existing impermeable linear infrastructure and the possible solutions for restoring connectivity



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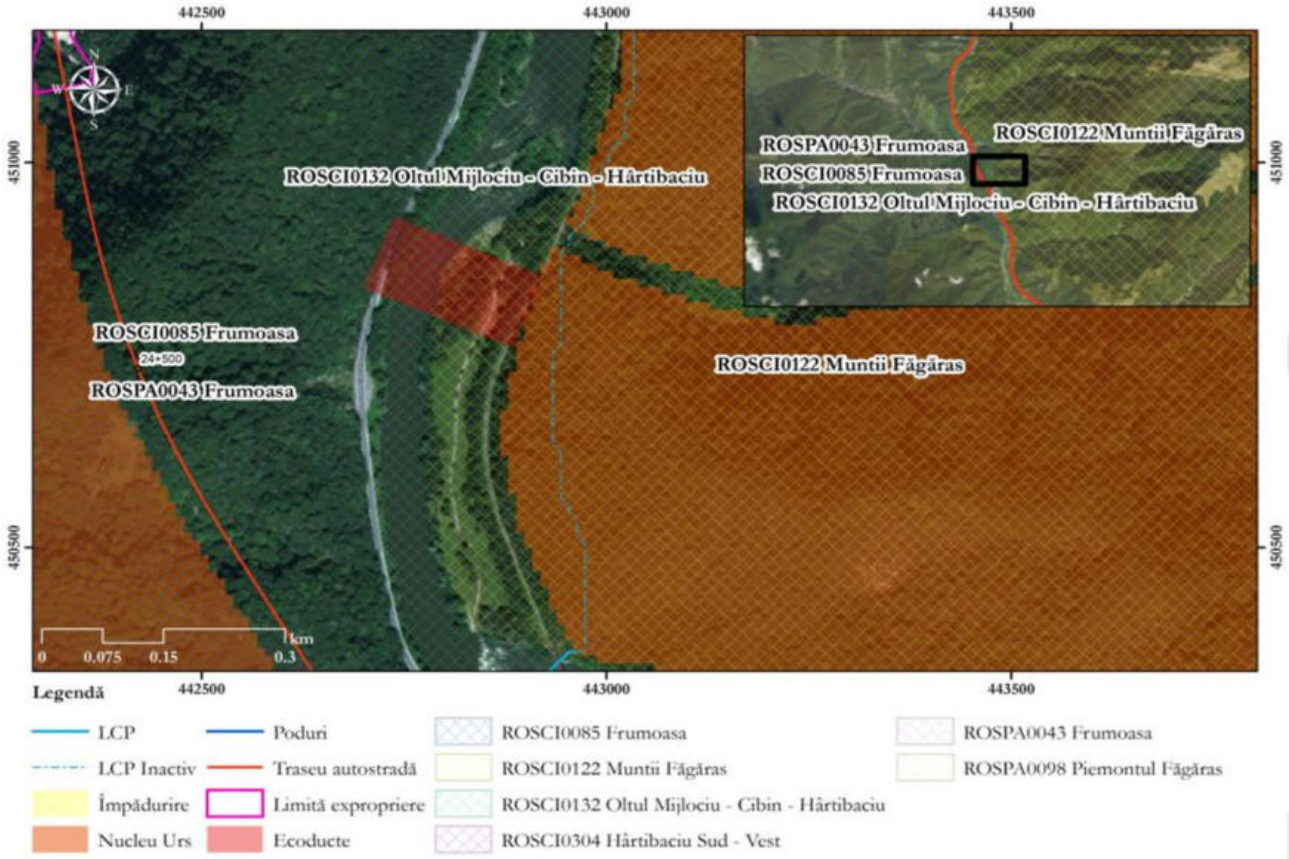
Examples of solutions (eco-ducts) proposed for restoring connectivity of corridors fragmented by existing linear infrastructure



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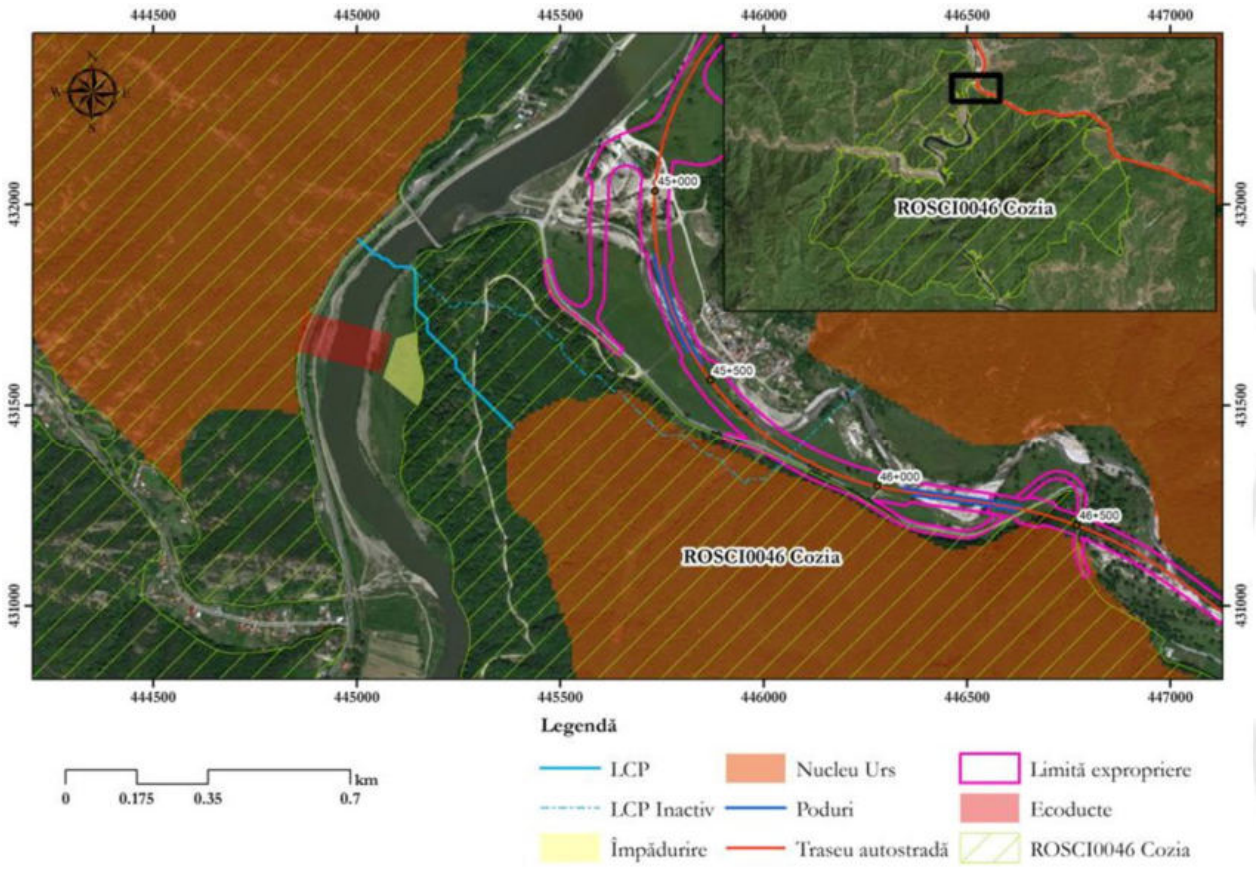
Examples of solutions (eco-ducts) proposed for restoring connectivity of corridors fragmented by existing linear infrastructure



Underpasses:

• **Bridges and viaducts** – standard structures of the classic infrastructure which is built in the areas with a high difference of altitude (ex. When the road crosses a valley) or when crossing a river;

• **Underpasses for small and medium size animals** – specially built structures designed to connect the areas important to maintain the permeability for different areas;

• **Multifunctional underpasses** – structures designed for both population and wild species. These are recommended only for underpasses of more than 10 m in width.

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- **Underpasses for small animals** – Pipes/tubes or rectangular tunnels with a diameter/width of 0.4 – 2 meters, used with the aim of facilitating the access of small animals;
- **Modified culverts** – structures designed for allowing the flow of water underneath the infrastructure: either for the passing of a very low flow stream, or for the drainage of rainfall. They can contain water either permanently or temporarily;
- **Fish passes** – structures designed mainly for ensuring the longitudinal connectivity for fish species and other aquatic organisms;
- **Amphibian tunnels** – structures necessary for preventing access to the road of amphibians, which during the reproductive period (but not only) undertake movements towards aquatic habitats for egg laying.

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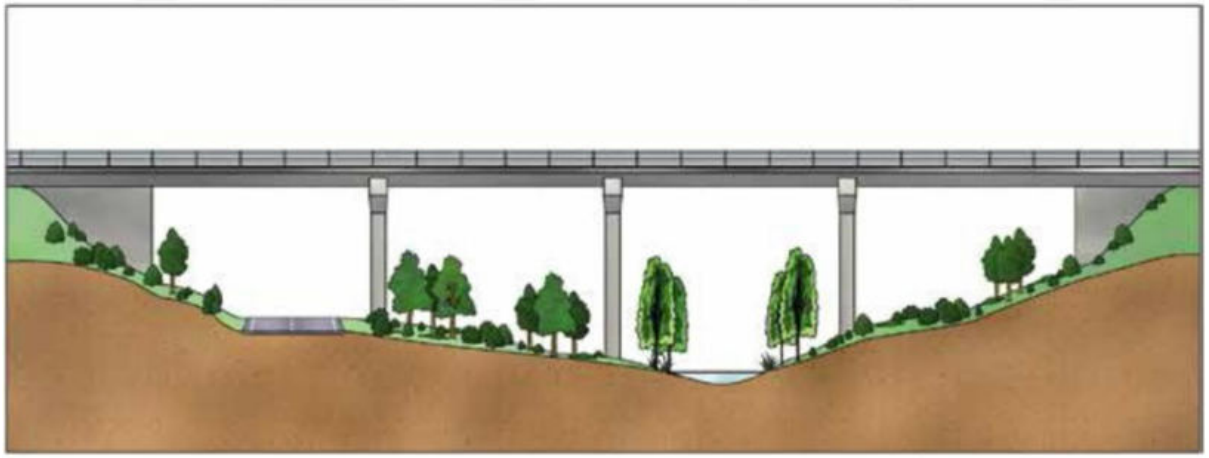

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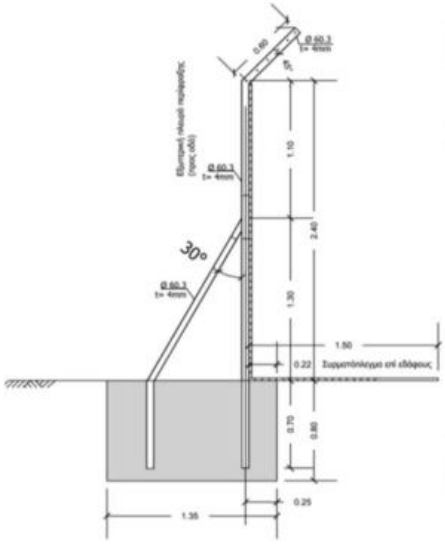

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ASSESSING THE QUALITY OF ENVIRONMENTAL ASSESSMENT STUDIES

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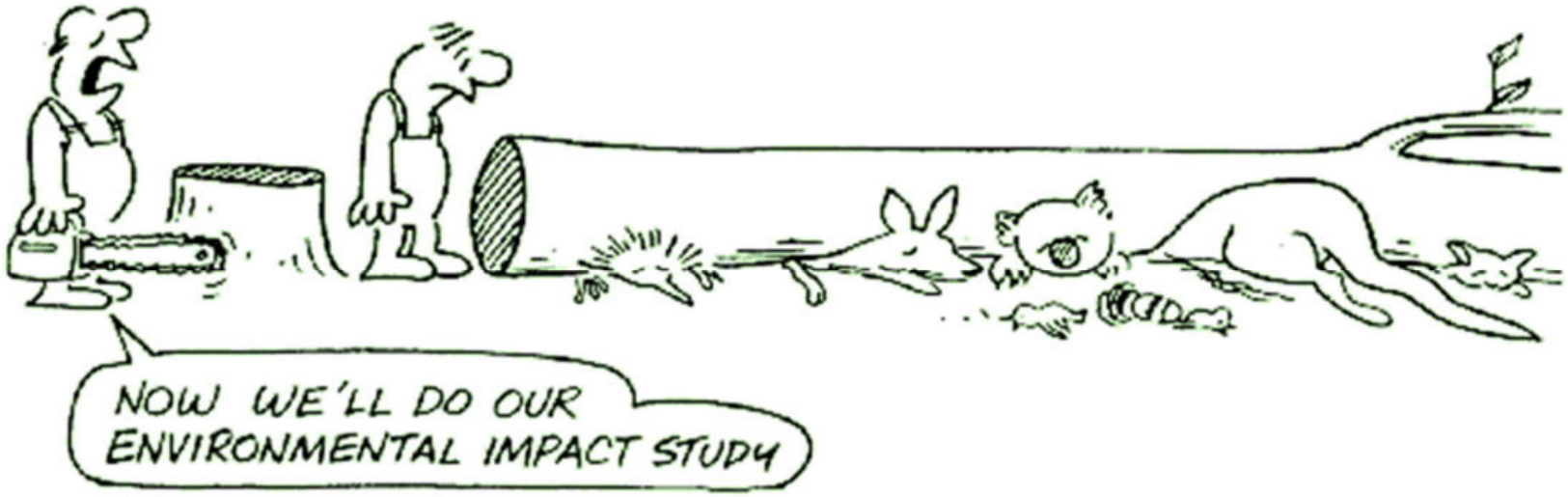

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The experts who conduct environmental impact studies*:

- Act honestly, impartially correctly, with professionalism and objectivity in every aspect of their profession;
- Are guided by /promote the highest standards and the best practices in their profession;
- Make sure that the studies they are conducting do not include distorting elements which could deliberately favour some decisions, or affirmations which the author doesn't consider true.

** Codul de Conduită Profesională şi Responsabilităţi Etice al IAIA (Asociaţia Internaţională pentru Evaluarea Impactului)*

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Summary of the critical requirements for a high quality environmental assessment:

1. Data collected from the field (minimum of 1 year, with monthly surveys);

2. Quantification of the current situation (baseline), e.g.: density of individuals, number of passes, number of victims, habitat surfaces, etc.;

3. Distribution maps, permeability maps (with/without the project), maps of the ecological corridors (national, regional, local).

4. Quantification of the permeability of the project structures;

5. Identification of all of the effects;

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6. *Quantification of effects (physical changes, emissions, waste);*
7. *Identification of direct, secondary, indirect and cumulative impacts;*
8. *Quantification of the types of impact;*
9. *Measures that allow for the avoidance/reduction of significant impacts;*
10. *Quantification of residual impacts;*
11. *A monitoring program focused on the validation of the residual impacts.*

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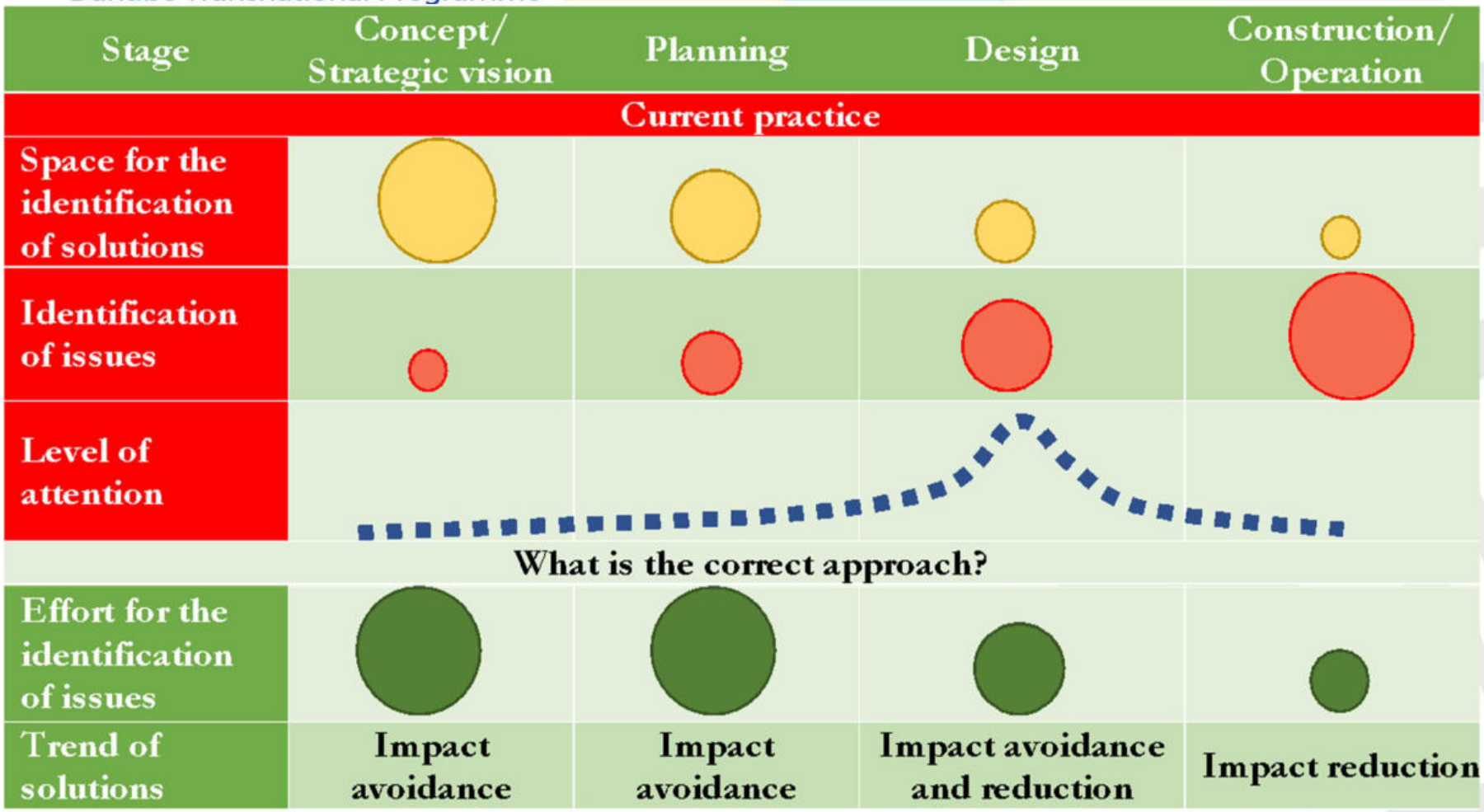

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