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European Environment Agency
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CARPATHIAN CONVENTION

Forest indicators to support regional policy and management in the Carpathian Mountains

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Background

The Carpathian Mountains are one of the most important forest ecosystems in Europe due to their **high concentration of virgin forests**;

The “**protocol for sustainable forest management**”, signed by the Carpathian Convention Parties is formalising the need to preserve the richness and ensure sustainable use of the Carpathian forests.

In this framework, EEA signed a partnership agreement with the Carpathian Convention Secretariat in July 2014 and included a work plan that is being implemented by one of its European Topic Centres (actually ETC/ULS) represented by the University of Malaga (UMA).

Work flow

In 2014:

The UMA produced a report assessing the multi-sourced Carpathian-wide input datasets available that could be used for this purpose;

In 2015:

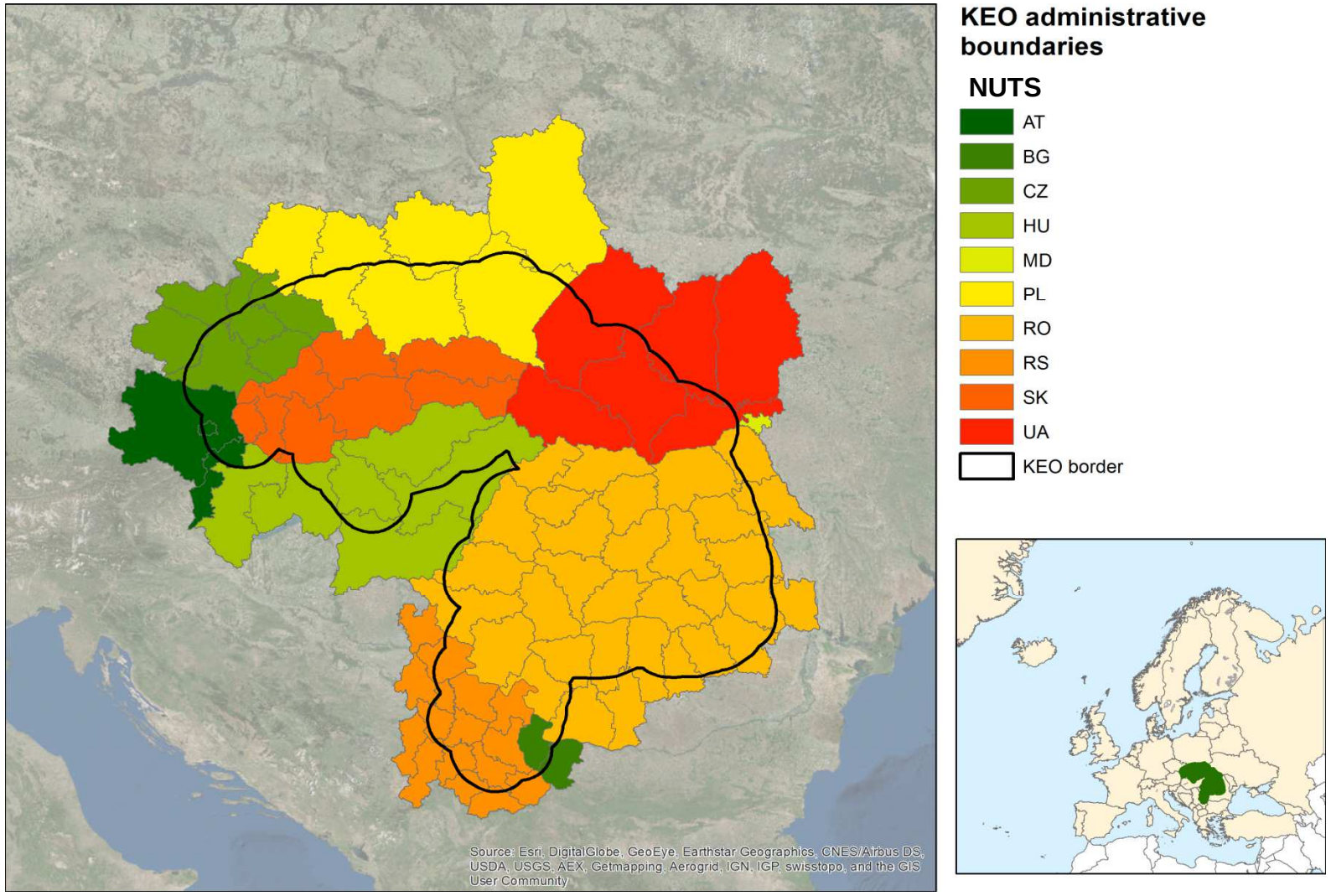
The Secretariat with the support of EEA and UMA produced a questionnaire and developed an assessment shared with the MSs to identify the local and national datasets available within the Carpathian countries;

In 2016:

The activities focused on the development of specific Carpathian wide forest resource indicators to support sustainable management:

- **Forest naturalness,**
- **Spatial data on virgin forests,**
- **Forest connectivity and fragmentation,**
- **Temporal change in forest cover in the region 2000-2012 (based on the temporal data flow of Corine Land Cover)**

Carpathian Environment Outlook



50 km buffer (black) around KEO limits of the Carpathian Mountains (EEA, 2007) and the NUTS regions included (ETC/ULS, 2016)

Limitations

- ✓ **Coarseness of global datasets;**
- ✓ **Lack of regional harmonised datasets** (i.e. different resolutions; different time coverage);
- ✓ **Gaps in the available European datasets;**
- ✓ **Very limited accessibility to national and regional data;**
- ✓ **Heterogeneity of local data;**

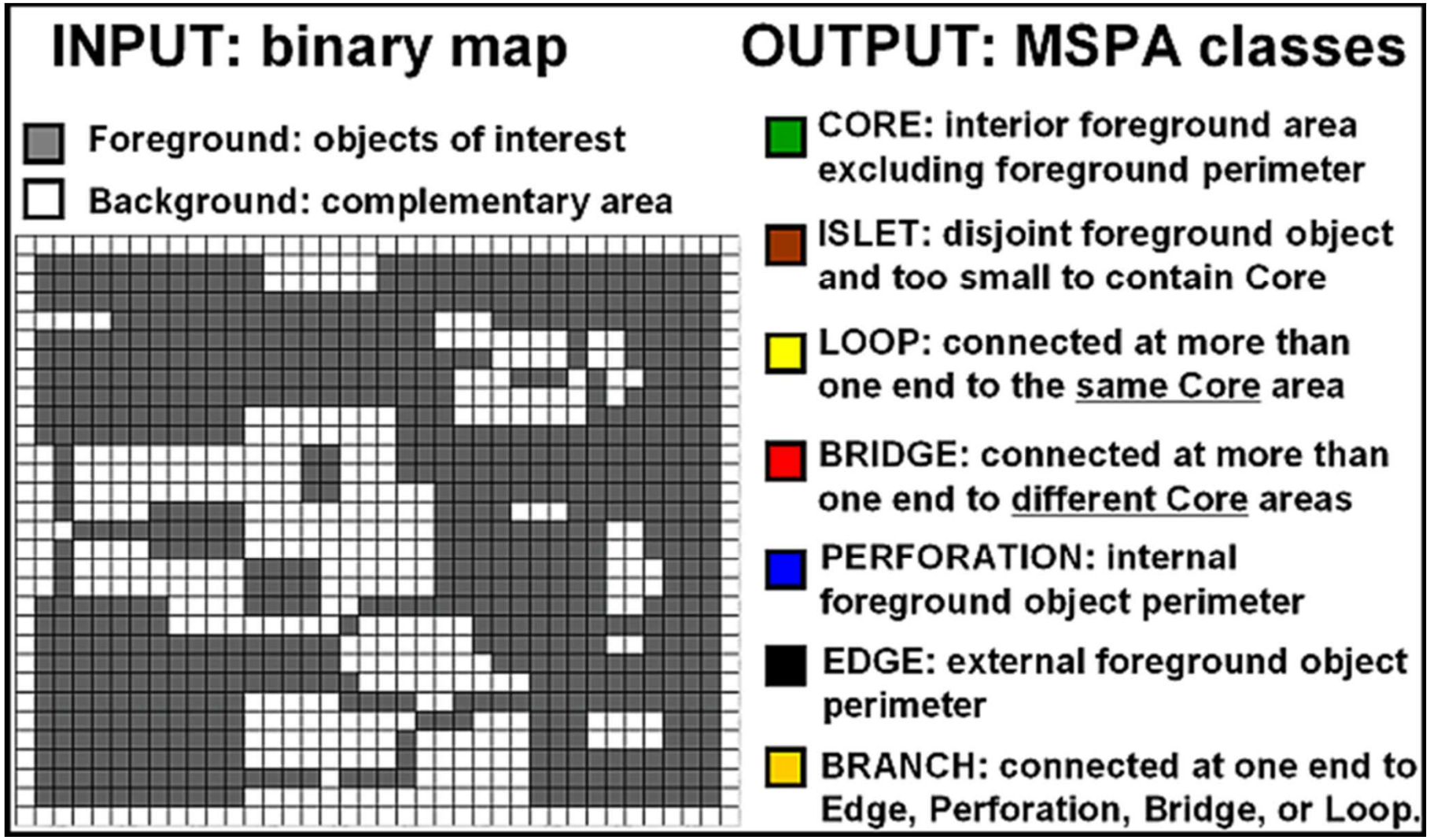
CLC 2012 layer in KEO Carpathian Area showing the gap of data in the case of Ukraine

Towards harmonised indicators

Regional		Year	Resolution ~
MANTRA project (Romania)		2005	N/A
Primeval Forest Hungary		2009	N/A
Forest statistics (country level)		2014	N/A
Provider	**European**	***Year***	***Resolution ~***
Copernicus	***High Resolution Level Forest***	2011/2013	25m
EEA	***Corine Land Cover***	2006/2012	100m
EEA	***Protected Areas***	2012	N/A
EEA	***High Natural Forest***	2006	100m
EFI	***Dominant species***	2011	1km
ESA	***Global corine***	2009	500m
Provider	**Global**	***Year***	***Resolution ~***
UNEP	***Protected areas***	2015	N/A
JAXA	***Palsar***	2014	25m
Un.Maryland	***Global forest***	2014	25m
USGS	***Landsat***	2014/2015	30m
ESA	***Sentinel 2***	2015	10/20m

Morphological structure of Carpathians forest

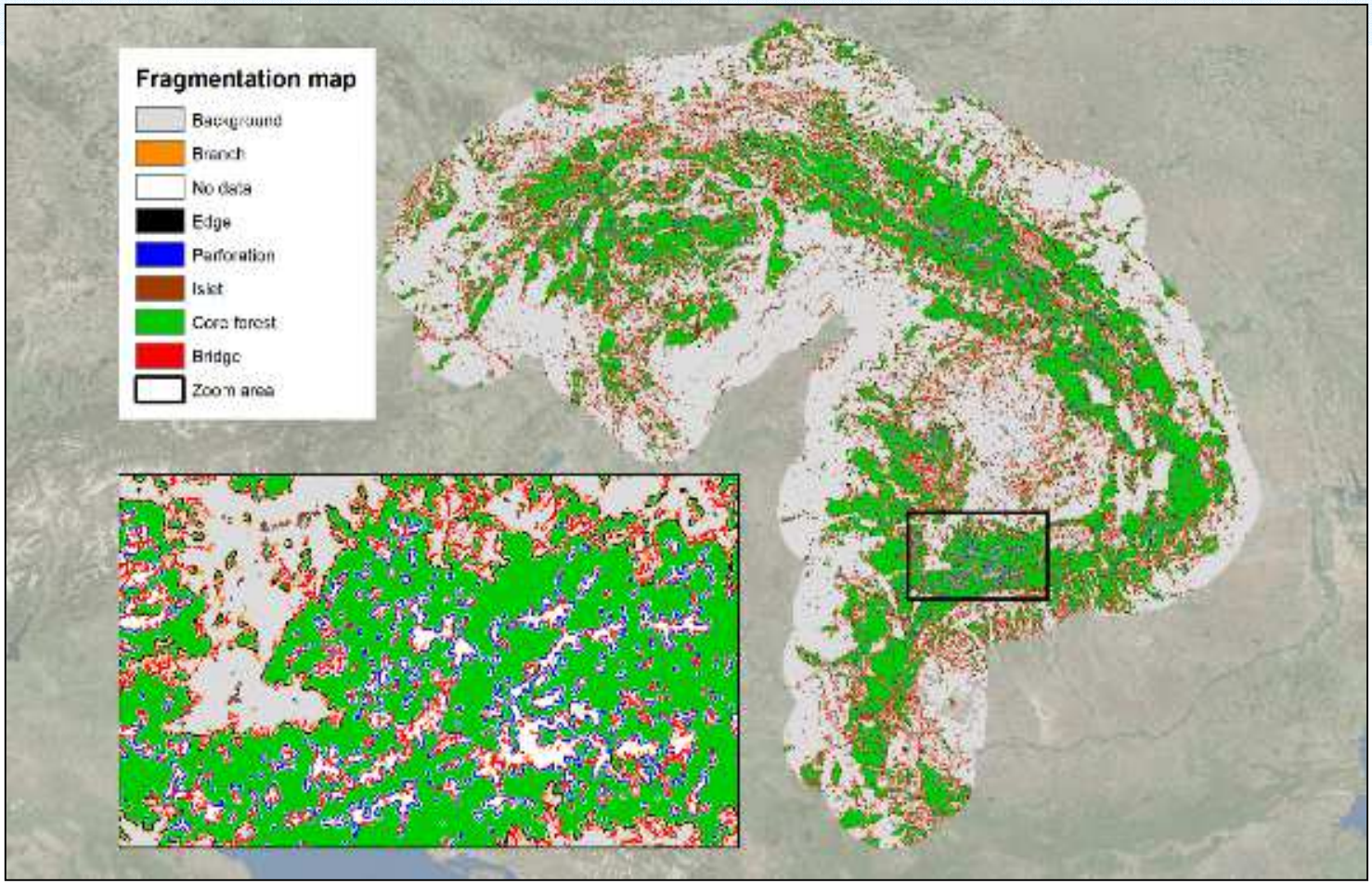
The indicator on the morphological structure of forests detects the geometry, patterns, fragmentation, and connectivity of forest ecosystems (Estreguil et al., 2012).



Patterns, fragmentation, &Connectivity

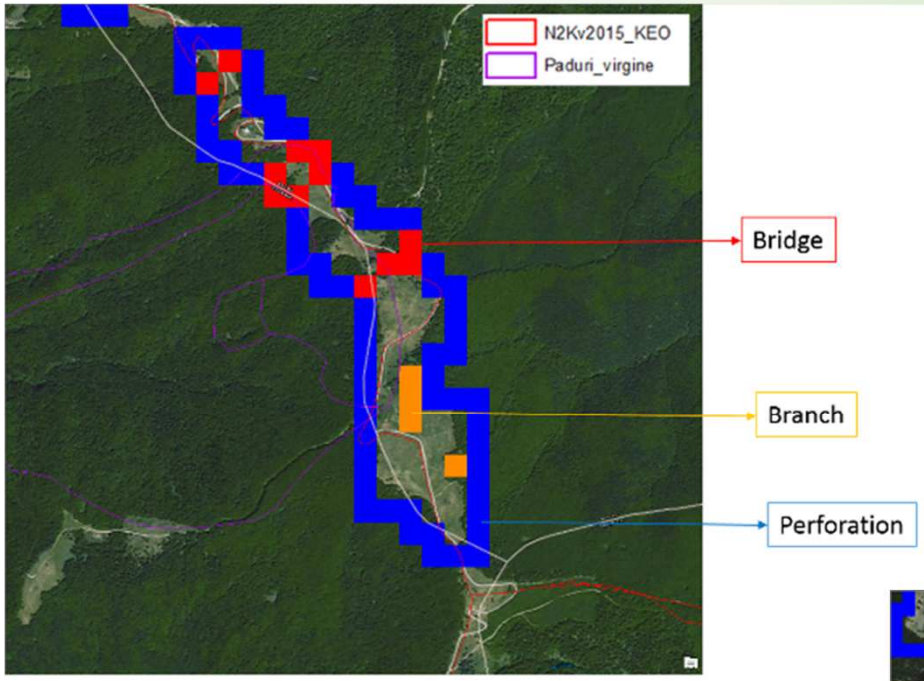
The indicator on the morphological structure of forests detects the geometry and the connectivity of forest ecosystems (Estreguil et al., 2012).

The core forests are estimated to cover a high share (79%) of the total forest of Carpathian Mountains.



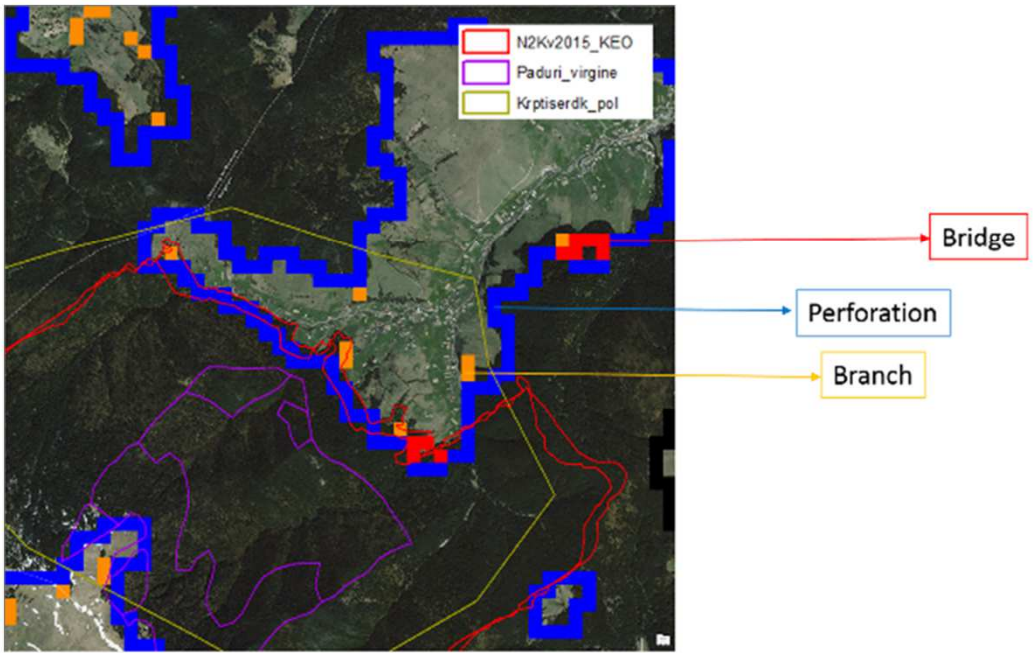
Patterns, fragmentation, &Connectivity

Examples of forest perforation

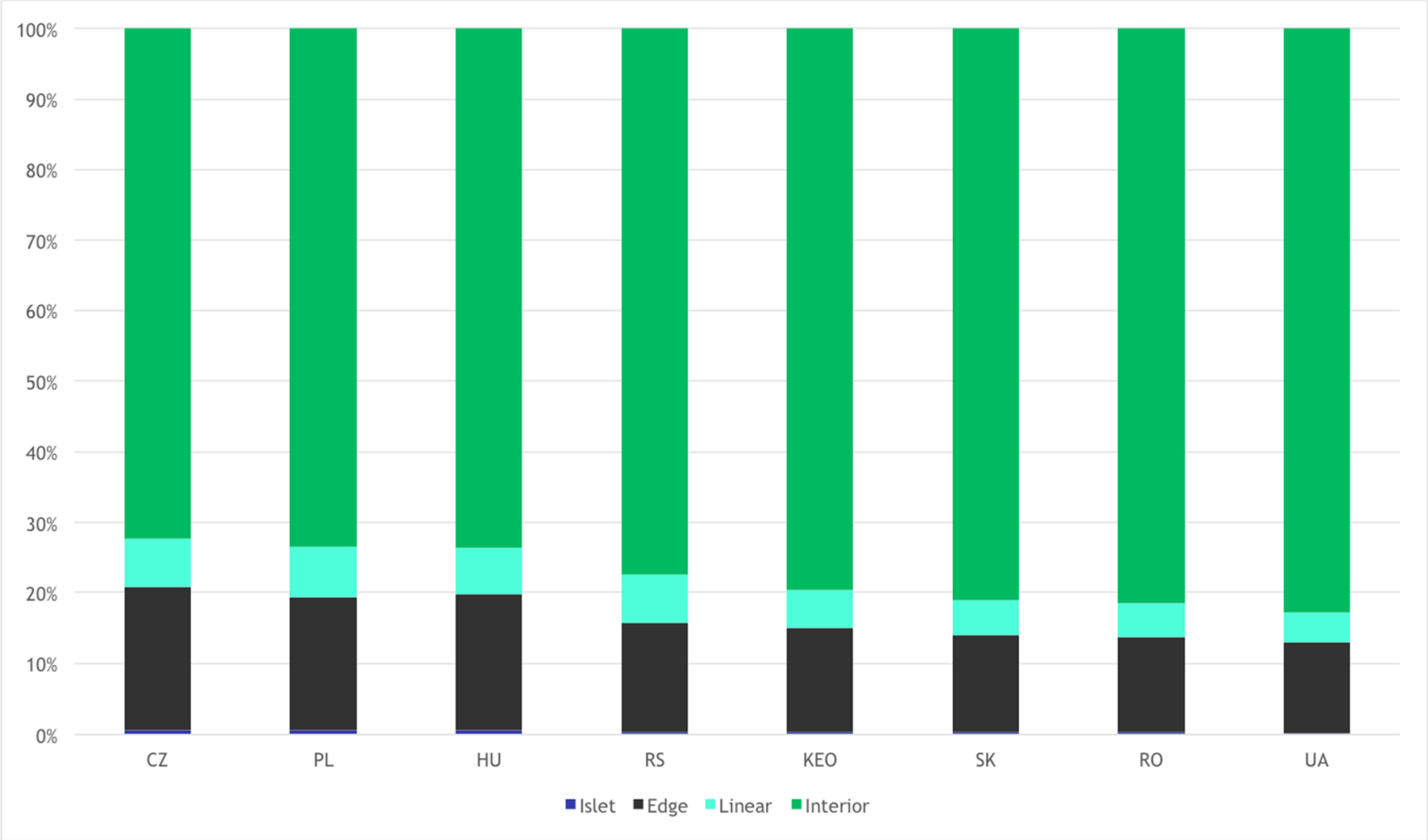


East side of Oituz – Ojdulaarea area (RO)

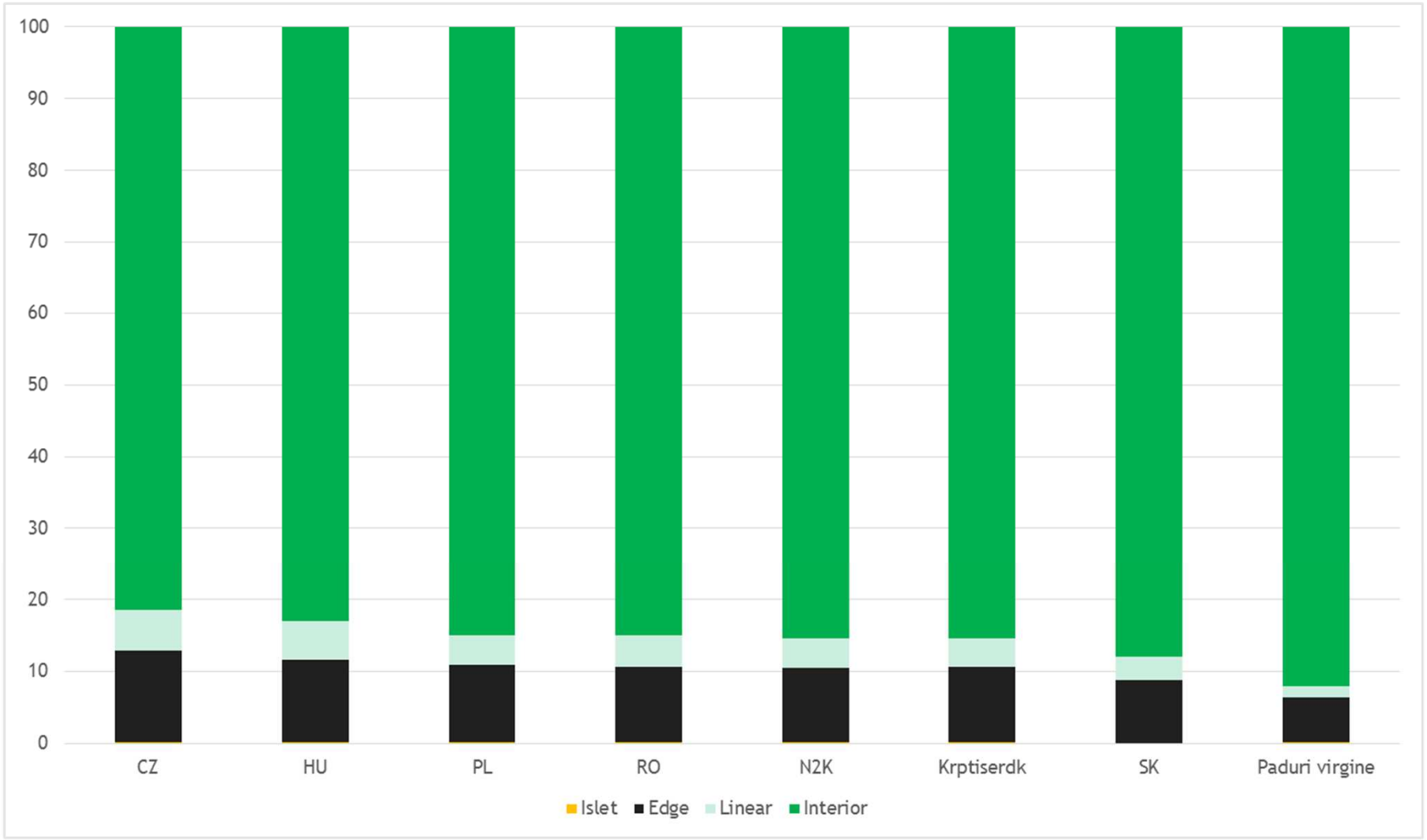
Example of perforation forest (Stulpicani, RO)



Connectivity per MS



Connectivity in N2k



Naturalness of Carpathian forests

$$N_i = DA/TF$$

DA: % dominant assemblages of species per biogeographical region (Barbati et al. 2011)

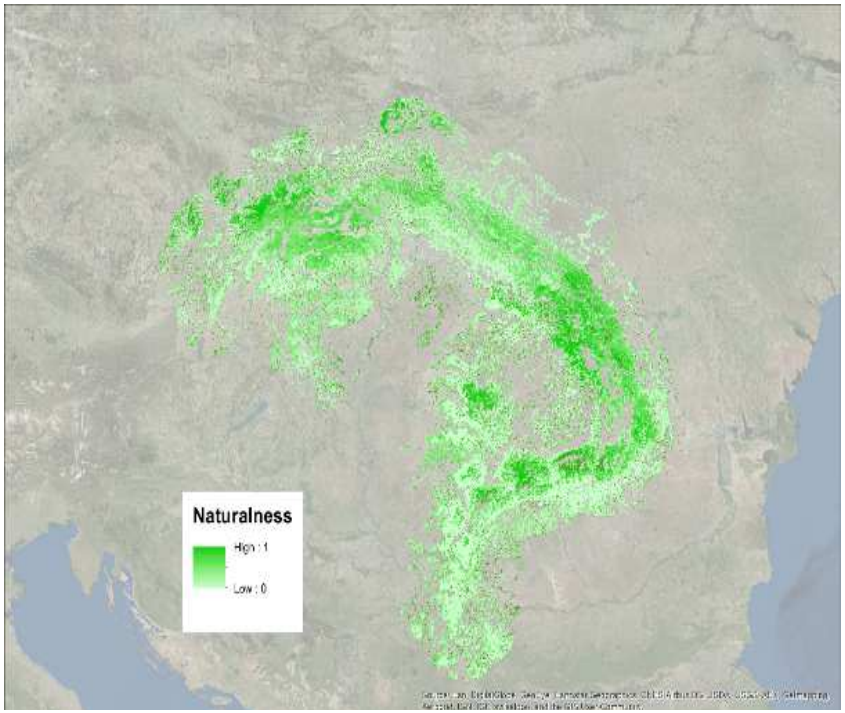
TF: % of total forest cover (PALSAR, 2015)

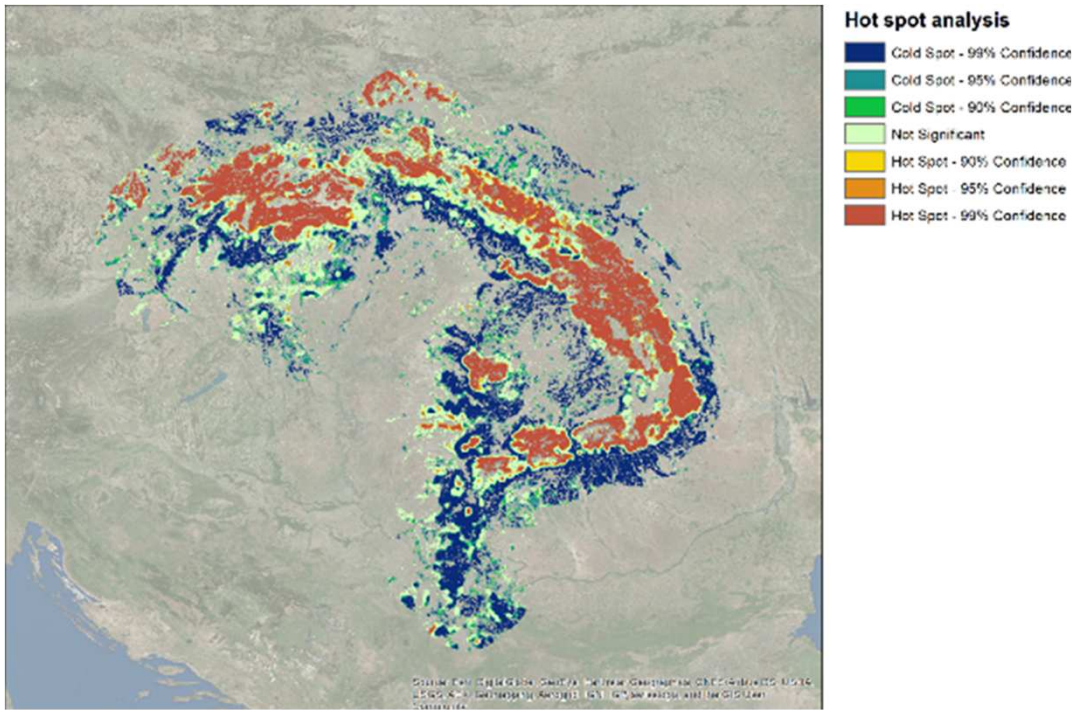
New European Forest Types (Barbati et al. 2011)	Main characteristics	Assemblage of tree species (Brus et al. 2011)
1. Hemiboreal and nemoral coniferous and mixed broadleaved-coniferous forest	Latitudinal mixed forests located in between the boreal and nemoral (or temperate) forest zones with similar characteristics to EFT 1, but a slightly higher tree species diversity, including also temperate deciduous trees like Tilia cordata, Fraxinus excelsior, Ulmus glabra and Quercus robur. Includes also: pure and mixed forests in the nemoral forest zone dominated by coniferous species native within the borders of individual FOREST EUROPE member states like Pinus sylvestris, pines of the Pinus nigra group, Pinus pinaster, Picea abies, Abies alba	• Fraxinus spp • Quercus robur/petraea • Pinus sylvestris • Pinusspp • PiceaSpp • AbiesSpp
2. Alpine forest	High-altitude forest belts of central and southern European mountain ranges, covered by Picea abies, Abies alba, Pinus sylvestris, Pinus nigra, Larix decidua, Pinus cembra and Pinus mugo. Includes also the mountain forest dominated by birch of the boreal region	• PiceaSpp • Abies Spp • Pinusspp • LarixSpp
3. Acidophilous oak and oak-birch forest	Scattered occurrence associated with less fertile soils of the nemoral forest zone; the tree species composition is poor and dominated by acidophilous oaks (Q. robur, Q. petraea) and birch (Betula pendula)	• Quercus robur/petraea • Betula spp
4. Mesophytic deciduous forest	Related to medium rich soils of the nemoral forest zone; forest composition is mixed and made up of a relatively large number of broadleaved deciduous trees: Carpinus betulus, Quercus petraea, Quercus robur, Fraxinus, Acer and Tilia cordata	• Quercus robur/petraea • Fraxinus spp • CarpinusSpp
5. Beech forest	Widely distributed lowland to submountainous beech forest. Beech, Fagus sylvatica and F. orientalis (Balkan) dominate, locally important is Betula pendula	• Fagus Spp • BetulaSpp
6. Mountainous beech forest	Mixed broadleaved deciduous and coniferous vegetation belt in the main European mountain ranges. Species composition differs from EFT 6, including Picea abies, Abies alba, Betula pendula and mesophytic deciduous tree species. Includes also mountain fir dominated stands	• Fagus Spp • PiceaSpp • AbiesSpp

Naturalness of Carpathian forests

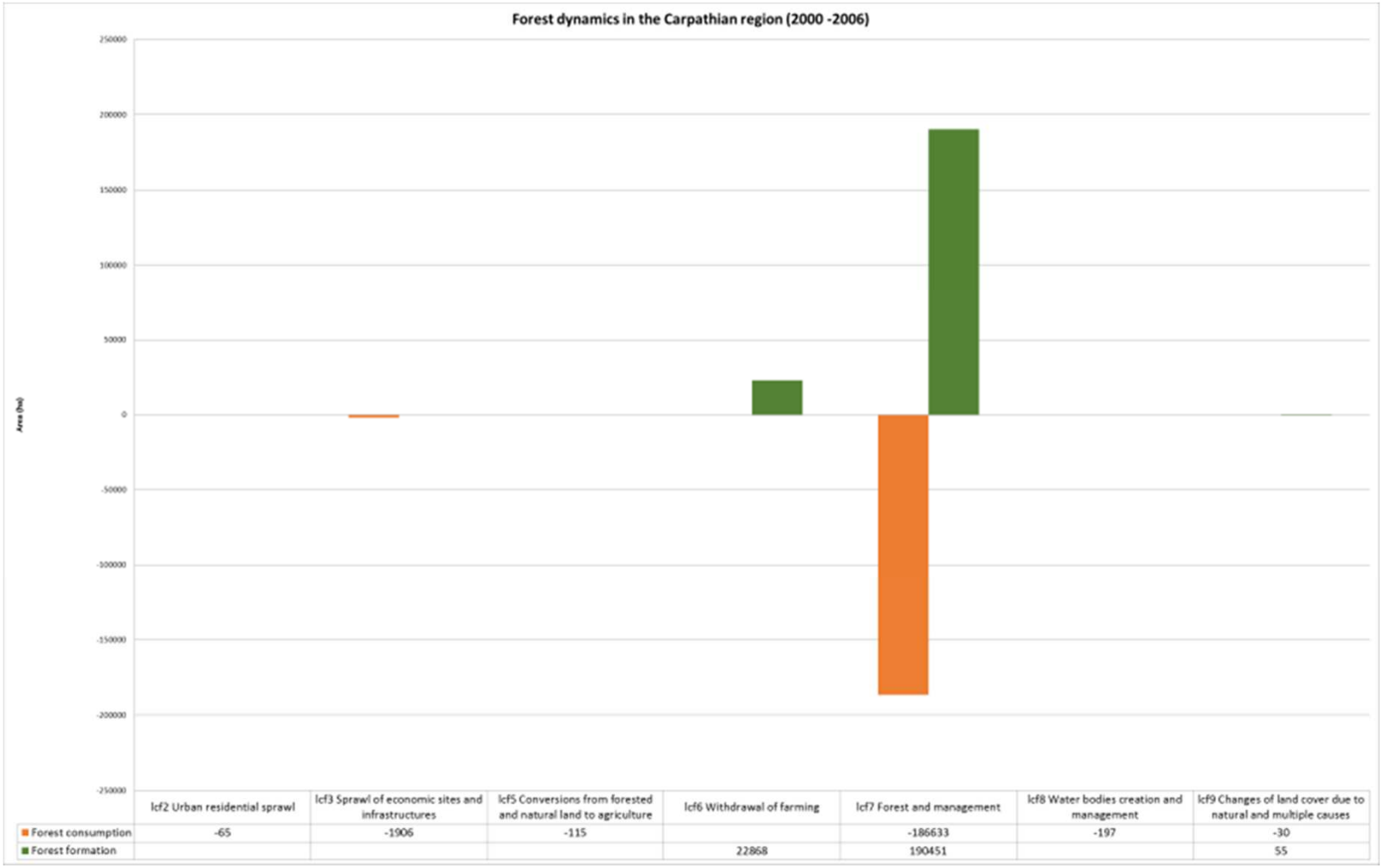
The **Naturalness Index** (N_i) identifies the relation between the **percentage of natural forest species presence and the percentage of forest coverage**

- ✓ Naturalness is distributed throughout the Carpathian Moutains;
- ✓ In virgin forests (local analysis) a very high percentage of Hotspot clusters were registered (Paduri virgine & Krptiserdk)





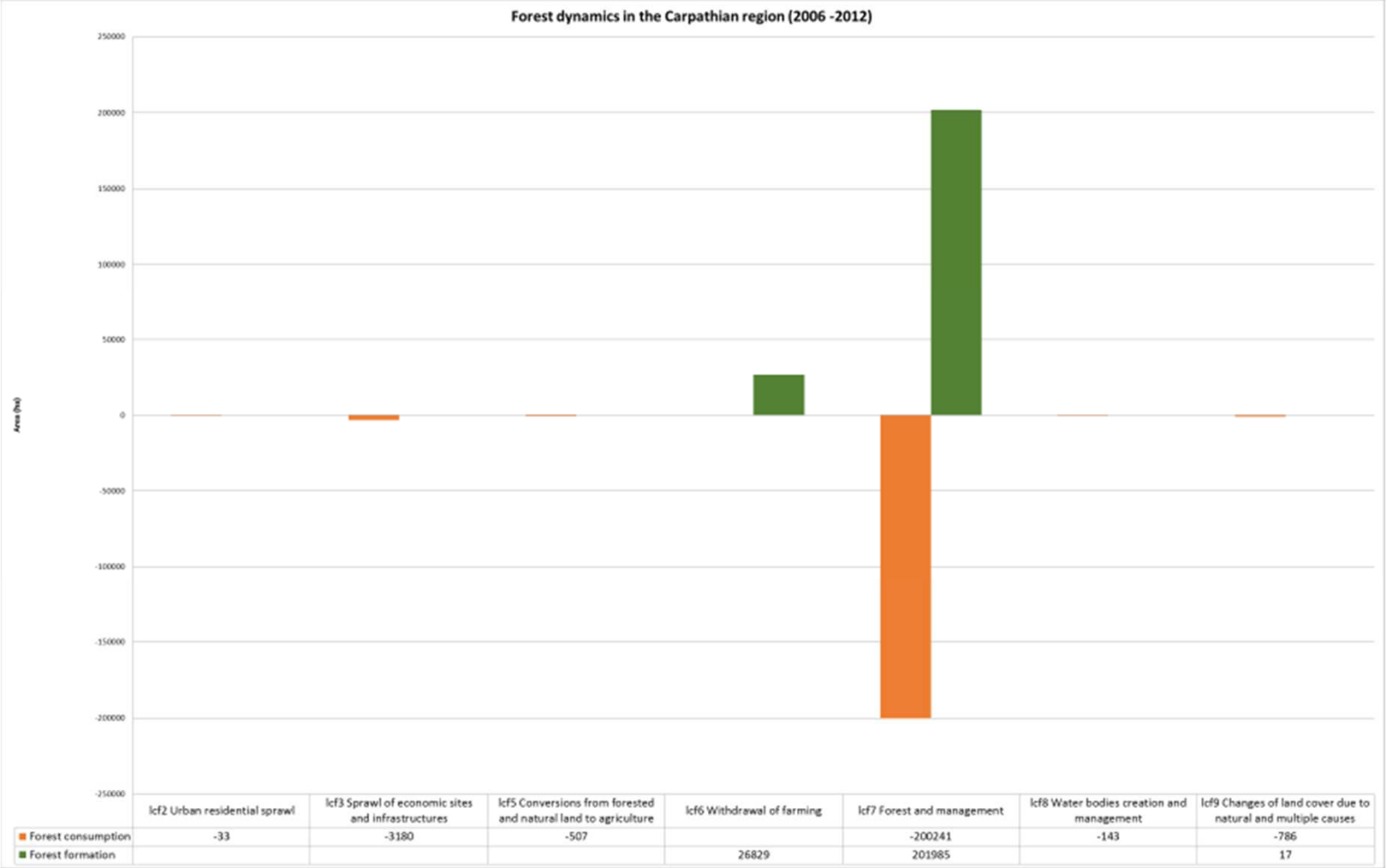
Forest changing trends (2000-2006)



	lcf2 Urban residential sprawl	lcf3 Sprawl of economic sites and infrastructures	lcf5 Conversions from forested and natural land to agriculture	lcf6 Withdrawal of farming	lcf7 Forest and management	lcf8 Water bodies creation and management	lcf9 Changes of land cover due to natural and multiple causes
Forest consumption	-65	-1906	-115		-186633	-197	-30
Forest formation				22868	190451		55

2000-2006: Forest loss mainly due to felling and transition

Forest changing trends (2006-2012)



	lcf2 Urban residential sprawl	lcf3 Sprawl of economic sites and infrastructures	lcf5 Conversions from forested and natural land to agriculture	lcf6 Withdrawal of farming	lcf7 Forest and management	lcf8 Water bodies creation and management	lcf9 Changes of land cover due to natural and multiple causes
Forest consumption	-33	-3180	-507		-200241	-143	-786
Forest formation				26829	201985		17

2006-2012: forest management & felling major causes of loss

Outlook

- **Validation of indicators → Accessibility to local data**
- **Generation of forest habitat indicators (EUNIS classification);**
- **Assessment of pressures and impacts on Carpathian forests**
- **Assessment of ecosystem services within Carpathian forests to support restoration priorities, conservation efforts,…**

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Thank you for your attention

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