Intersessional Working Group on
Linear Infrastructure and Migratory Wildlife
Vilm, 27 June – 1 July 2022

EUROPEAN DEFRAGMENTATION MAP
&
PLANNING PRINCIPLES FOR SAFEGUARDING CONNECTIVITY

T 5.2 Marita Böttcher, Heiner Reck, Cindy Baierl

SOME NOTES ON HISTORY ABOUT THE DEVELOPMENT OF
THE EUROPEAN DEFRAGMENTATION MAP (EDM)

Scientific background:
Habitat fragmentation by artificial barriers is one of the most serious threats to European biodiversity. This is because life needs mobility to sustain viable populations as well as to withstand the challenges of landscape dynamics and climate change.

IENE 2012 - Potsdam Declaration
"OVERCOME BARRIERS – EUROPE-WIDE AND NOW"
Life Needs Mobilit **Regarding this and the EU Green Infrastructure Strategy, and the White Paper on Transport the IENE 2012 conference participants strongly recommend: to develop an integrative**
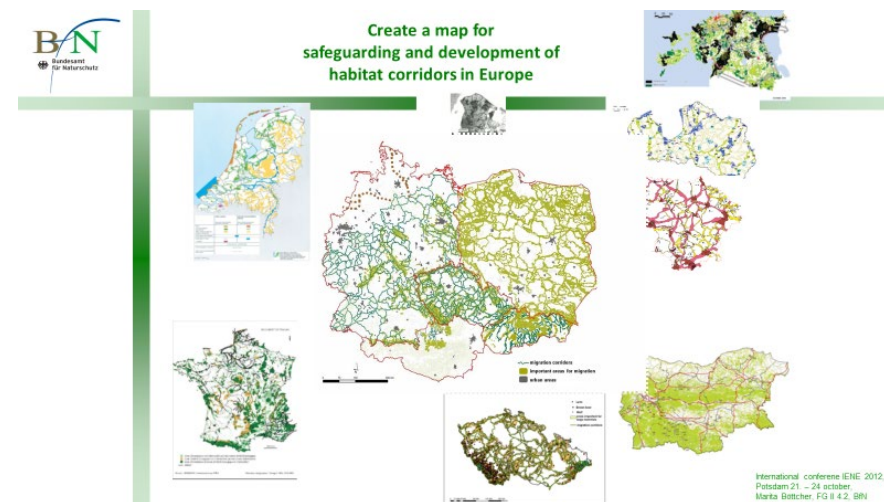## European Defragmentation Program

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IENE-Conference Eindhoven, 2018
"CONNECTING EUROPE, CONNECTING NATURE"
We - the IENE community – therefore call the European Commission to support the development of a
European Defragmentation Program,
as a synergy between the TEN-T and TEN-G strategies.

Create a map for safeguarding and development of habitat corridors in Europe

International conferene IENE 2012, Potsdam 21 – 24 october, Marita Böttcher, FG II 4 2, BfN

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Cindy Baierl,
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EUROPEAN DEFRAGMENTATION MAP (EDM) 2022
Ecological Networks on national/transnational level

so far integration for 17 European countries
& 2 transnational areas

- **Overview Countries/national level:**

Austria (AT), Belarus (BY), Belgium (BE) only Flanders,
Czech Republic (CZ), Germany (DE), Great Britain (GB,
England, Central Scotland, Wales), Denmark (DK),
Estonia (EE), France (FR), Hungary (HU), Lithuania (LT),
Latvia (LV), Netherlands (NL), Poland (PL), Portugal (PT),
Slovakia (SK), Spain (ES), Switzerland (CH)

- **Overview transnational level:**

- Carpathian Corridors (CZ, SK, HU, PL, RO, RS, UA)

- Alp-Carpathian-Corridor (AT, SK)

- In prep. : Alp-Atlas (DE, FR, CH, AT, SI)

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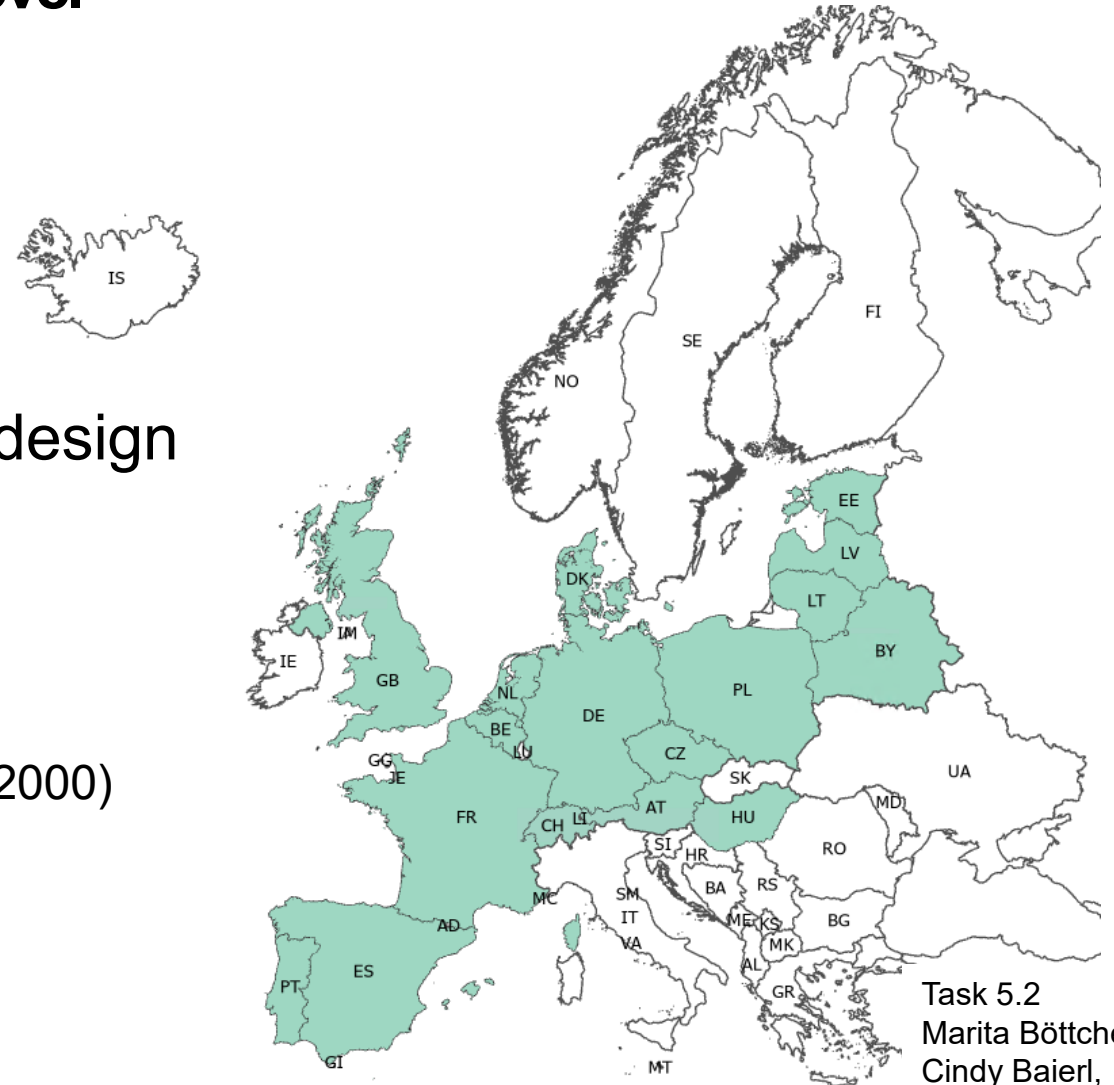Marita Böttcher,
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EUROPEAN DEFRAGMENTATION MAP (EDM) 2022
Ecological Networks on national/transnational level

- **Facts**

  - are developed and based on different methods
    → different spatial and content-related design of the networks

  - represent more or less functional connected/related areas
    → mostly they depict more (than NATURA 2000) potential or real ecological connections between habitats/ecosystems

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EUROPEAN DEFRAGMENTATION MAP (EDM) 2022
Ecological Networks on national/transnational level

- **Consideration in the EDM as**

    - generalized
    - cores and corridors (not ecosystem specific)

- **Process of integration**

    - Selection of relevant network elements
    potential, to be developed or restored elements, as well as buffer zones were not considered

    - Generalization
    elimination of ecosystem-specific differentiations

    - Unification
    in the presentation and if possible differentiation in cores and corridors

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EUROPEAN DEFRAGMENTATION MAP (EDM) 2022
Overview of integrated data : Natura 2000 Network

- **Facts**
  - For protection of Europe's most valuable and threatened species & habitats
  - 8 % of the EU's land area
  - stretches across all 27 EU countries

- **Consideration in the EDM**
  - Sites of the Habitats Directive: Sites of Community Importance (SCIs) & Special Areas of Conservation (SACs)

  - Various land area coverage

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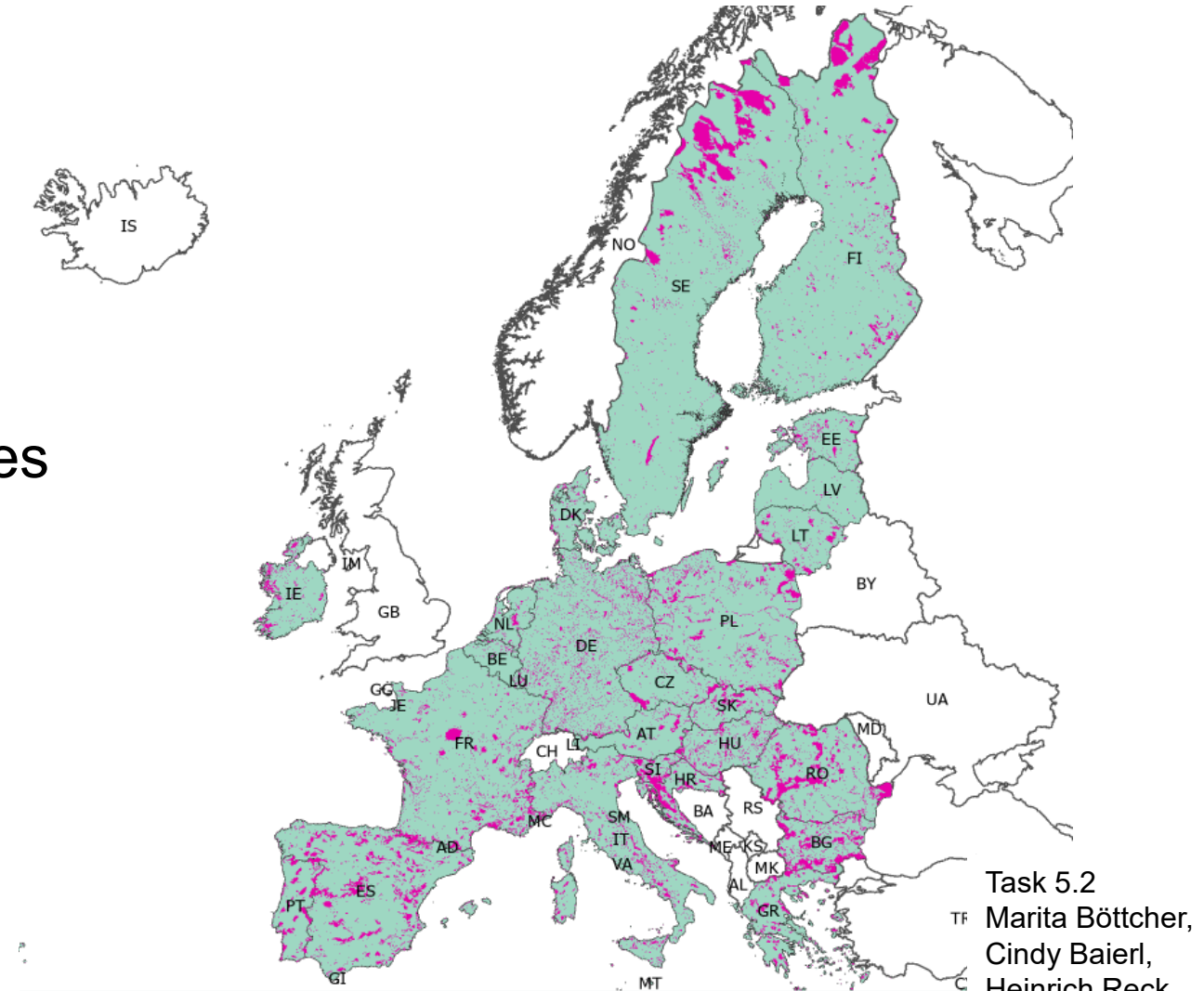
EUROPEAN DEFRAGMENTATION MAP (EDM) 2022
Overview of integrated data : Nationally designated areas (CDDA)

CDDA: Common Database on Designated Areas =
European Inventory of Nationally designated Areas

- **Facts**
  - CDDA = European inventory of nationally designated areas
  - protected area information from 37 European countries

- **Consideration in the EDM**
  - IUCN I to IV

  - Various land area coverage
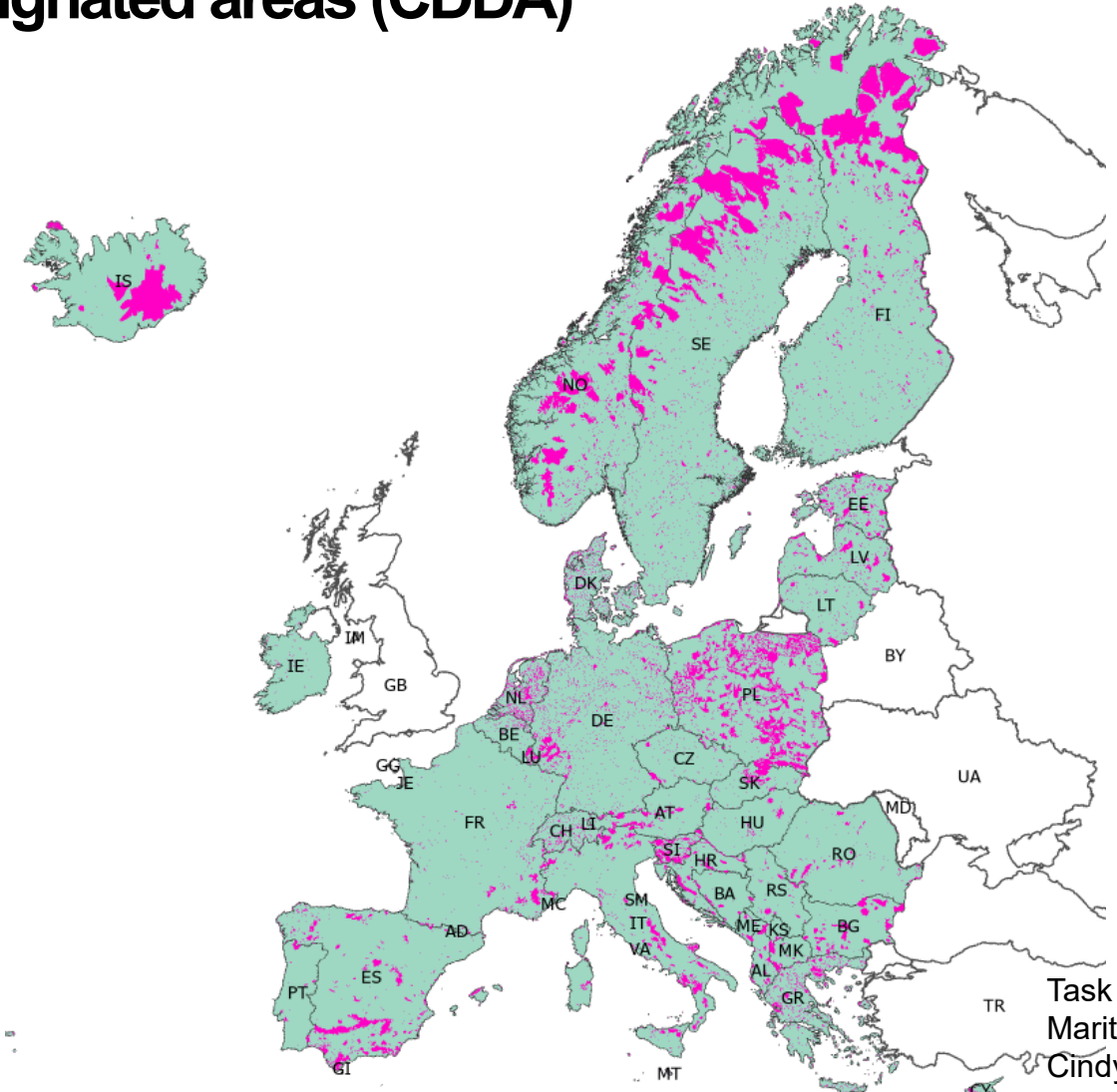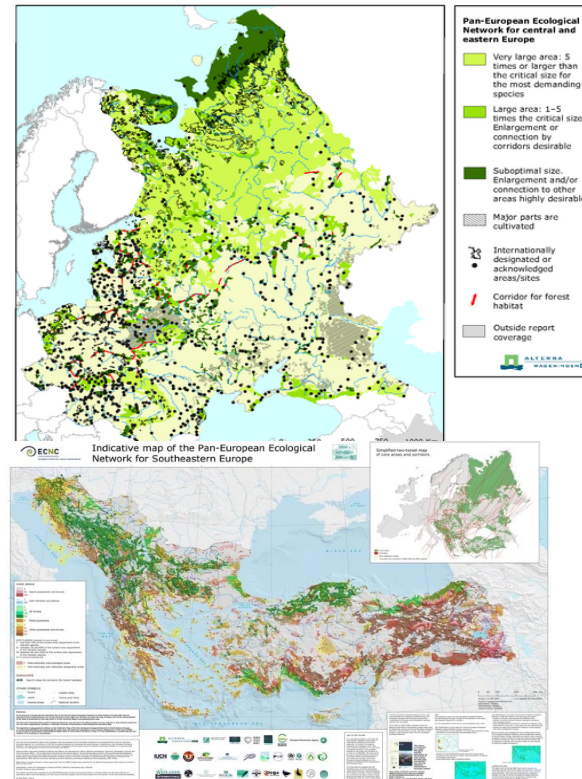

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EUROPEAN DEFRAGMENTATION MAP (EDM) 2022

Emerald Network

PEEN (Pan European Ecological Networks for central and eastern Europe, 2002, 2006)
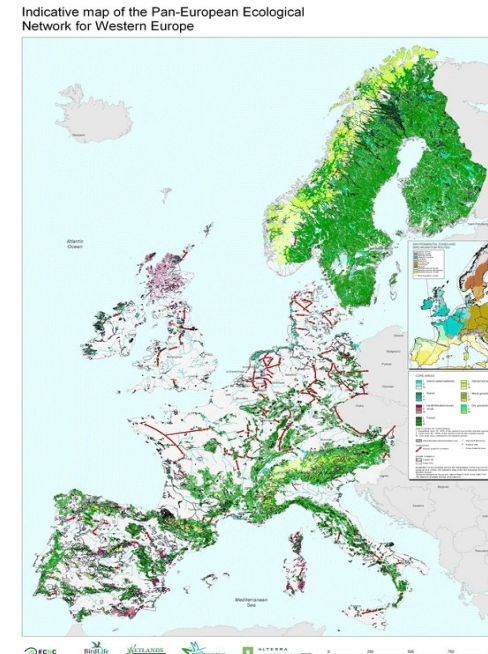
Identifies the core nature areas of European Importance, existing corridors between these areas, and where new corridors could and should be established to meet the conectivity requirements of key species.

No GIS-data, schematic Presentation of corridors

develloped for the implementation of the CBD

Ecol. Network for the conservation of wild animal and plant species and natural habitats of European importance.
Bern Convention (1989, 1996)

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PERSPECTIVE : EUROPEAN DEFRAGMENTATION MAP 2025

Update of the Map // Contents // R+D-needs

Improving data quality and closing data gaps

Source: pixabay

- E. g. with remote sensing data, using Artificial intelligence
- Habitats // Habitat quality on EU-Level (automatic habitat classification with remote sensing)
- Creating a European HabNet?! // Creating European Corridors: method, data bases
- Integration of e. g. wilderness areas, (long distance) migration routes (incl. transhumans) as core areas for reestablishment of a functional eco network

Source: Esri

Selected R+D needs

- methods for improved determination of most effective EU-Corridors for future development; Creating a European HabNet?!
- data bases for habitats of European importance beside Natura 2000
- Re-establishment of habitat connectivity at coastlines (across ports and habour cities)
- minimal average grid densities for ecological corridors

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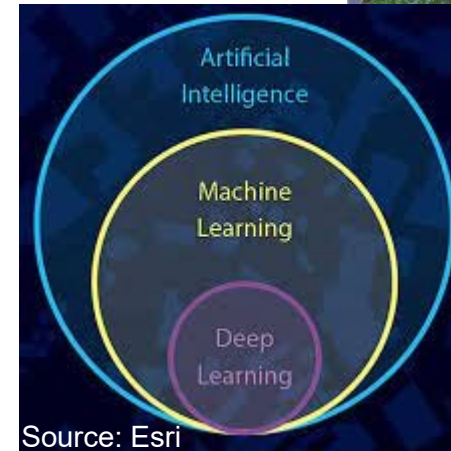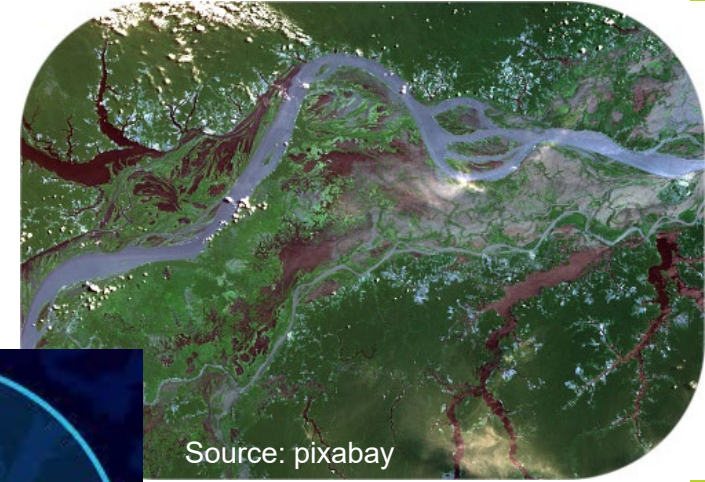
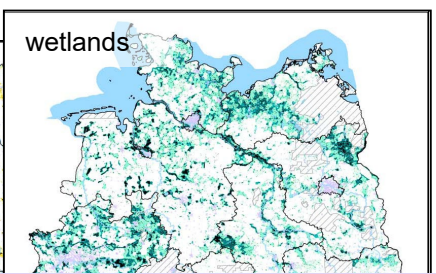# E. G. AIMED MINIMAL AVERAGE** GRID DENSITIES FOR ECOLOGICAL CORRIDORS

Examples from Germany, compilation by H .R. 2022
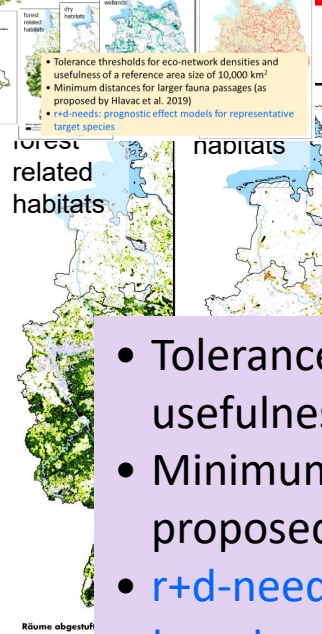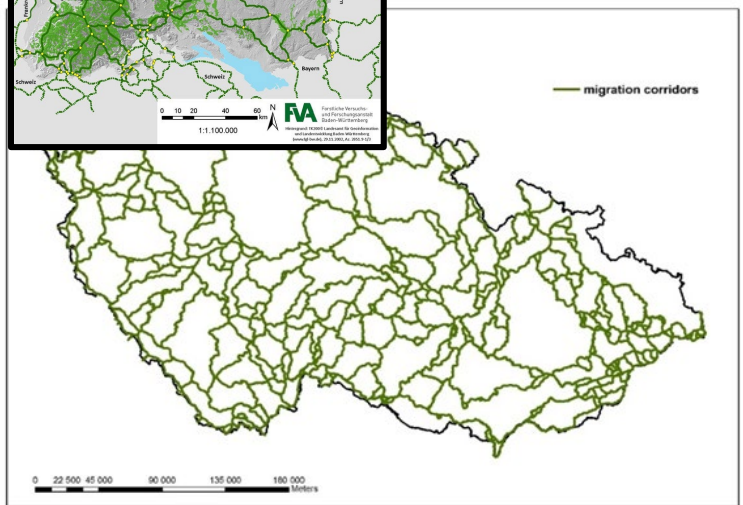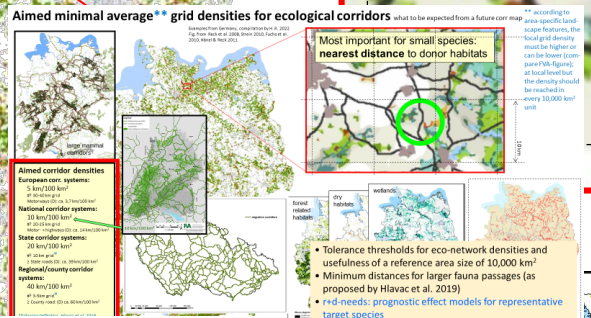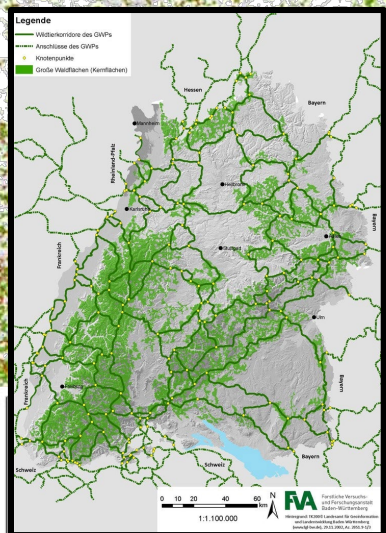Fig. from Reck et al. 2008, Strein 2010, Fuchs et al. 2010, Hänel & Reck 2011

** according to area-specific landscape features, the local grid density must be higher or can be lower (compare FVA-figure); but the density should be reached in every 10,000 km² unit

Most important for small species: **nearest distance** to donor habitats

10 km

large mammal corridors
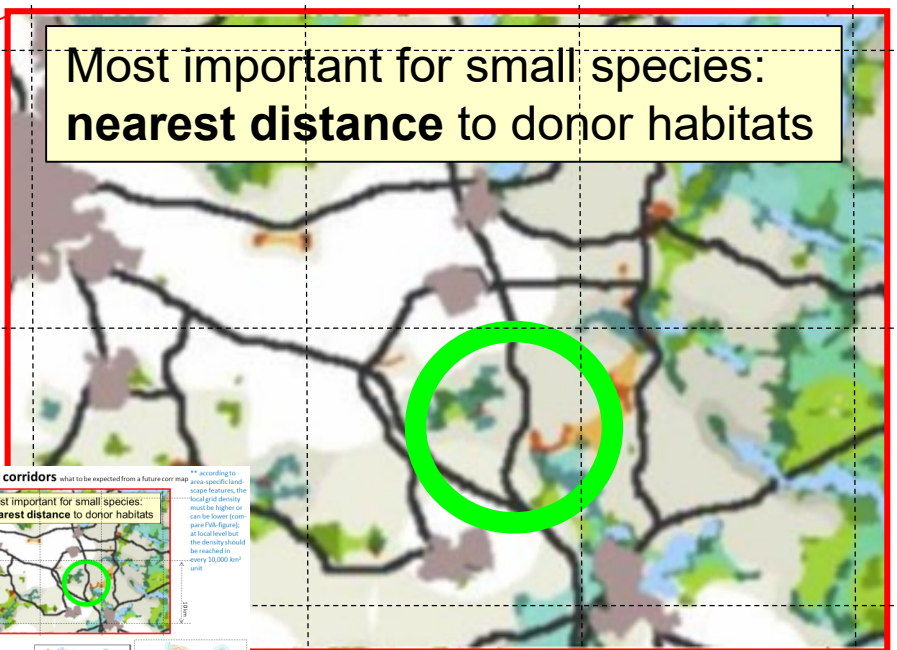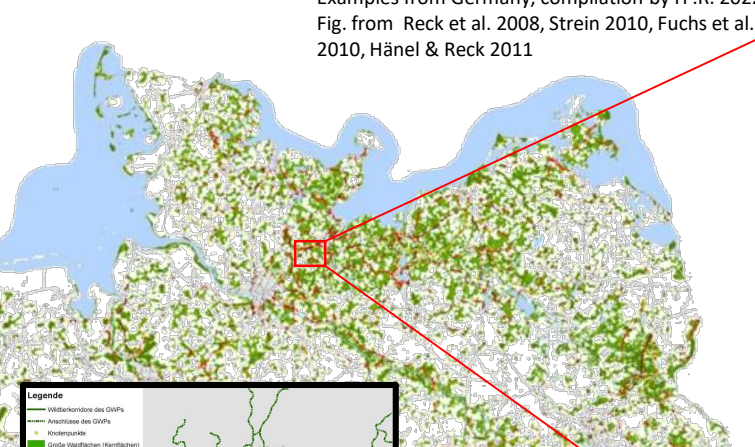
Aimed corridor densities

European corr. systems:

5 km/100 km²

#? 30-40 km grid
Motorways (D): ca. 3,7 km/100 km²

National corridor systems:

10 km/100 km²

#? 20-25 km grid
Motor- + highways (D): ca. 14 km/100 km²

State corridor systems:

20 km/100 km²

#? 10 km grid*
≥ State roads (D): ca. 39 km/100 km²

Regional/county corridor systems:

40 km/100 km²

#? 3-5km grid*
≥ County road: (D) ca. 60 km/100 km²

following/reflecting Hlavac et al. 2019

— migration corridors

dark red: 30.000 conflict sectors with crossing roads

wetlands

forest related habitats

dry habitats

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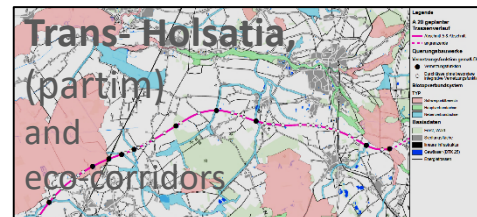Task 5.2
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- Tolerance thresholds for eco-network densities and usefulness of a reference area size of 10,000 km²
- Minimum distances for larger fauna passages (as proposed by Hlavac et al. 2019)
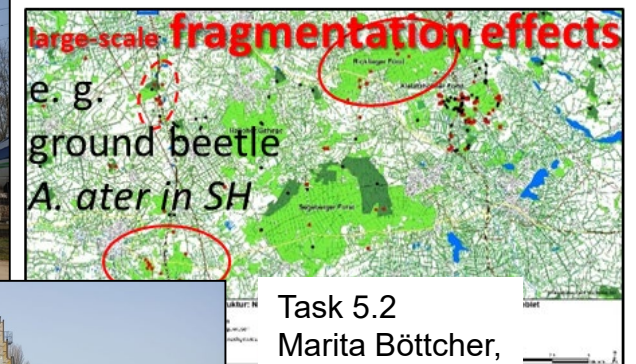- r+d-needs: prognostic effect models for representative target species

D5.3/2: To identify research priorities for best avoidance of TI-barrier effects or – better even promoting biodiversity or defragmentation

„planning" working principle **by *compiling planning recommendations with respect to research or development needs***

(1) starting form deficits => which are most relevant?

(2) indicating best possible practice recommendations

(3) Thereby revealing decision-relevant lack of knowledge or know-how and the respective research and development needs (r+d-needs)

Trans-Baltica, Latvia — 60 m

Trans-Jurassica, Bad.-Württ.

Trans- Holsatia, (partim) and eco-corridors

Via Egnatia Greece …

= too many planning deficits as (amongst others)

- nearly no representative biodiversity approach (despite of CBD),
- no (or only rarely) coherent and integrative impact-related defrag-mentation concepts as basis for sustainable mitigation and compensation,
- no active development of side areas as habitat corridors
- Common ignorance of adverse bundling effects … **leading to:**

strange solutions on **local scale** and

large-scale **fragmentation effects**
e. g. ground beetle *A. ater in SH*

The new Machu Picchu fauna passage across a high speed railway in the state Bad.-Württemberg

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Inappropriate definition of the impact areas for fragmen[tation] (scoping)

Inappropriate selection of impact indicators (besi[des]
small fauna (and therefore the main share of s[pecies])
neglecting (the demands of) large herbivores (a[nd]
listed as endangered while concentrating on str[...]
(unbalanced prioritization of Annex IV and Annex [...]

Neglecting the various concepts, maps and plans for ecolo[gical]
Thresholds for (a) distances and (b) size of fauna passages at strong barriers

Neglecting: - negative bundling effects of TI
- Mitigation and Compensation with no regard to the next bordering TI
- the opportunity for parity GI planning
- the role of verges and side areas as habitats and (possibly)
Ecol. corridors

Addition from the Workshops:

Inappropriate or no consideration of expected environmental changes such as range expansions of bears or red deer or, for example, more pronounced annual fluctuations in precipitation or drought periods.

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Scales for the assessment of - fragmentation, - defragmentation - habitat corridors along/across TI	≤ 1:300.000 SEA (TEN-T, …)	±1:200.000 SEA + EIA (NHP)	± 1:50.000 SEA + EIA	± 1.10.000 EIA, IA of SAC	≥ 1: 5.000 impact regulation compens. balance
	+ localisation of supra-reg. important conflict pts.	+ regional important conflict points	+ important fauna passages	+ necessary defragmentation	+ avoidance/mitigation/compensate
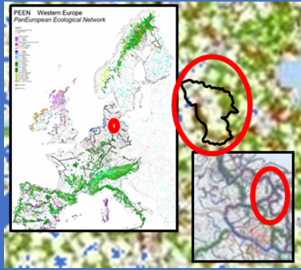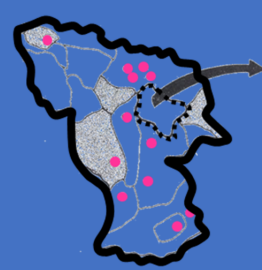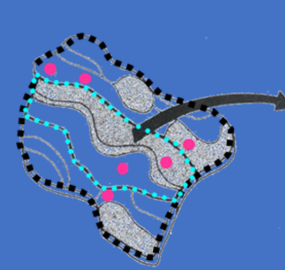
Best indicators:

Principle; Contents see tables

Existing plans or data *versus* Original field surveys

Small scale analysis
Priority is on plans for green infrastructure and project-specific interpretation of landscape features

Priority is on project-specific field surv
(further information and specification of gr

Impact of EDM on TI planning * = currently based on national concepts that represent incoherent ecological approaches	Very high and to be used in context with Sites of Community Importance/ SCIs and other strictly protected areas	High but in need to be supplemented by existing or special developed regional eco-corridors	In need to be supplemented by existing or special developed local eco-corridors	… to be supplemented by TI project-specific, parity reconnection concepts */**	*.
Further supplements in need (regarding ecological corridors and its function) **Additionally req. info**	International + national migration corridors of migrating species … See add. indicator slides	+ regional migration corridors of species See add. indicator slides	+ road- & railkill hotspots See add. indicator slides	+ main game trails and amphibian or reptile migration paths See add. indicator slides	See add. indicator slides
R&D needs concerning corridor maps and defragmentation priorities	e.g. European-wide methods to identify best corridors , based on habitat topology; criteria for prioritization.	e. g. methods (remote sensing, artificial intelligence) to identify best habitat corridors; methods to detect regional migration corridors, …	e. g. methods for monitoring rail- and roadkill hotspots	* at the level of project approval an equal reconnection concept can in most cases lead to efficient safeguarding of biological diversity despite the intervention	** standard methods (minimum requirements) for the development of project specific but cross-sectional reconnection concepts must be developed

Overview about already developed principles, which are currently improved due to the results of 2 workshops in March (western EU) and May (Eastern EU)

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The related questions are:

- Which indicator taxa (representing ecological guilds) should (amongst other indicators) be standard taxa for impact assessment in the different eco-regions?

- Which species would represent the European wide most important Eco-corridors and the most important demands on corridor quality (="European target species list")?

And (more general)
- *Are species and biotopes listed in the Annexes of the Habitats Directive representative for biodiversity affected by TI and especially for defragmentation needs?*

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All indicators

Obligatory taxa due to climate zones

List of priority European target species for defragmentation

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Best indicators

Decision –making indicators and relevant scales	for areas North of 55° latitude, 47°-55° lat., South of 47° lat. (57°N = Göteborg, 47 ° = Dijon) ?or more oriented on EU-Ecoregions?		
≤ 1:300.000 SEA (TEN-T, …) / ±1:200.000 SEA + EIA (NHP) / ± 1:50.000 SEA + EIA / ± 1.10.000 EIA, IA of SAC / ≥ 1: 5.000 impact regulation compens. balance	Lat.> 57°N (cold)	Lat. 47°- 57N (temperate)	Lat. < 47° (warm)
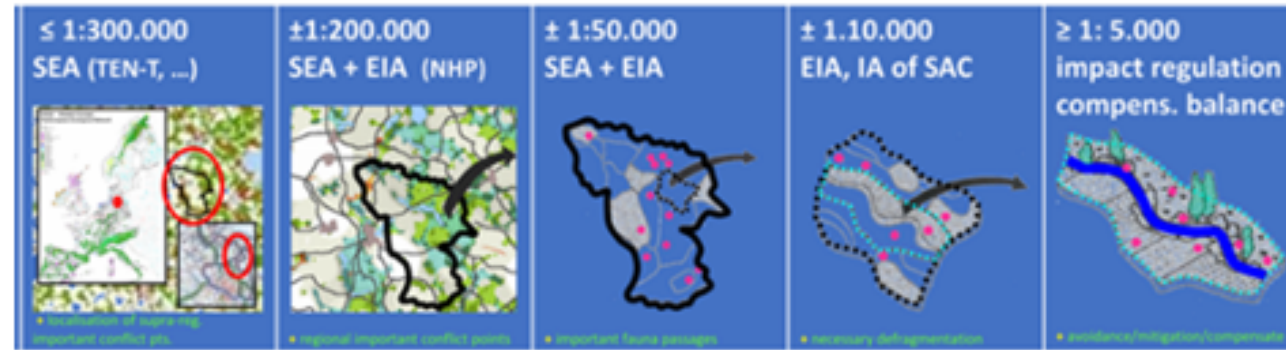
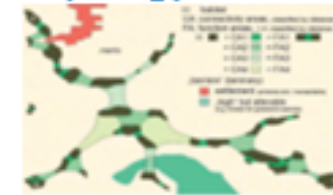| Barrier impacts and defragmentation			
Delineated Eco-Corridors and protected areas	**no cold-warm difference (δ)**		
EDF-corridors + other supra-regional important ecological corridors (1)	≤ 1:1.000,000	No differences (δ) between "cold", "temperate" or "warm"	
Topology of Wildernes Areas / SAC / National Parks / Nature Reserves (=strongly protected areas)	≤ 1:1.000,000	r+d needs 1: Best models for creating corridors from habitat topology-Info	
TI-project specific update of (1) in the possible effect area (	≤ 1:200,000		
Regionally important ecological corridors and spatially explicit species or habitat protection schemes on regional or supra-regional level	≤ 1:50,000		
Ecological corridors of local importance and/or elements (Art.10) or connecting elements (links) respectively between biotopes and spatially explicit species or habitat protection schemes on local level	≤ 1 : 10,000	r+d 2: guidelines for planning of parity defragmentation concepts	
Parity defragmentation concept	≤ 1 : 10,000		

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Best indicators

Obligatory indicator taxa for assessment regarding planning scales larger than ± 1 : 75,000

Indicator ! in addition to e.g. # Delineated Eco-Corridors and protected areas, # Habitat topology or # migration routes and # fragmentation sensitive Annex II species of further taxa	for areas north of 55° latitude, 47°-55° lat., south of 47° lat. ?or more specified? or closer to the EU-Ecoregions? 57°N = Göteborg, 47 ° = Dijon		
	Lat.> 57°N (cold)	Lat. 47°- 57N	Lat. < 47° (warm)
obligatory indicator taxa for assessing fragmentation effects			
for water bodies and banks	mammals - amphibians fish* dragon flies ground beetles	mammals reptiles amphibians fish* dragon flies ground beetles	mammals reptiles amphibians fish* dragon flies ?large ground beetles
for arable fields	mammals - ground beetles ?	mammals - ground beetles Saltatoria	mammals reptiles ?large ground beetles ? Oedipodinae
for other open habitats and forest edges:	mammals reptiles amphibians - ground beetles bees	mammals reptiles amphibians saltatoria (ground beetles)	mammals reptiles amphibians ? Oedipodinae
for tree dominated habitats (forests)	mammals - - ground beetles	mammals - (amphibians) ground beetles (saltatoria) bees	mammals reptiles amphibians ?large ground beetles
??? for coast lines	?	?	?

*Fish don`t have to be surveyed if, as a standard, any watercourse crossings by TI are always designed to be passable for all aquatic and riparian species

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European-wide important target species for eco- corridor or defragmentation concepts

Principle of a possible table / Idea of a basic list of flightless species,

"as it is species,
which actually make use of such a network
the Eco-corridor approach should consider both
(1.) habitat-specific and site-specific aspects and even more
(2.) the presence and the habitat or migration requirements of "management indicator species for
ecological networks" or "target species for interlinking biotopes" respectively"

Legend: Boreal Bo, Alpine Al, Atlantic At, Continental Co, Mediterranean Me, Pannonian Pa, Steppic St, Black Sea BS
(not regarding the Macaronesian region)

Species type a	Of relevance in EU Eco-region:	Bo	Al	At	Co	Me	Pa	St	BS
	Special features e.g. species listed by Bonn or Bern Convention, Habitats Directive, IUCN red list ...								
e. g. mammals									
Bison bonasus		##	#	##	##		?		
Rangifer tarandus		##	#						
Alces		##			##				
Cervus elaphus		#	#	#	#	#	#	#	?
Rupicapra		#	##	#	#	#			
...									
Lynx		##	##	##	##	#	#	?	
Lynx pardinus						#			
...									
Spermophilus citellus						?	##	##	?
e. g. grasshoppers									
Saga pedo						?	##	##	#	#
Decticus verrucivorus		#	#	##	##				

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Best indicators

game path densities	≤ 1:5,000
TI-Project specific animal inventories	**partly high climate and eco-regional δ**
Overview assessment: Faunistic expert opinion, based on a single site visitation (and interpretation of existent data)	≤ 1:50,000 r+d 9: report guidelines
Occurrence of indicator taxa (higher density of survey areas or points in 1: 5,000 than in 1:10,000)	≤ 1:10,000 (scale dependent survey intensities) **climate specific selection see table "taxa"** r+d 10: representativeness of best indicator combinations
Occurrence of target species (scale dependent survey intensities: higher density of survey areas or points in 1: 5,000 than in 1:10,000)	≤ 1:10,000 (scale dependent survey intensities) **eco-region specific selection see pre-selection of Central-European "target species"** r+d 11: Selection of representative species for habitat corridors r+d 12: Test of representativeness of Habitat's directive Annex species and habitats for (a) biodiversity and (b) especially for habitat corridor or eco-network functions
Interpretations; e. g. : ≤ 1:1.000,000: needs for large fauna passages, ≤ 1:10,000: needs and feasibility for all necessary passages and for compensation, if necessary PVA: Population vulnerability analyses, ≤ 1:5,000: detailed mitigation and compensation plans / *Parity defragmentation concept*, Sustainability of mitigation and compensation measures; ≤ 1:2,500: Detailed design of mitigation and compensation measures ...	
Other impacts than barrier effects and/or exceptional cases	*Additional, indicator taxa an target species*

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INTEGRATION OF THE FUNCTION OF TI-RELATED HABITATS
INTO TI PLANNING AND INTO ASSESSMENT PROCEDURES

see chapter "deficits", otherwise not yet elaborated

For discussion (if of interest):

- Research needs about the role of verges as functioning corridors

- Research needs for defining (eco-regional, if necessary) standards for verge design**

**e.g.

- is the principle to use meagre substrates for herbaceous verges in Central Europe applicable in other areas
  /eco-regions,   WS-Result: Yes

- how to define minimum distances of shrubs to reduce bird and game kill (and how to compensate for the
  therewith connected increased barrier effect for woodland species)

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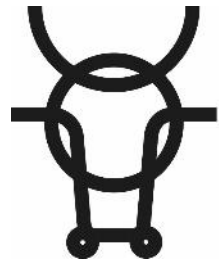Marita Böttcher,
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Vilm, 27 June – 1 July 2022**

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http://bison-transport.eu

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