Appendix 1: Notes on selective habitat mapping and the GIS-Algorithm “Habitiat-Net”

The following pictures show principles of the GIS algorithm ‘Habitat-Net’: After developing simple ecological model rules (effective distances that indicate ecologically functioning habitat systems for species of different migration abilities) it is possible to process data on the natural inventory in vector-format in order to provide information on existing or restorable habitat networks at regional level.

The data basis regularly available in Germany includes data from selective habitat mapping (selective Biotopkartierung) in the Federal States, CORINE Land Cover 2000, digital landscape models, CIR – inventories of habitat types and land use types as well as different data on the identification of habitat development potentials (soils, climate) and species-specific data. Due to a frequent lack of comparable data on the occurrence of species, the data of the selective habitat mapping are the most important source of information. For different guilds (representing different demands on habitat type, area size, dispersal distance), respective systems of classified functional areas can be created as habitat networks (e.g. for species of semi-natural woodland, dry grasslands or wetlands).

Altogether, the Federal States of Germany located 1.5 million sites with valuable habitat conditions (single habitats or habitat conglomerations). Using GIS, these sites are described by 2 million data files. Therefore it’s possible to look for the topology of e.g. wetland habitats or habitats of dry grasslands or of woodlands of special qualities.

\[1\] Hänel 2007
Fig. A1: Areas identified and described by selective habitat mapping in the surrounding of the Kiebitzholm overpass in comparison to the detailed habitat mapping near the overpass.
Fig. A2: Results of selective habitat mapping

Left side: Valuable wetlands (blue) between Zeven, Rotenburg and Schneverdingen (the towns as well as other settlement are indicated in reddish colour; forests are represented in green)

Right side (Reck et al. 1996): Most of the mapped habitats are conglomerates or mosaics of different habitats – the respective data files give information on the predominant habitat type and all other included habitat types

The Algorithm “Habitat-Net” looks for the most effective areas for networking, intending to safeguard areas of high connectivity and the most efficient migration areas from further dissection or to mitigate isolation in those areas.
Fig.A3 principle of ecological networks

Valuable habitats
(e.g. dry grassland)

Areas of high connectivity
(low and moderate distances)

Migration areas
(priorities for creating stepping stone habitats etc.)

Barrier areas

Villages, industrial plants
Supra-regional networks are identified automatically by iterative neighbourhood analysis.

Step 1: Identifying relevant habitats (e.g. valuable dry grasslands).

Step 2: Identifying close habitat systems (low distance, e.g. 250 – 500 m, depending on habitat size and alignment)
Step 3: Regarding irremediable barriers

Step 4: Identifying wide habitat systems (e.g. within distances of 500 – 1000 m depending on habitat size and alignment) and isolated small habitats that cannot be part of an efficient network (small habitats that are not in between larger habitat systems or function areas respectively)
Step 5: Elimination of isolated small habitats from further networking by distance analysis.

Step 6: Identifying networks for strong dispersers (e.g., distances between 1000 – 2000 m depending on habitat size and alignment) as well as areas that are suitable for efficient networking.
Step 7: Applying further distance analysis (e.g., distances between 1500 – 3000 m depending on habitat size and alignment)

Step 8: Identifying laminar barriers that can be overcome by habitat improvement
Step 9: Identifying linear barriers and priorities for mitigation measures. Overpasses, viaducts etc. should be built in conflict areas where endangered species are severely affected by dissection and/or in areas where close habitat systems are dissected that are part of a supra regional habitat network.

Fig.A4: Application between Zeven and Rotenburg, areas for wetland networks regarding dispersal ≤ 1000 m
Fig.A5: Rebuffering (1000 m type) and additional areas regarding possible dispersal ≤ 1500 m
Fig. A6: Area between Zeven and Rotenburg; wetland network and conflict areas with traffic infrastructure (roads with traffic loads of more than 1000 cars/day)

Fig. A7: Results for different habitat types (wetland and dry grassland; clipping from upper Danube river, Fuchs et al. 2008)
Fig. A8: Possible habitat-Network in Germany and its dissection by federal roads

Acknowledgement

We are grateful to C. C. Casper for improving the English
## Appendix 2: Synopsis of Central European Defragmentation Approaches

The following table is part of a scheme comparing the current European concepts and programmes on connectivity and defragmentation. The scheme is not fixed yet (December 18, 2008) and should, if possible, be used to give a European overview as well as the now intended Central European perspective.

The table has been compiled on the basis of presentations given at the international workshop "De-fragmentation concepts in Central Europe" (Island of Vilm, Germany, September 14–18, 2008) as well as information of IENE members and publications.

<table>
<thead>
<tr>
<th>Country</th>
<th>Austria</th>
<th>Belgium</th>
<th>Czech Republic</th>
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<th>The Netherlands</th>
<th>Poland</th>
<th>Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Surface / 1000 km(^2)]</td>
<td>AT 53.86</td>
<td>BE 30.53</td>
<td>CZ 78.87</td>
<td>DK 43.09</td>
<td>DE 357.02</td>
<td>FR 553.90</td>
<td>LI 0.16</td>
<td>LU 2.59</td>
<td>NL 41.53</td>
<td>PL 312.69</td>
<td>CH 41.28</td>
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<tr>
<td>[Population / million]</td>
<td>AT 8.33</td>
<td>BE 10.67</td>
<td>CZ 10.38</td>
<td>DK 5.48</td>
<td>DE 82.22</td>
<td>FR 63.75</td>
<td>LI 0.04</td>
<td>LU 0.48</td>
<td>NL 16.40</td>
<td>PL 38.12</td>
<td>CH 2.59</td>
</tr>
<tr>
<td>[Population density / Inhabitants/km(^2)]</td>
<td>AT 99</td>
<td>BE 349</td>
<td>CZ 132</td>
<td>DK 127</td>
<td>DE 230</td>
<td>FR 116</td>
<td>LI 221</td>
<td>LU 187</td>
<td>NL 395</td>
<td>PL 122</td>
<td>CH 184</td>
</tr>
<tr>
<td>[Length of road network / 1000 km]</td>
<td>2.1</td>
<td>1.7</td>
<td>0.6</td>
<td>1.0</td>
<td>12.4</td>
<td>10.8</td>
<td>0</td>
<td>0.1</td>
<td>0.7</td>
<td>0.6</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Note: The table has been compiled on the basis of presentations given at the international workshop “De-fragmentation concepts in Central Europe” (Island of Vilm, Germany, September 14–18, 2008) as well as information of IENE members and publications.*

### Country Code
- AT: Austria
- BE: Belgium
- CZ: Czech Republic
- DK: Denmark
- DE: Germany
- FR: France
- LI: Liechtenstein
- LU: Luxembourg
- NL: The Netherlands
- PL: Poland
- CH: Switzerland

### Surface Area
- Austria: 53,860
- Belgium: 30,530
- Czech Republic: 78,870
- Denmark: 43,090
- Germany: 357,020
- France: 553,900
- Liechtenstein: 0.16
- Luxembourg: 2.59
- The Netherlands: 41.53
- Poland: 312.69
- Switzerland: 41.28

### Population
- Austria: 8,330
- Belgium: 10,670
- Czech Republic: 10,380
- Denmark: 5,480
- Germany: 82,220
- France: 63,750
- Liechtenstein: 0.04
- Luxembourg: 0.48
- The Netherlands: 16.40
- Poland: 38.12
- Switzerland: 2.59

### Population Density
- Austria: 99
- Belgium: 349
- Czech Republic: 132
- Denmark: 127
- Germany: 230
- France: 116
- Liechtenstein: 221
- Luxembourg: 187
- The Netherlands: 395
- Poland: 122
- Switzerland: 184

### Motorways
- Austria: 10.6
- Belgium: 12.6
- Czech Republic: 6.2
- Denmark: 0.6
- Germany: 41.0
- France: 25.2
- Liechtenstein: 0.8
- Luxembourg: 6.7
- The Netherlands: 18.3
- Poland: 0.4
- Switzerland: 1.4

### National roads
- Austria: 12.6
- Belgium: 6.2
- Czech Republic: 0.6
- Denmark: 24.0
- Germany: 116
- France: 610.0
- Liechtenstein: 2.3
- Luxembourg: 59.4
- The Netherlands: 377.3
- Poland: 51.4
- Switzerland: 37.4

### Other roads
- Austria: 888.0
- Belgium: 136.6
- Czech Republic: 72.3
- Denmark: 60.9
- Germany: 413.0
- France: 610.0
- Liechtenstein: 2.3
- Luxembourg: 59.4
- The Netherlands: 377.3
- Poland: 51.4
- Switzerland: 37.4

### Total road density
- Austria: 134.3
- Belgium: 152.2
- Czech Republic: 127.8
- Denmark: 72.3
- Germany: 644.5
- France: 1005.9
- Liechtenstein: 2.3
- Luxembourg: 59.4
- The Netherlands: 424.5
- Poland: 216.1
- Switzerland: 71.1

### Road density
- Austria: 1.6
- Belgium: 5.0
- Czech Republic: 1.6
- Denmark: 1.7
- Germany: 1.8
- France: 1.8
- Liechtenstein: 2.4
- Luxembourg: 2.0
- The Netherlands: 1.9
- Poland: 5.2
- Switzerland: 3.0

### Present / planned overpass density
- Austria: 0.72
- Belgium: 3.12
- Czech Republic: 0.37
- Denmark: 0.94
- Germany: 0.48
- France: 0.54
- Liechtenstein: 0.54
- Luxembourg: 0.31
- The Netherlands: 0.61
- Poland: 0.37
- Switzerland: 3.16

### IENE Membership
- Austria: +
- Belgium: +
- Czech Republic: +
- Denmark: +
- Germany: +
- France: –
- Liechtenstein: –
- Luxembourg: –
- The Netherlands: +
- Poland: +
- Switzerland: +

### Participation in COST 341
- Austria: +++
- Belgium: ++
- Czech Republic: ++
- Denmark: +
- Germany: +
- France: ++
- Liechtenstein: +
- Luxembourg: +
- The Netherlands: +
- Poland: +
- Switzerland: +

### National connectivity programmes
- Austria: (integrative (biodiversity) ++ / focused on certain ecosystem types or species groups ++ / focused on single target species +)
- Belgium: +
- Czech Republic: +
- Denmark: +
- Germany: +
- France: +++
- Liechtenstein: ?
- Luxembourg: ?
- The Netherlands: +
- Poland: +
- Switzerland: +

### National connectivity concepts
- Austria: ++
- Belgium: +
- Czech Republic: +++
- Denmark: ++
- Germany: +
- France: ++
- Liechtenstein: +
- Luxembourg: +
- The Netherlands: +++
- Poland: +
- Switzerland: +

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7. In addition, there are approximately 600 small underpasses on roads and other fauna passages such as tree bridges and ecoducts by owners of fauna passages at the motorway system in Denmark. NERI Technical Report No. 631, 172 p. Online available at [http://www2.dmu.dk/Pub/FR631.pdf](http://www2.dmu.dk/Pub/FR631.pdf) [Last accessed 2008-11-16]. In addition, approximately 60 fauna passages were constructed in Jutland between 1988 and 1994 (COST 341 Denmark 2000).
8. In addition, there are 72 underpasses for game and 176 bridges across rivers and streams carefully designed to allow animals to pass. Source: Böttcher et al. (2008).
9. In additio n, there are 2 overpasses on railways and 263 underpasses on roads: 48 for large mammals (e.g. red deer), 16 for medium-sized mammals (roe deer, wild boar), 159 for small mammals (hare, fox, badger), 70 for amphibians, rodents etc. Source: Wlodzimierz Jedrzejewski & Sabina Nowak: Efforts for defragmentation and connectivity protection in Poland. Presentation given at the international workshop “De-fragmentation concepts in Central Europe” (Island of Vilm, Germany, September 14-18, 2008).
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<td>VEN &amp; IVON, MINA, SDER</td>
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<td>Save the Otter</td>
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For further information see workshop report "De-fragmentation concepts in Central Europe"