

Further GIS solution for the better definition of geographical/landscape boundaries

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Contents

Landscape from different approaches

Problems with the boundary of the landscape

Applied method

- fuzzy logic
- selected data sets
- why homogeneity (heterogeneity, reverse)

Results

- delineation of landscape boundary
- *from statistical point of view*

Verification

There are so many different explanations of landscape,
is it really important to speak about the „exact” spatial
position of the boundaries?!

- One of the most important **fundamental spatial category** in geography
- Therefore it would be **scientific** content – careful application of the methods → similar results (landscape boundaries)
- the landscape planners, developers and managers would like to see **boundary** (with defined errors)

So --- IMPORTANT

There are so many different explanations of landscape,
is it really important to speak about the „exact” spatial
position of the boundaries?2

Landscape from our interpretation: **integrated unit, based on physical nature**, but the social (eg. cultural, ethnical) „factors” has important role (Pusta Hortobágy in Hungary – natural versus cultural landscape – animal husbandry). The primary character defined by the physical parameters, so: no real integration (not highly integrated).

Problems

Lot of different „landscape”: eg. based on vegetation, geomorphology, on ethnical coherence, defined from esthetical, functional units

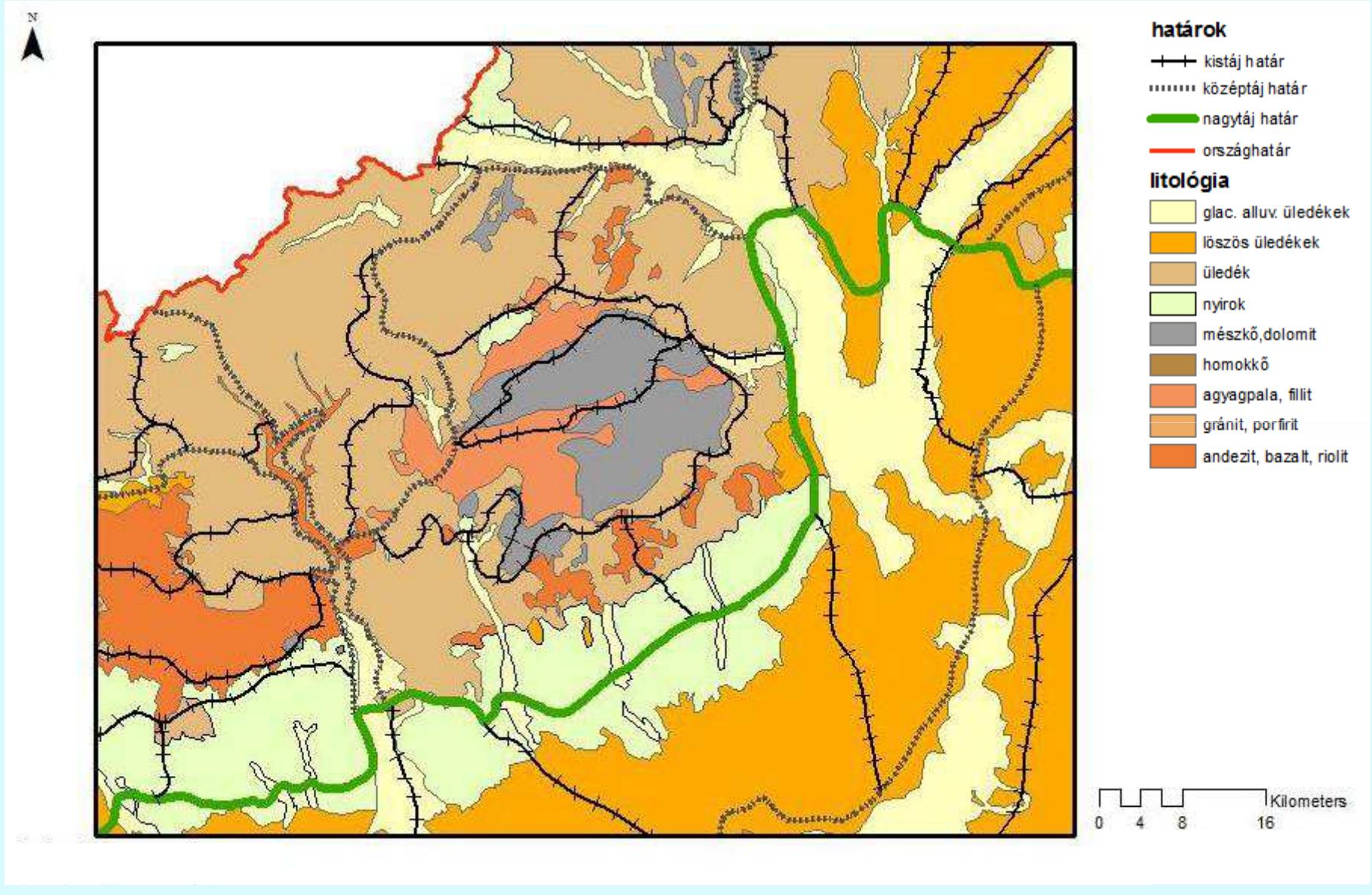


Problems with the boundaries

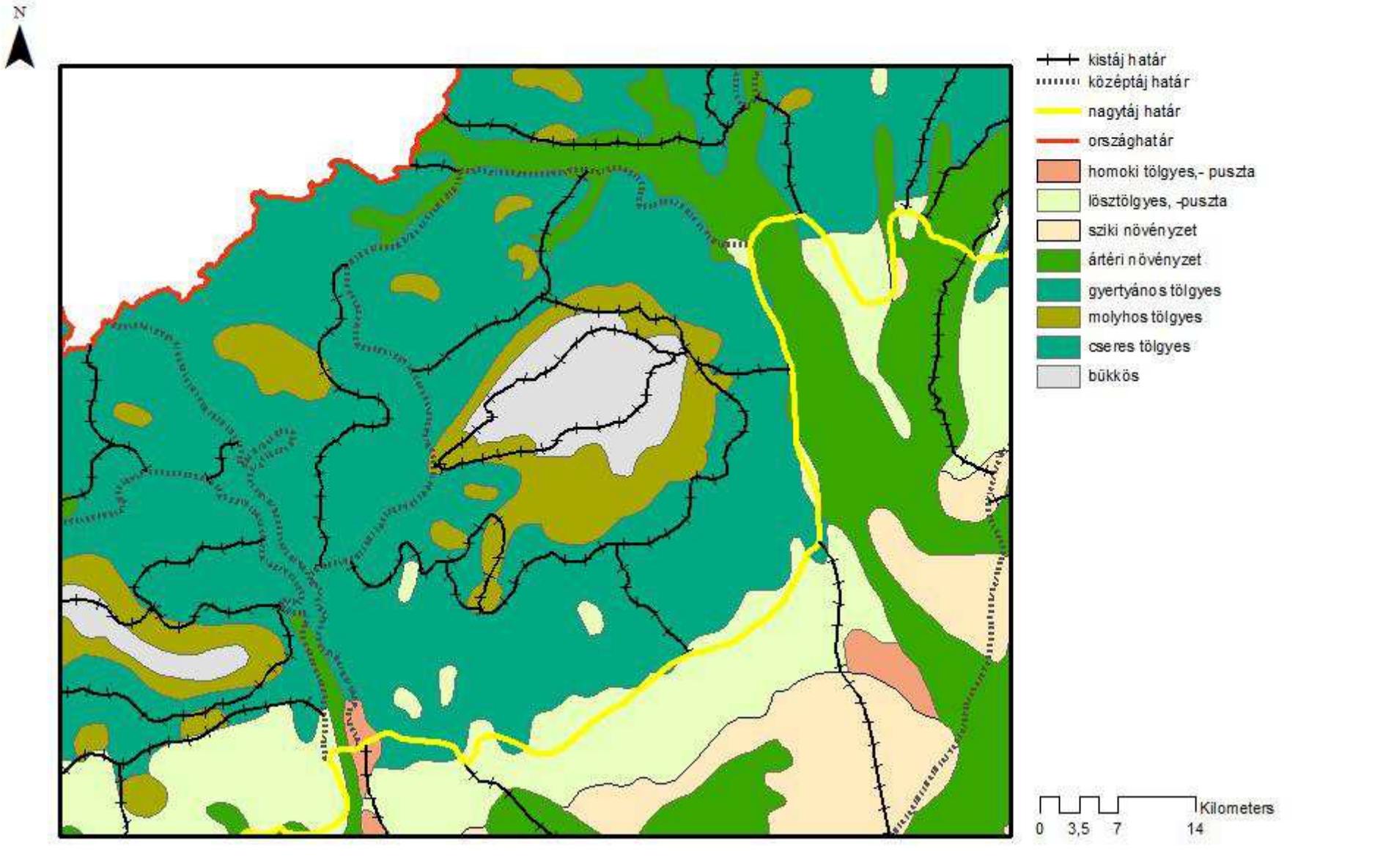
- Boundaries depend on the content
- Let see only one parameter 
- Pattern are highly different – patches cannot be fully overlain
- Errors
 - a. spatial
 - b. of content because of the integration

Delineation would be important

Lithology and the boundary 1



Vegetation and the boundary2

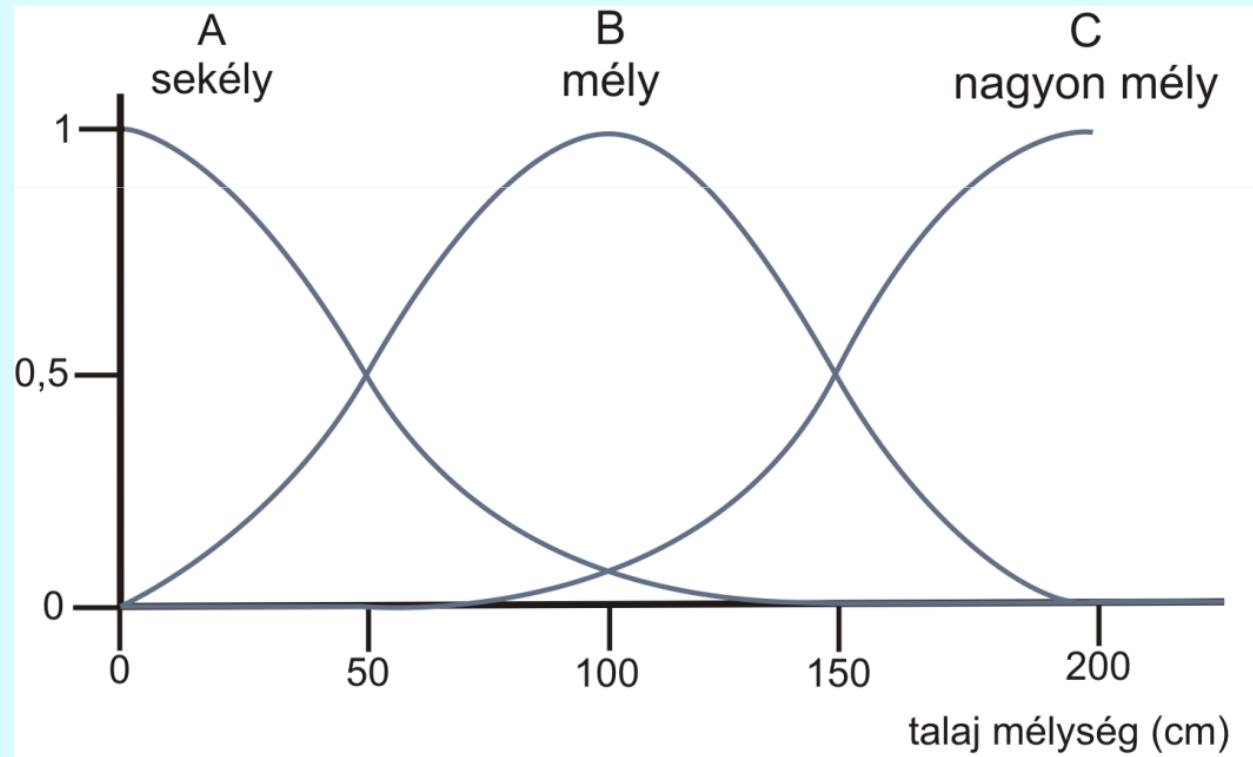


Method1

1. For the boundaries the concept of **ecotone** was applied (transit zone with different width)
2. **Fuzzy method** seems logical solution for the evaluation of boundaries – using ArcGIS
3. **Database**
 - list of applied parameters
 - values of homogeneity

Method2

Fuzzy logic: an element of a set (boundary) in some measure belongs to the „neighboring” sets.

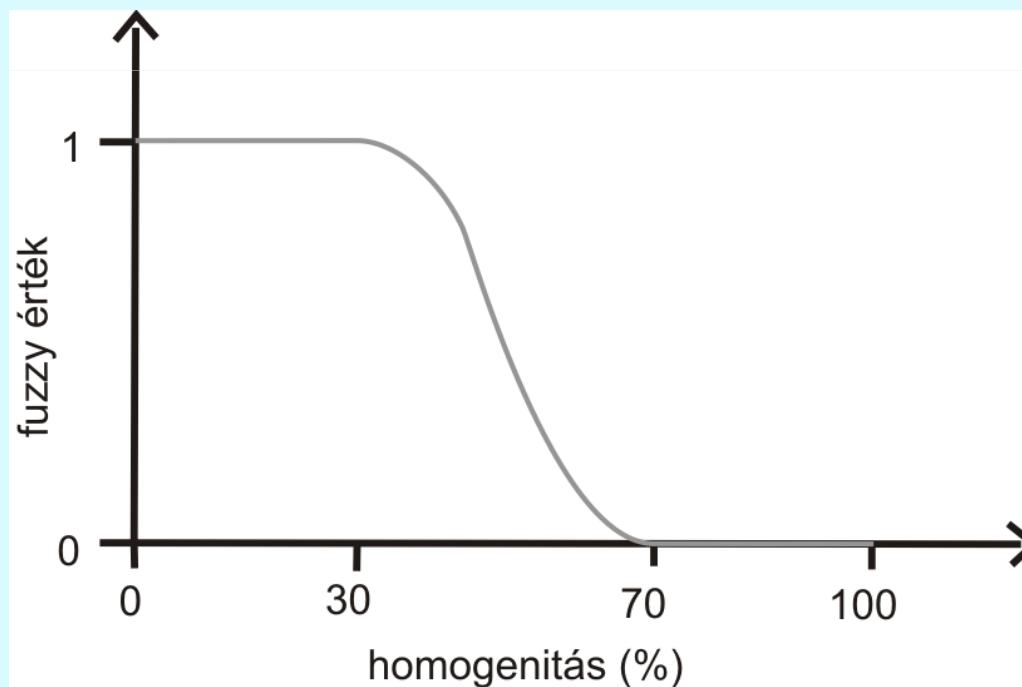


Landscapes as soft sets

Application of fuzzy logic

A fuzzy halmazoknál alkalmazott számítás úgy írható le, hogy:

- 30 % homogenitási értéknél kevesebb értékű területek = határzónák halmaza ($x=1$),
- 70 % homogenitási értéknél nagyobb értékű területek = homogén táji magok halmaza ($x=0$),
- Az ezektől eltérő homogenitási értékű területek olyan új értéket kapnak, amely azt mutatja, hogy az hány százalékban tartozik az egyik illetve a másik halmazhoz ($0 < x < 1$).



Method3

Database

4 landscape forming factor was selected (lithology, relief, soil, vegetation)

	lithology	soil	type of vegetation	orography
<i>Number of categories</i>	9	9	10	8
<i>Number of patches</i>	659	1701	109	480
<i>Mean area of patches km²</i>	141.2	54.7	4861.4	123.7

Sensitivity of data selection

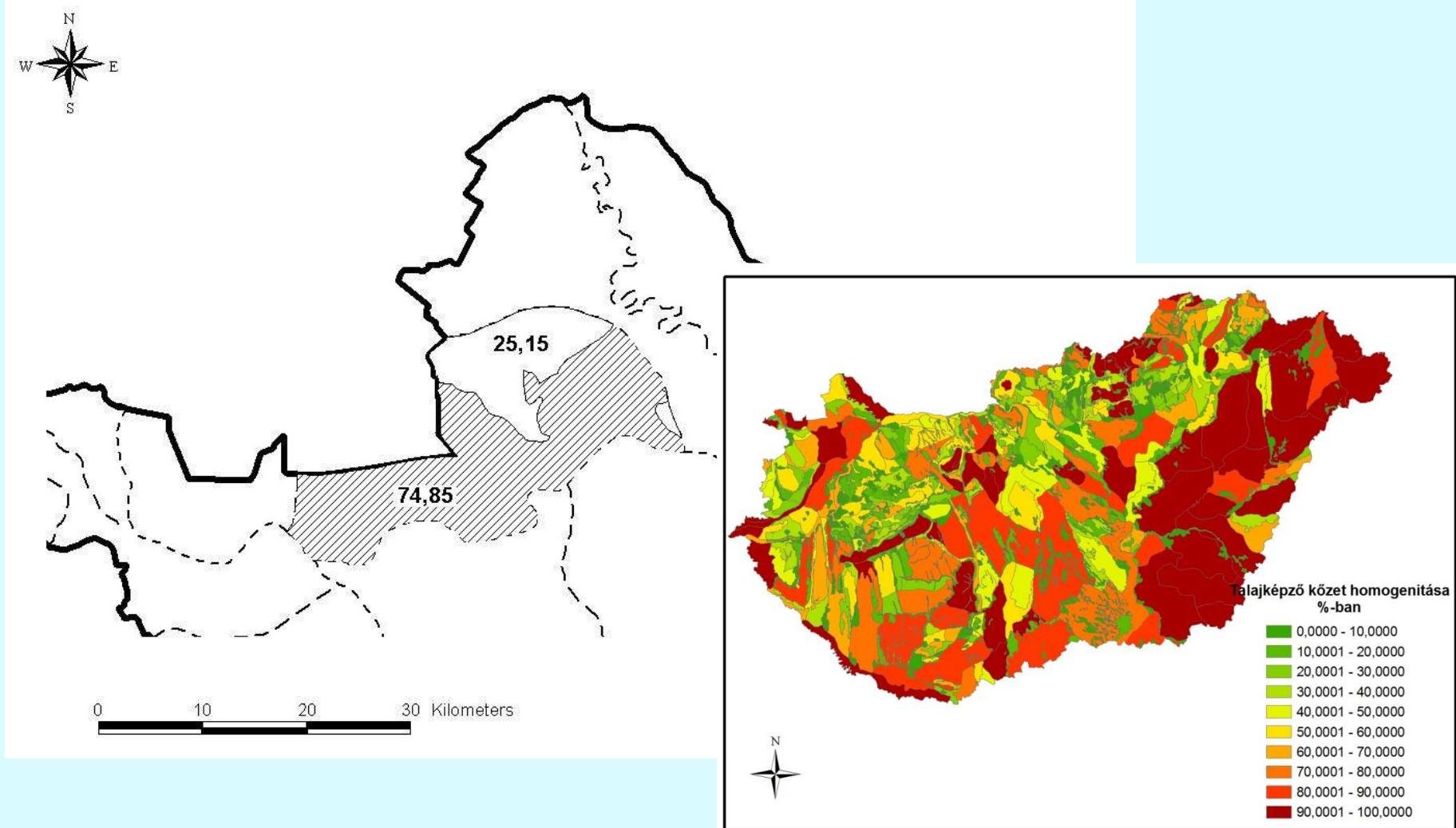
- similar number of units
- same type of data-types (scalar, nominal, interval)

Sources of homogeneity data

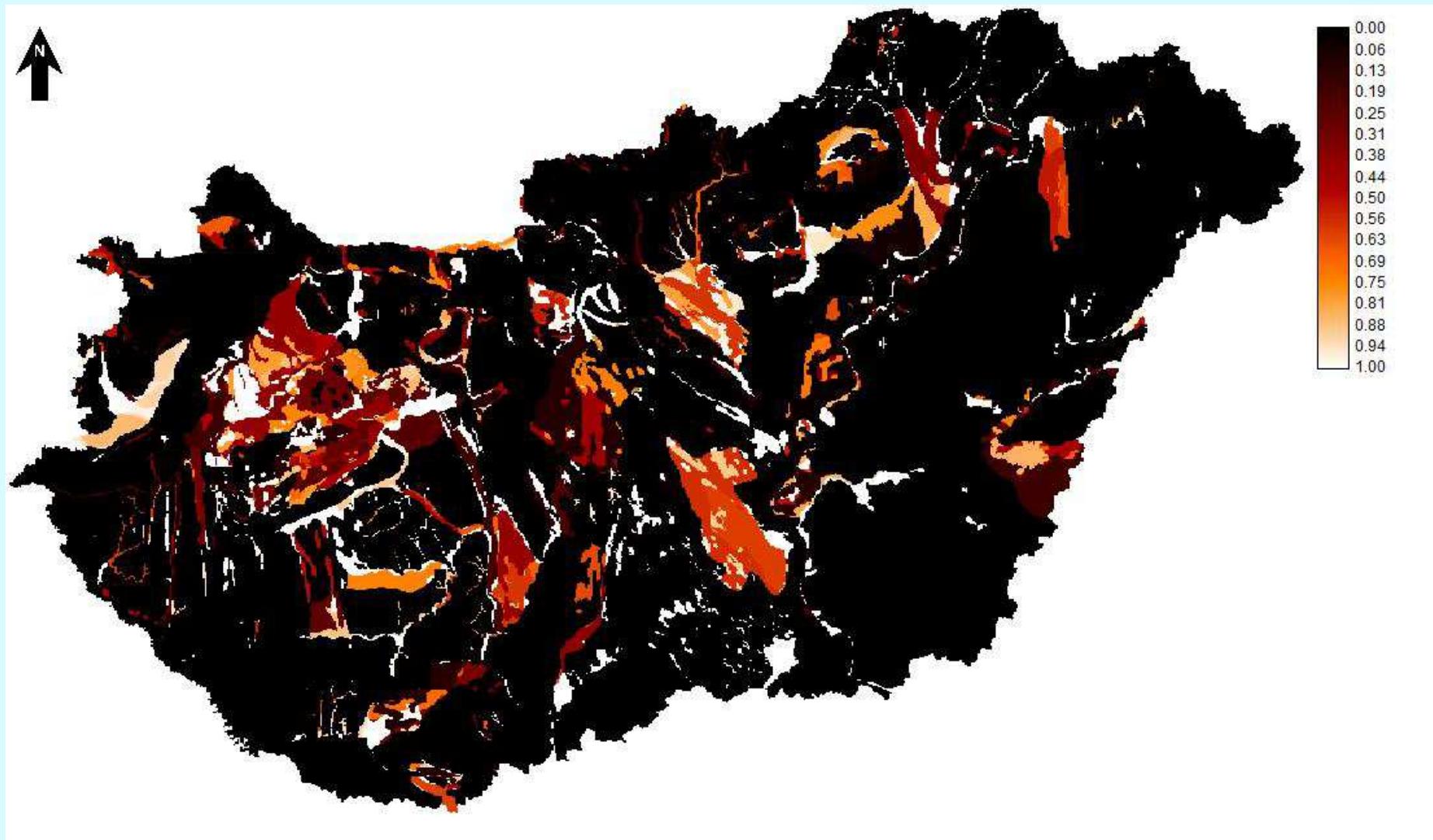
Analysis of homogeneity

Lithology

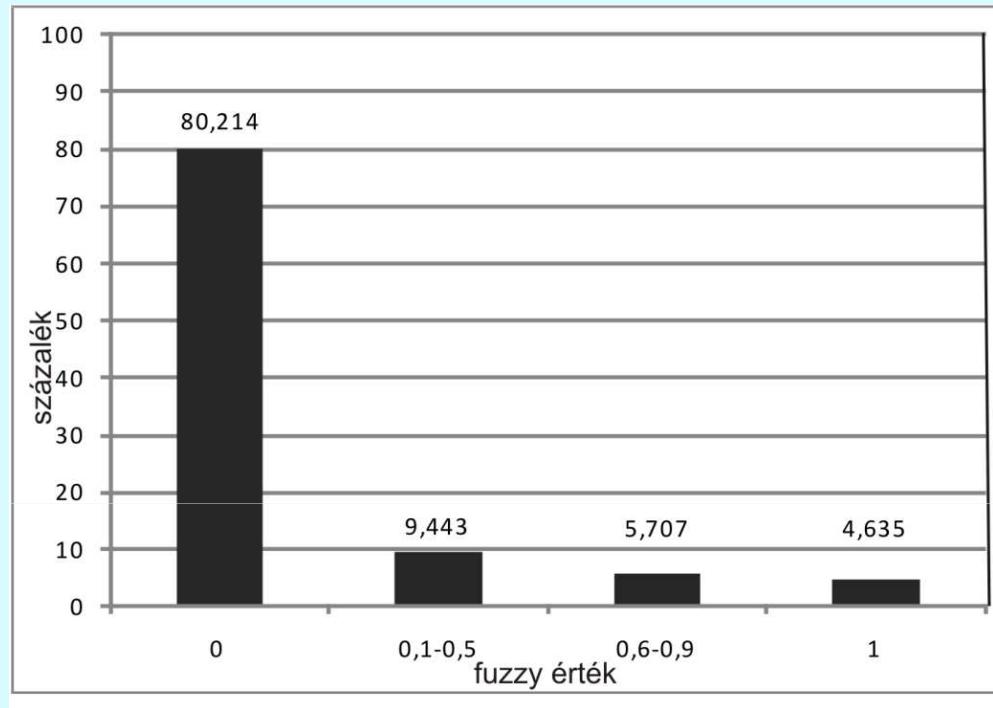
Egy kistájban belül az egyes tájalkotó tényezők különböző típusainak százalékos megjelenése.



Result of fuzzy analysis using four parameters



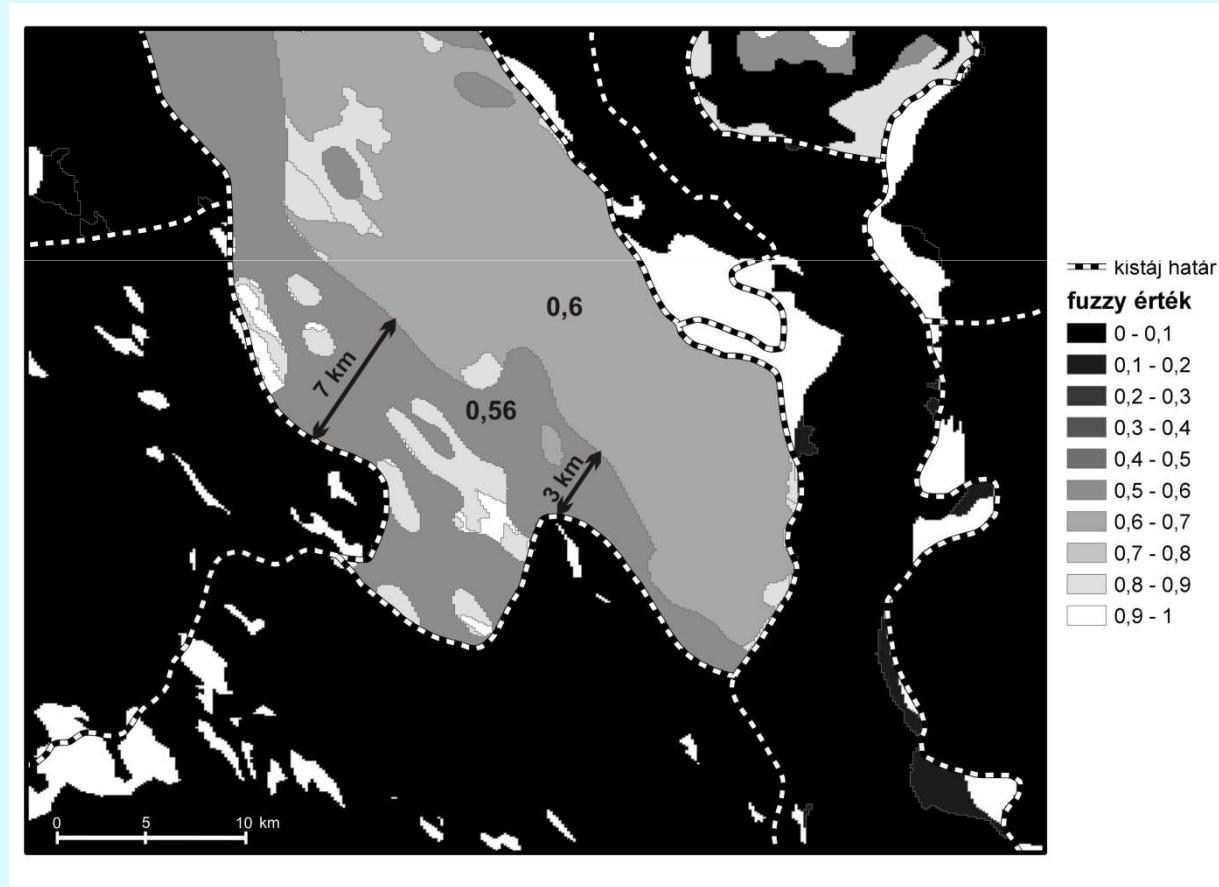
A statisztikai vizsgálatokban a szerint a fuzzy átlagos értéke: 0,64.
Az eredményadatokat négy kategóriába csoportosítottuk:



- A 0 fuzzyértékű területek a felszín 80 %-át fedik és tekinthetőek a tájak „magjainak”.
- Másfelől 1-es fuzzy értékű területek a felszín közel 5 %-át foglalják el, amelyek mentén a fenti tényezők alapján határ nem húzható.
- Ezen túl mintegy 15 %-nyi az ezen értékek közötti átmenet.

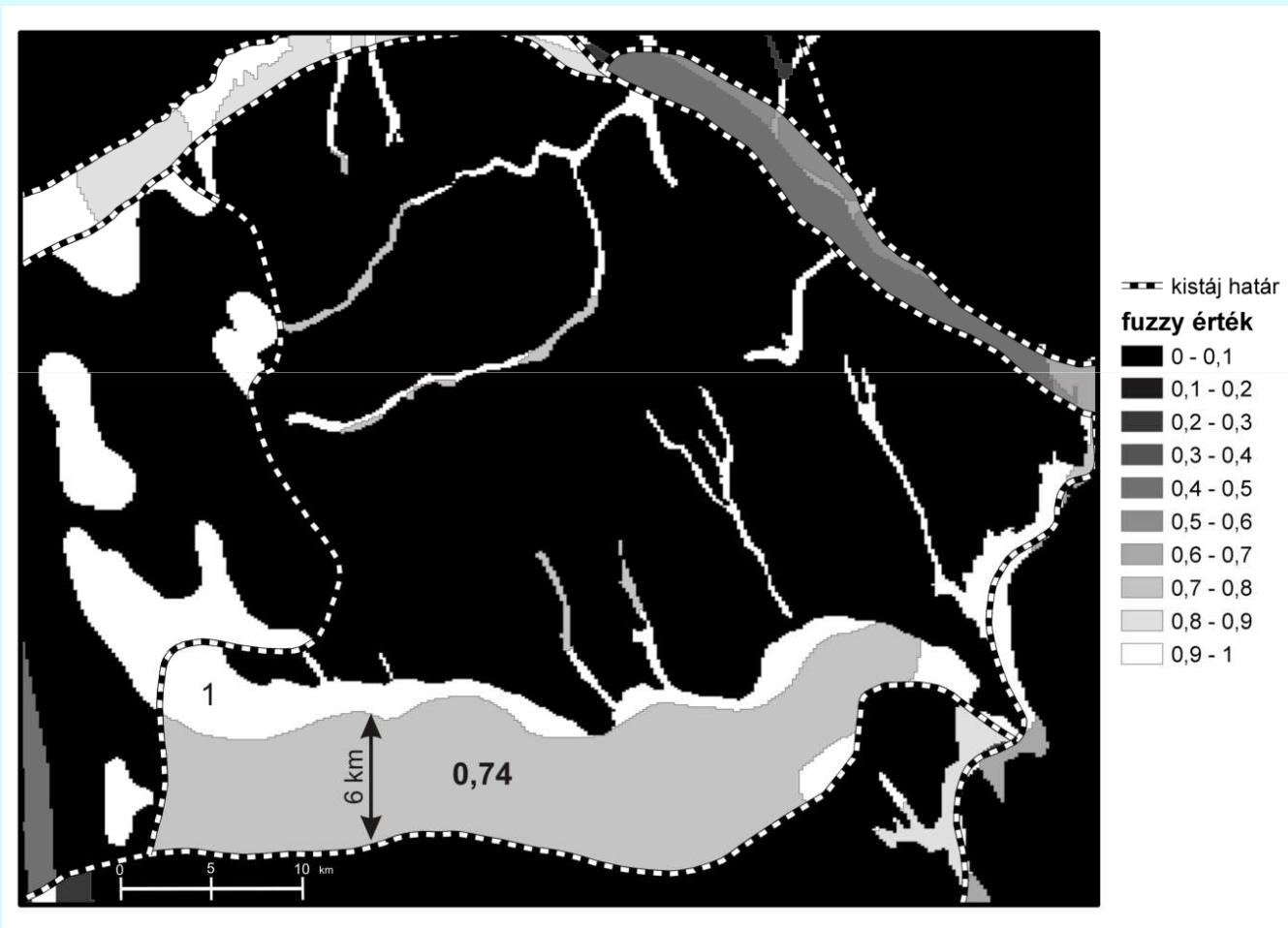
A Kiskunsági - löszöshát

- DNy-i részén bizonytalan a határ
- nagyobb területű inhomogén foltok kérdése (amelynek 0,9 fuzzy értékéhez mindenütt alacsony homogenitás tartozik)
- érhető, ha a vegetáció alapján néhányan a tájhatár módosítását javasolják



Kelet - Külső Somogy

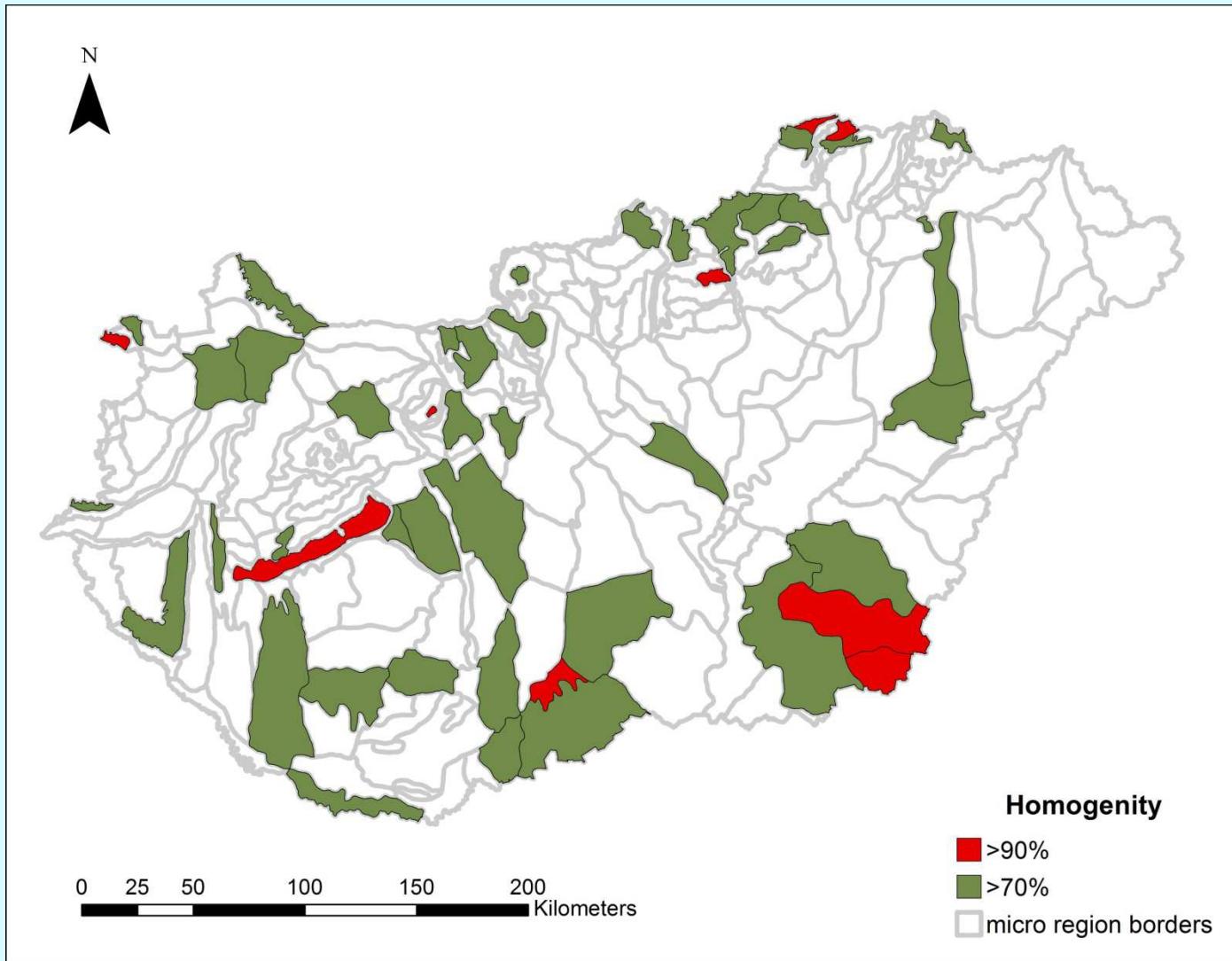
- D-en kis homogenitású terület - tájhatár nem egyértelműen azonosítható
- A mintegy 6 km-es sáv a talaj nem következetes csoportosításból adódhat



The degree of definition can also be interpreted as the degree at which landscape units, being integrated from the complex of landscape forming factors, transfer original information.

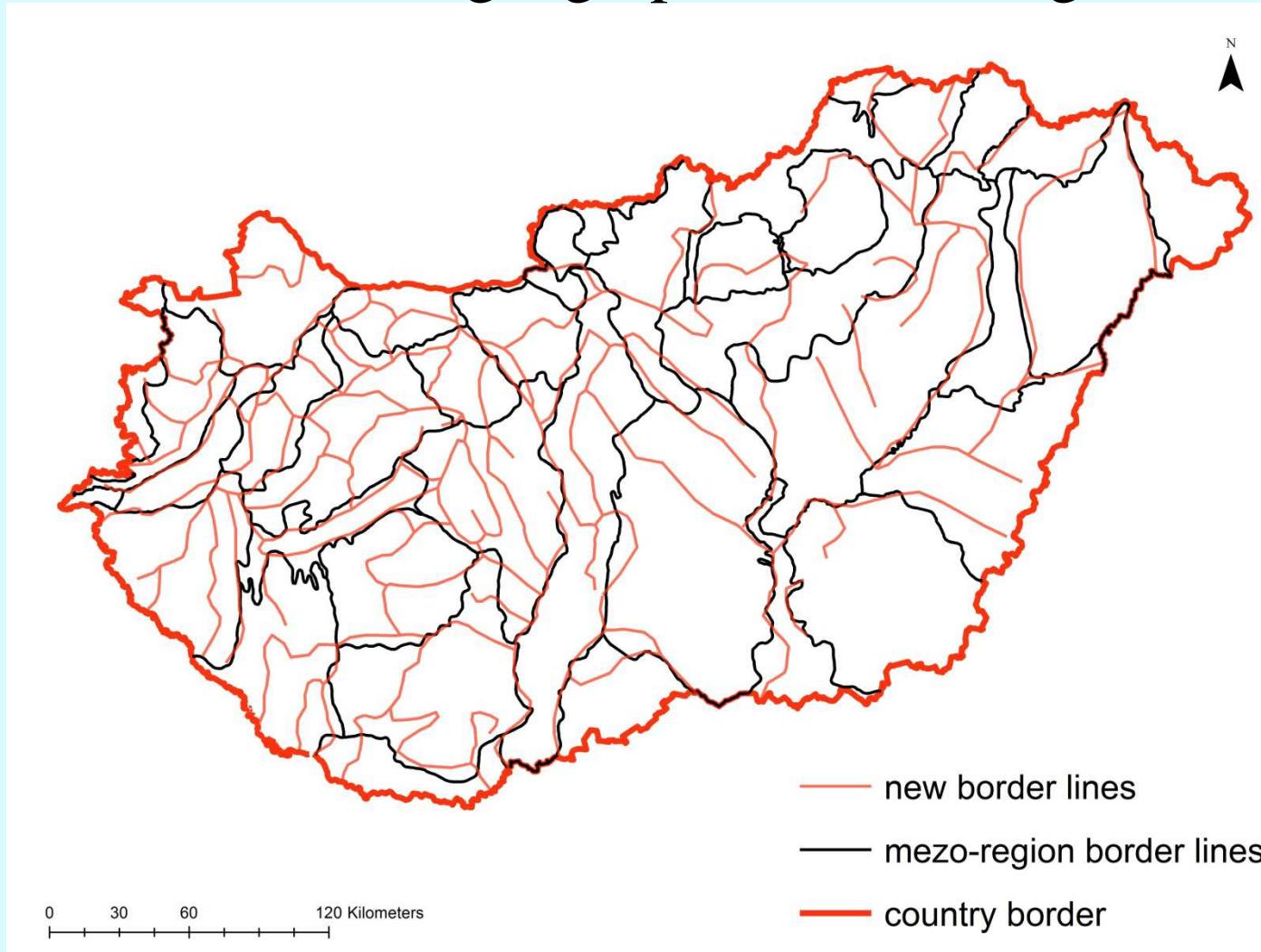
About 30 % of the small landscapes are good defined from statistical point of view

those landscape units were considered more well-defined from a geographical aspect, which were homogeneous in terms of the investigated controlling variables.



Statistically well-defined landscape units based on three landscape forming elements. 1 – homogeneity of each element exceeds 90 %, 2 – homogeneity of each element is between 70 and 90 %.

New GIS based boundaries and the traditional boundaries of geographical meso-regions



73 % of the newly defined boundaries (having a total length of 4500 km) coincided with the buffer zones of meso-scale regions.

Thank you for your attention!