Mapping Blue-Green infrastructure to evaluate conditions in the Estonian coastal zone

EGU22 BG3.14 – 'Land use and land cover change effects on surface biogeophysics, biogeochemistry, and climate.'

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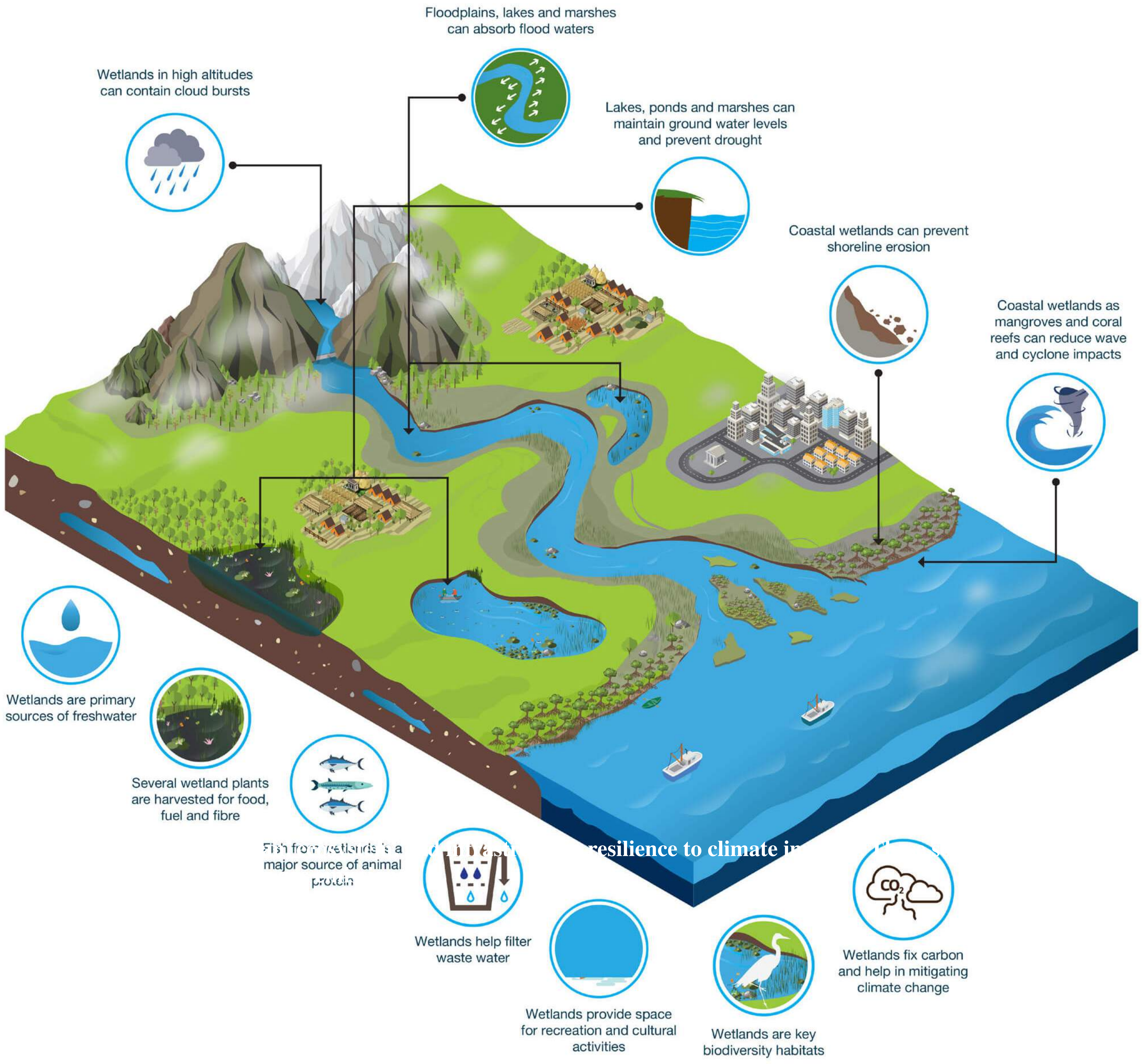
Vienna, Austria, 23–27 May 2022

Eesti Maaülikool
Estonian University of Life Sciences

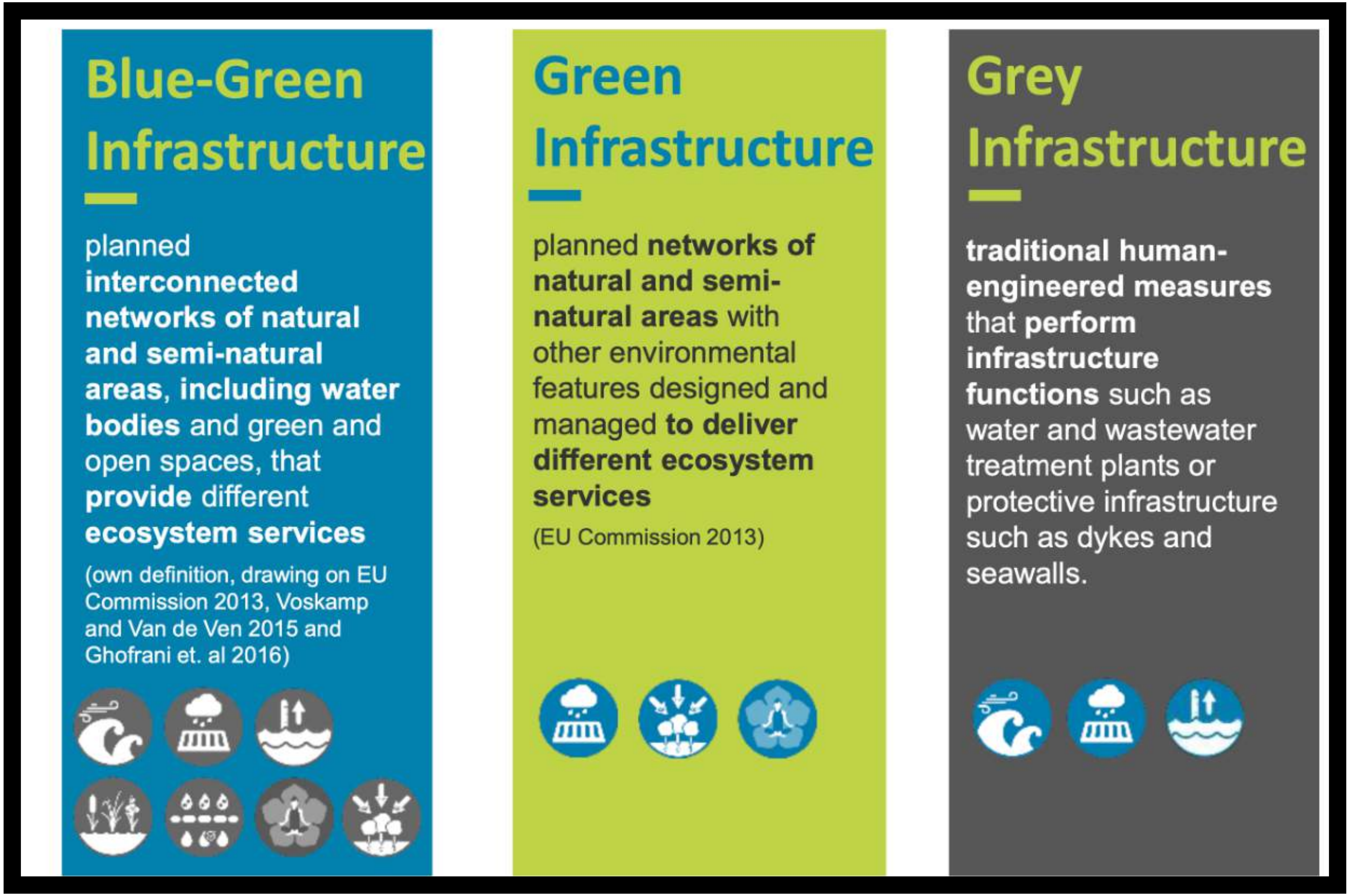
EGU European Geosciences Union

Blue-Gree Infrastructure

is a framing concept concerning the connectivity of ecosystems, founded on nature-based solutions and a multi-functionality approach, which includes contributions by nature to disaster risk reduction, infrastructure resilience, erosion control, land formation, and other ecosystem services
(World Risk Report, 2012).

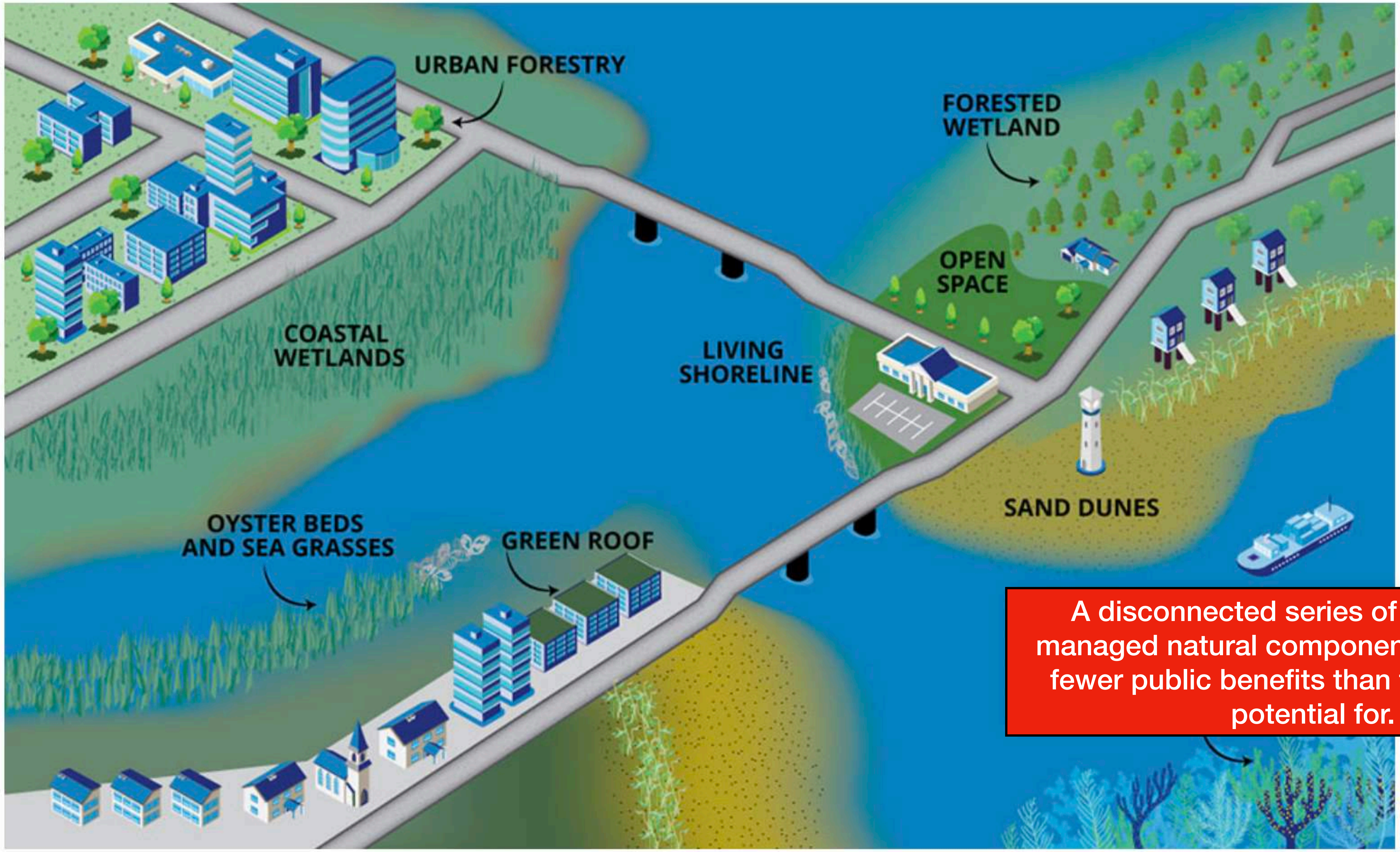


Infographics: Wetlands International



Infographics: Wetlands International

Helping communities **reduce** extreme weather impacts using **nature's processes**.



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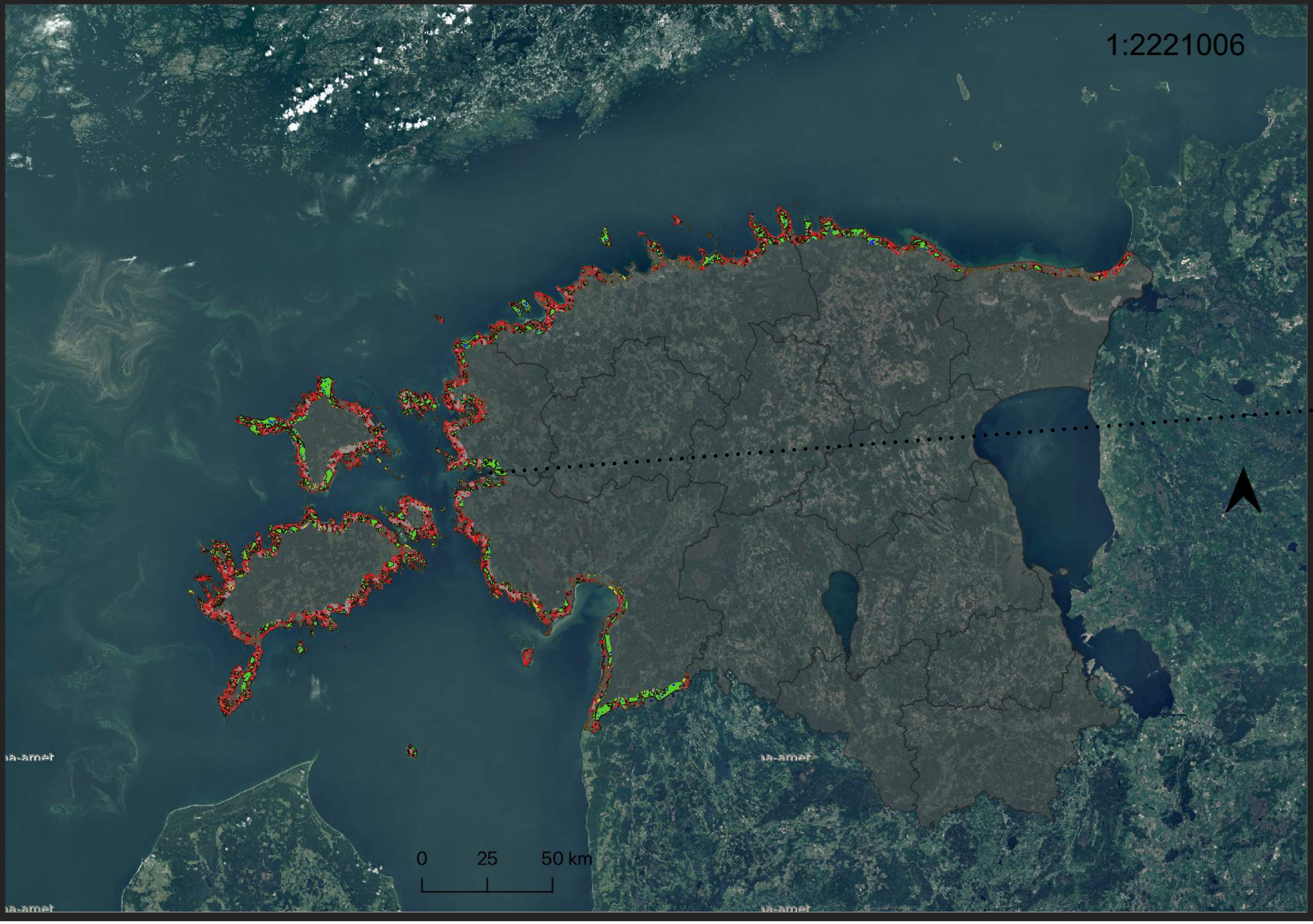
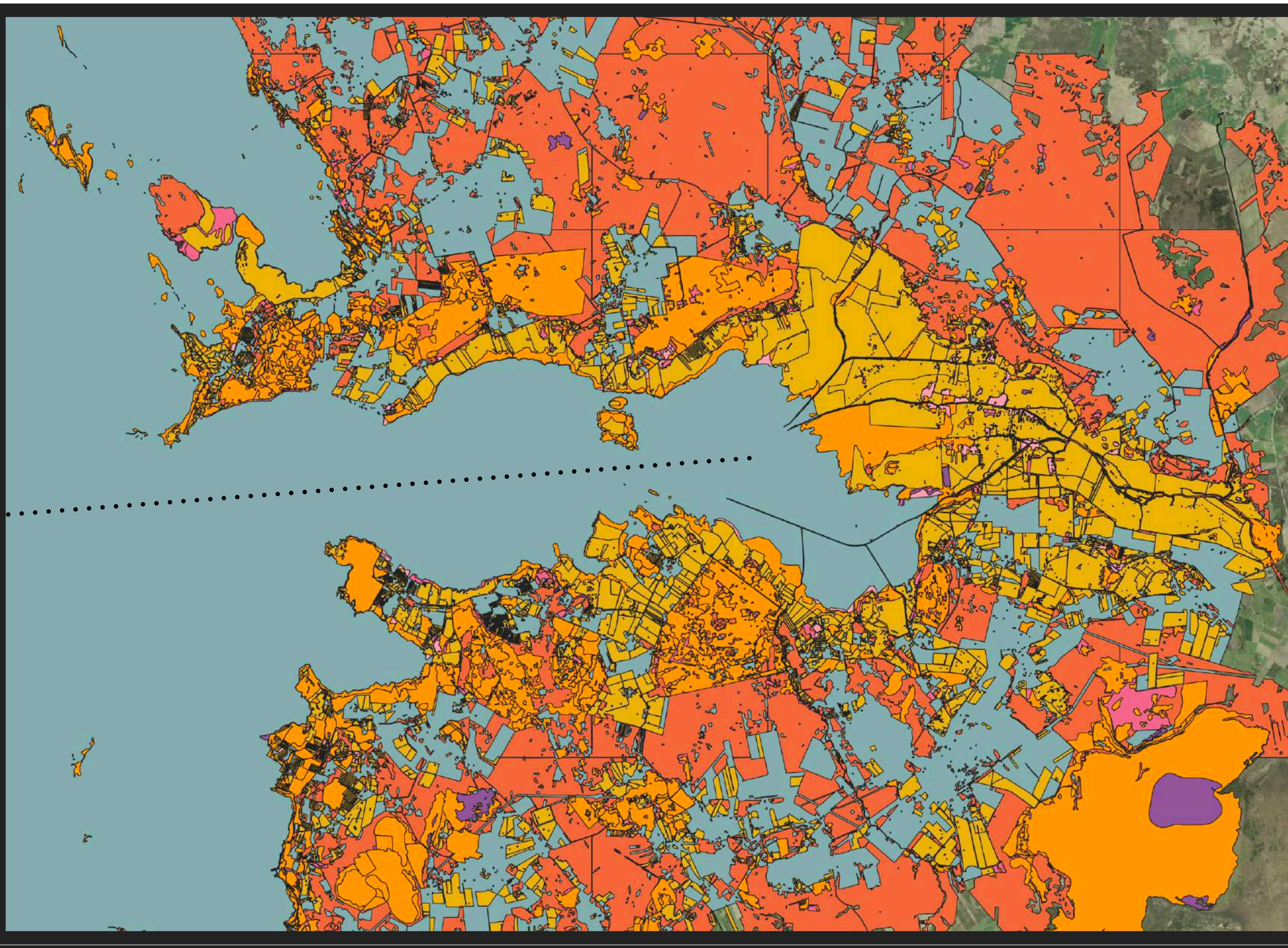
A disconnected series of inefficiently managed natural components produce far fewer public benefits than they have the potential for.

Green infrastructure practices provide ecological, economic, and societal benefits that play a critical role in making coastal communities more resilient to natural hazards.

Blue-Green Infrastructure on the Estonian coast

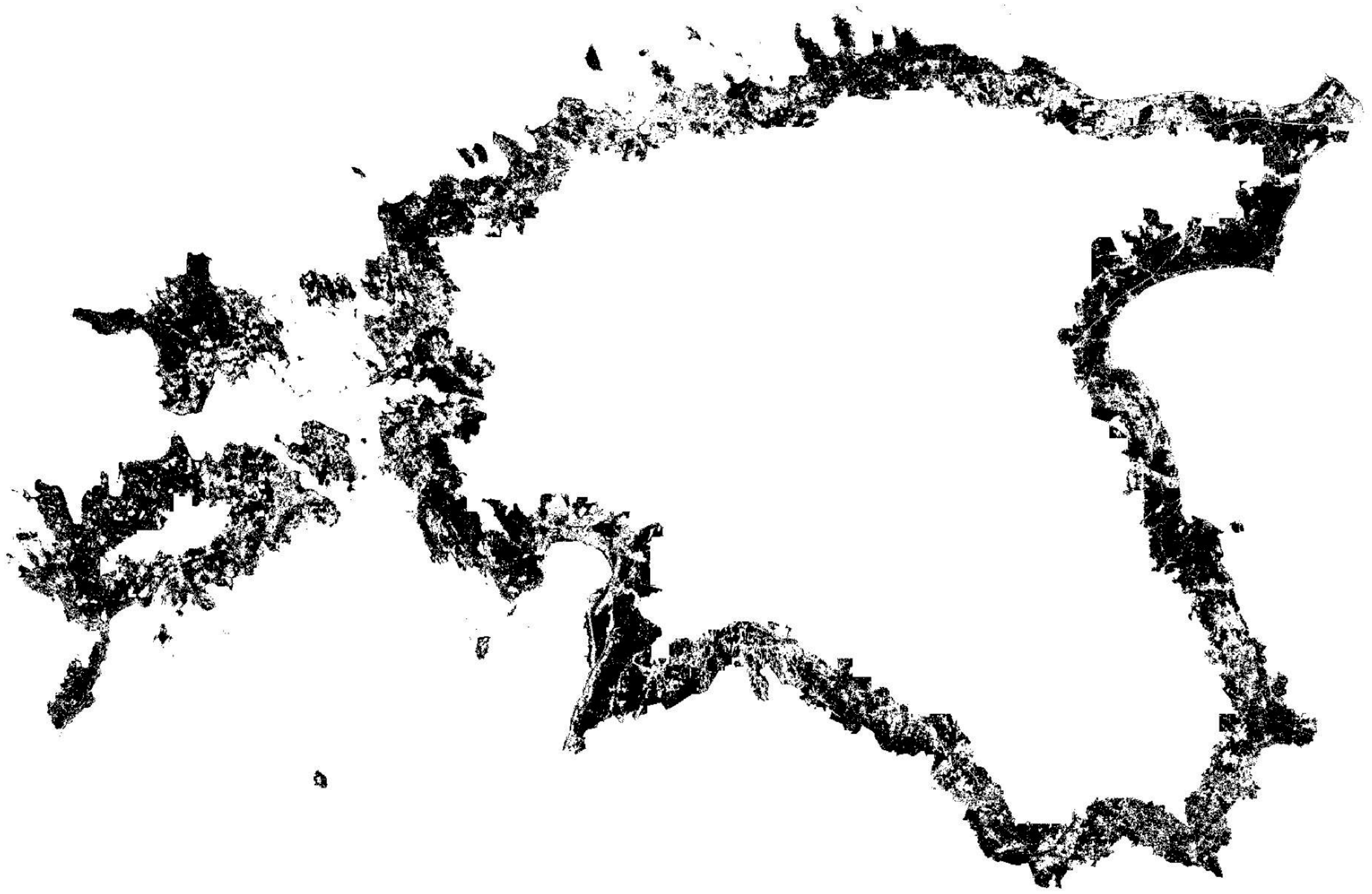




The study reviews the potential of areas of BGI to mitigate climate change and produces maps showing fragmentation areas along the Estonian coast using UAVs and satellite imagery for a more detailed and objective evaluation of the indicators of the conservation state and potential improvement of future connectivity between BGI elements, ensuring coverage of appropriate protection status for coastal habitats.

Workflow

Stage1: Integration of spatial datasets



Buffer zone

Coastal area(s) (same as a coastal zone) is defined as a zone following the Baltic Sea coastline, extending 3 km landwards from the mainland coast to the adjacent marine offshore areas.

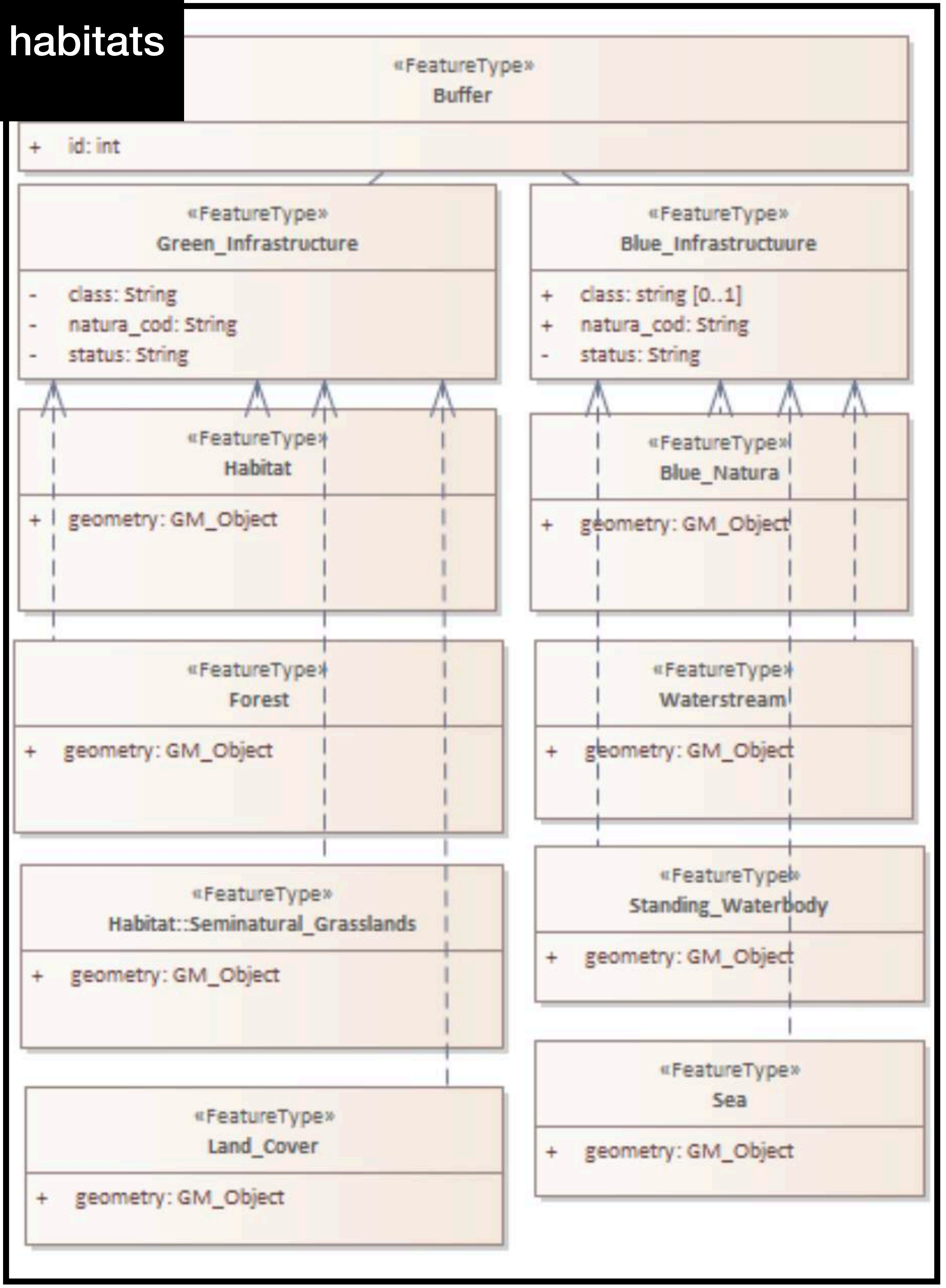
The offshore areas extend from the outer border of the coastal areas as far offshore as it in each case is relevant for the sustainability of marine and coastal biodiversity and geodiversity (diversity of the geomorphology and geology), in particular if these areas are used or intended to be used in a way that conflict or may conflict with the aims of Article 3 of the Helsinki Convention.

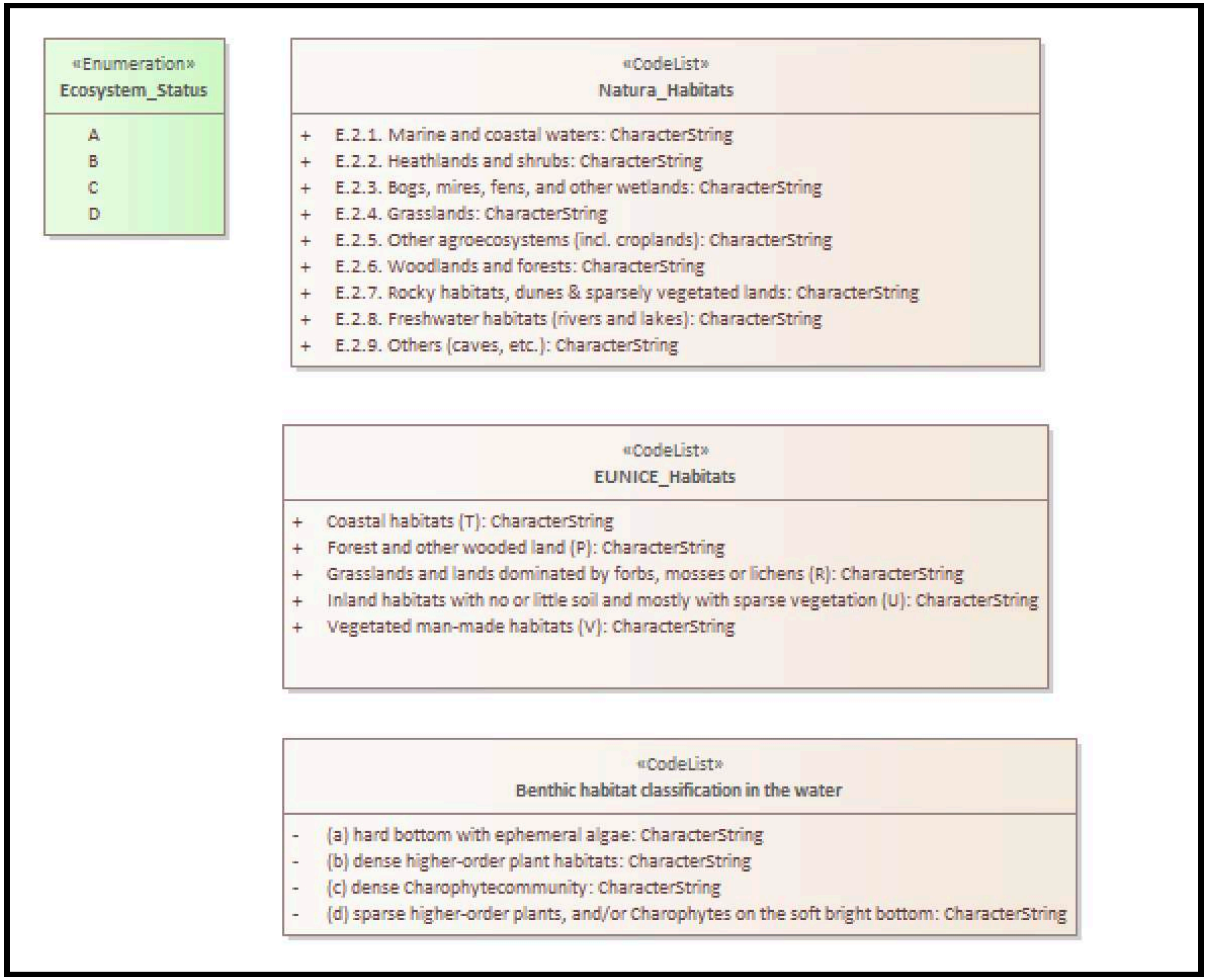
These zones cover Baltic Sea waters, the underlying seabed, and coastal terrestrial areas including the biota as well as abiotic resources.

(HELCOM Recommendation 15/1)

BGI Attributes

(1) Natura 2000
(2) Corine
(3) Benthic habitats
(4) PRIA





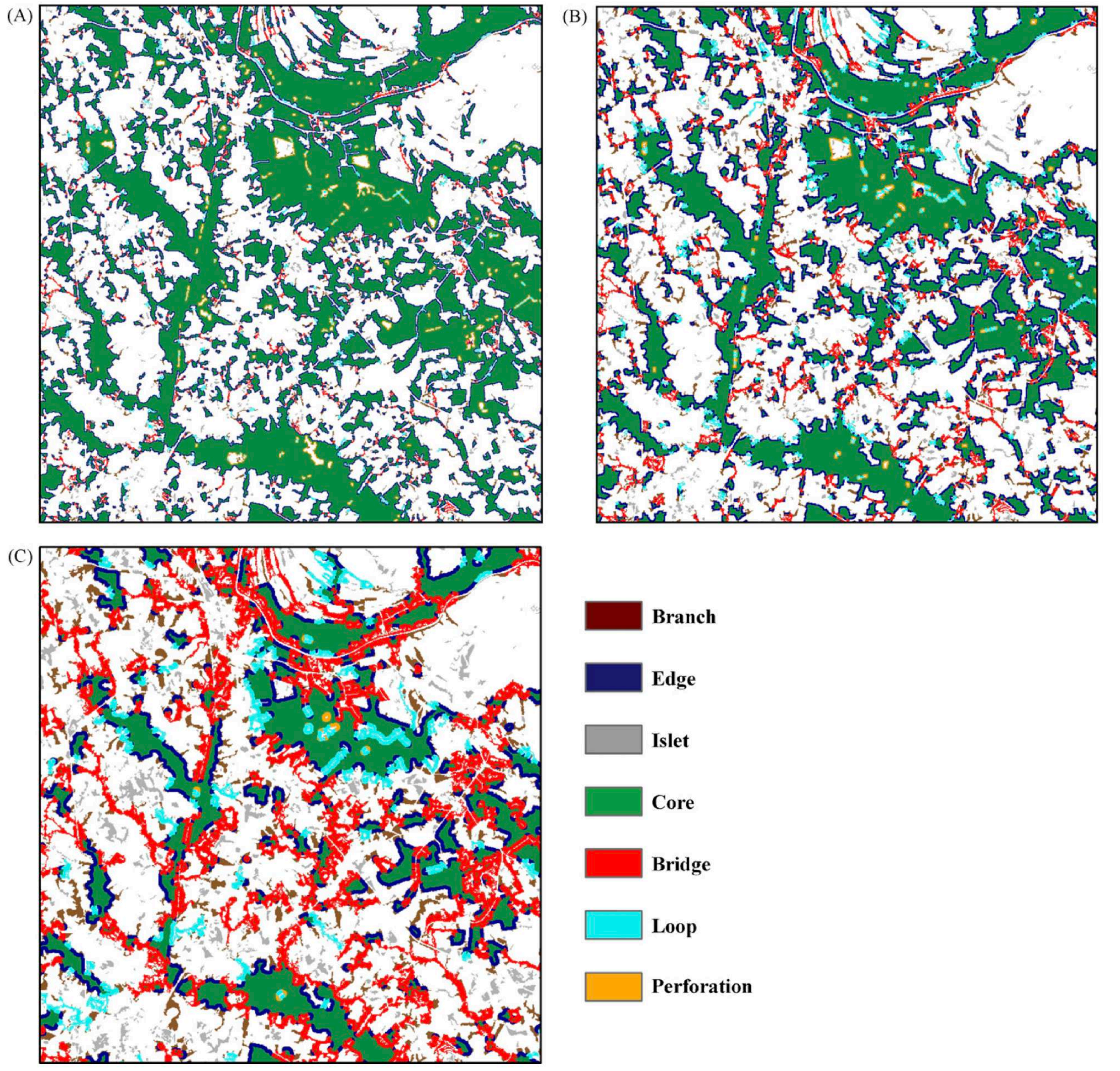


Fig. 1. Illustrations of MSPA for edge width equal to 30 m (A), 60 m (B), and 120 m (C).

forest.jrc.ec.europa.eu/en/activities/lpa/mspa/

Illustration of MSPA for edge width equal to 30m(A), 60m (B) 120m (C)

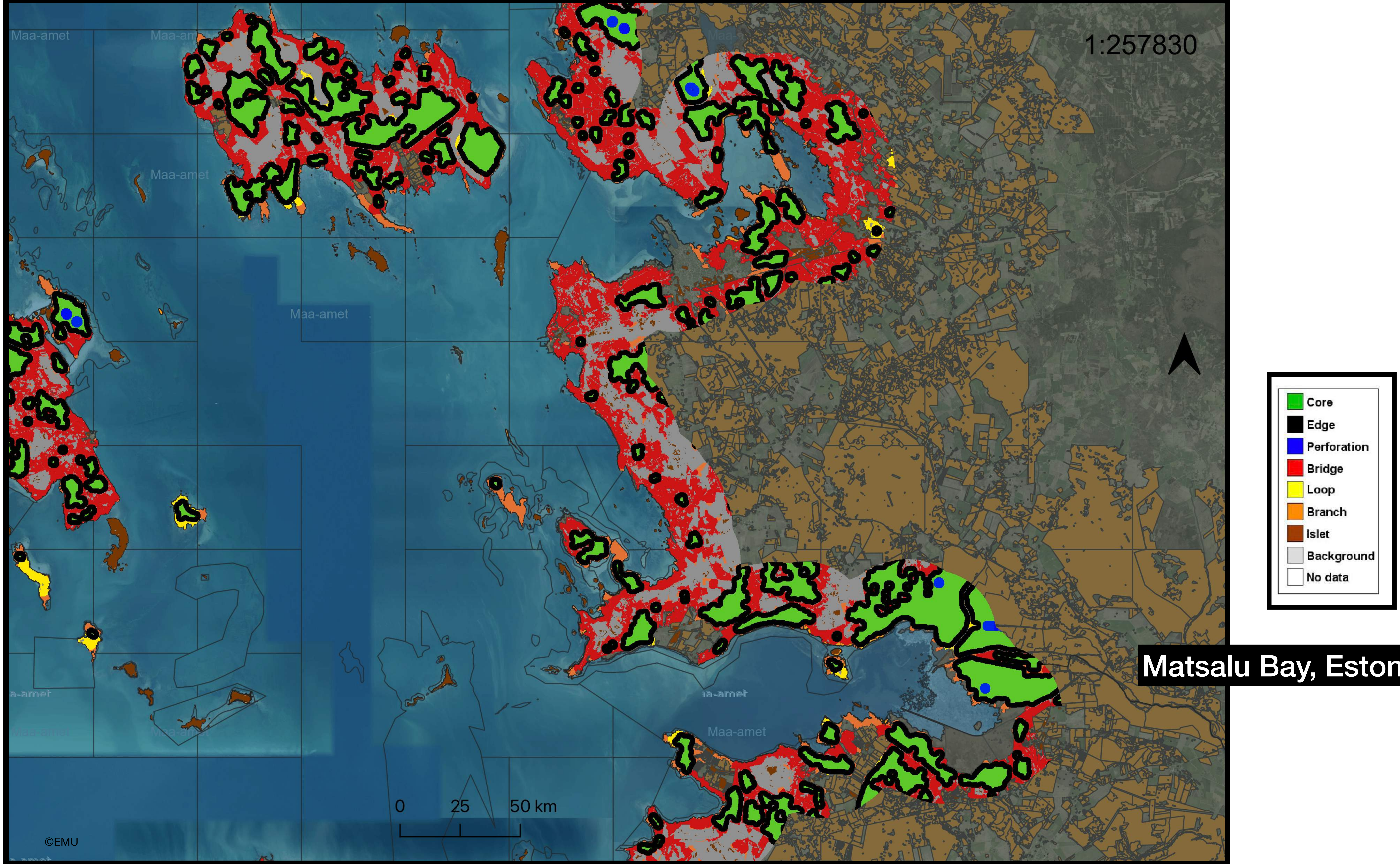
STAGE 2: CONSTRUCTION OF GREEN/BLUE INFRASTRUCTURE NETWORK USING MORPHOLOGICAL SPATIAL PATTERN ANALYSIS (MSPA) IN GUIDOS SOFTWARE

The European Environment Agency (EEA) recommends the use of the free software GUIDOS to assess the coherence and fragmentation of natural areas including the coherence of green infrastructure (analysis of number/size/quality of cores and corridors).

The methodology of Morphological Spatial Pattern Analysis (MSPA GuidosToolbox) was developed by the Joint Research Center and recognized in 2017 by the EEA.
(Vogt, 2016)

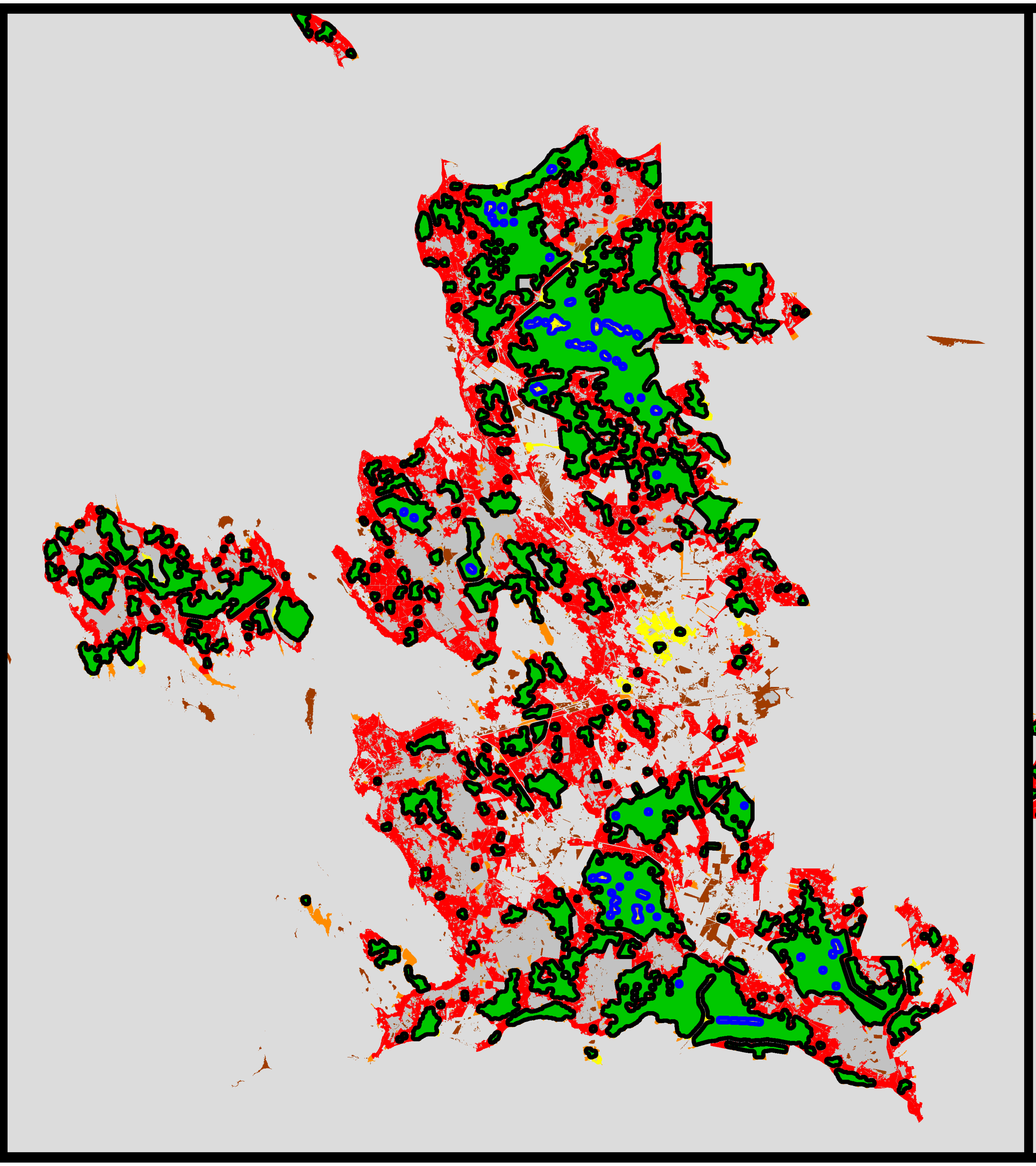
>> 20 × 20 meter raster of so-called built-up areas

>> Different sources refer to the need for corridors of different widths. In order to ensure coherence, 240 meters edge width which gives us 480meters min core width.

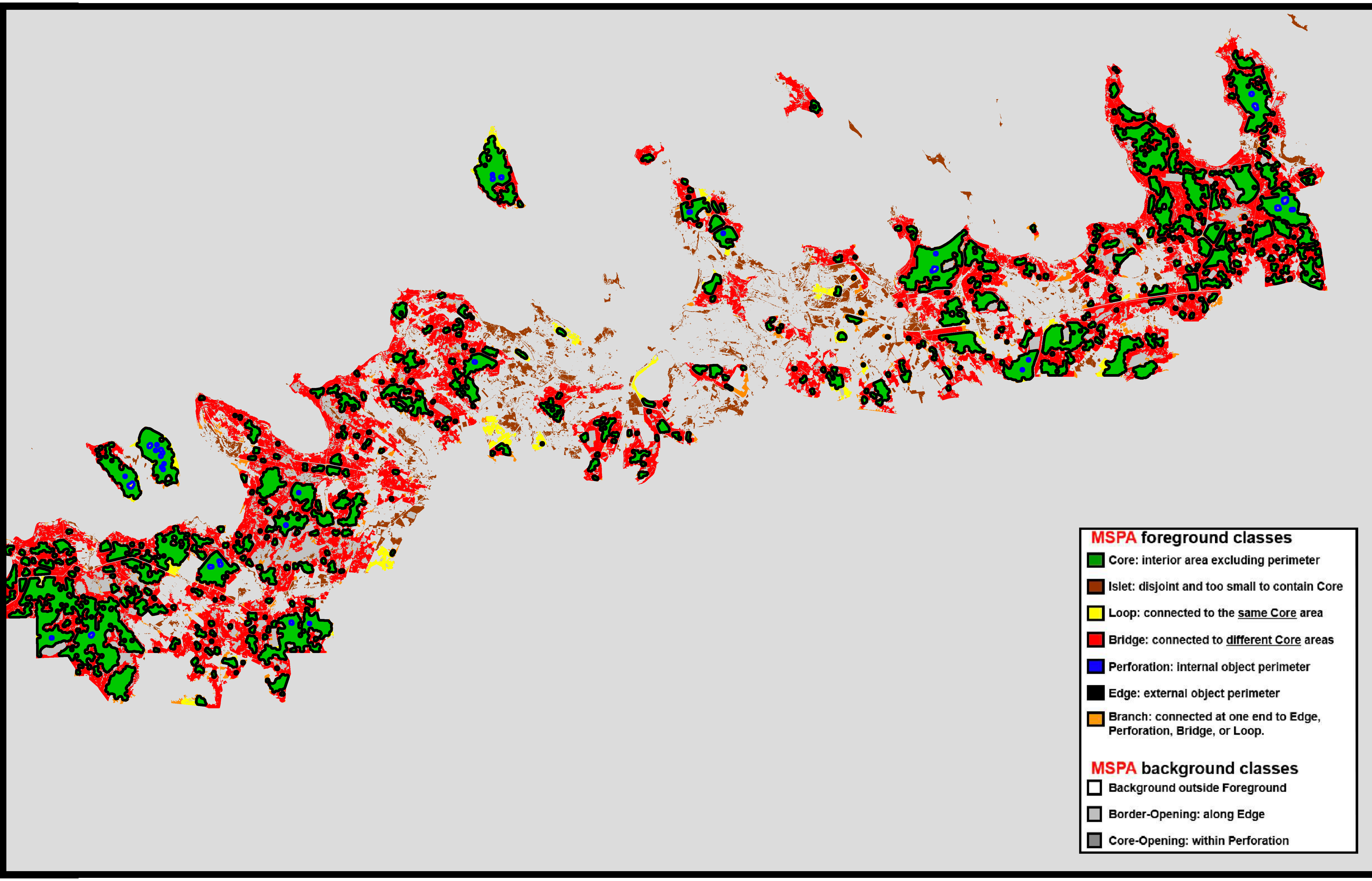


Matsalu Bay, Estonia

Lääne maakond, Estonia



Harju maakond, Estonia



STAGE 3: ANALYSIS OF PRESSURES AND IMPACTS

Using existing datasets, mostly derived from remote sensing data, to analyze the most important impacts on the ecosystems that integrate the coastal green network.

>> Conversion to artificial surfaces and soil sealing: imperviousness dataset from the Copernicus portal (time series since 2006).

>> Land abandonment: high impact in semi-natural meadows (PRIA dataset and remote sensing).

>> Clearcuts: most important impact in forests (data from remote sensing sources).

>> Fragmentation by roads: paved roads or any road on the mire ecosystem.

>> Agricultural intensification: Nitrogen Vulnerability Zones.

STAGE 4: Summary. Basic spatial statistics

>>Average core size, landscape metrics R.

>>The total area of Green Network elements.

>>The total area of islets and cores.

>>Statistics of impacts and cumulative impacts.


Blue-Green infrastructure core zones of Lääne and Harju regions
1 : 180 000
Tallinn area
Harju maakond
Lääne maakond
0
10
20 km

Landscape Metrics

measurable units of landscape composition and act as a surrogate for change, thus allowing for the description and quantification of spatial patterns and ecological processes over time and space (Turner et al., 2001).

Landscape metrics	Lääne maakond	Harju maakond	Tallinn vald
Largest patch index (LPI), area of cores LPI equals the area (m2) of the largest patches of the corresponding patch type divided by the total landscape area (m2), multiplied by 100 (to convert to a percentage); i.e., LPI equals the percentage of the landscape comprised by the largest patch	16.3 %	9.76 %	18.7 %
Mean area (area_mn), the average area of patches, The metric summarises each class as the mean of all patch areas belonging to class i.	188 ha	194 ha	111 ha
Patch density (PD), calculates the "patch density index", the number of patches per square kilometer	0.532	0.517	0.902
Landscape shape index (LSI), the complexity of the shape indicates the divergence of the shape of a landscape patch from the circle, which is considered ideal	14.2	15.7	6.64
The largest patch size (area$value)	3126.16 ha	2322.76 ha	497.76 ha

Nature-based Solutions are ways to actively protect, sustainably manage, and restore natural or modified ecosystems to address these societal challenges.

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