Habitat classification & connectivity analysis along the European Green Belt using high-resolution satellite imagery

Interreg Danube Transnational Programme
DaRe to Connect

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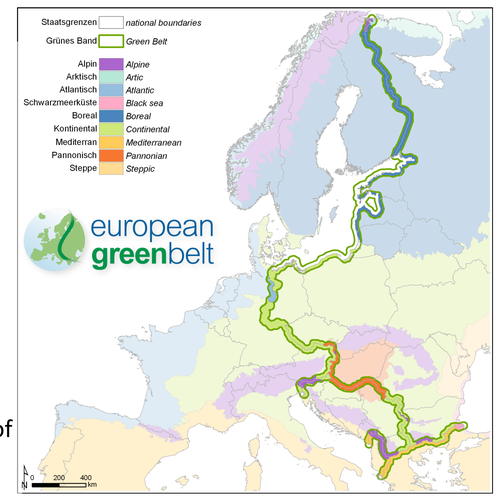
The European Green Belt

- 12.500km length
- Traverses 8 biogeographical regions in 24 countries
- Includes
  - Wilderness areas
  - Cultural landscapes
  - Aquatic ecosystems and coasts
  - Endangered animal and plant species
- Contributes substantially to the diversity of European nature
- ...and to the Europe-wide ecological network
- Incorporates over 1100 protected areas within a corridor of 1km width along the former Iron Curtain
- Unique European memorial, that connects nature and history



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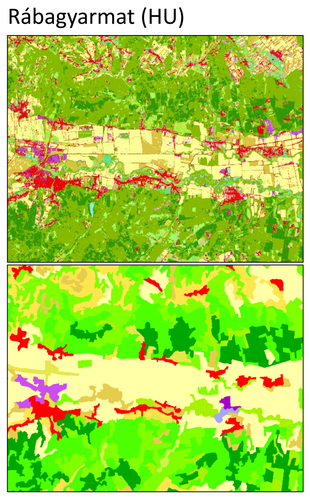
Habitat classification via machine learning

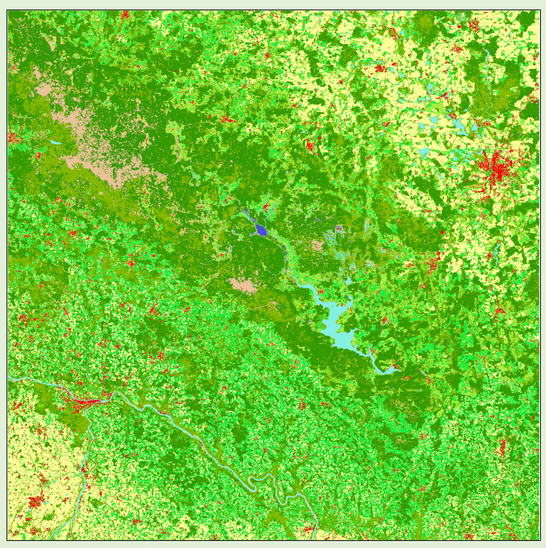
- "Supervised learning" by the Random Forest Classfier
- Remote sensing data as feature for the differentiation of classes:
  - Sentinel-2 time series (spectral bands and derived products)
  - Terrain information from the Copernicus EU-DEM
- Modell is trained with data from existing biotope mappings
- Random Forest Classifier is able to recognize important properties as well as define correlations between them
- For each 1 m pixel, a decision will be made based on the spectral signature of the Sentinel-2 time series
- Extensive automated applicability
- Result: Habitat map with 10m spatial resolution
- Application in 4 pilot regions (100x100km area)



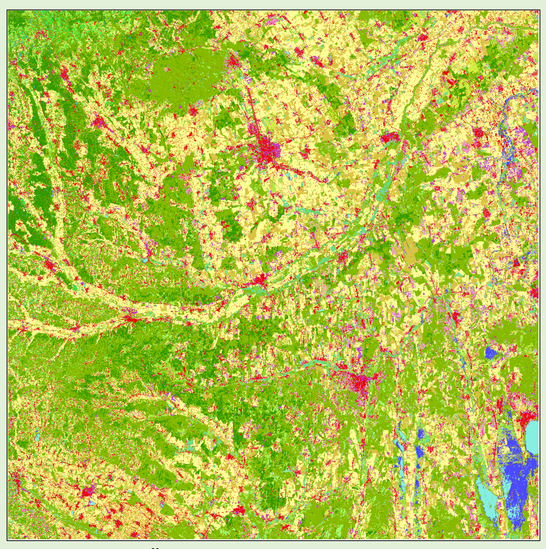
Comparison of the Sentinel-2 habitat classification (above) and CORINE Landcover 2018 (below).

Results of the habitat classification in the 4 pilot regions

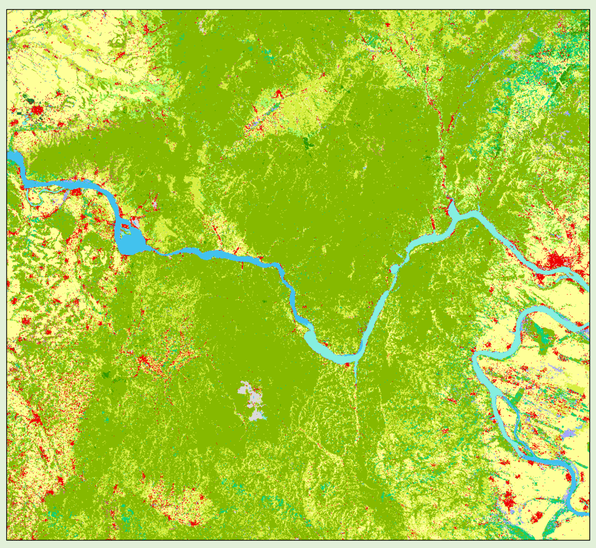
Using all (mostly) cloudfree Sentinel-2 scenes for each pilot region from 2017/18



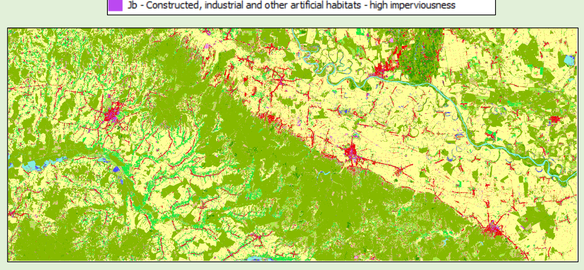
Nationalpark Šumava (CZ),
Nationalpark Bavarian Forest (DE),
Mühlviertel (AT)



Nationalpark Őrség (HU),
Nature park Raab (AT),
Nature park Goričko (SLO)



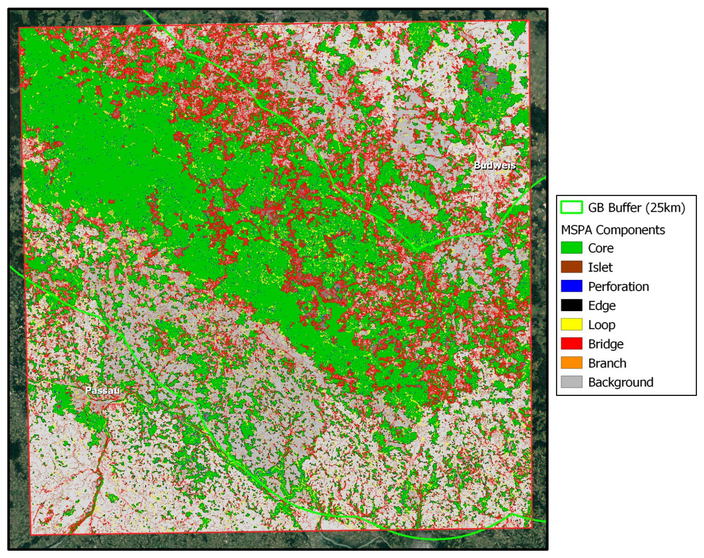
Danube at the Serbian & Romanian border
Nationalpark Đerdap (SRB),
Nature park Iron Gates (RO)



Drava at the Croatian & Hungarian border.
Virovitica-Podravina County (HR)

→ Connectivity analysis

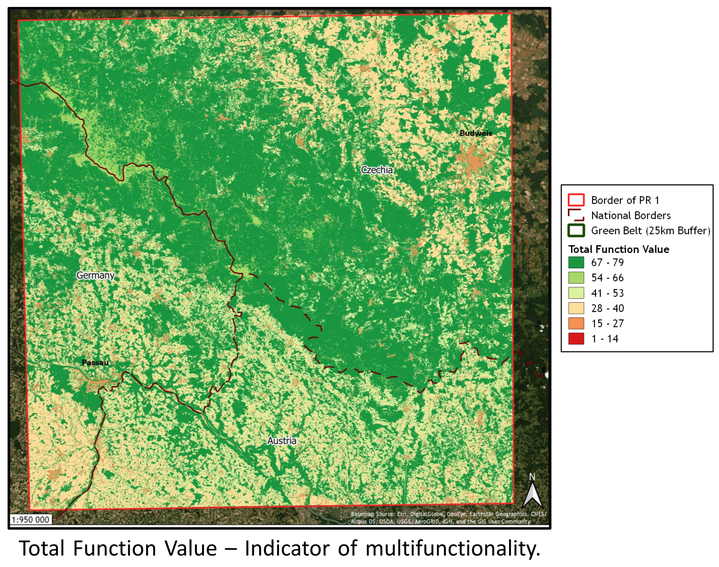
- Definition of Green Infrastructure (GI) dependent on the target of (re)connectivity – e.g.:
  - GI = forests, grasslands, waterbodies, bogs, etc.
  - Non-GO = built-up areas, landfills, farmland, etc.
- Application of GUIDOS Toolbox (EU Science Hub) for raster analyses:
  - Morphological Spatial Pattern Analysis (MSPA)
  - Euclidean Distance
- Habitat map as basis for the analyses with GUIDOS
- Combination of Euclidean distance map and MSPA allows conclusions on geometry, connectivity and intactness of Green Infrastructure
- Important corridors between core areas of GI can be derived from the results



MSPA – Classification of GI in core areas (green) and possible corridors between different (red) and the same (yellow) cores.

→ Ecosystem services analysis

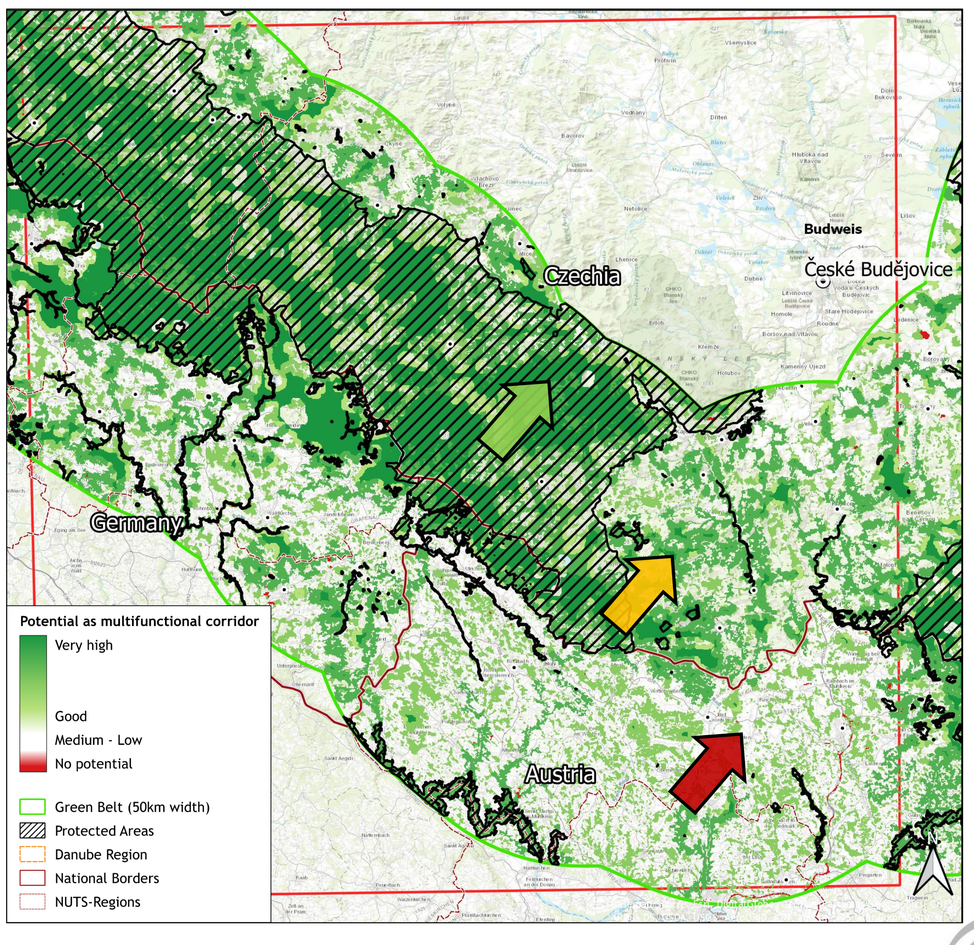
- Linking of Broader Habitat Types (BHT) with a capacity matrix of provided ecosystem services
- Matrix consists of 30 single ESS, cumulated in 5 main categories (regulation, habitat, production, information & carrier function) and the total value of all ESS – the „Total Function Value"
- Assessment of BHTs from „very high" (5) to „no capacity" (0)
- Depiction of functional valuable regions and habitats



Total Function Value – Indicator of multifunctionality. Rating scale for areas with very high capacity (green) to areas without the capacity (red) of providing ESS.

→ Connectivity-Functionality Index (CFI)

- Combination of indices from the Connektivity- and ESS-analyses
- Shows potential corridors with:
  - High functional value → qualitative habitat types
  - An important role as connecting landscape element
- Definition of 3 Areas of Action: **Maintain** – **Safeguard** – **Restore**



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