CLASSIFICATION OF RURAL/URBAN AREA USING FUZZY LOGIC

Vít PÁSZTO

Department of Geoinformatics, Faculty of Science, Palacký University in Olomouc, Tř. Svobody 26, 771 46 Olomouc, Czech Republic

ON PROGRAM…

- Introduction to rural and urban area definition problem

- Fuzzy approach and visualization of the problem

- Overview of Czech Statistical Office's (hereafter as CZSO) registers and its visualization

RURAL OR URBAN

Rural & urban area delimitation problem

- Recent years – substantial change in population's movement (suburbanization)
- Villages ➡ semi-urban areas/urban areas
- Not significantly stated

? ? ?

Which villages belong to urban area and which do not

RURAL vs. URBAN

- There is no uniform defintion
- One and only widely accepted definition by OECD:
  - Population in area / population density (less than 150 pers./km^2)
- For international comparisons
- All world countries have these data

???

Is this definition of rural area sufficient enough

RURAL vs. URBAN

In Czech Republic

- Program for rural development (for period 2007 – 2013)

- Two criteria for rural area:
  - Population (less than 2,000 inhabitians)
  - Population density (less than 150 pers./km^2)

- New approach:
  - The CZSO's Departments of regional analyses and information services
  - 8 variations in definition of rural areas
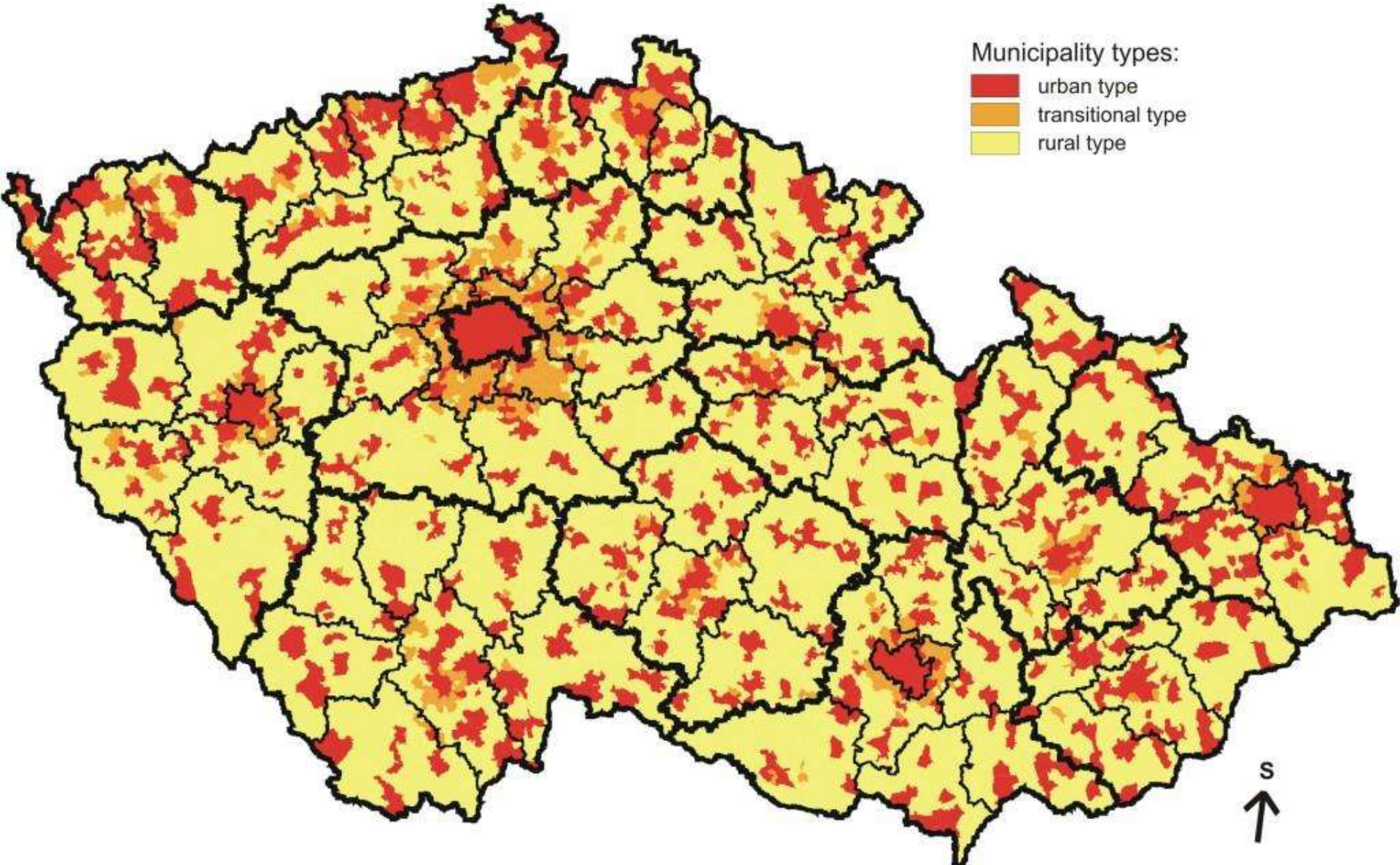 - Studied on municipalities (NUTS 5 or LAU 2)

RURAL vs. URBAN

Variation 8:

- Weighted combination of several criteria

- Based on suburbanization trends

- Most comprehensive version (multi-criteria evaluation)

- Defined municipalities:
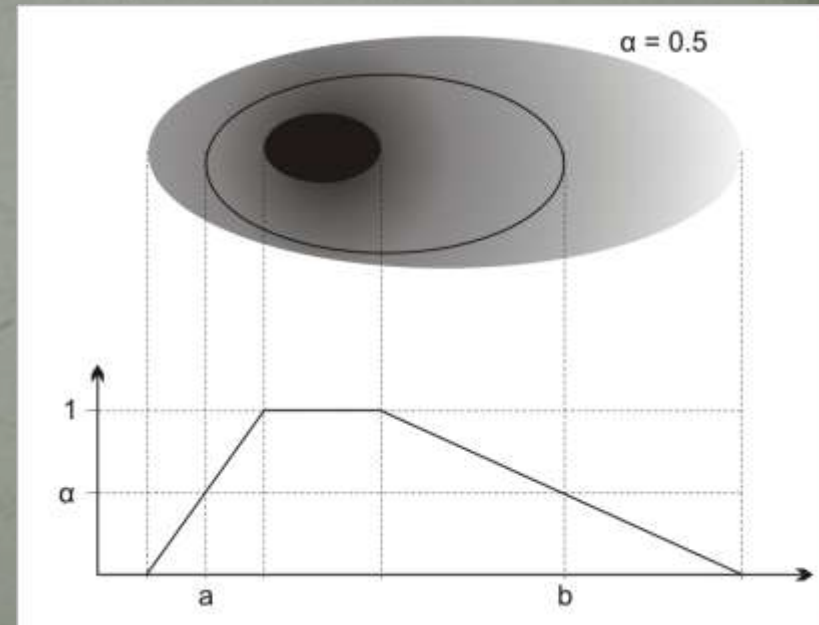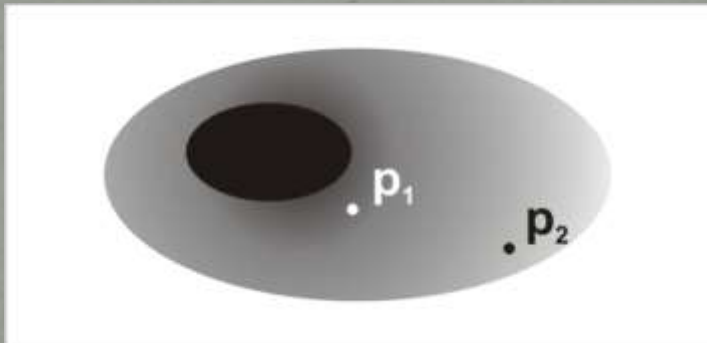 – Urban type
  – Transitional type
  – Rural type

RURAL vs. URBAN

Municipality types:
- urban type
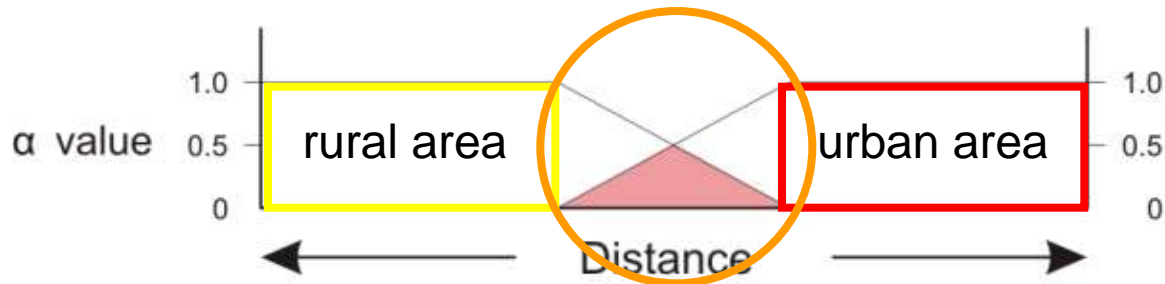- transitional type
- rural type

RURAL vs. URBAN

Fuzzy approach

- Solves abrupt transitions
- Provides smoother transitions
- Degree of membership instead of boolean yes/no state (or 1/0)

RURAL vs. URBAN

Population

- Variation 1
  - Lower boundary is 2,000 inhb. and upper is 5,000
- Variation 2
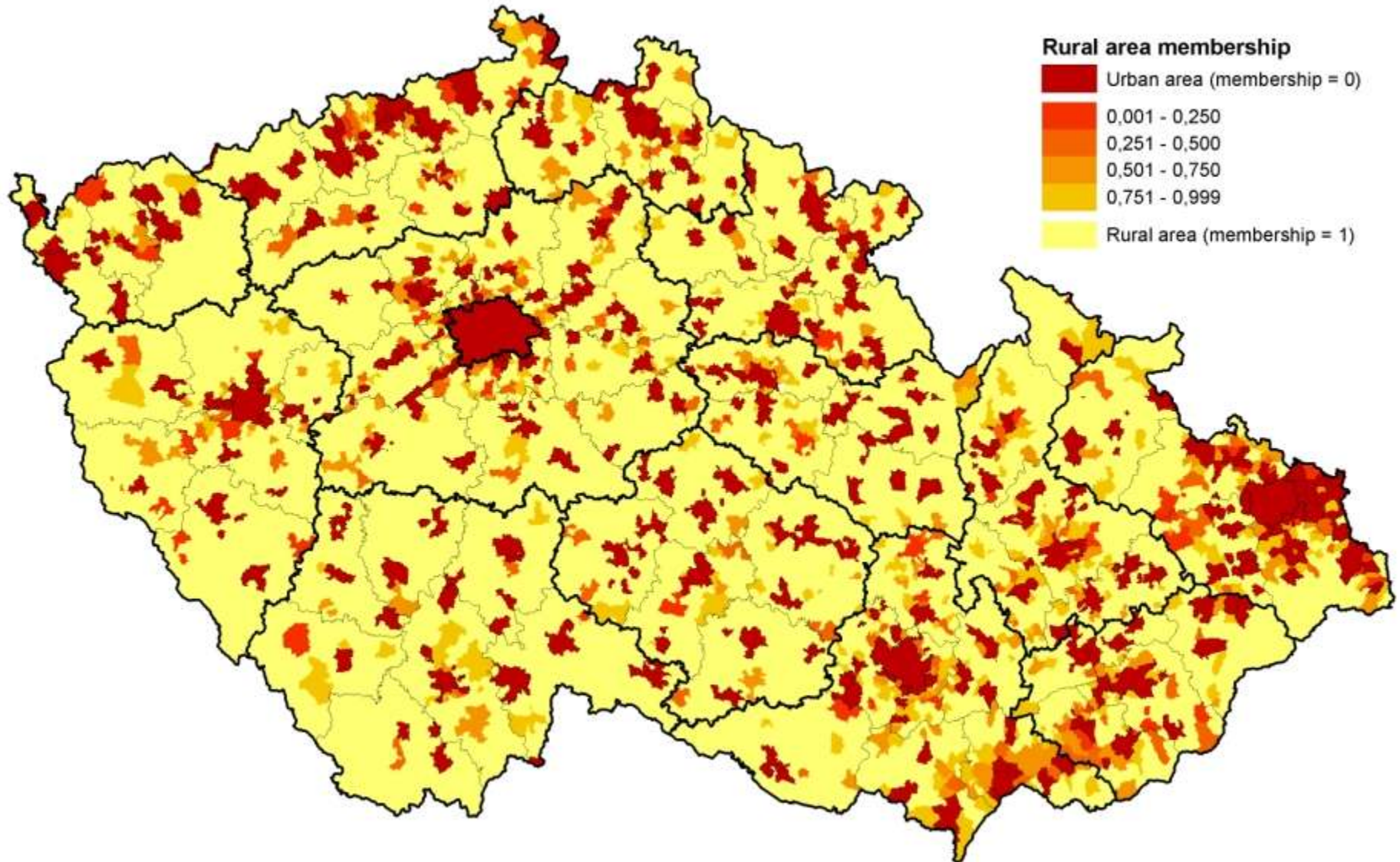 - Lower boundary is 1,500 inhb. and upper is 5,000

Population density

- Lower boundary is 100 persons per km^2
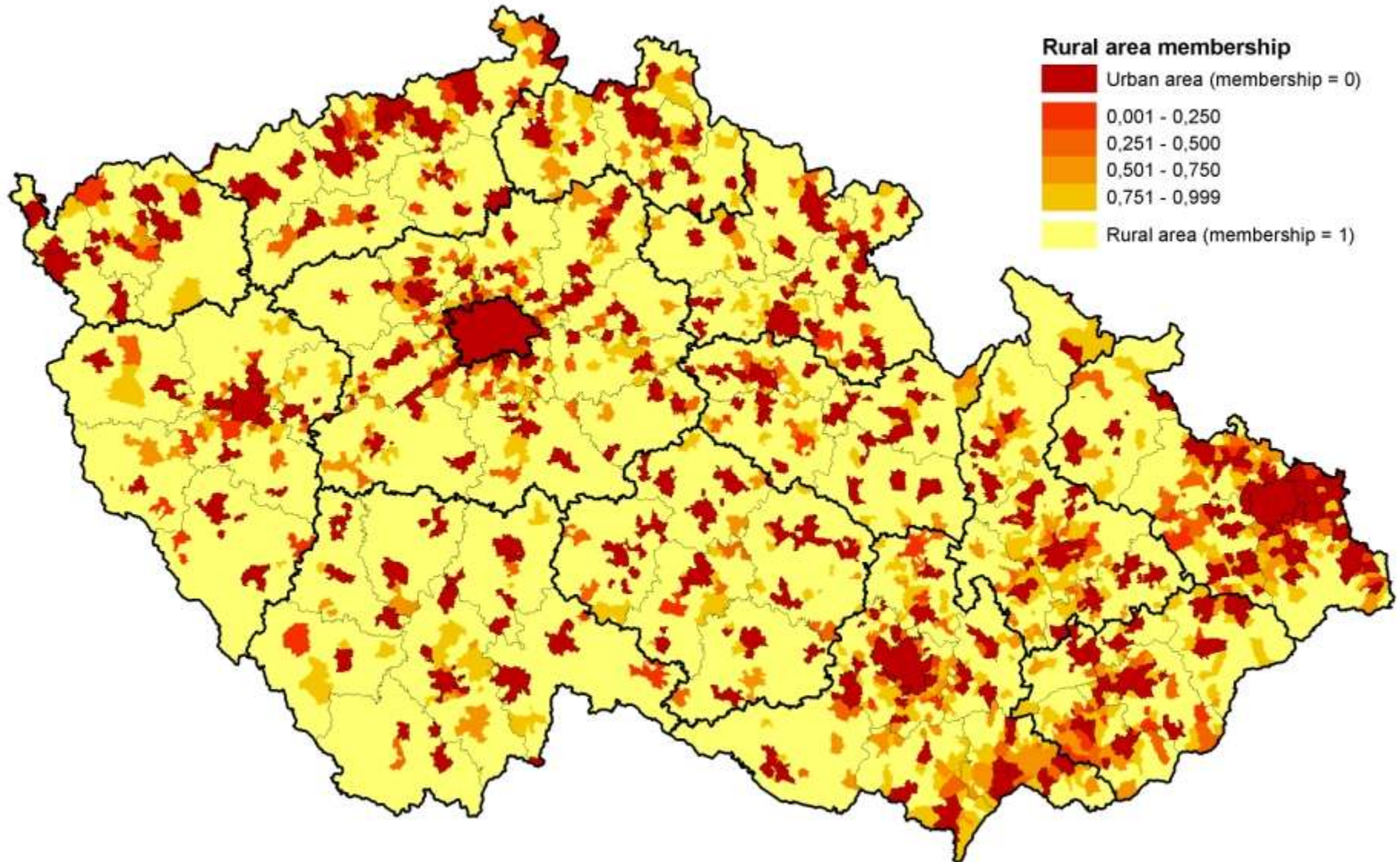- Upper boundary is 200 persons per km^2
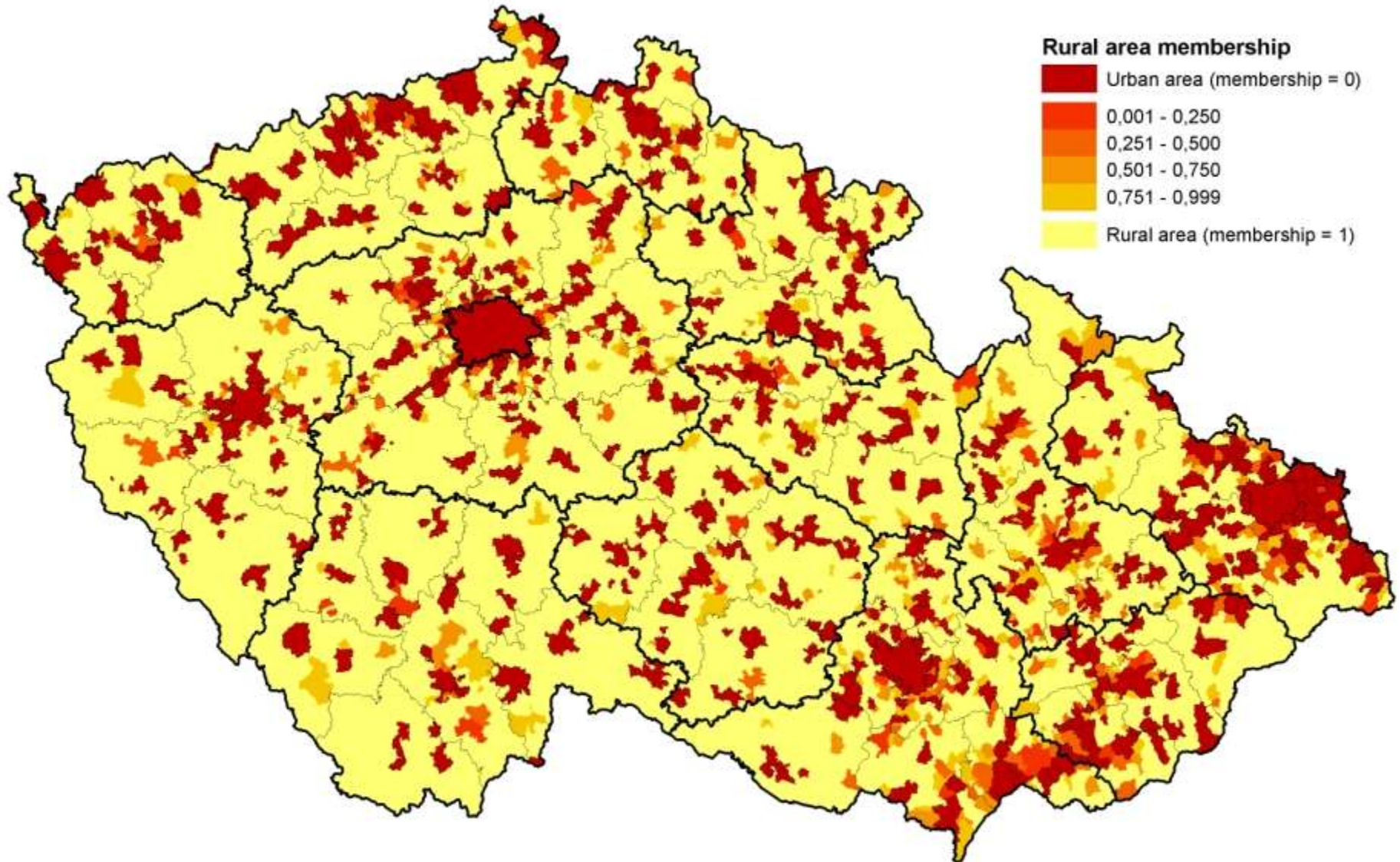
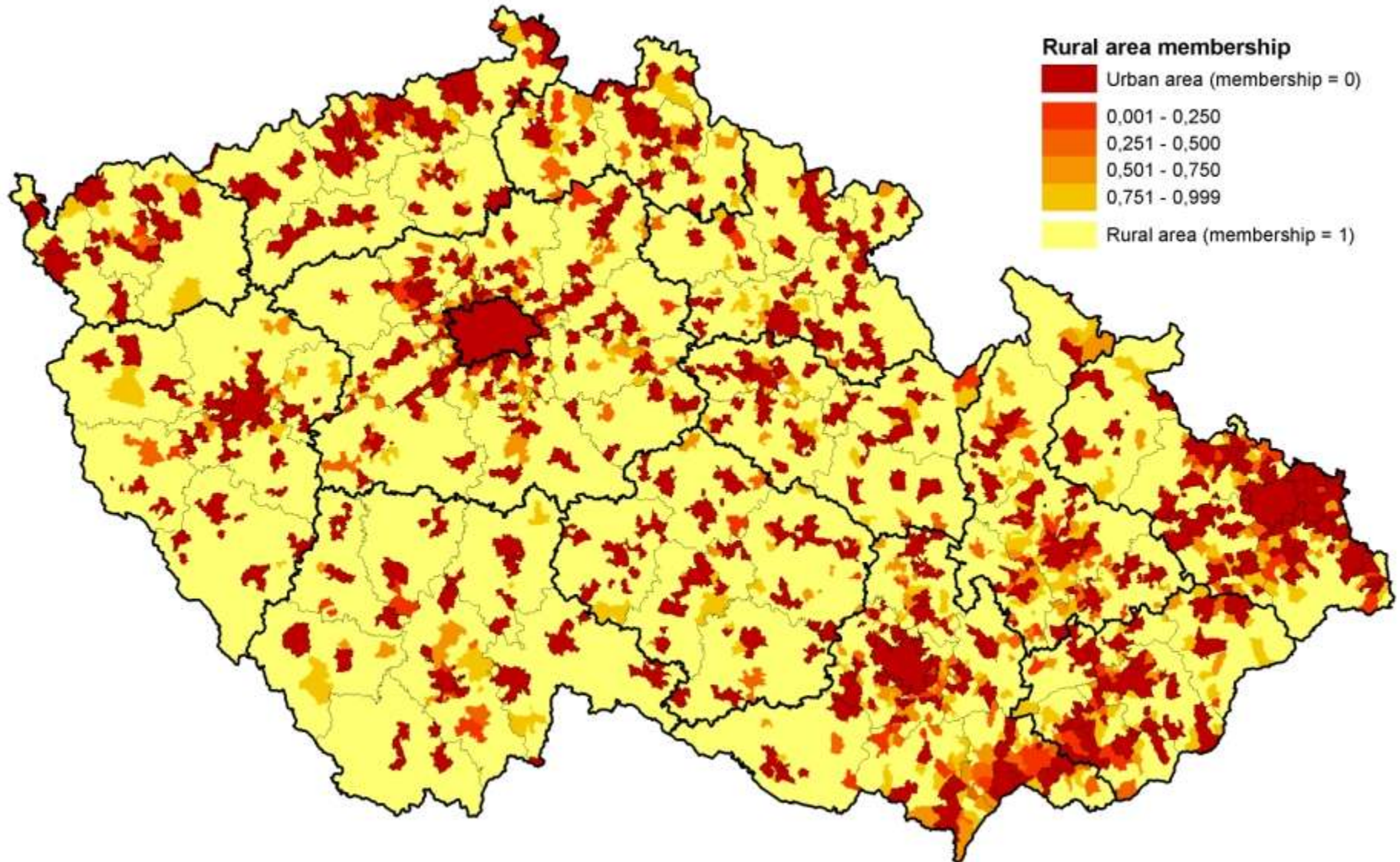# RURAL vs. URBAN

Visualization

- 4 maps:
  - first group (average of fuzzy membership of indicators)
    - Variation 1 and population density
    - Variation 2 and population density
  - second group (Lukasiewitz t-norm fuzzy logic)
    - T-norm map 1
    - T-norm map 2
    - This approach is more strict (not that wide transitional zone)

Rural area membership

Urban area (membership = 0)

0,001 - 0,250
0,251 - 0,500
0,501 - 0,750
0,751 - 0,999

Rural area (membership = 1)

Rural area membership

- Urban area (membership = 0)
- 0,001 - 0,250
- 0,251 - 0,500
- 0,501 - 0,750
- 0,751 - 0,999
- Rural area (membership = 1)

Rural area membership

- Urban area (membership = 0)
- 0,001 - 0,250
- 0,251 - 0,500
- 0,501 - 0,750
- 0,751 - 0,999
- Rural area (membership = 1)

Rural area membership

- Urban area (membership = 0)
- 0,001 - 0,250
- 0,251 - 0,500
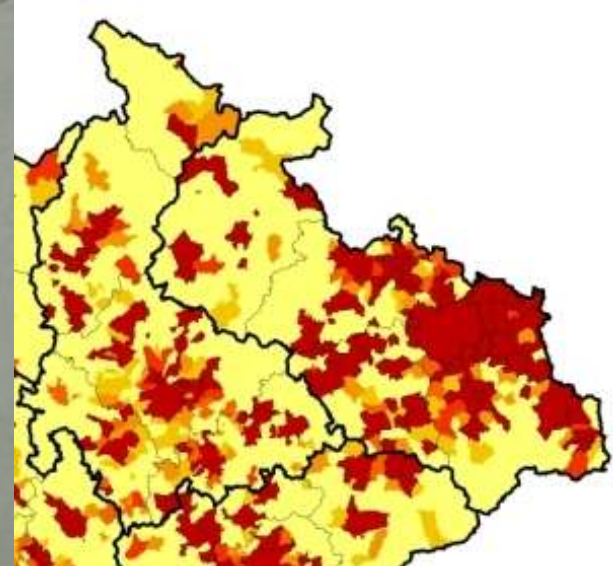- 0,501 - 0,750
- 0,751 - 0,999
- Rural area (membership = 1)
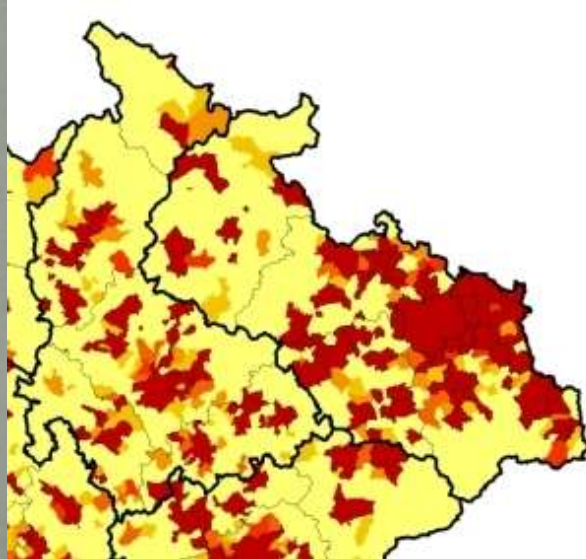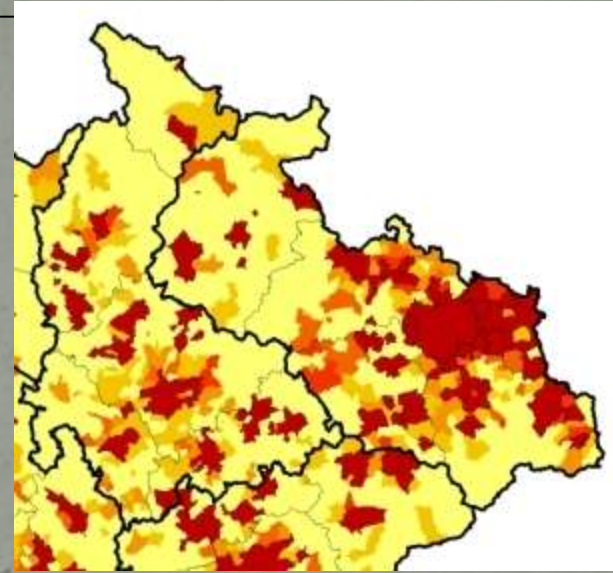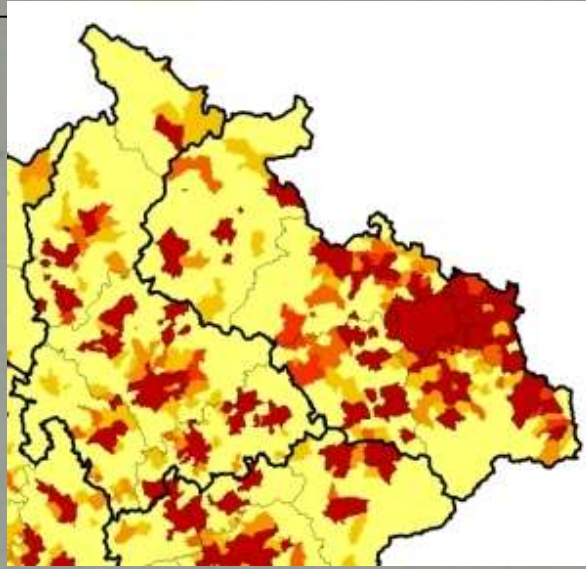
OSTRAVA SUBURB

CURRENT RESEARCH

- Five more indicators
    - Population on built area
    - Rate of flats in houses
    - Population/finished flat
    - Population change (1997-2006)
    - Distance from main regional city
- Problem – keeping recency of data

- Solution – National census of population, houses and flats 2011

THANK YOU FOR YOUR ATTENTION

Vít PÁSZTO

vit.paszto@gmail.com

Department of Geoinformatics, Faculty of Science, Palacký University in Olomouc,Tř. Svobody 26, 771 46 Olomouc, Czech Republic

CZSO's REGISTERS & VISUALIZATION

- Plenty of registers and databases:
  - Register of Economical subjects, Register of Enumeration Districts and Buildings, Register of Accommodation, Database of Foreign Trade, Municipal statistics
- …and Population and Housing Census (2001)
- New national concept – 4 cardinal registers:
  - Register of Territorial Identification and Addresses (in Czech RÚIAN)
  - The Register of Citizens (in Czech ZRO)
  - The Economy register
  - Estate register (in Czech ZRN)

CZSO's REGISTERS & VISUALIZATION

- Most of them – spatial pattern

And their visualization???

⬇

– „just" static maps (images)
– or clickable maps

? ? ?
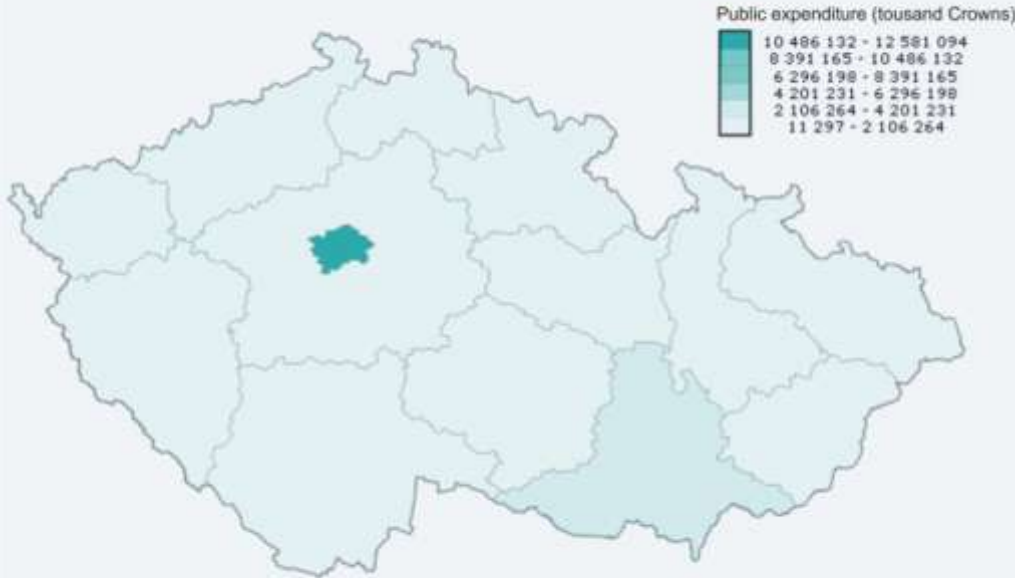
What about modern technologies

CZSO's REGISTERS & VISUALIZATION

Public database (PDB)

- One basic and uniform source

- Public presentation of mainly CZSO's data

- Downloadable free data

- Wide range of topics

- Simple visualization via maps
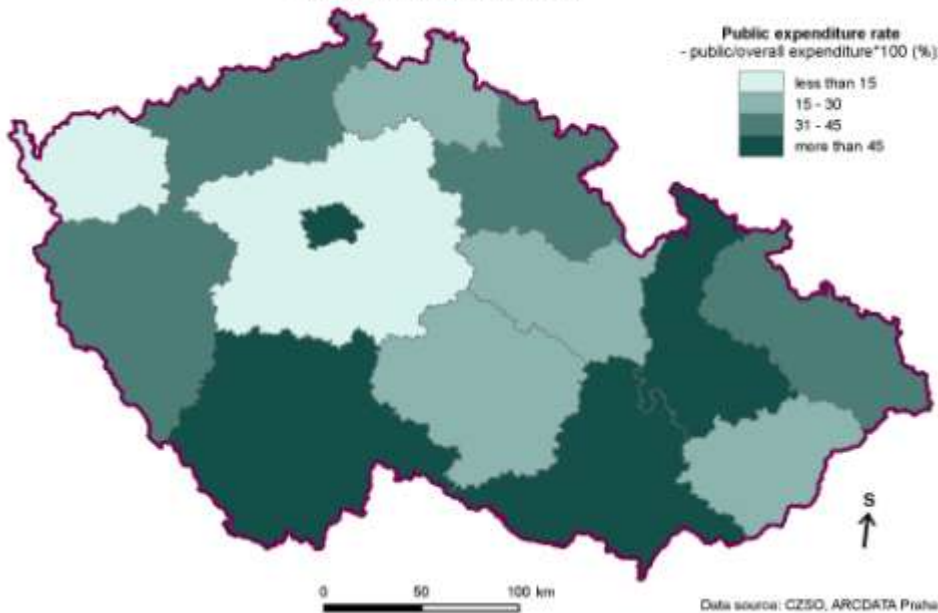
- Quick information tool

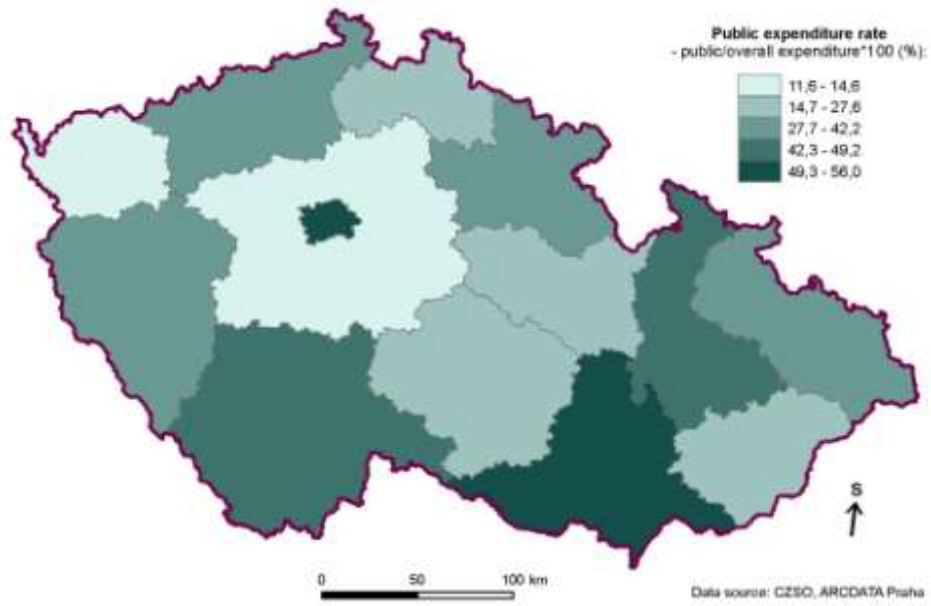Public expenditure on research and development (2007)

Public expenditure (tousand Crowns)
10 486 132 - 12 581 094
8 391 165 - 10 486 132
6 296 198 - 8 391 165
4 201 231 - 6 296 198
2 106 264 - 4 201 231
11 297 - 2 106 264

EXPENDITURE ON RESEARCH AND DEVELOPMENT IN CZECH REPUBLIC
Public expenditure rate in 2007

Public expenditure rate
- public/overall expenditure*100 (%)
less than 15
15 - 30
31 - 45
more than 45

Data source: CZSO, ARCDATA Praha

EXPENDITURE ON RESEARCH AND DEVELOPMENT IN CZECH REPUBLIC
Public expenditure rate in 2007

Public expenditure rate
- public/overall expenditure*100 (%):
11,6 - 14,6
14,7 - 27,6
27,7 - 42,2
42,3 - 49,2
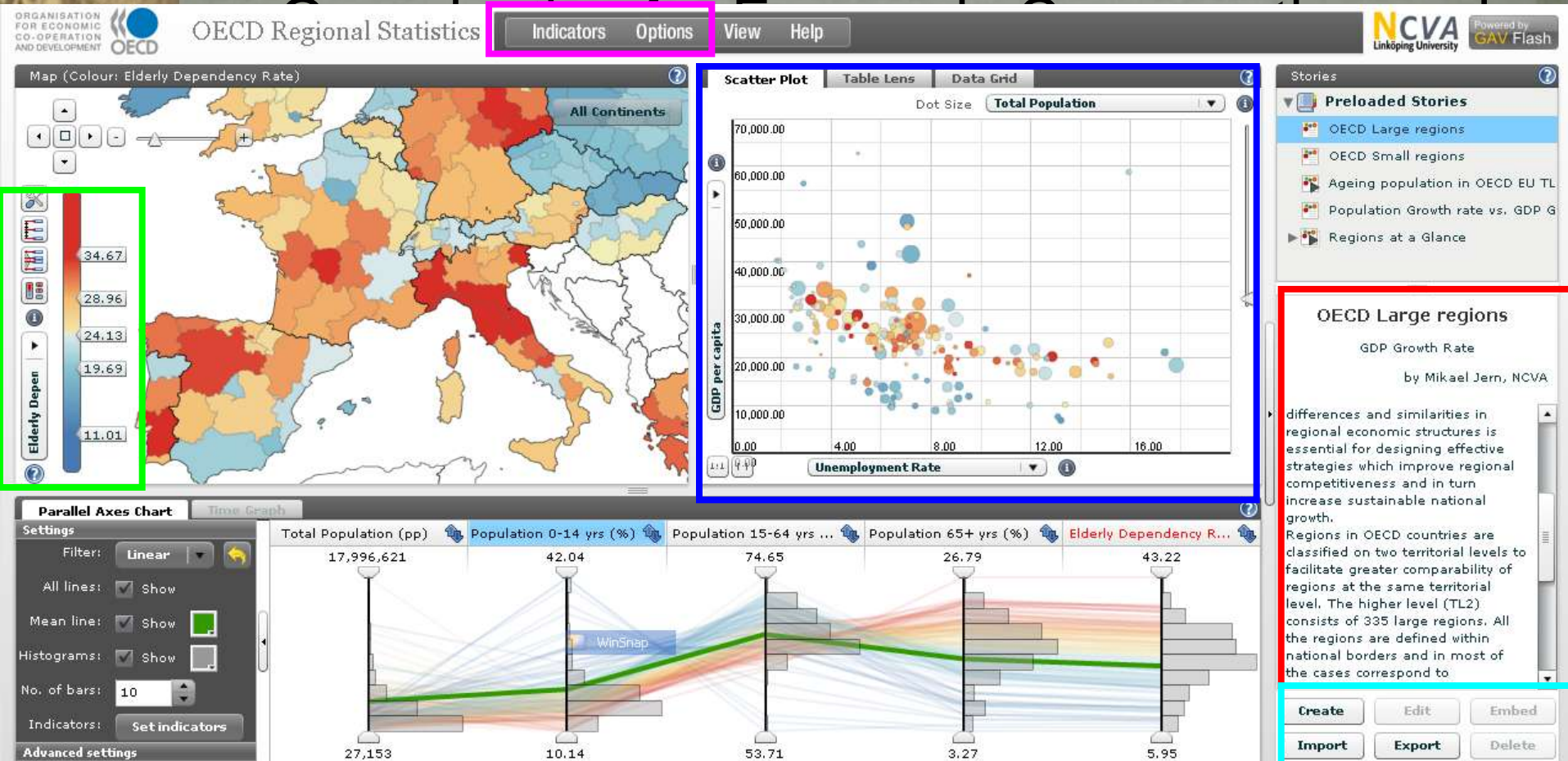49,3 - 56,0

Data source: CZSO, ARCDATA Praha

OECD VISUALIZATION

- Organisation for Economic Co-operation and Development

OECD eXplorer

– Web application

– Interactive maps for regional statistics

– Analytical tools

– Trends over time (time animations)

– 2D statistical graphs (e.g. scatter-plot)

– Export/import (.XML), upload own data

– And more…

OECD VISUALIZATION

– And more…

THANK YOU FOR YOUR 2nd ATTENTION

Vít PÁSZTO

vit.paszto@gmail.com

Department of Geoinformatics, Faculty of Science, Palacký University in Olomouc, Tř. Svobody 26, 771 46 Olomouc, Czech Republic