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DaRe to Connect

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european greenbelt

DARE TO CONNECT

TRANSNATIONAL STRATEGIC VISION EUROPEAN GREEN BELT IN THE DANUBE REGION 2030

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ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

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Javna ustanova za upravljanje zaštićenim dijelovima prirode i ekološkom mrežom Virovitičko-podravske županije

DJERDAP NATIONAL PARK SERBIA

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AIM AND PURPOSE OF THE STRATEGIC VISION

This Transnational Strategic Vision "EUROPEAN GREEN BELT IN THE DANUBE REGION 2030" aims to bundle the results and experiences gathered within the project to give an integrative overview on how to further develop the Pan-European network of protected areas.

This Strategic Vision aims to substantiate and support the goals of the European Green Belt Initiative as a whole and especially of the stakeholders located and acting in the Danube Region. The conducted works of the different workpackages in the DaRe to Connect project can serve as a blueprint for future projects in other regions with similar topics as well as for projects along the European Green Belt in other regions. The project consortium created a comprehensive set of planning criteria for the implementation of nature conservation- and restoration measures that can serve to a range of politically expressed aims and targets. Of uttermost importance here is the transboundary character of the achieved results. Thereby for European Green Belt in the Danube Region.

These are expressed in the so called "Eisenach Resolution" that was adopted by the participants of the 10th Pan-European Green Belt Conference on 16-18 October 2018 and the "DaRe to Connect Declaration for the European Green Belt in the Danube Region" that was promoted and endorsed by project members at the DaRe to Connect Final Conference on 10 November 2021. Among others these Resolutions express the support of the European Green Belt Initiative to the EU Strategy on Green Infrastructure (COM/2013/0249 final; SWD/2019/193 final). The Commission here states that GI should become an integral part of spatial planning.

As the Directorate-General for Environment of the European Commission states in its Biodiversity Strategy for 2030 (COM/2020/380 final) it is crucial for the EU to extend the share of protected areas of the land surface to at least 30%. The focus of the designation of new protected areas, the strategy says, should be laid on areas of very high biodiversity value or potential. The Commission further stresses out the importance of the establishment of ecological corridors to create a Trans-European Nature Network. These ecological corridors are crucial for the prevention of genetic isolation, migration of species and thereby

maintain functioning ecosystems. The Commission follows thereof that support and promotion of Green Infrastructure as well as cross-border cooperation.

As it was shown in the R+D Project "European Green Belt as part of European Green Infrastructure", funded by the German Federal Agency for Nature Conservation, the European Green Belt does serve as a backbone of a transnational ecological network on a European scale. This fact is widely recognised on the EU-level. The European Green Belt is e.g. part of the Commission´s publications "Guidance on a strategic framework for further supporting the deployment of EU-level green and blue infrastructure" (SWD/2019/193 final) and "Strategic Green Infrastructure and Ecosystem Restoration: geospatial methods, data and tools" (ESTREGUIL et al. 2019).

As it can be seen in *Figure 1* The study "Ecological Connectivity in the Danube Region" which was commissioned by the Bavarian State Ministry of the Environment and Consumer Protection in its role as Leader of the PA 6 of the EUSDR, the European Green Belt is considered as a main corridor of the Green Infrastructure in the Danube Region.

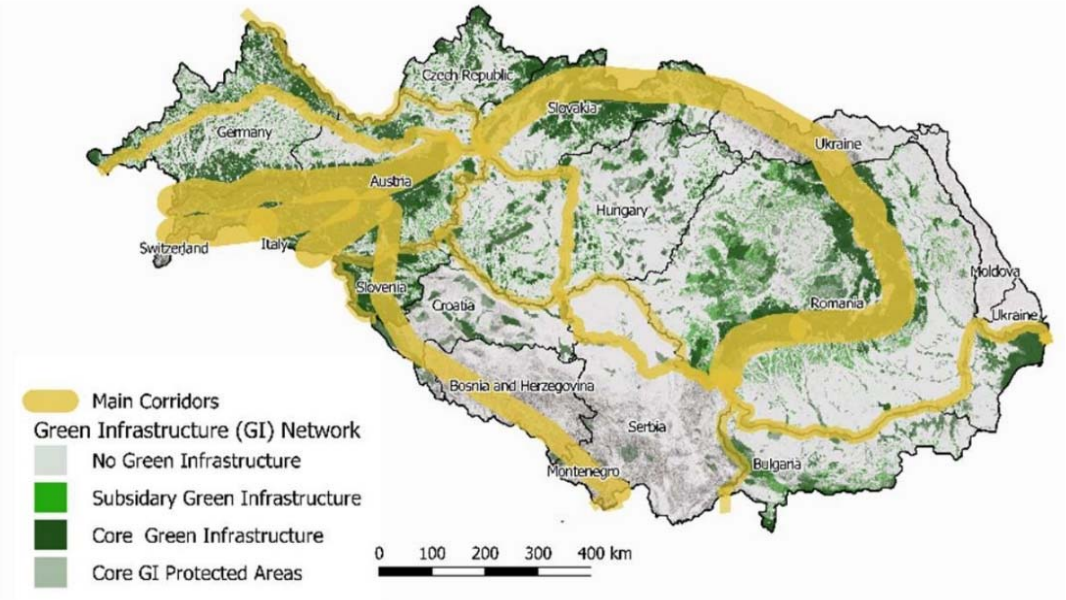

Figure 1: Main Corridors of Green Infrastructure in the Danube Region (HUBER et al. 2018)

DATA ANALYSIS

In order to create a consistent data basis for the whole European Green Belt in the Danube Region, information on habitat classification, ecosystem services and the connectivity of protected areas were gathered and derived as it is described in the following.

Analysis of Ecosystem Services Provided by Habitat in the EGB

Since the approach of the project is not limited to singular ecosystems or habitat types the Analysis of Ecosystem Services takes a comprehensive set of Services into account.

The term "Ecosystem Services" (ESS) integrates goods and services provided by ecosystems to sustain fundamental human needs. Based on the definition provided by the Millennium Ecosystem Assessment (MEA 2005) the services provided by ecosystems are subdivided into the following categories:

- Provisioning services (e.g. food, fresh water, fresh air)
- Regulating services (e.g. climate regulation, water retention)
- Cultural services (e.g. recreation, education)
- Supporting services (e.g. soil formation)

These ESS also bear a high economic value (TEEB 2010). The ESS approach helps to emphasize the benefits human gain by the various ecosystems along the European Green Belt in the Danube Region.

In order to be able to quantify these complex socio-ecological systems and develop models of ecosystem services, assessment matrices are an important tool in this research field (BURKHARD ET AL., 2009, 2012; STOLL et al., 2015).
For the evaluation methodology, the matrix of STOLL et al. (2015) was used as a foundation. It assigns a value from 0 (no capacity) to 5 (very high capacity) to each CORINE land cover class to indicate their capacity for every ecosystem service.
In comparison to ecosystem services, landscape services take spatial patterns, which result from human and natural processes, as well as the social dimension more into account (VALLÉS-PLANELLS et al. 2014). This makes the broader concept of landscape services better

applicable and thus it is commonly used in landscape planning. Therefore, the ecosystem services of STOLL et al. (2015) were matched to the corresponding terms of DE GROOT et al (2002, 2010).

In a process of including expert knowledge, the matrix was revised in a multi-step approach. After the initial review round in order to adapt the values to the characteristics of each project region, the mean values for each capacity score were calculated. The resulting table was once again sent out for discussion to come to a joint consensus. Eventually, the outliers, namely values that varied by more than ±2 from the original score, were analysed and the final value was calculated.

By linking the final ESS-Matrix to the broader habitat types using CORINE land cover classes as reference, the BHT could be assigned to the landscape services and ultimately to the consequential Total Function Value. For the translation between EUNIS habitat types and CORINE land cover classes the crosswalk table provided by the EEA was used.

This analysis resulted in a set of spatial data as it is exemplary shown in Figure 2. While the figure shows the Total Function Value, a combination of all Ecosystem Services analysed, the single Services and Service Categories are available on the DaRe to Connect Web Application (FUCHS & WRBKA 2021).

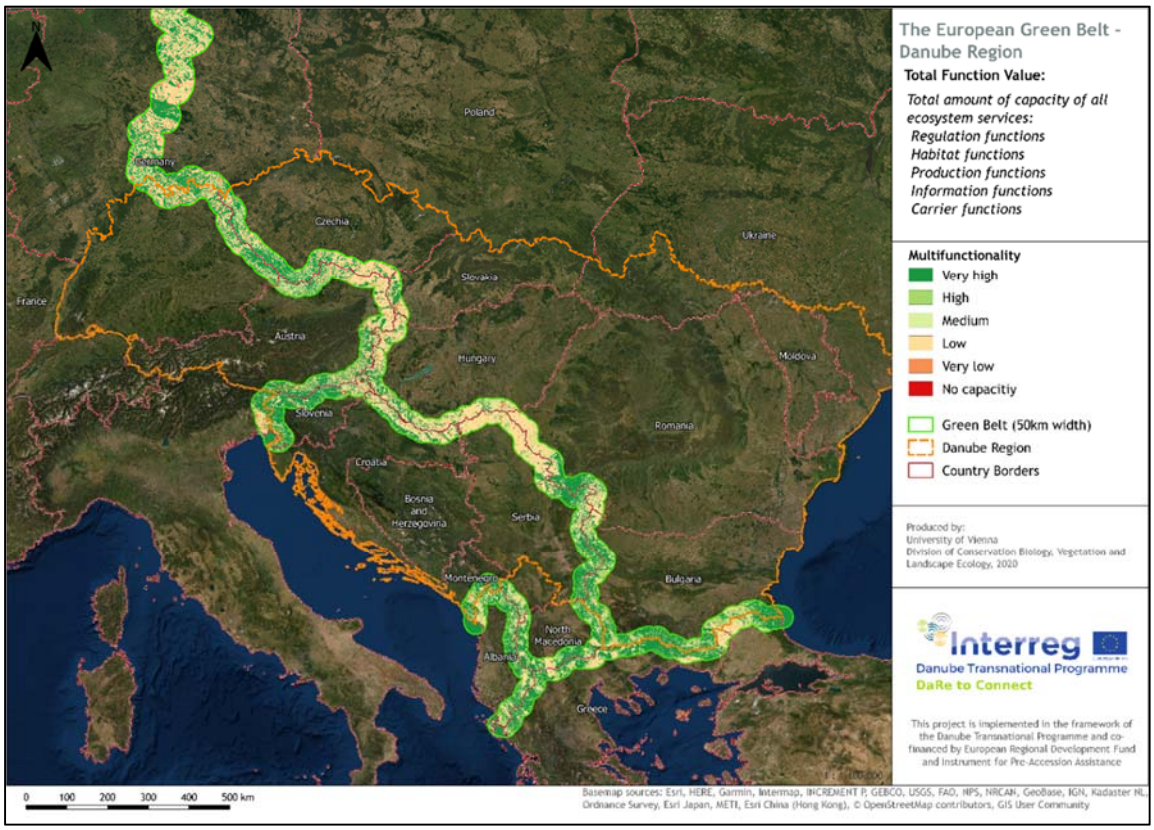

Figure 2: Map of the European Green Belt within the DTP Region showing the Total Function Value of the landscape in the 50km corridor

Connectivity Analysis

In order to be able to make valid statements regarding the ecological Connectivity of Habitat and Protected Areas along the European Green Belt in the Danube Region, a set of analysis was conducted.

Preperatory Analysis

In digital image analysis concepts of mathematical morphology are a common tool to use and form the foundation of GuidosToolbox (Graphical User Interface for the Description of image Objects and their Shapes). GuidosToolbox (VOGT & RIITTERS, 2017) is a free software collection by Peter Vogt (Joint Research Centre, European Commission) and offers a variety of modules targeted to investigate several spatial aspects of raster image objects, for example pattern,

connectivity, cost, fragmentation, etc.. The GuidosToolbox was used the conduct the analysis as described below.

Morphological Spatial Pattern Analysis (MSPA)

The MSPA (Morphological Spatial Pattern Analysis) is a generic and universal pattern analysis framework provided by a custom sequence of morphological operators (SOILLE & VOGT, 2008).

MSPA performs a segmentation on a binary image to identify and localise mutually exclusive morphometric feature classes describing the shape, connectivity and spatial arrangement of image objects by mapping and classifying them into categories (VOGT et al., 2017). The MSPA module automatically detects geometry and connectivity of the image components. Therefore, the foreground area of a raster based binary image is partitioned into seven MSPA classes: Core, Islet, Perforation, Edge, Loop, Bridge and Branch.

In terms of the assessment of the connectivity of BHT of interest, MSPA uses a series of image processing routines to identify hubs, links (corridors), and other features after reclassifying the raster land-cover map into foreground (forests or grassland) and background (all other classes) (VOGT et al., 2007).

The category of core is equivalent to hub, and bridge is synonymous to link (corridor). First the MSPA processing identifies the category core, which is based on the connectivity rule used to define neighbours and the value used to define edge width (SOILLE & VOGT, 2008).

In the basic settings of MSPA connectivity can be set to either four (cardinal directions only) or eight neighbours. The minimum size of core and the number of pixels classified as core is affected by the settings of the edge width. By increasing the edge width, the minimum size of core increases and thereby reduces the number of pixels defined as core areas. The decrease of core areas that results from increasing edge width arise in gains for all other classes, not just edge. This way increasing the edge width can shift core to islet if the area of core is small and core to bridge if the area of core is narrow. (WICKHAM et. al. 2010)

In the application of MSPA in DaRe to Connect eight-neighbour connectivity and an edge width value of two (2) corresponding an effective pixel size of 10 metres was used for this analysis.

The input data is the raster (grid) map of the Sentinel-2 BHT classification of WP3 Activity 3.1 of the pilot region. The input map must contain the two data classes Foreground (BHT of interest) and Background (other BHT). Also this analysis was conducted for the data set on Protected Areas.

Euclidean Distance

To measure the degree of intactness, shape and spatial arrangement of patches on a given binary map, the analysis methodology of Euclidean Distance offers a practical and effective method of implementation. The module of Euclidean Distance analysis scheme is also available in GuidosToolbox and uses the same input data as the MSPA described above.

This application creates maps of objects of interest showing the Euclidean distance map inside and outside those objects. To illustrate the influence zones of each object and to derive the pairwise proximity between neighboring image objects this type of analysis may be further pursued. For the establishment of cost-efficient reconnecting pathways in restoration planning proximity may be used to locate close encounters of existing objects. (VOGT et al., 2017)

In terms of the connectivity of BHT of interest the generated distance maps provide spatially explicit information allowing for highlighting hotspots of highly fragmented areas or those dominated by well-established networks of forests or grassland. The spatial information of these distance maps may be of high importance for monitoring, planning and risk assessment.

Additionally, the simple, yet intuitive analysis scheme is easy to communicate and can be related to a variety of spatial planning measures by illustrating the degree of fragmentation or intactness and allowing direct comparisons with results among the pilot regions.

Results

The described analysis were applied to a data set on the network of Protected Areas and on a data set on Broader Habitat Types along the European Green Belt in the Danube Region.

The findings and results were presented to and discussed with relevant national stakeholders in the countries of the project partners. All results and maps can be retrieved and interactively used through the DaRe to Connect User-friendly GIS-tool (FUCHS & WRBKA, 2021) here.

Connectivity Analysis of Protected Areas

Figure 3 and Figure 4 show the results of the MSPA Analysis and the measurement of the Euclidean Distance of protected areas within a 50 km corridor along the European Green Belt.

When looking at the MSPA results (Figure 3) it becomes obvious, that larger segments of the EGB are lacking an adequate comprehensive protection status. This is especially valid for the chosen corridor width of 50 km. Analysis of a larger corridor of 150 km showed that the connectedness of the network of protected areas is higher in this case. This shows the importance of the EGB as ecological network and connecting element to other ecological corridors in the Danube Region. Yet it figures the necessity to enhance the network of protected areas in the immediate vicinity of the former Iron Curtain.

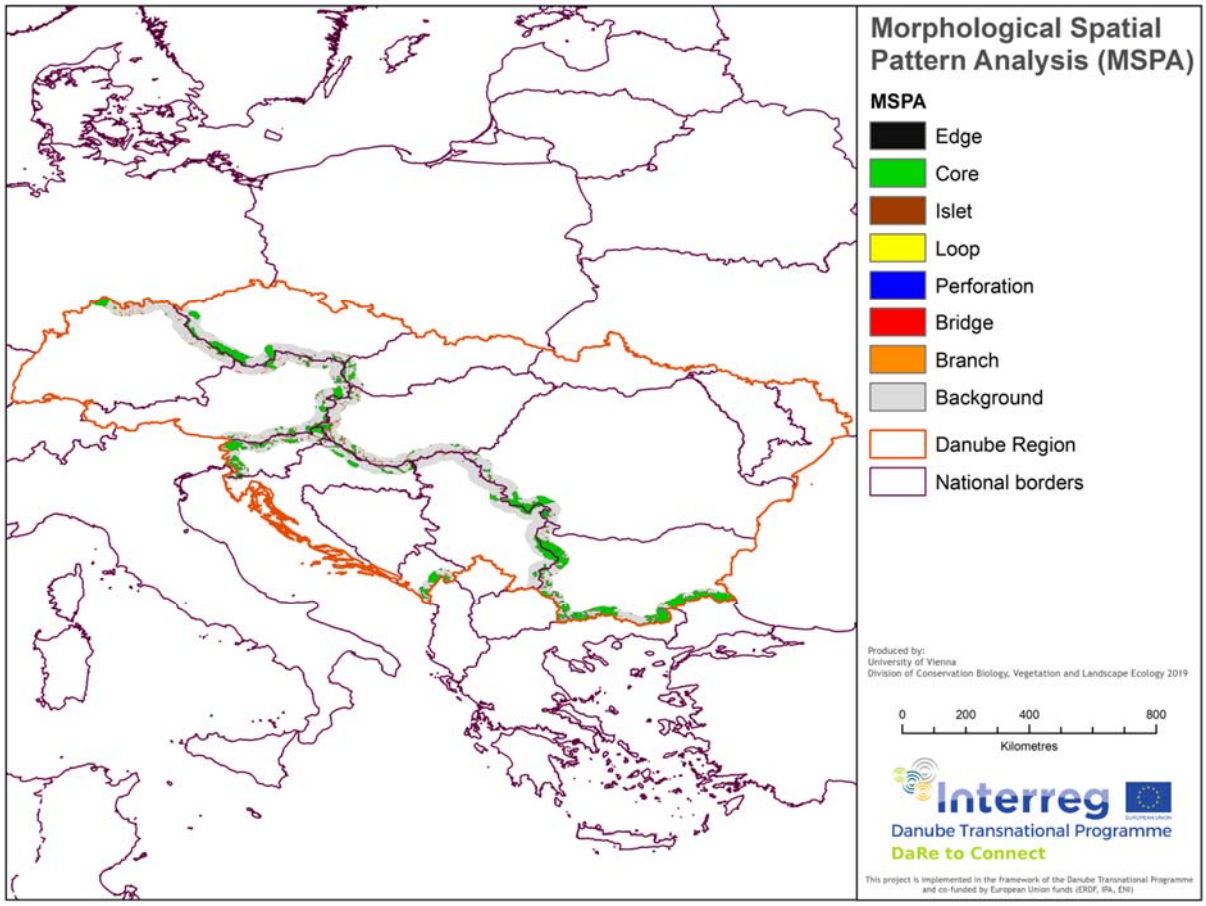

Figure 3: Result of the Morphological Spatial Pattern Analysis of protected areas along a corridor of 50 km

The results of the Analysis of the Euclidean Distance in Figure 4 of the protected areas within the 50 km corridor along the European Green Belt indicates a high potential for further connecting this network of protected areas. To close many of the existing gaps, a distance of under 45 km needs to be bridged.

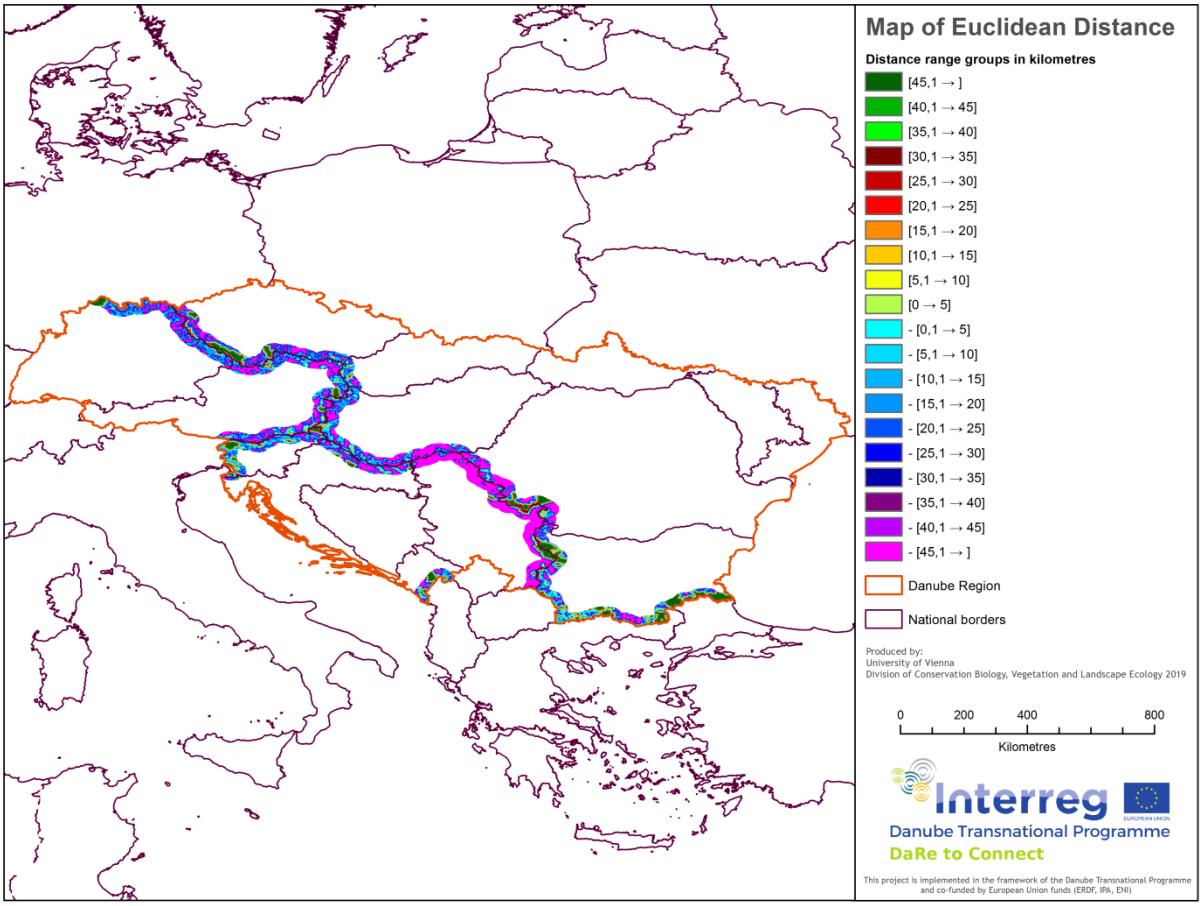

Figure 4:Result of the measurement of Euclidean Distance of protected areas along a corridor of 50 km

Connectivity Functionality Index

To retrieve a comprehensive and easy to read set of information, the results of an MSPA analysis of relevant BHT and the ESS were merged to the Connectivity-Functionality-Index (CFI). This is the basis for the actual analysis of the possible connections between the protected areas. The combination of the connectivity and functionality analysis was achieved by creating indices from 0 to 1 for each of the two parameters and merging them into a joint Connectivity-Functionality-Index (CFI). This index serves as an indicator for areas with a high potential as corridor between the protected areas of the European Green Belt. It therefore indicates areas of high functional value of Ecosystem Services and importance for connecting existing protected areas. However, aspects like the costs and necessity of corresponding actions, willingness of the land owners, etc. as well as suitable measures to secure or

improve the recent ecological situation are not considered here. The resulting maps are rather intended as an important tool for political recommendation and for prioritization to identify areas where which sort of general actions are necessary to improve the function of the European Green Belt as a transnational ecological network and as the backbone of EU Green Infrastructure within the Danube Region.

Using a qualitative approach of categorization, so called Areas of Action (AoA) were designated. An Area of Action is considered as a region with a crucial role for the further development of connectivity along the European Green Belt in the Danube Region.

A main objective of DaRe to Connect is to enhance the connectivity between existing protected areas along the European Green Belt in the Danube Region. Therefore areas inside of protected areas where explicitly excluded from the analysis. Even though the results clearly point out the fact that also here by far not all areas show a “Good” or “Very high” potential as multifunctional corridor, an examination of areas was focused solely on non-protected areas. This means that also at certain locations inside the vast majority of protected areas, certain steps and measures, adapted to the respective local situation, need to be taken in future to improve this situation. E.g. the aims and goals as given in the respective management plans of Natura 2000 sites should be implemented where it is still needed.

The **category “Safeguard”** focusses on areas outside of existing large-scale protected areas, where the analyses indicate a high potential as a multifunctional corridor in general. Within such designated areas future nature conservation measures should mainly focus on the preservation of the existing good conditions that may ultimately lead to the designation of new protected areas. Especially the conversion of valuable habitat towards non-sustainable forms of land-use should be avoided and the potential within the area as multifunctional corridor be enhanced and amplified wherever possible.

In contrast the **category “Restore”** points out larger areas with both unprotected areas and a low potential to serve as a multifunctional corridor. Regarding the future implementation of nature conservation measures and the improvement of the functioning of the ecological

network along the European Green Belt in the Danube Region the focus here is to be set in general mainly on the re-installation of functional quality of the existing habitat.

In the designation of the areas, a focus was laid on regions with a transnational significance. It is desirable to create especially protected areas on a trans-boundary level. In the context of the European Green Belt, the transnationality of cooperation taking place is one of the factors to make this ecological network and living memorial landscape unique. In total 15 AoAs were designated along the European Green Belt in the Danube Region. Eleven Safeguard AoAs and four Restore AoAs as they are shown in Figure 5.

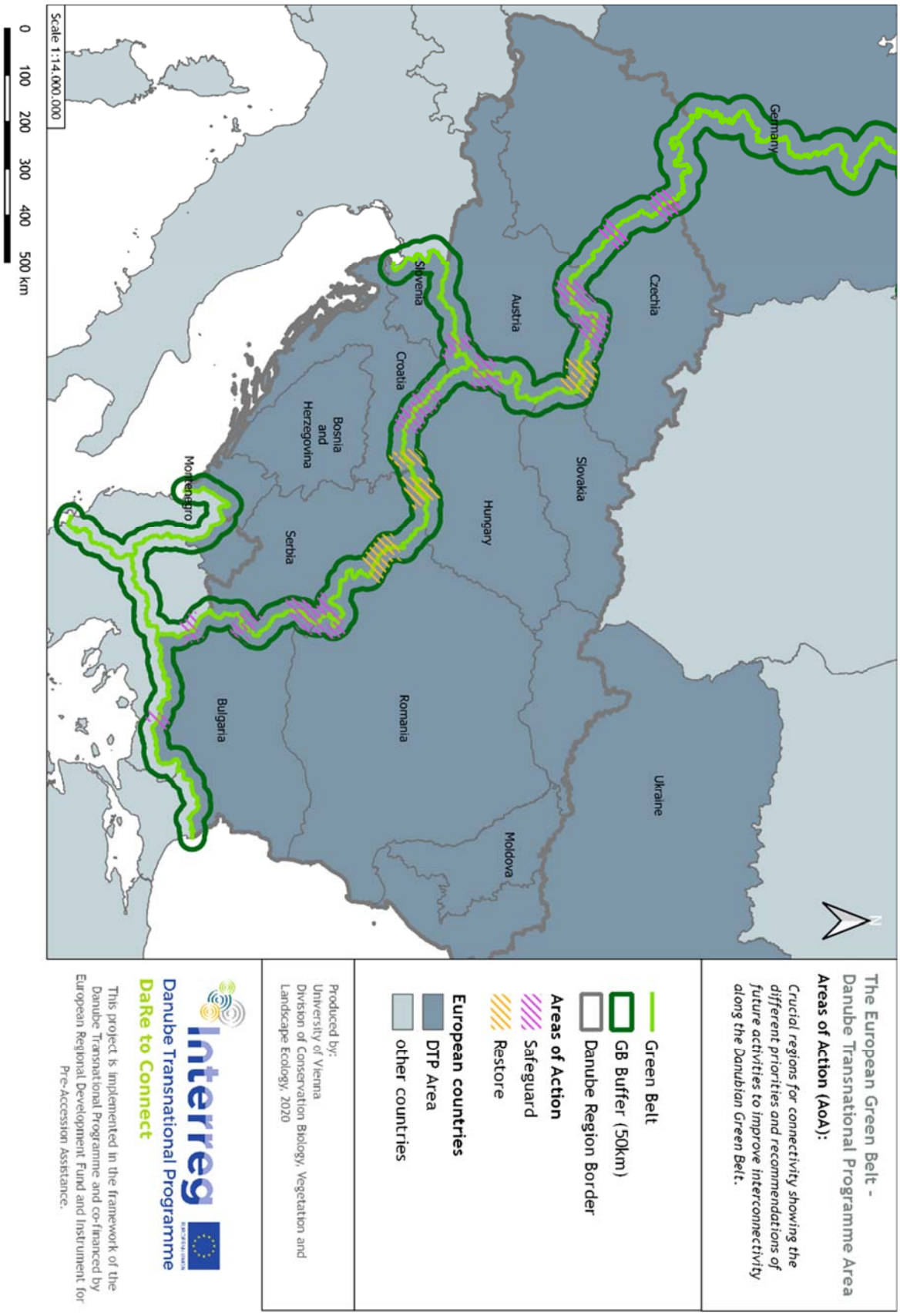

Figure 5: Overview of designated AoAs along the European Green Belt in the Danube Region

STRATEGY

The European Green Belt is an important backbone of the ecological network of Europe. Thereby it serves as an important tool for the provision of Ecosystem Services for people, for the preservation of important habitats and structures and the survival of threatened species. With its total length of 12.500 km, thereof 3500 km in the Danube Region, relatively low level of disturbance, the high level of connectivity, the trans-boundary and trans-national dimension in cooperation (including GO and NGO stakeholders) and ecological connectivity, the large share of protected areas, and the variety of habitat types in eight biogeographical regions of the European continent and all five biogeographical regions of the Danube Region, the European Green Belt can contribute sustainably and significantly to the conservation of European biodiversity and the deployment of Green Infrastructure. For the development of the European Green Belt in the upcoming years to 2030, a set of strategies, actions and measures are important to be addressed to sustainably maintain and develop this ecological network of European-wide importance. The findings and results of the DaRe to Connect project, which are summarised in this catalogue of measures, gives guidance on how to align the contribution of the European Green Belt to such strategies in a target-oriented way.

To effectively tackle the ongoing loss of biodiversity and increase of habitat fragmentation in Europe, the European Green Belt as a whole and in the Danube Region can serve as a starting point for the implementation of important nature conservation and environmental protection strategies. A strong focus here is put on the relevant policies on EU-level. Corresponding policies on national and regional level should supplement and complement these.

The EU-Biodiversity Strategy for 2030 (COM 2020/380/final) is an integral part of the European Green Deal and a key-document, backing the aims and goals for sustainable nature conservation along the European Green Belt as part of the European Green Infrastructure. For the protection and restoration of nature in the EU, the EU Biodiversity Strategy is targeting toward a coherent network of protected areas on the one hand and the restoration of ecosystems on the other.

Tool for spatial planning

The transboundary and trans-national ecological networks between Natura 2000 areas along the European Green Belt in the Danube Region, identified in the project, give clear spatial orientation for the implementation of a coherent Trans-European Network for Nature. The identified Areas of Action offer a detailed tool for planning and targeting interventions. As the applied methods and results are repeatable, they can be transferred also to other regions of the European Green Belt and regions in- and outside the EU for a Pan-European approach for Green Infrastructure. For this purpose, it is desirable, the results are further mainstreamed under relevant stakeholder groups on all levels, the European Green Belt Initiative will take further efforts in this regard, also after the project duration.

To safeguard the valuable assets, the European Green Belt provides and to further develop them, a holistic approach should be followed to ensure the accounting ecological and historic as well as socio-cultural aspects.

Guiding principle: ecological network of heterogeneous and diverse habitats

Regarding the ecological coherence and functioning of ecosystems along the European Green Belt, a mosaic of heterogeneous and diverse habitat should be a guiding principle in the implementation of measures for nature and landscape protection. The ongoing loss of biodiversity in general and increasing land-use pressure on the European Green Belt has the effect of increasing habitat fragmentation. This fragmentation affects the functioning of ecosystems, therefore connectivity of natural and near-natural habitat has to be key element in spatial planning decisions. This holds true for areas inside, outside and between protected areas. All actions undertaken to improve connectivity of the European Green Belt should respect and incorporate local and regional specifics of nature, landscape and culture. safeguard the European Green Belt as memorial landscape and a living symbol of the overcoming of the Cold War for future generations.

Potential for new protected areas

The regions of the European Green Belt bear a high potential for the designation of new protected areas, as the results of DaRe to Connect, building upon recent projects, have

shown. All responsible institutions are called upon to make use of this potential and thereby contribute to the aim of the EU Biodiversity Strategy, to put 30 % of land surface under protection by 2030 (EU 2020). A joint effort to reach the aim of a designation of the European Green Belt as UNESCO world heritage site would be a major step forward in protecting the natural and cultural assets of the European Green Belt.

Strengthening GI in existing protected areas

Furthermore, the protection goals, as they are set in management plans of already existing protected areas should be pursued with a high priority. Even though it was not a focus in the analysis, the results of the CFI make it obvious, that also within existing protected areas, there is potential for strengthening the ecological network and achieving the upcoming aims regarding restoration of ecosystems in the EU Biodiversity Strategy. The results retrieved by the project DaRe to Connect can and should be further capitalised by using them as a foundation for spatially distinct analyses in preparation for e.g. implementation measures for nature conservation efforts.

Long-term aim: UNESCO world heritage

The D2C project partners are also aware about the responsibility to secure the Green Belt as memorial landscape and living symbol for the overcoming of the Cold War for future generations. All ten Green Belt riparian countries in the Danube Region signed the Joint Declaration of Intent (DoI 2013) on the European Green Belt or sent letters of support acknowledging the importance of the European Green Belt. The ecological network along the European Green Belt is backed up by a broad and strong Initiative, committed to its preservation and development. Naturally this Initiative has a strong focus on transnational and transboundary cooperation, which at the same time is a key to bring forward this project of Pan-European importance. Governmental Organisations from EU- to local level are invited to intensify their contribution to this network. To put the European Green Belt on a next level of international recognition and appreciation, the competent bodies of the countries along the European Green Belt should take (further) steps to bring forward a nomination of the EGB as UNESCO world heritage.

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