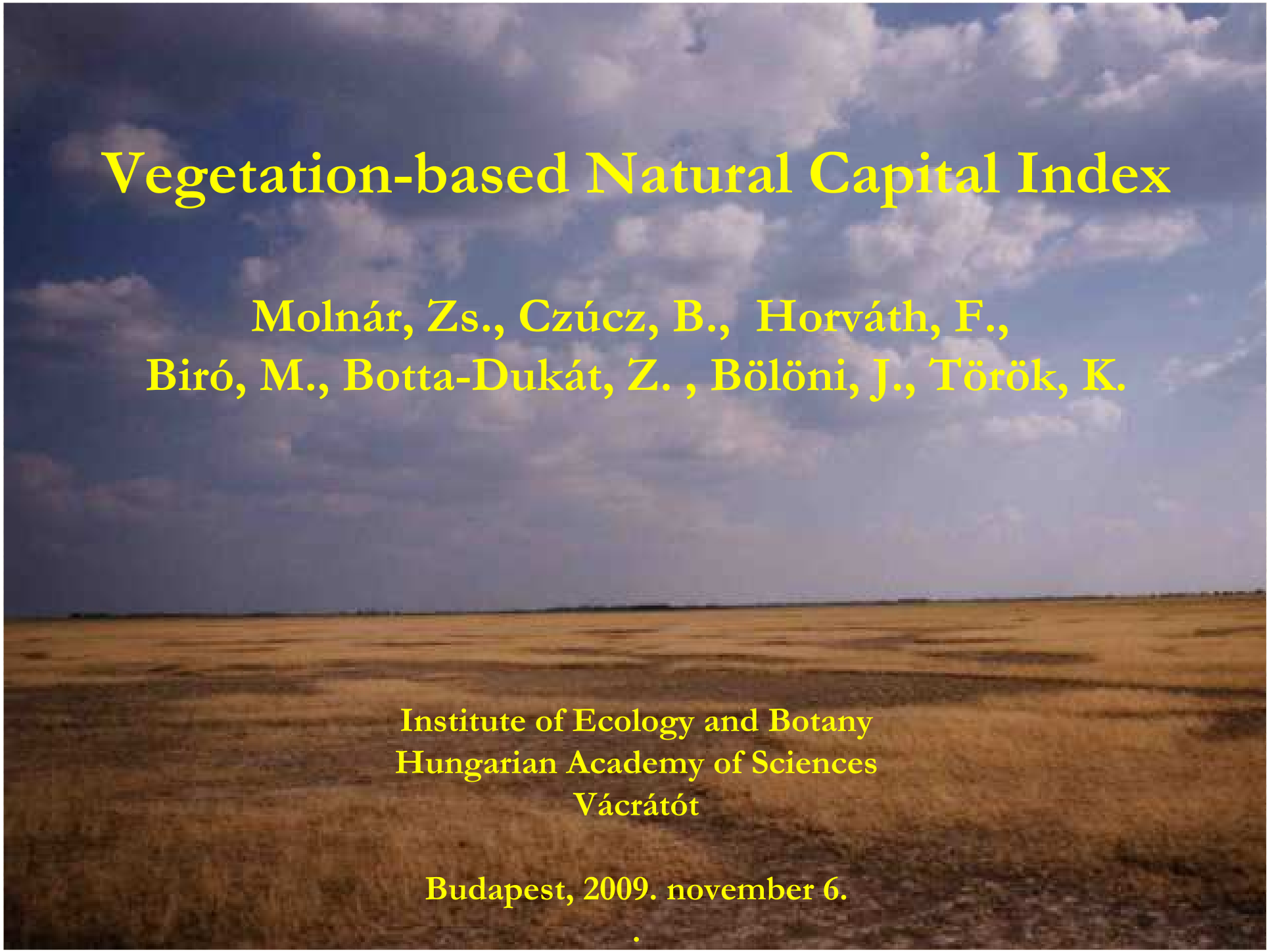


Vegetation-based Natural Capital Index

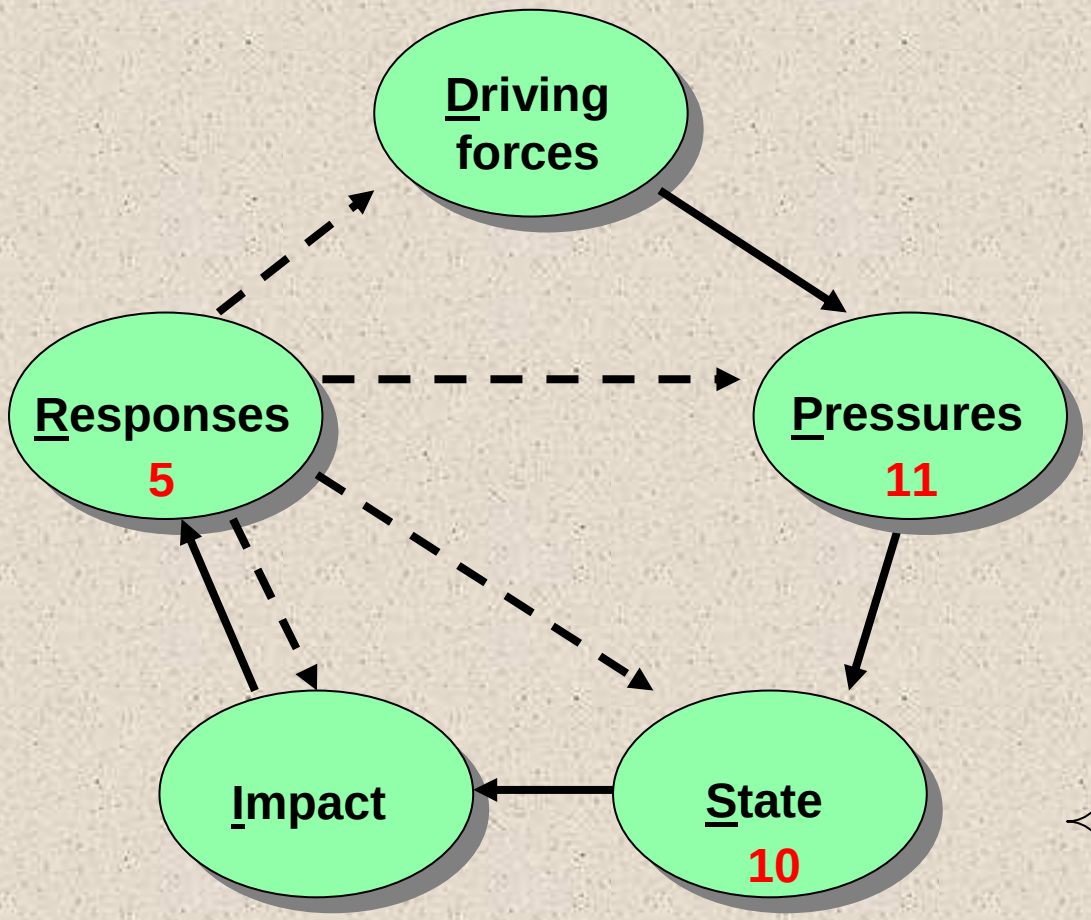
Molnár, Zs., Czúcz, B., Horváth, F.,
Biró, M., Botta-Dukát, Z. , Bölöni, J., Török, K.

Institute of Ecology and Botany
Hungarian Academy of Sciences
Vácrátót

Budapest, 2009. november 6.

.

The DPSIR model



- Mean Species Abundance (MSA)
- Red List Index (RLI)
- Ecosystem Coverage (EC)
- …

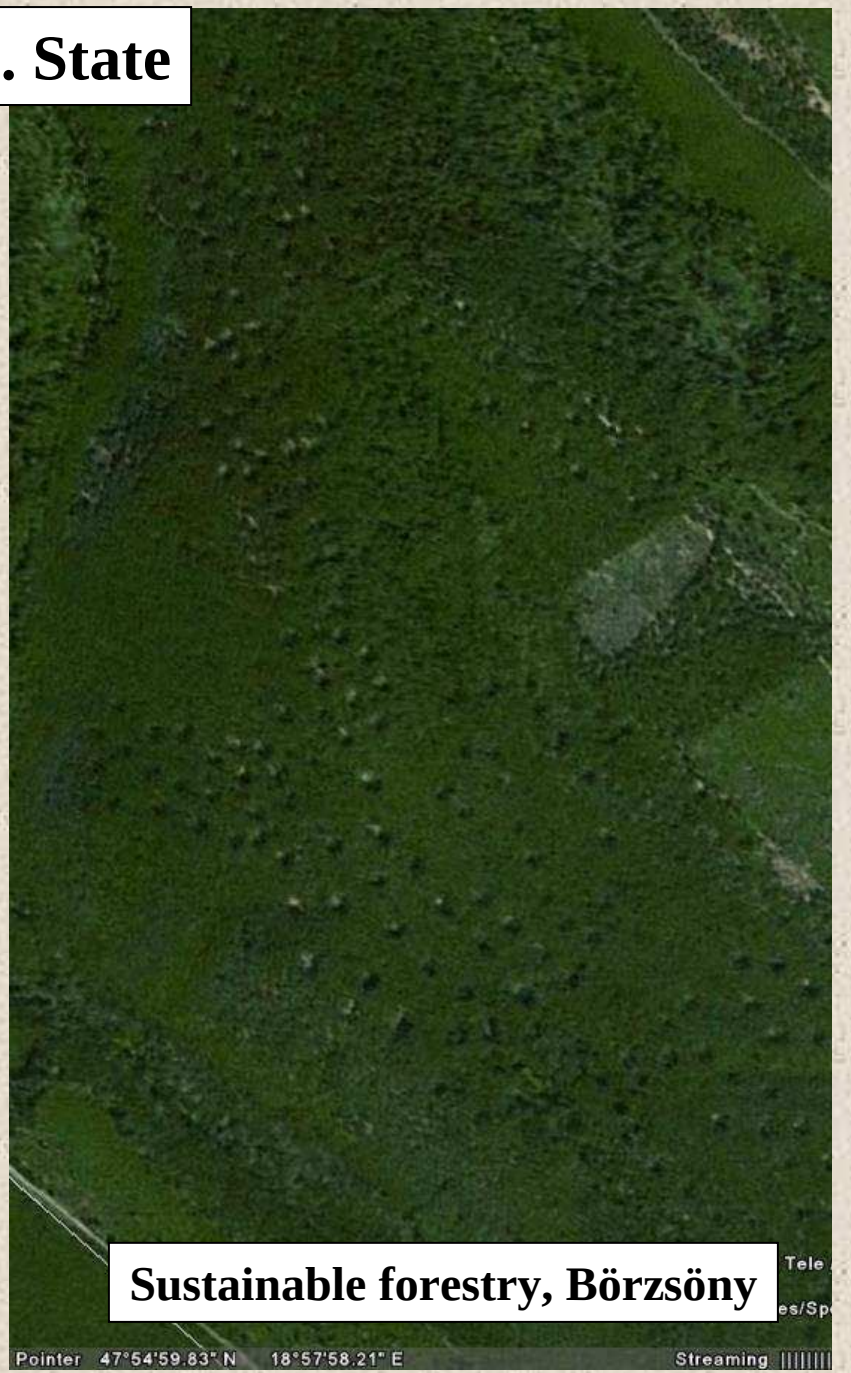
Why a new state indicator?

Most established indicators (MSA, RLI, EC)

- …only work at broad spatial scales
  → our aim: **local / regional policies**
- …are thematically rigid
  → our aim: a **flexible framework**

Pressure vs. State

Abandoned landscape
Fülöpháza, 5*5km

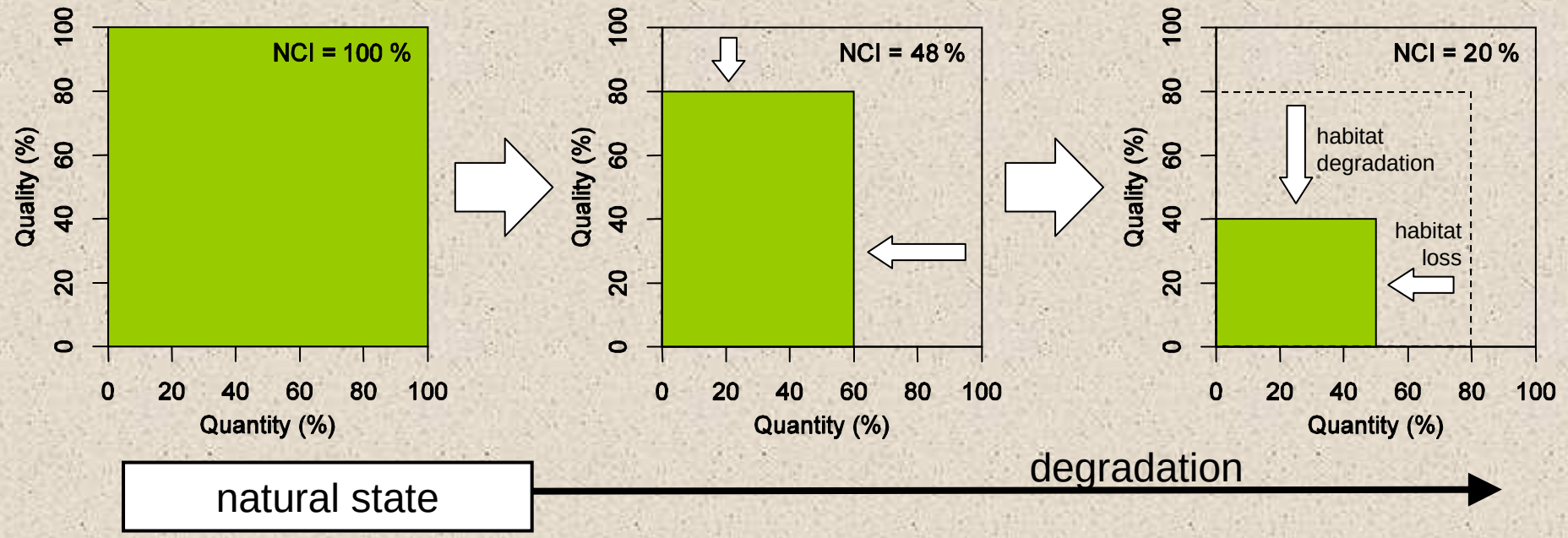


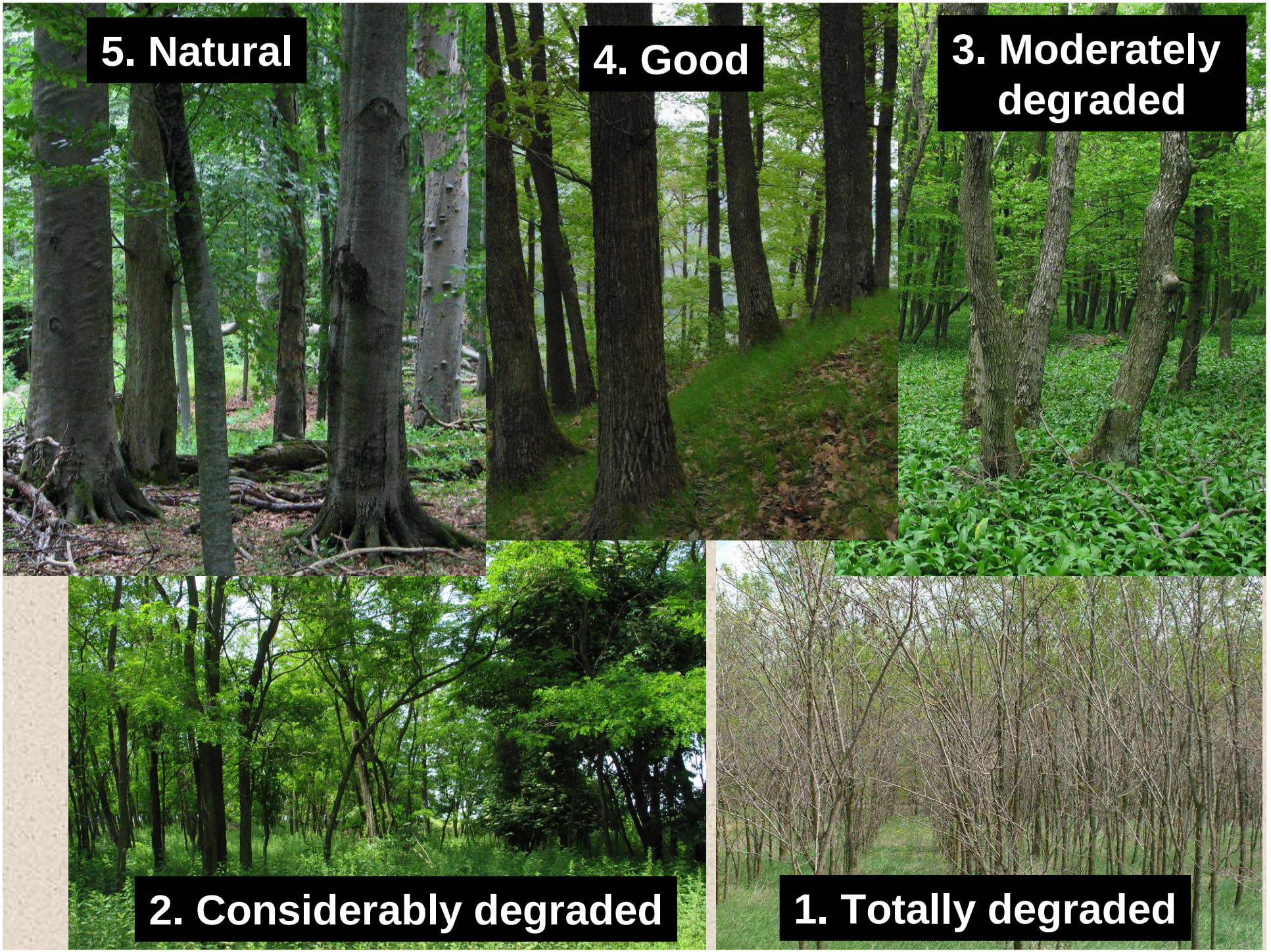
Sustainable forestry, Börzsöny

Vegetation-based Natural Capital Index (NCI)

- A policy relevant highly aggregated indicator of biodiversity (ten Brink 2000)

NCI = ecosystem quantity × ecosystem quality




5. Natural
4. Good
3. Moderately degraded
2. Considerably degraded
1. Totally degraded

Naturalness-based habitat quality (Németh & Seregélyes 1989)

5: Rich in species that are specialists; stands with good structure; with no or low cover of weeds and invasive species.

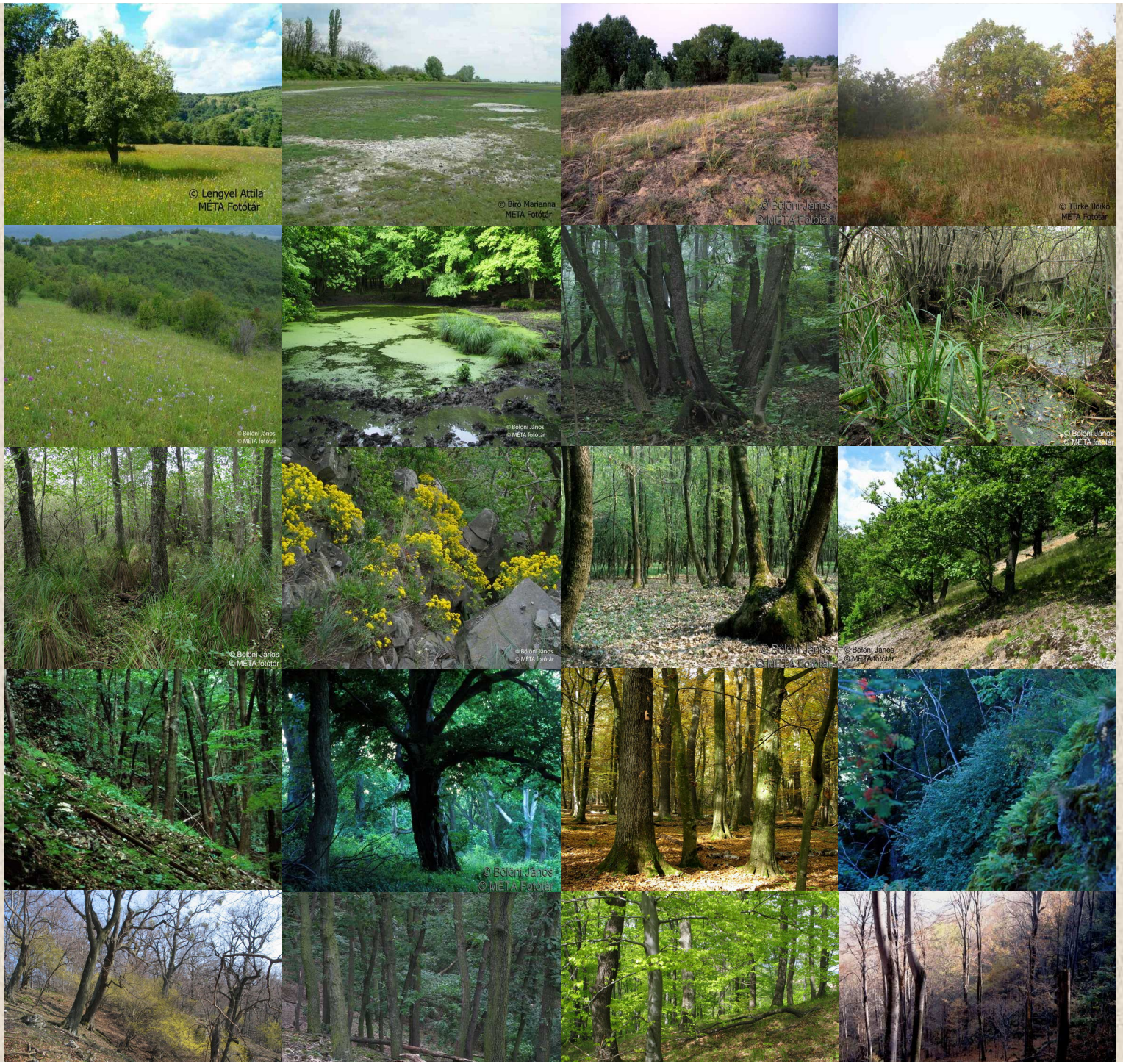
4: A state designated as "good", "close to natural", "well recovered" if:

1. patches with low number of species, perhaps with several weeds, but with admirable structure, 2. patches quite rich in species, but without a good structure, 3. ageing forest stands, but missing certain species or with poor structure, 4. one of the vegetation layers is of considerably higher quality, than the other one.

3: moderately degraded / in a mean regeneration state; dominated by natural species, but with few characteristic ones; in other cases with several characteristic species but with numerous disturbance tolerant ones, poor vegetation structure (homogeneous, with stands of equal age or with unnatural patchiness of vegetation) / in other cases with better structure but with uncharacteristic species composition.

2: considerably degraded / scarcely regenerated state, with uncharacteristic species composition, dominated by disturbance tolerant and invasive species, vegetation structure collapsed or undeveloped, vegetation often fragmented.

1: totally degraded / state, weeds and uncharacteristic, indifferent species, or artificial surfaces.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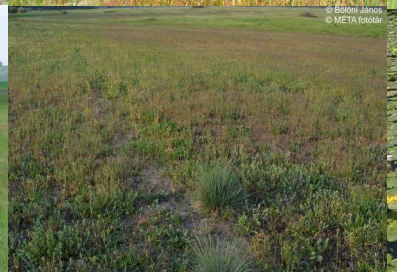
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Examples from the Habitat Guide (Artemisia salt steppes, code: F1a)

Species richness, number and dominance of halophytes are important features when evaluating the naturalness of Artemisia salt steppes. In stands closer to the natural state more steno- and astenohalophytic species occur (see Bodrogközy's columns in the Flora Database of Hungary). One reason for the degradation is leaching caused by draining of the habitat, which decreases the values of extreme environmental factors and thus enables glycophytes to colonize the area. For weeds this vegetation is hard to colonize, it easily regenerates and it has its own weedy species. According to our experiences, around the stands closer to the natural state the vegetation mosaic of the salt steppes on the landscape level is also more natural and more diverse. Permanent over-pasturing provokes species-loss and makes the habitat more weedy, but only around the folds and the wells has it serious effects. Existence of weeds is hard to recognize in spring, they are more visible from June.
Dominant species are resistent to degradation. The habitat is not threatened by invasive species or the invasion of shrubs. The number of annual halophytes depends not on the naturalness of the site but on the spring inland waters and the amount of litter from the previous year. Leaching is the only process that may cause the alteration of this vegetation type into an other one. Successionally stable. Patchiness and physiognomy seems to be of minor importance when evaluating naturalness. Landscape context has insignificant effect on the naturalness of the stands. Burning does not ruin it considerably, mechanical damage causes only temporary weed-colonization.

5: rich in halophytes, often diverse micro-topography; without species of the loess steppe, tall herb salt meadows or mesotrophic meadows; being as vast as possible (covering at least a hectare-wide area), and be a part of a complex zonal system or mosaic of vegetation (be loess steppes at higher and salt pioneer swards and salt meadows at lower regions), there is no sign of draining and leaching (e.g. only few glycophytes on the Artemisia steppes or no Artemisia on the pioneer salt habitat)

4: stands with patches of weeds (e.g. Bromus mollis), but rather with mean species richness, dominated by halophytes; over-pastured stands, that are a part of a less complex zonal system or mosaic of vegetation
4: stands on leaching soil, but still rich in halophytes also belong to this category
4: those secondary patches also belong here that have properly regenerated species composition and dominance structure, relatively rich in species, not homogenous, not weedy (diverse micro-topography regenerates much more slowly)

3: stands with low number of species, Artemisia or Festuca pseudovina are sometimes completely missing
3: stands with low number of species, Artemisia or Festuca pseudovina are sometimes completely missing, and Bromus mollis, Hordeum hystrix, Poa bulbosa has high abundance (should both Artemisia and Festuca pseudovina – and even other halophytes – be missing, the habitat is rather [OC])
3: those patches are also classified here, that are secondary (stripes of plough-in, signs of a former fish pond or a rice-field are visible, the surface is suspiciously flat), but regenerated poorly, has low number of species, are quite homogenous, sometimes weedy (simple micro-topography, occasionally with patches of open alkali soil surface; overlaps of Artemisia steppes and pioneer salt swards are characteristic, since they do not separate well)

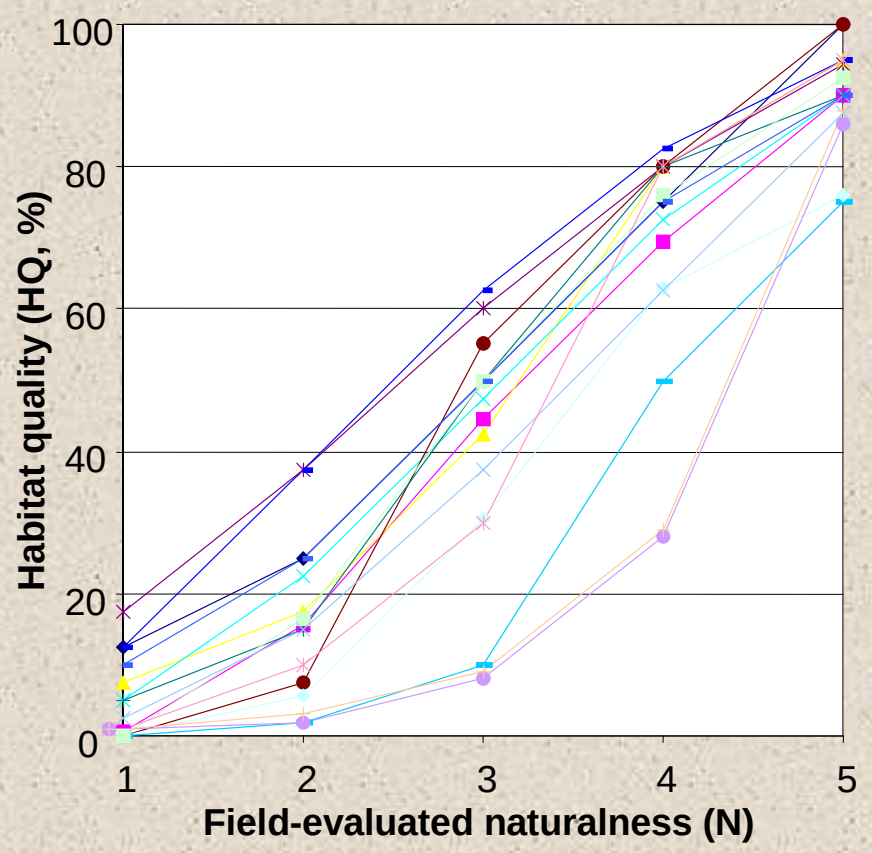
2: this kind of stand is very rare, since it cannot be invaded by weeds to such extent or become so uncharacteristic (only if it is leached as well, but then it is not a salt grassland, but [OC])
2: stands exposed to serious mechanical damage – and thus collapsed, weedy, sparse and has few species – temporarily and very locally can reach this state of degradation

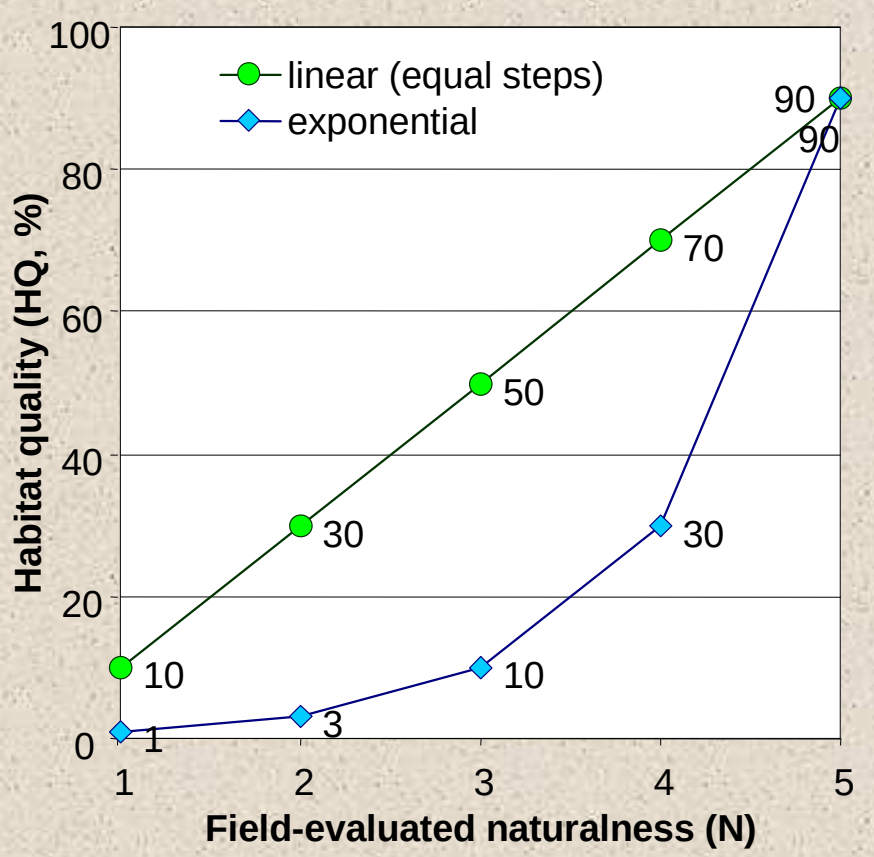
Standardization

	Values given by the pairs of mappers	Values given by the pairs of mappers	Standard value according to the Guide
First site of the field-training	2, 4r3, 3r2, 4, 2		3r2
	5-4, 5, 5, 3, 5r4		5r4
	4, 5-3, 4r3, 4, 3, 3		4
	4, 3, 4, 2, 3r2, 4		3r2
	4r3, 4r3, 4r3, 4r3, 3-2		4r3
	5, 5r4, 5r4, 3r2, 4, 4		4r3
	5, 5r3, 4r3, 5, 3		4-3
Last site of the field training	3, 4, 3, 4, 4, 4, 4		4
	4, 4-3, 4, 4r3, 3, 4r3, 4		4r3
	5r4, 4, 4, 4, 4, 4, 4		4
	3, 3, 4, 3, 3		3
	5, 5, 5-4, 5r4		5r4
	4, 4, 5r4, 5r4, 4		4
	4, 4, 4, 4, 4, 3		4

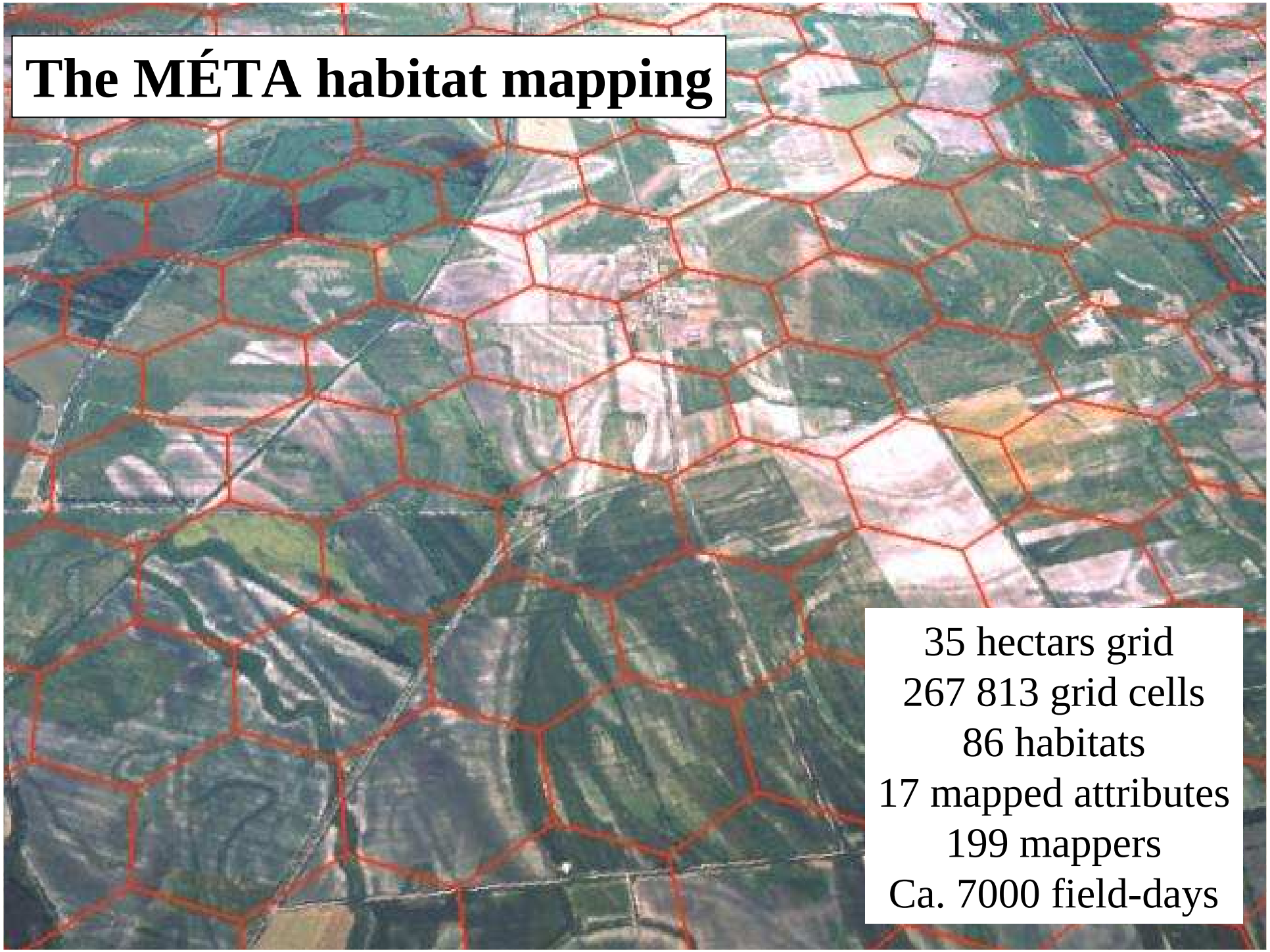
Good
Acceptable
Bad

Ordinal → absolute scale

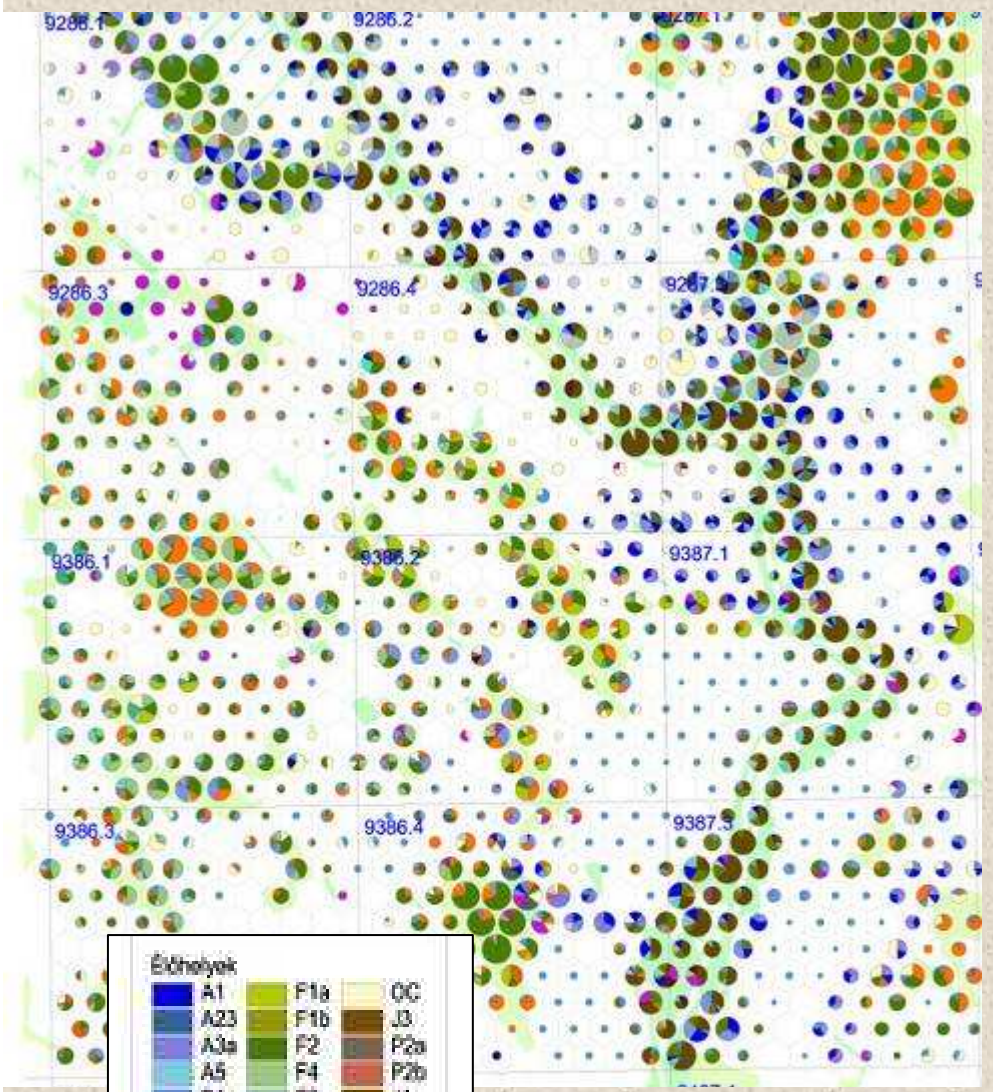


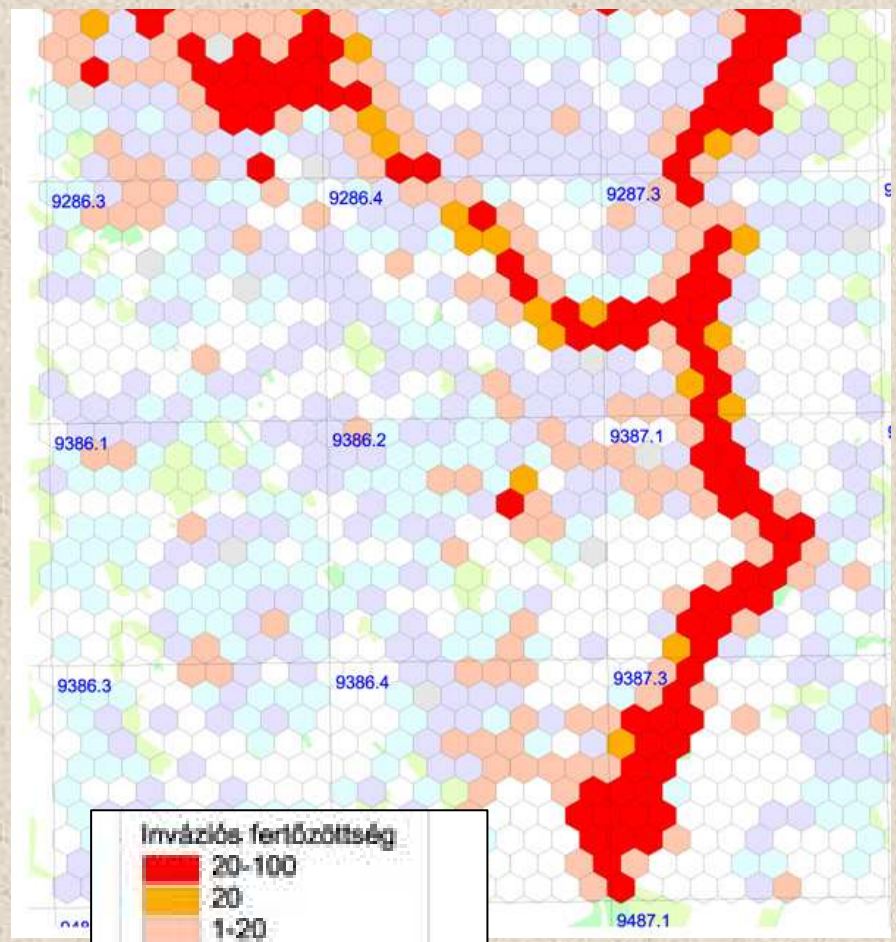


The MÉTA habitat mapping



35 hectars grid
267 813 grid cells
86 habitats
17 mapped attributes
199 mappers
Ca. 7000 field-days

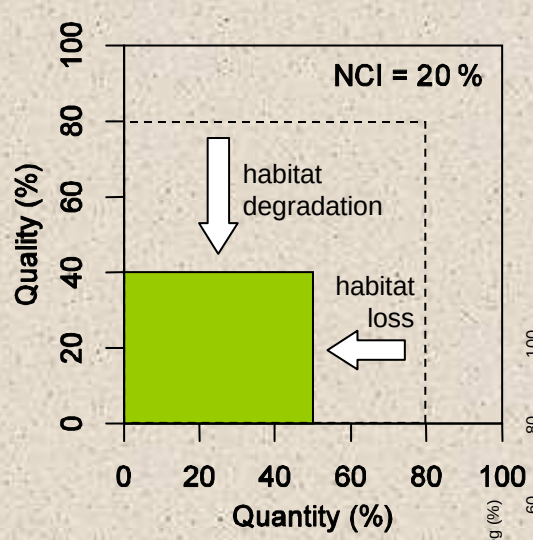


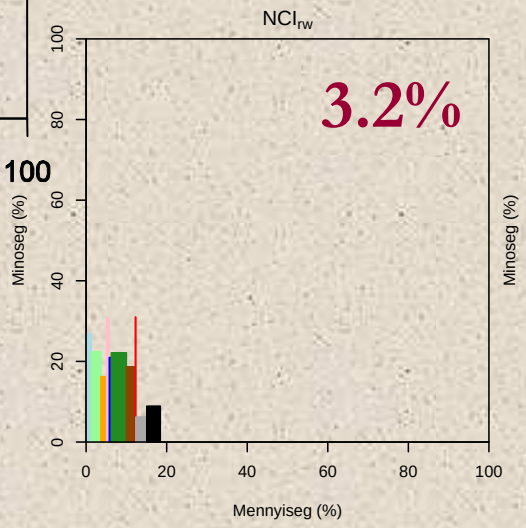


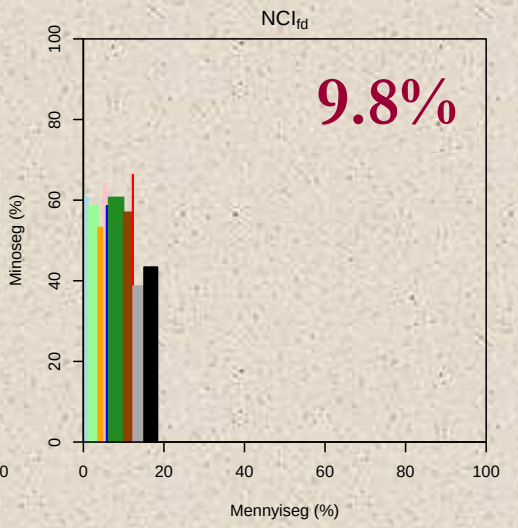
17 mapped variables, e.g.
quantity and quality of habitats in the hexagon

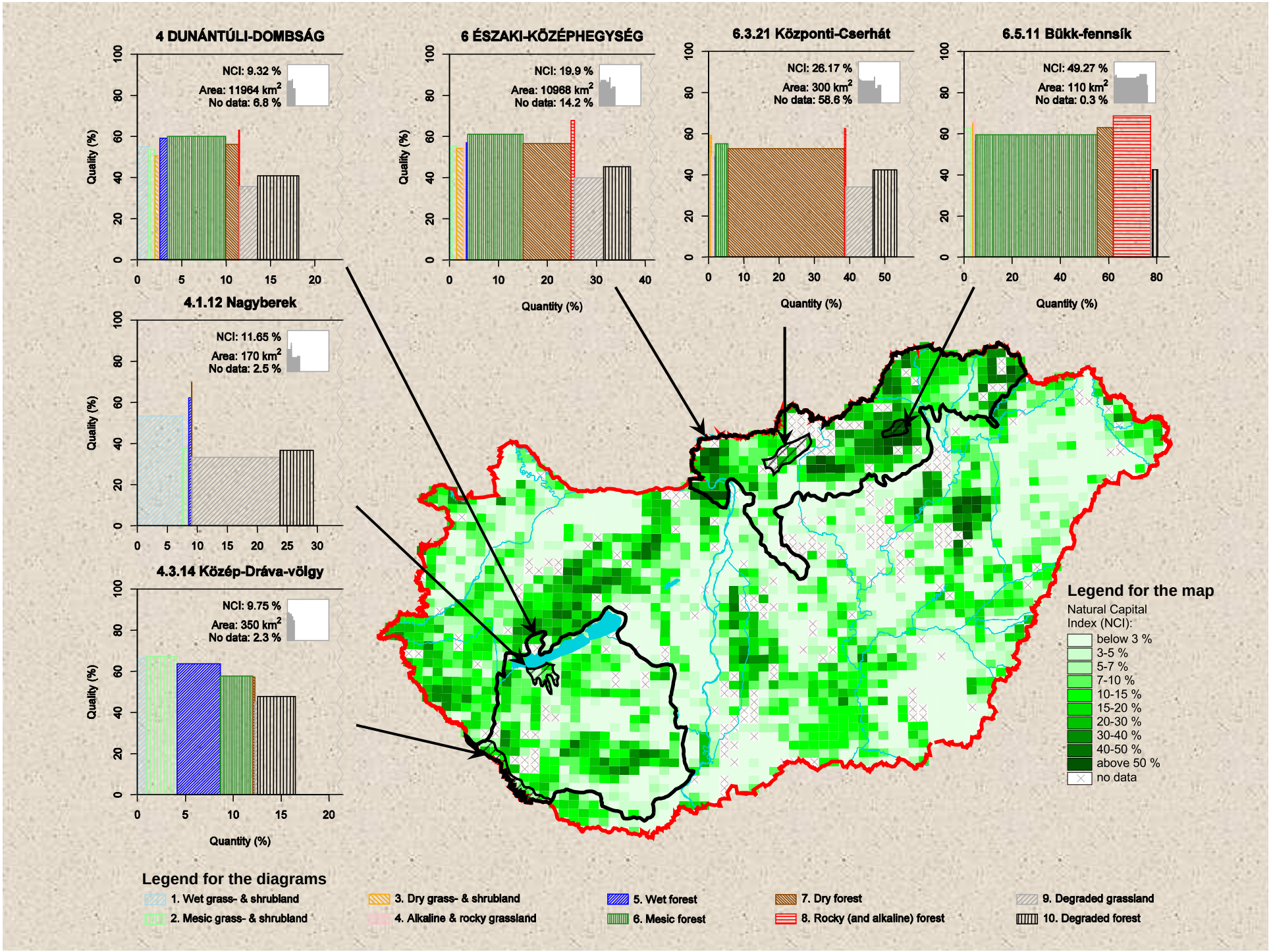
Vegetation-based Natural capital =

quantity × quality

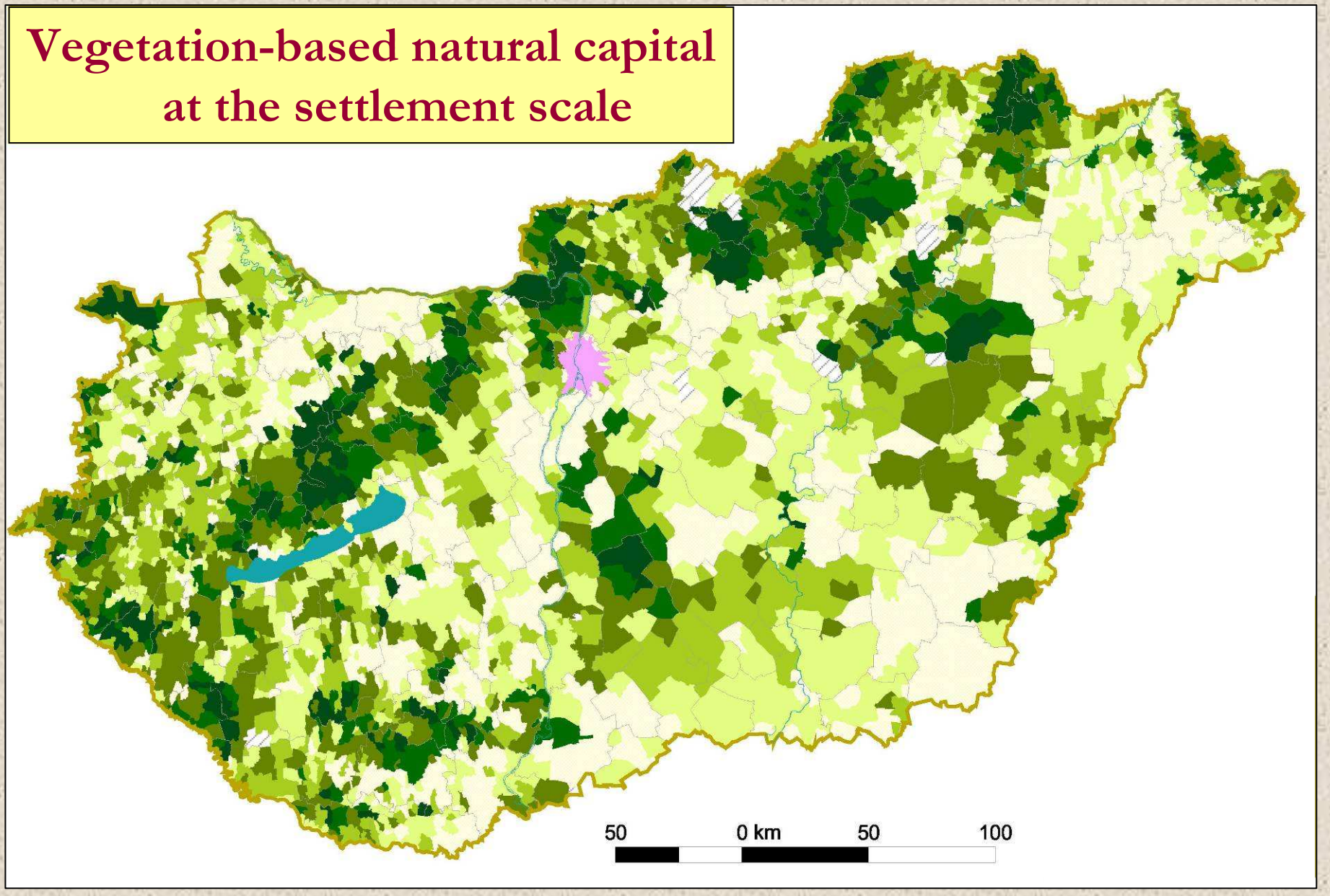




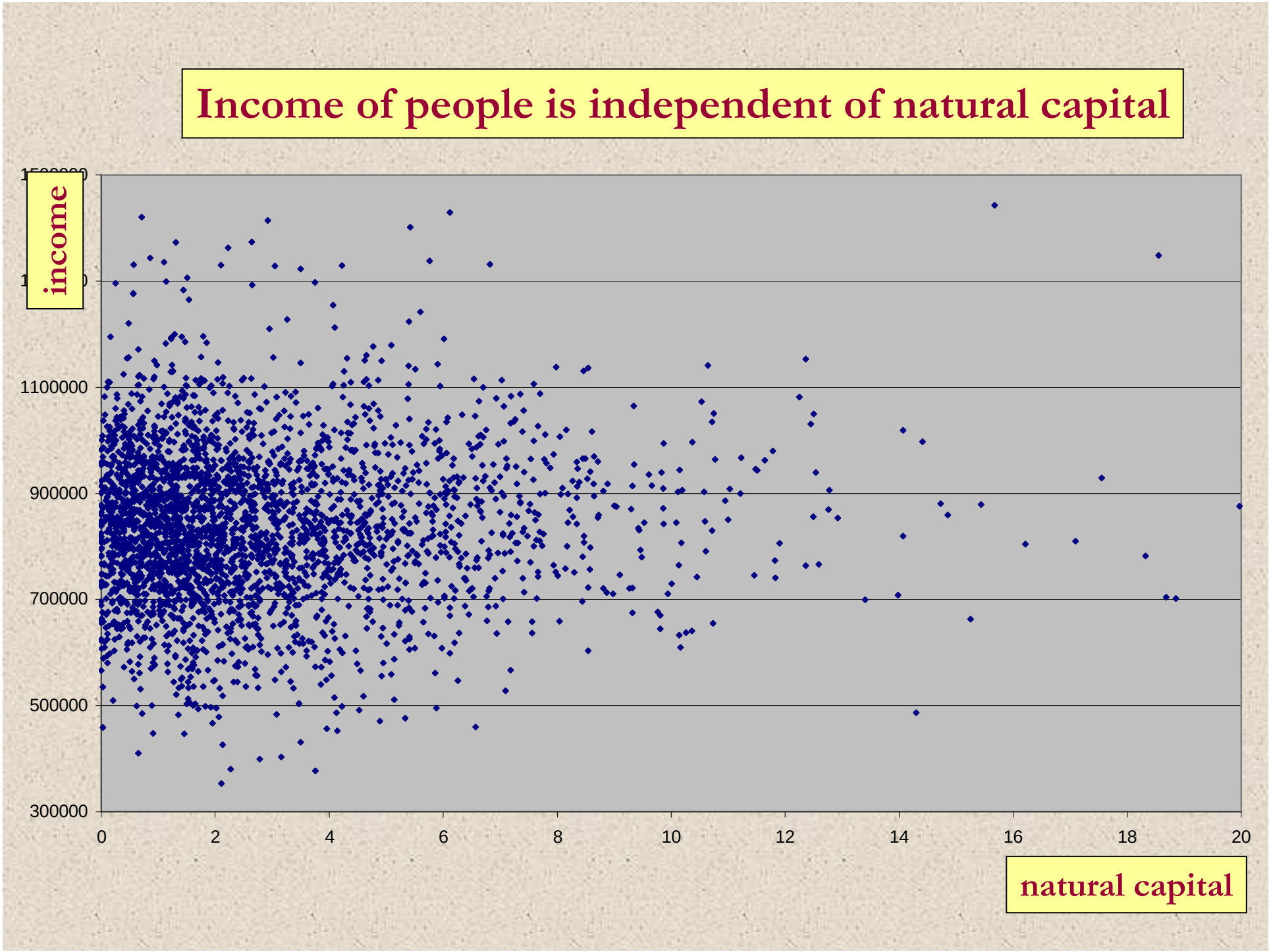



4 DUNÁNTÚLI-DOMBSÁG
NCI: 9.32 %
Area: 11964 km²
No data: 6.8 %
6 ÉSZAKI-KÖZÉPHEGYSÉG
NCI: 19.9 %
Area: 10968 km²
No data: 14.2 %
6.3.21 Központi-Cserhát
NCI: 26.17 %
Area: 300 km²
No data: 58.6 %
6.5.11 Bükk-fennsík
NCI: 49.27 %
Area: 110 km²
No data: 0.3 %
4.1.12 Nagyberek
NCI: 11.65 %
Area: 170 km²
No data: 2.5 %
4.3.14 Közép-Dráva-völgy
NCI: 9.75 %
Area: 350 km²
No data: 2.3 %
Quality (%)
Quantity (%)
Legend for the map
Natural Capital Index (NCI):
below 3 %
3-5 %
5-7 %
7-10 %
10-15 %
15-20 %
20-30 %
30-40 %
40-50 %
above 50 %
no data
Legend for the diagrams
1. Wet grass- & shrubland
2. Mesic grass- & shrubland
3. Dry grass- & shrubland
4. Alkaline & rocky grassland
5. Wet forest
6. Mesic forest
7. Dry forest
8. Rocky (and alkaline) forest
9. Degraded grassland
10. Degraded forest

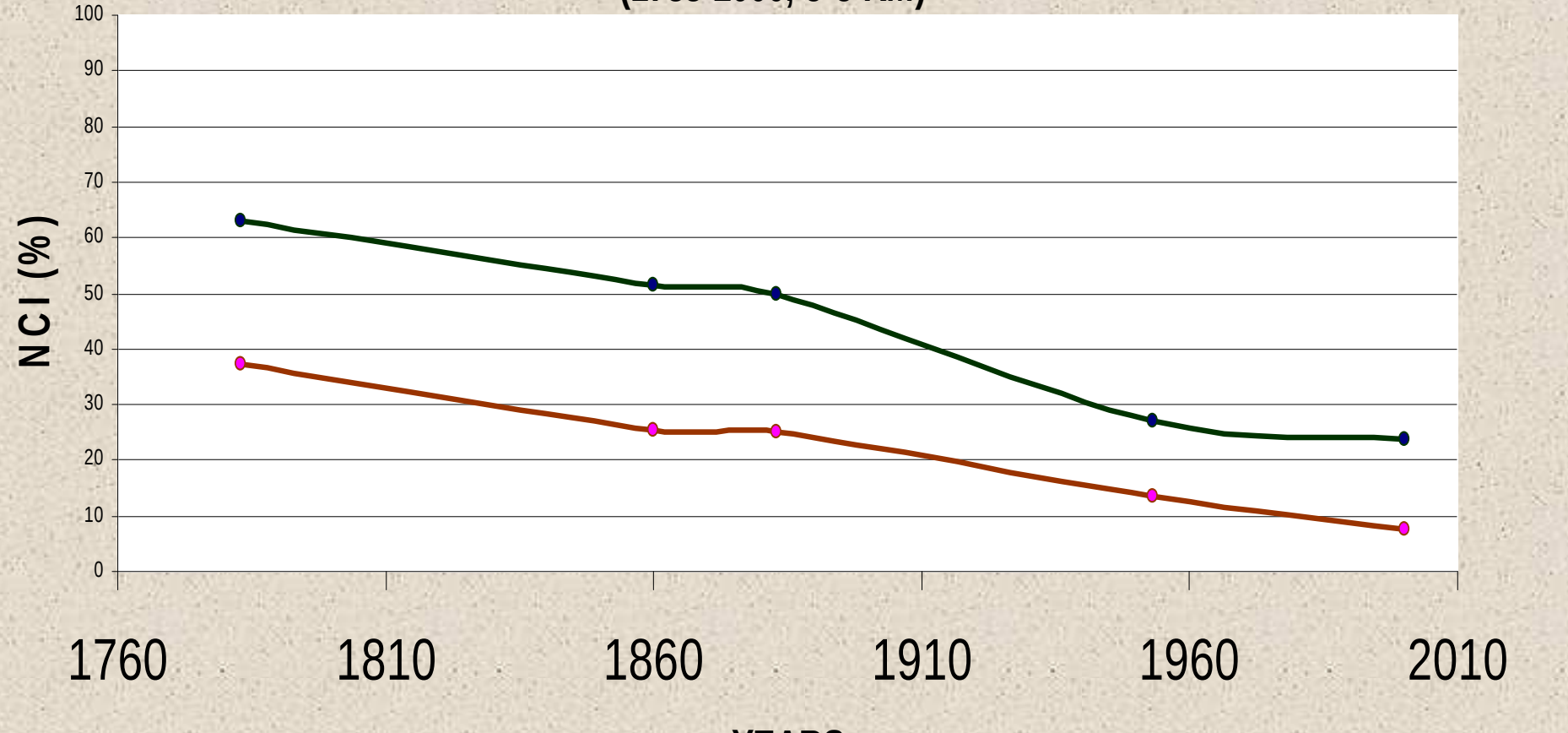
Vegetation-based natural capital at the settlement scale

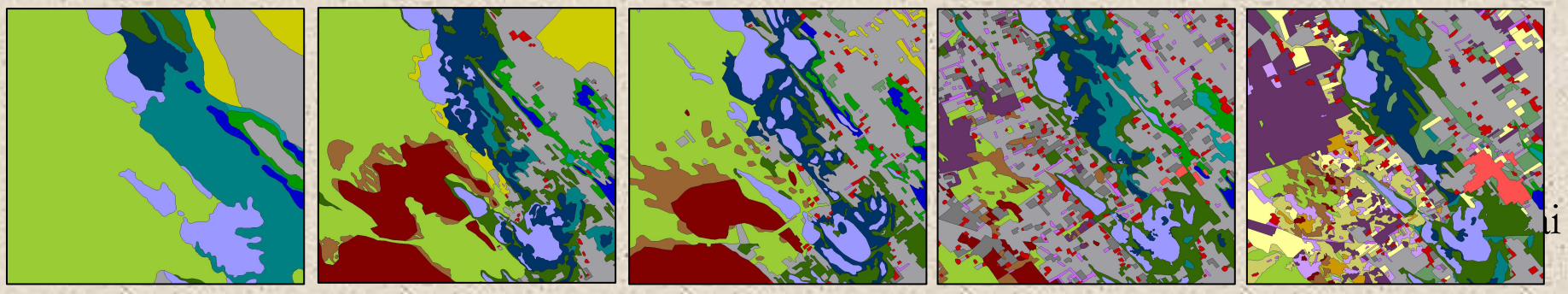


Income of people is independent of natural capital

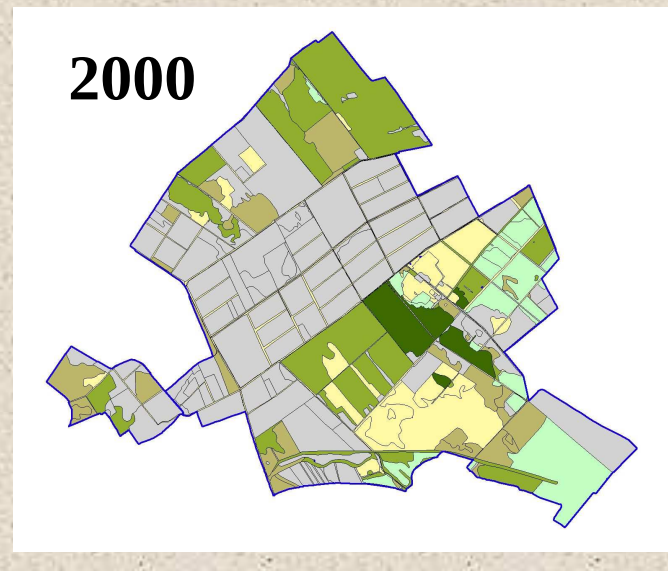


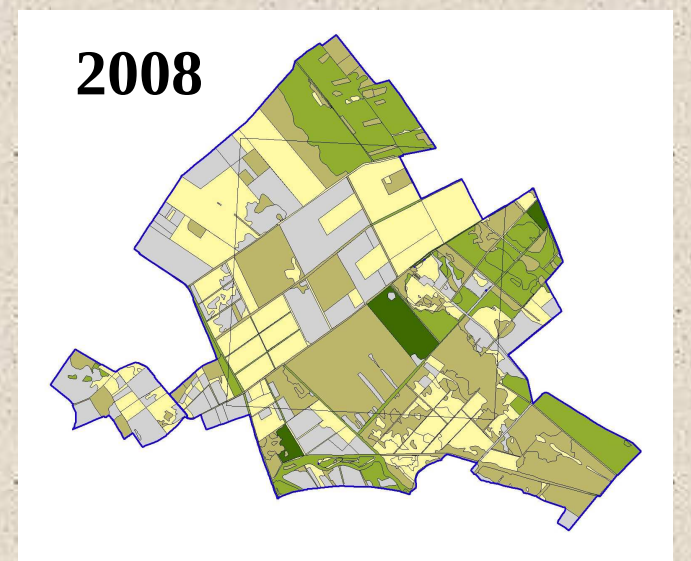
CHANGE OF VEGETATION-BASED NATURAL CAPITAL IN FÜLÖPHÁZA
(1783-2000, 5*5 KM)

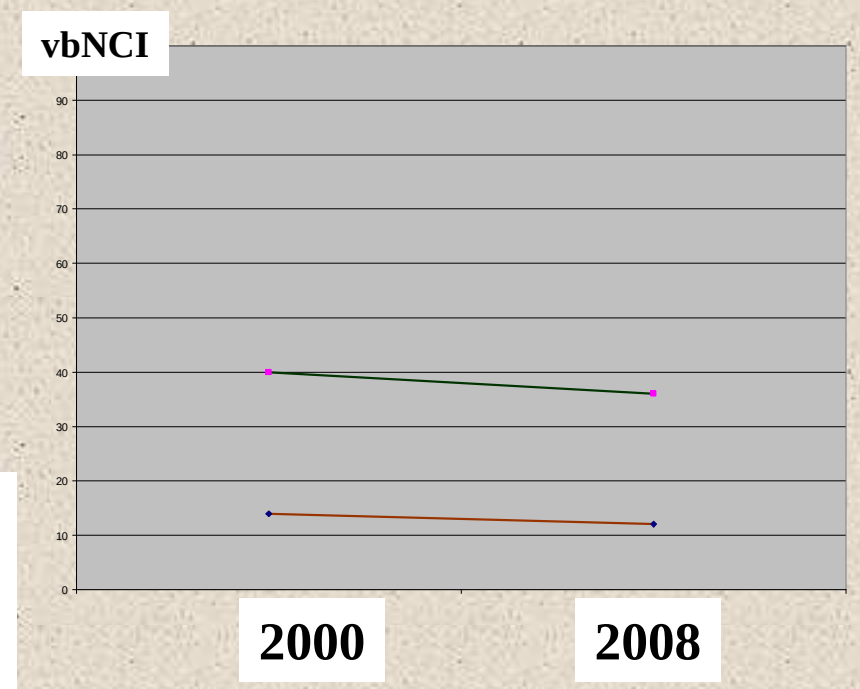




Use of vbNCI in biodiversity monitoring







Applicability of vbNCI world-wide

National-level scaling (1 to 5)
National guides for estimation

Sample areas for monitoring

International calibration of national values

International synthesis

Publications:

Czúcz B., Molnár Zs., Horváth F., Botta-Dukát Z. (2008): The natural capital index of Hungary. *Acta Botanica Hungarica* 50: 161-177.

Czúcz, B.; Molnár, Zs.; Horváth, F.; Botta-Dukát, Z.; Török, K. (2009): A scalable aggregation framework for biodiversity indicators: the natural capital index. *Submitted after revision.*