Local Monitoring Plan of the Rila-Verila-Kraishte Pilot Area

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Foreword

The local monitoring plan represents a first response to the pressure identified in the Rila-Verila-Kraishte pilot-area – the **lack of coherent monitoring and adaptation.** The monitoring plan will be integrated into the CSOP as it uses the same logical framework and by referencing the specific CSOP objectives.

It consists in a selected list of monitoring actions foreseen to be implemented during SaveGREEN project duration by the project partner Bulgarian Biodiversity foundation with support from the second Bulgarian partner Black Sea NGO Network and local stakeholders.

The approach used in developing the present local monitoring plan aimed for the plan to be:

- **representative:** it will reflect the specifics and the main needs of the pilot area in terms of connectivity;
- **feasible:** it will be tailored to reflect the local capacity for implementation during SaveGREEN duration;
- **compatible** with the other project local monitoring plans (it includes the "minimum requirements" set at project level);
- **complementarity** with other SaveGREEN local monitoring plans, ensuring exchange of know-how;
- **documented in order to have a demonstrative character.**

The **objective** of the local monitoring plan is to facilitate an integrated monitoring programme (procedures, database, indicators, assessment) aiming to collect data relevant data for decision-making at the pilot-area level. The present plan will be updated and developed further during SaveGREEN project and will be the basis for the overall monitoring plan of the pilot area.

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1. Introduction

When making the methodology of monitoring in the pilot area Rila-Verila-Kraishte corridor, first of all it is necessary to consider the PA's specifics. In the following chapters, the structure of the landscape and additional information needed for the methodology are described as well as the chosen monitoring design.

1.1. Specifics of the Rila-Verila-Kraishte Pilot Area

The pilot area in Bulgaria is located in the deep Dupnitsa Valley drained by the Struma River and tributaries and flanked by the mountains Rila, Verila and some other ranges to the south west of the capital Sofia. A 16-kilometer stretch of Lot 1 of the Struma Motorway, with 15 facilities for wildlife (3 of them large – overpass, viaduct and underpass), runs across it. Their effectiveness and sufficiency as mitigation measures, individually and as an integrated system for limiting the fragmentation effect, will be addressed by the project and improvements suggested.

The area is important as case study/pilot area because it is highly fragmented being at the same time on the route of important ecological corridors – three of the main ecological corridors in Bulgaria and some local migratory routes in the mountain area. It is significant for migration of large and medium size mammals (brown bear, jackal, wolf, fox, wild cat, roe deer, wild boar, marten, badger etc.) inhabiting adjacent mountains and protected areas. The area is described as a bottle neck from ecological point of view in the Bulgarian road and rail road network (Van der Grift at al. 2009). Despite of this there is limited data of the species occurrence and distribution and how fragmentation influences their populations. Nevertheless, mitigation measures were prescribed and partially implemented. The area has two distinct patches: in the first one the predominant landscape is arable land and pastures, influenced by settlements and industrial activities; in the second patch forests fragmented by pastures are the dominant

feature. Large open areas and the proximity of settlements, grazing, poaching and linear transport infrastructure are factors influencing the fragmentation. The stretch is a conflict point of motorway, parallel 1st class road, country roads, railroad, and further mitigation measures are necessary.

Large number of Natura 2000 sites are present. East of the corridor is Rila –Verila region. This is a non-fragmented mountain range of Rila, Verila and Vitosha mountains with 5 SCIs Rila BG0000495 (National Park Rila), Rilski manastir BG0000496, Niska Rila BG0000636, Verila BG0000308, Vitosha BG0000113– protecting key breeding populations of brown bear and wolf. West of the corridor is Kraishte region with number of SCIs. SCI Konyavska planina BG0000298 is also protecting the breeding of wolf population, and occasional migration of brown bear is noted there. The last site plays the role of a stepping stone towards an unfragmented Kraishte mountain range and a number of SCIs there situated near or at the border with Serbia and Northern Macedonia - Zemen BG0001012, Karshalevo BG0000294, Karvav kamak BG0001017, Osogovska planina BG0001011, Ruy BG0000313. In Kraishte there are breeding populations of wolf and lynx and potential bear habitats (the last species is restricted there due to high level of poaching). The project area is the only potential bio corridor between the mountain ranges of Rila-Verila and Kraishte for providing connectivity for wolf and for spreading and restoration of populations of bear and lynx in their historical range.

The area is fragmented by Lot 1 of the Struma Motorway with heavy traffic associated with the proximity of the capital and some busy smaller roads as well as a railroad. Intensively used agricultural lands and pastures, 4 towns and 28 villages are located in the wider area. These are considerable barriers for wildlife. It is a mountain area crossed by the motorway, local road and railway and surrounded by mixture of shrubby pastures, arable lands and small patches of forest. In the close vicinity (several hundred meters to 5-6 km) from both sides there are forested mountain slopes providing potential possibility for restoration of connectivity between SCIs situated west and east of the area.

The mitigation measures implemented along the 16-km long Lot 1 of the Struma Motorway in the form of a system for improved wildlife crossings and fences

aiming to reduce wildlife and human mortality – can be regarded as part of the measures necessary to mitigate the negative effects of fragmentation. The main facilities include: an ecoduct/overpass for large mammals at km 314+070; an underpass for wolves, small and middle mammals at km 315+900; a non-specialized viaduct at km 314+400; bridges with dry paths, tube culverts for reptiles and amphibians, rabbit fences and guiding concrete fences for amphibians. The functionality and effectiveness of the facilities, the technical state of the facilities so as to achieve functional connectivity of the landscape will be studied and assessed as part of the project.

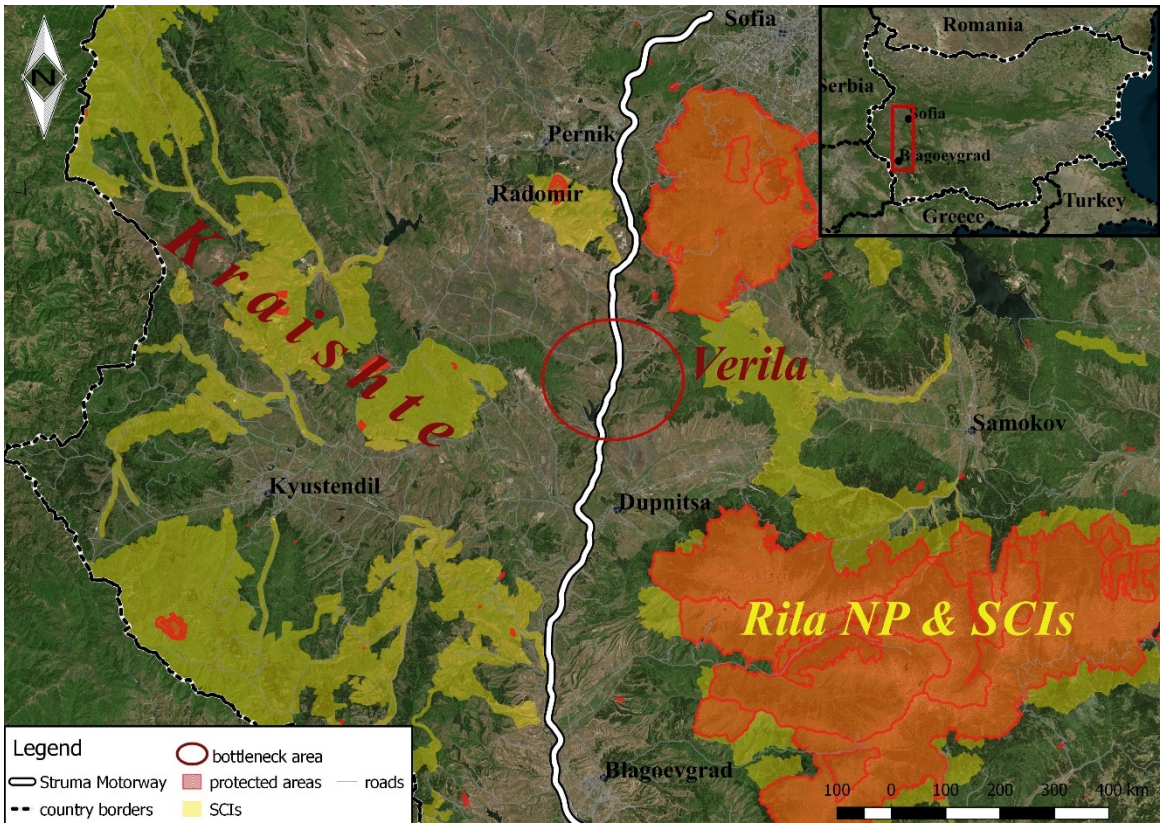

Figure 1 Map of Rila-Verila-Kraishte Pilot Area

1.2. The concept of structural and functional monitoring

Structural and functional connectivity focus on different aspects of landscape: *structural connectivity* indicates the part of the landscape that is actually connected through e.g. corridors. In contrast, *functional connectivity* includes species-specific aspects and their interaction with landscape structures. Thus, functional connectivity is the actual connectivity from species' perspective" (see Scaletool n.d.).

Therefore, in a first step, spatially explicit information from different sources that are suitable to describe the structural endowment of an area are used in a GIS-based model to identify areas that can serve as corridors on the one hand, and to assess these corridors in terms of their structural suitability on the other hand. At sites whose suitability as corridors seems to be limited due to structural features, the functional suitability will be checked by monitoring of both the structures found and the presence of wildlife, and compared with sites whose suitability is not limited by structural features. This procedure should enable an evaluation of the corridor with regard to its functional quality and serve as a basis for proposals for measures that can improve the structural suitability of the corridor.

Note: Additional information is provided in D.T1.1.2. (Grillmayer & Plutzar 2021).

1.3. GIS modelling tool and maps of structural connectivity

The starting point was the consideration to develop a uniform approach for all pilot areas, which is based on homogeneous data sets and identifies the structural corridors with the same methodology. Since there is no distribution data available for most of the pilot areas on order to develop a data-driven bottom-up approach, it was decided, following the meeting of December 7, 2020, to conduct the modelling for structural monitoring using an expert model.

For this purpose, rules for the designation of core areas and for the definition of resistance surfaces – both substantial inputs for the calculation of the corridors –

have to be specified for the selected species-groups based on available information and knowledge.

These calculations should use data sets that are largely available in comparable form for all pilot areas. As an added benefit, data that are periodically updated on an ongoing basis will be preferred. In this way, an established set of rules that is transparent and comprehensible can be applied in an analogous manner to future studies. These considerations result in a top-down GIS model based on data available to the EU level and subsequently complemented and improved by regional and local knowledge and field surveys.

Note: Fig. 2 shows the workflow of the GIS-model, using the PA Pöttsching as an example. Additional information is provided in D.T1.1.2. (Grillmayer & Plutzar 2021).

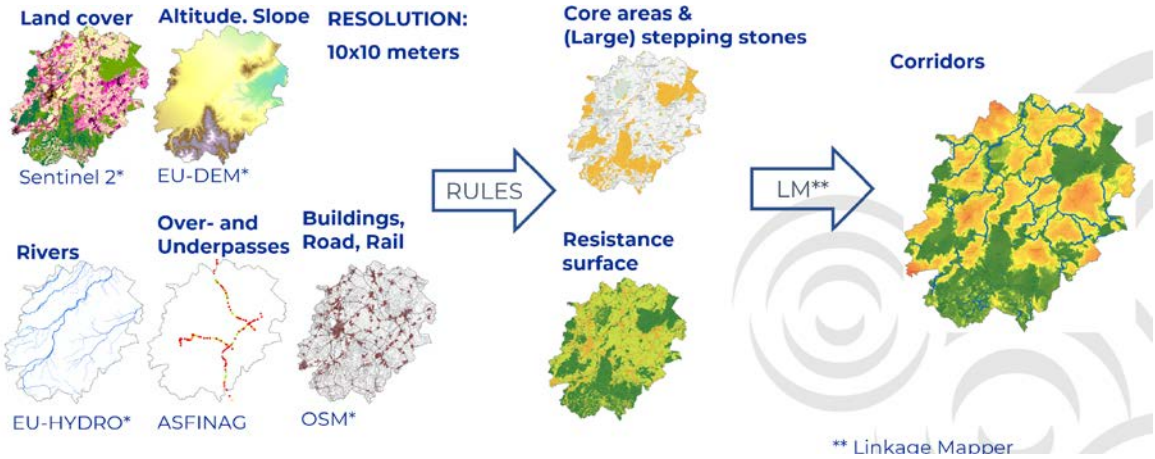

*Fig 2: Schematic workflow of the GIS-model to assess the structural connectivity of corridors. * indicates data sets available on EU-level. ** Linkage Mapper is a widely used modelling framework for the calculation of corridors (see https://circuitscape.org/linkagemapper/linkage-mapper-tools/)*

1.4. Local criteria for prioritization/selection of monitoring plots

The criteria for selection of **monitoring sites** were as follows:

1. To include major structural barriers (artificial – transport infrastructure- Struma Motorway LOT1) and their important connectivity sectors (on transport infrastructure - special mitigation measures and other objects not dedicated for wildlife passages);
2. Key bio corridors of large and medium size mammals and reptiles

1.5. Target Species

The target species groups are presented in the table below:

Group	Species	Notes	Type of relevant ecosystems for monitoring of target species
Large-sized mammals	Wild boar, red deer, lynx, wolf, bear		Forest, grassland, forested grassland, riparian, agriculture, aquatic.
Medium-sized mammals	Wild cat, fox, badger	*Other mustelids, Golden jackal?*	Forest, grassland, forested grassland, riparian, agriculture
Amphibians & reptiles	TBD	*After the first field overview*	Forest, grassland, forested grassland, riparian, agriculture, aquatic, built areas

1.6. Monitoring methodology, guidelines & tools

After the monitoring sites have been identified, SaveGREEN aims to conduct the monitoring in the eight pilot areas in a consistent way. In order to be able to guarantee this aim, a guideline was developed. This guideline – D.T1.1.3 (Grillmayer, Plutzar & Sedy 2021) – includes the development of standard data forms for the fieldwork as well as a decision matrix to specify which parameters/ measurements have to be carried out for which species and which methods shall be used. The monitoring process will be supported by an electronic

application toolbox, which is currently developed for SaveGREEN. The toolbox will support the following project activities:

- Consistent and quality-assured storage of all data created within the framework of the project genesis
- fieldwork and monitoring of functional connectivity within the pilot areas
- Consistent data flows between field workers and IT infrastructure
- Publishing the data and exposing them to general public

Note: Additional information on the toolbox is provided in D.T1.2.1. (Borgwardt, F. & Grillmayer R.).

2. An overview of the monitoring sites

Monitoring site #1:

- **General description:** Overpass for bears near Deyan village - critical area on Struma motorway LOT1 part of mitigation measures for large mammals
- **Target species:** Large Carnivores, Ungulates, Medium size mammals, reptiles

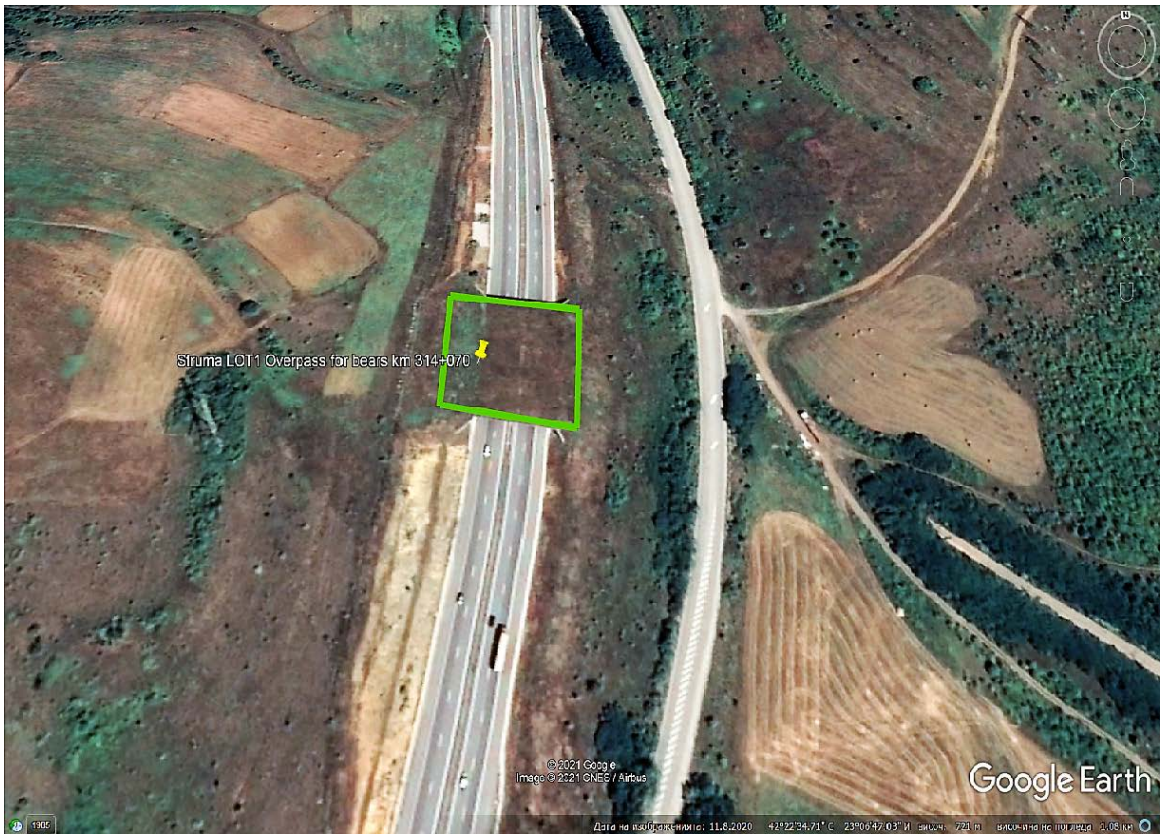

Figure 3 Monitoring site #1

Monitoring site #2:

- **General description:** Viaduct near Deyan Village – nonspecialized viaduct suitable for wildlife crossing on Struma Motorway LOT1
- **Target species:** Large Carnivores, Ungulates, medium size mammals, reptiles.

Figure 4 Monitoring site #2

Monitoring site #3:

- **General description:** Underpass for wolves near Topolnitsa village - critical area on Struma Motorway LOT1 a part of the mitigation measures for wolves, other medium and small size mammals
- **Target species:** Large Carnivores, Ungulates, Medium size mammals

Figure 5 Monitoring site #3

Monitoring site #4:

- **General description:** Natural ecological corridor in East direction from the implemented mitigation measures of Struma Motorway LOT1 MS 1-3 towards Rila-Verila Mountains
- **Target species:** Large Carnivores, Ungulates, Medium size mammals

Monitoring site #5:

- **General description:** Natural ecological corridor in West direction from the implemented mitigation measures of Struma Motorway LOT1 MS 1-3 towards Konyavska mountains (a part of Kraishe)
- **Target species:** Large Carnivores, Ungulates, Medium size mammals

Note: Other monitoring sites will be selected after the first field overview.

3. Monitoring plan – the logical framework

Where?		*What?*	*How?*	*When?*	*Who?*		
Code	**Description – role for connectivity, why it was selected?**	**Target species, other factors**	**Methods-codes**	**Calendar**	**Responsible**	**Notes**	**CSOP - objectives**
Site 1	**Overpass for bears**	Red deer Wild boar Brown bear Grey wolf Eurasian lynx Medium size mammals	F	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			Si	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			T	Dec. 21 Feb. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
		Reptiles	A	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	Species to be determined after the first field overview	1-2.

			S	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	Species to be determined after the first field overview	1-2.
Site 2	**Viaduct**	Red deer Wild boar Brown bear Grey wolf Eurasian lynx Medium size mammals	F	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			Si	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			T	Dec. 21 Feb. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
		Reptiles	A	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	Species to be determined after the first field overview	1-2.
			S	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	Species to be determined after the first field overview	1-2.

Site 3	**Underpass for wolves**	Red deer Wild boar Brown bear Grey wolf Eurasian lynx Medium size mammals	F	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			Si	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			T	Dec. 21 Feb. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
		Reptiles	A	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	TBD after the first field overview	1-2.
			S	Jul. 21 Oct.21 Apr.22 Jul.22	BBF	TBD after the first field overview	1-2.
Site 4	**Natural ecologica**	Red deer Wild	F	Jul. 21 Jul. 22	BBF		1-2.

	l corridor (East)	boar Brown bear Grey wolf Eurasian lynx	Si	Jul. 21 Jul. 22	BBF		1-2.
			T	Dec. 21 Feb. 22	BBF		1-2.
Site 5	**Natural ecologica l corridor (West)**	Red deer Wild boar Brown bear Grey wolf Eurasian lynx	F	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			Si	Jul. 21 Jul. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.
			T	Dec. 21 Feb. 22	BBF	Red deer, Brown bear and Eurasian lynx not expected since no suitable habitats in the Site	1-2.

Legend:

Monitoring methods / codes:

A = personal observation
F = photo trap
Rk = collecting of road killed individuals
S = track collector including sand bed
Si = signs
T = animal tracks in snow, mud, sand, ...

CSOP objectives – selection:

1-01. Ensure support-data for new infrastructure projects
1-1. Ensure functionality of underpasses
1-2. Ensure functionality of overpasses
3-12. Develop and use an integrated database as decision-supporting tool to address traffic incidents (to implement / adjust measures to prevent wildlife traffic-kills, damages, human casualties)
5b-2. Support adequate management of natural features / marginal habitats
5b-3. Support and promote development of good-practice examples of connectivity-sensible agriculture, water management and forestry practices

4. Monitoring results, feedback & data base

Data and information collected will be implemented in a dedicated database as mentioned in 1.6. This database will be based on the open source database technology PostgreSQL[1] with the extension PostGIS[2] for the backend to implement a uniform SaveGREEN database schema. The PostGIS extension also enables the storage and analysis of geographic data. This is a proper way to ensure the reuse of the developed tools in other projects without additional licensing costs.

As described in D.T1.2.1. (Borgwardt, F. & Grillmayer R. 2021), the opensource software QField will be used for the first monitoring season. The intension of the first monitoring season is to gather experience and to adjust the monitoring concepts, if necessary, in the second season. Based on the users experience of the first monitoring season, all parameters from the functional monitoring set up, which have great potential for a citizen science monitoring approach, will be implemented on mobile devices which are based on Android. Therefore, the existing mobile application “Roadkill” will be extended with these features.

Hence, all relevant feedback from the first period will be used for further development and refinement of methodology, guidelines and tools.

[1] https://www.postgresql.org/

[2] https://postgis.net/

5. Communicating the monitoring results

Monitoring results are critical for data-based decisions, therefore will be used to facilitate the engagement of relevant stakeholders for decision-making or of those engaged in different monitoring within the pilot area (ant not only). In this respect, monitoring data are crucial for further development of the local Cross-Sectoral Operational Plans.

Part of data will be relevant for the general public also (a special attention should be given to sensitive data – i.e. rare or protected species important sites: crossings, breeding sites etc. – and should be kept confidential), hence the communication section of the Cross-Sectoral Operational Plans will be further informed by the monitoring results.

6. References

Borgwardt, F. & Grillmayer R. (2021): Documentation for specifications for the development of the electronic application toolbox - Deliverable D.T1.2.1. Report for the INTERREG-project SaveGREEN. Environment Agency Austria, 44pp.

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Grillmayer, R., Plutzar, C. & Sedy, K. (2021): Draft Guidelines for standardised monitoring of functional connectivity - Deliverable D.T1.1.3. Report for the INTERREG-project SaveGREEN. Environment Agency Austria, 23pp.

Scaletool (n.d.): Differences between structural and functional connectivity. http://scales.ckff.si/scaletool/?menu=4&submenu=0