

# Long term land use database of Czechia (1845-2010): Methods of evaluation.

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# Overview of historical land use ideas

- Some authors as ideological background:  
Worster, W. Turner II, A. Mather, Y. Himiyama, H. Geist,
- Czech and Slovak authors:  
F. Žigrai, Z. Lipský, J. Kolář, J. Kolečka,  
J. Feranec, J. Otahel,
- Dynamic/ historical land use as a tool for studying landscape changes and interaction Nature- Society in data of land use
- What kind of changes are realized? Changes of functions given by Society in different level of development to the landscape in different location, natural, economic and social condition
- Big differences between land use structure in preindustrial, industrial and postindustrial phase of development
- Main break between historical and industrial development of land use structure is in Czechia on the end of 19th century. Second break point started on eighties and especially after Velvet revolution (1989)

# Database of land use change

- Database is derived from Franziscanian cadastral mapping in Cisleithania (Austro-Hungarian Monarchy) Years: 1826-1843; Scale 1: 2880, ca 13 000 cadastral units, from this maps was derived base of statistical evidency 50 recognized classes of land use (LU)!
- Evaluation of maps into tables and comparisson with data 1948 are localized in Central Archive of Cadastral Office in Prague, beggining of the fifties data tables were recalculated into metric units: hectars, kvadrat metres) but only some 20 classes of LU.
- Newly based state - Czechoslovakia (1918) used this system and calculated with 12 classes LU in 1918 – 2002. 11 classes are registered today.
- We applied old data from 1826 – 1843 (= 1845, when data were published for districts), then other time horizons were applied (1948 and 1990 as beggining and the end of communist goverments).
- Data from 2000 show ten years of social economic transformation and influence on the land use structure and size changes of different classes in Czechia.

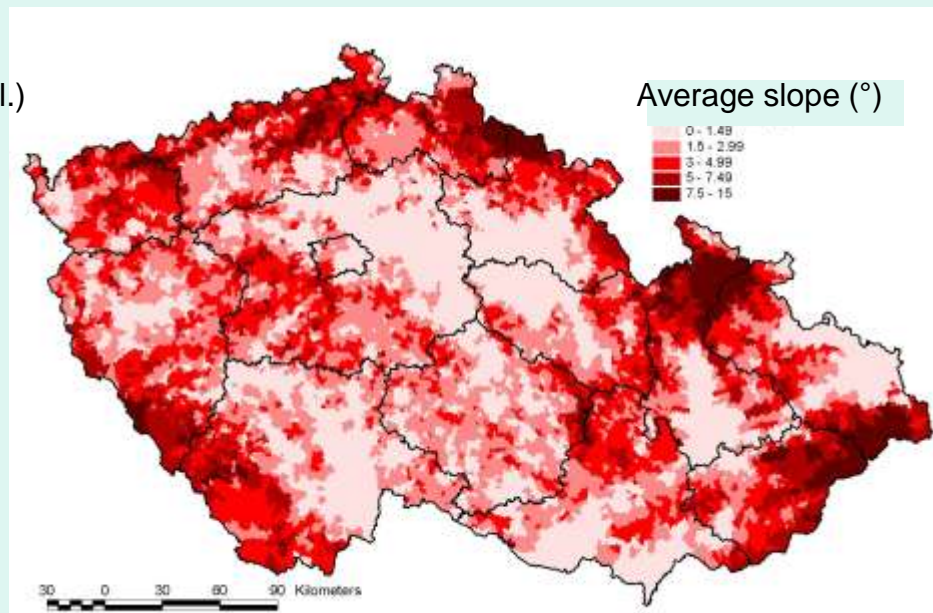
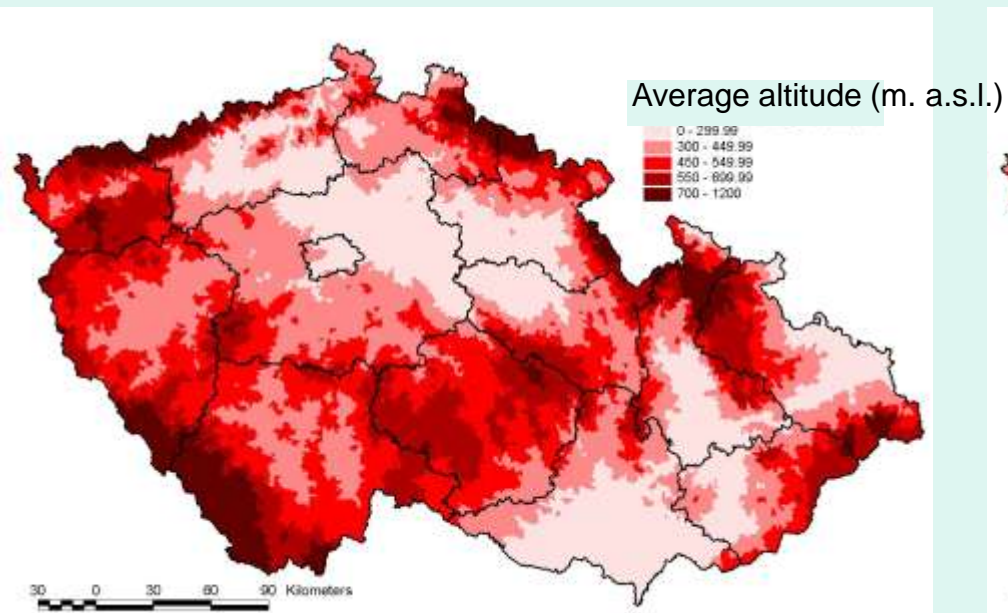
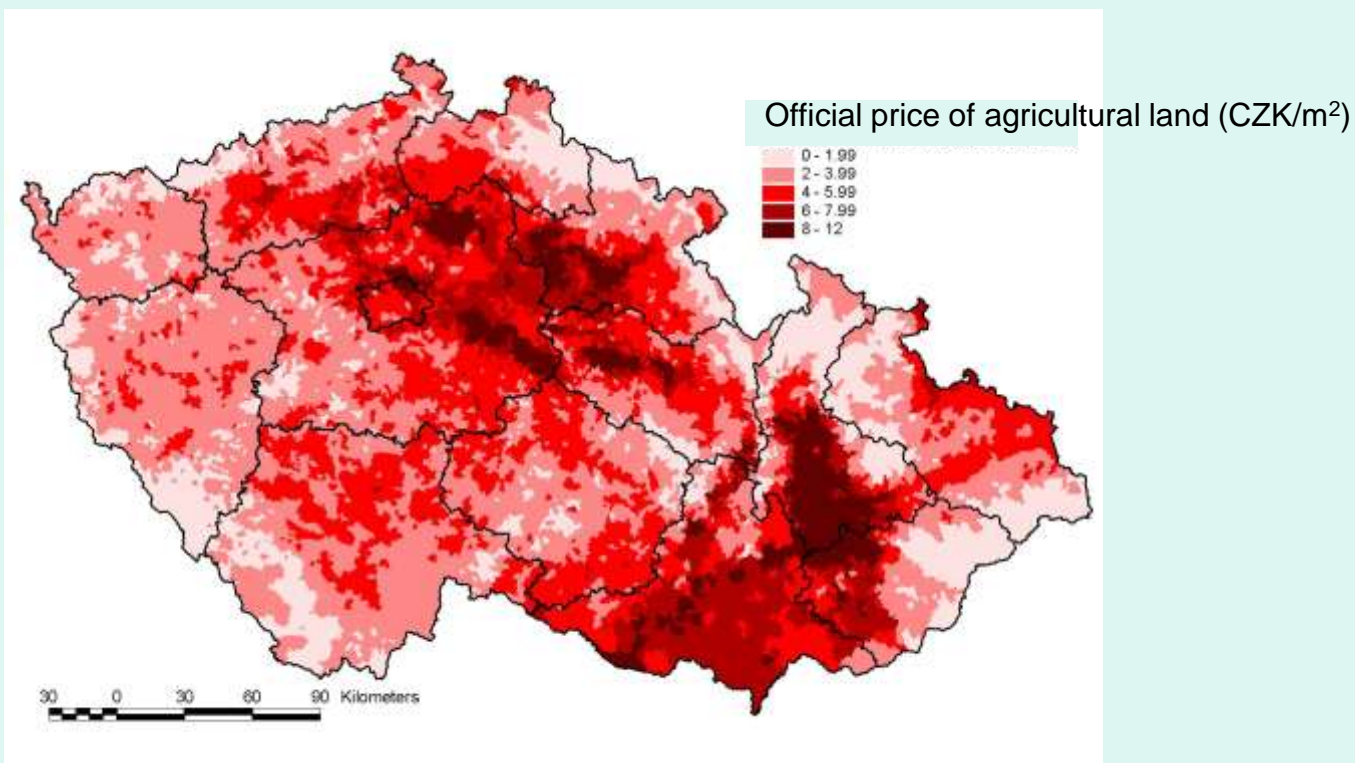
# Database of land use change

- Creation of Basic Territorial Units (BTU) comparable in four time horizons in size and structure = 8 classes:
- arable, permanent cultures (=vineyards, hopyards, orchards and garden), meadow, pasture (together =Agricultural land AGL), forest area, water bodies, built up, other area.
- From 13 000 cadastral units we created 8 903 BTU (with application size differentiation 1 % of their´s total area)
- Database was arranged 2 years ago on the website as individual BTU land use structure: [www.lucc.ic.cz](http://www.lucc.ic.cz) .
- **Problems of data´s quality: forest area x forests; gardens in the past and today, some other area = 1. zone of National parks, cemetary, military areas etc.**

# Aims of investigation

- Evaluation of the main processes realized in the landscape in special periods in last two centuries
- What kind of driving forces played main role in different periods, - external or internal or local/regional
- Regional differentiation of land use changes
- Comparisson of land use changes in Czechia and other Middle European countries
- Prediction of size development in different land use classes
- Impact of agricultural and environmental policy on the land use development
- **Application of different methods and comparing of the results**
- **Typology of land use structure changes**

Basic  
differentiation  
of natural  
conditions of  
Czechia  
(by J. Kabrda)

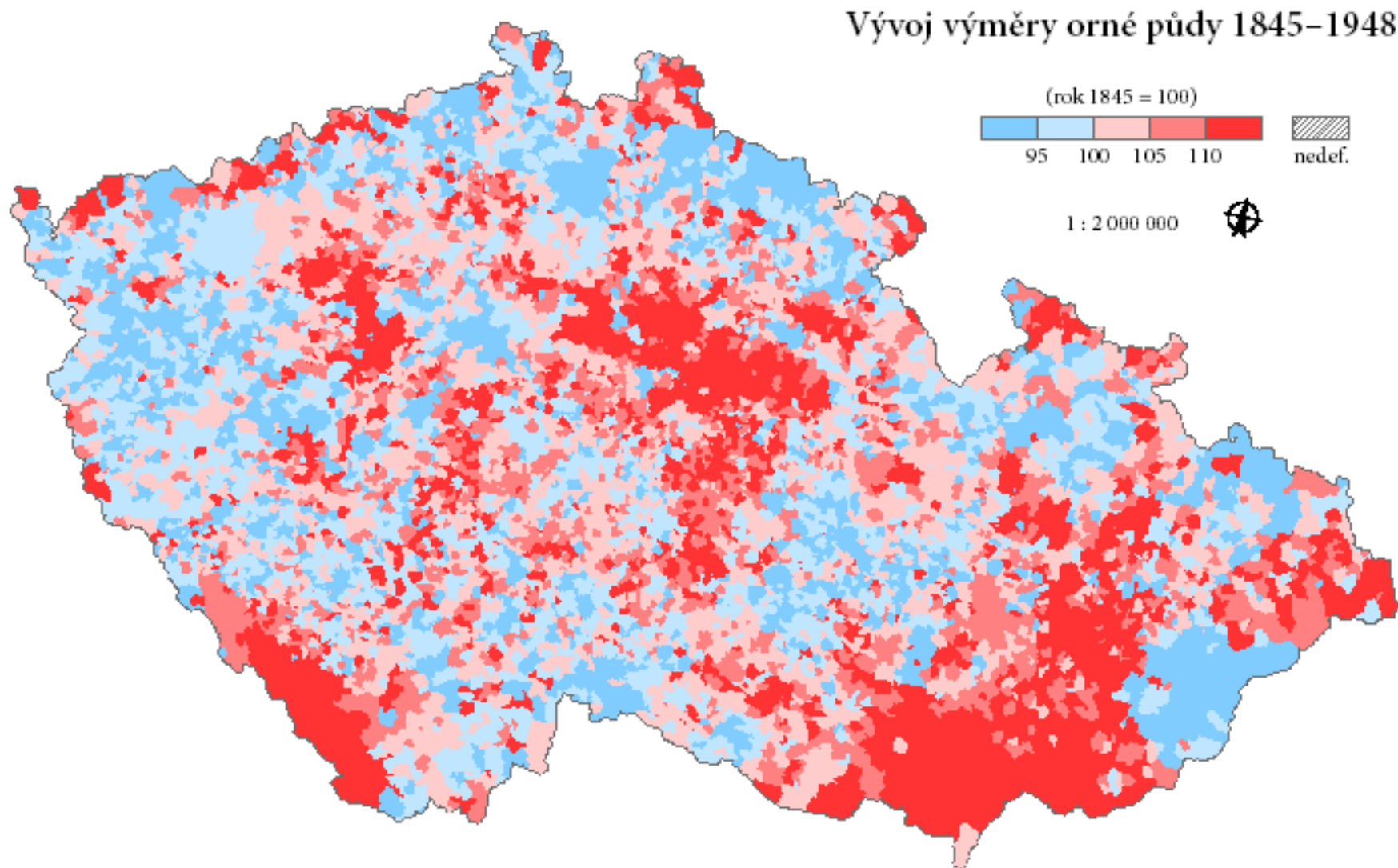




Development of classes between two time horizons:  
( $S_2/S_1 \times 100$ )

- Development of arable land size shows in period 1845-1948 big territorial differentiation
- In lowlands were size of arable land higher (grassland lost significance, abolishing of ponds, melioration of streams etc.) out of cities neighbouring
- Also some mountain areas fastly afforested started be used for wood production. Population grew up in high altitude and also small parts of arable land grew up quickly (from the small ground)
- Most of territory characterized decrease of arable land continuing till today and seems to be also in the future
- All territory of Czechia in the period lost in the period 1948-1990 arable land (ca 18 % of size from 1948 year)

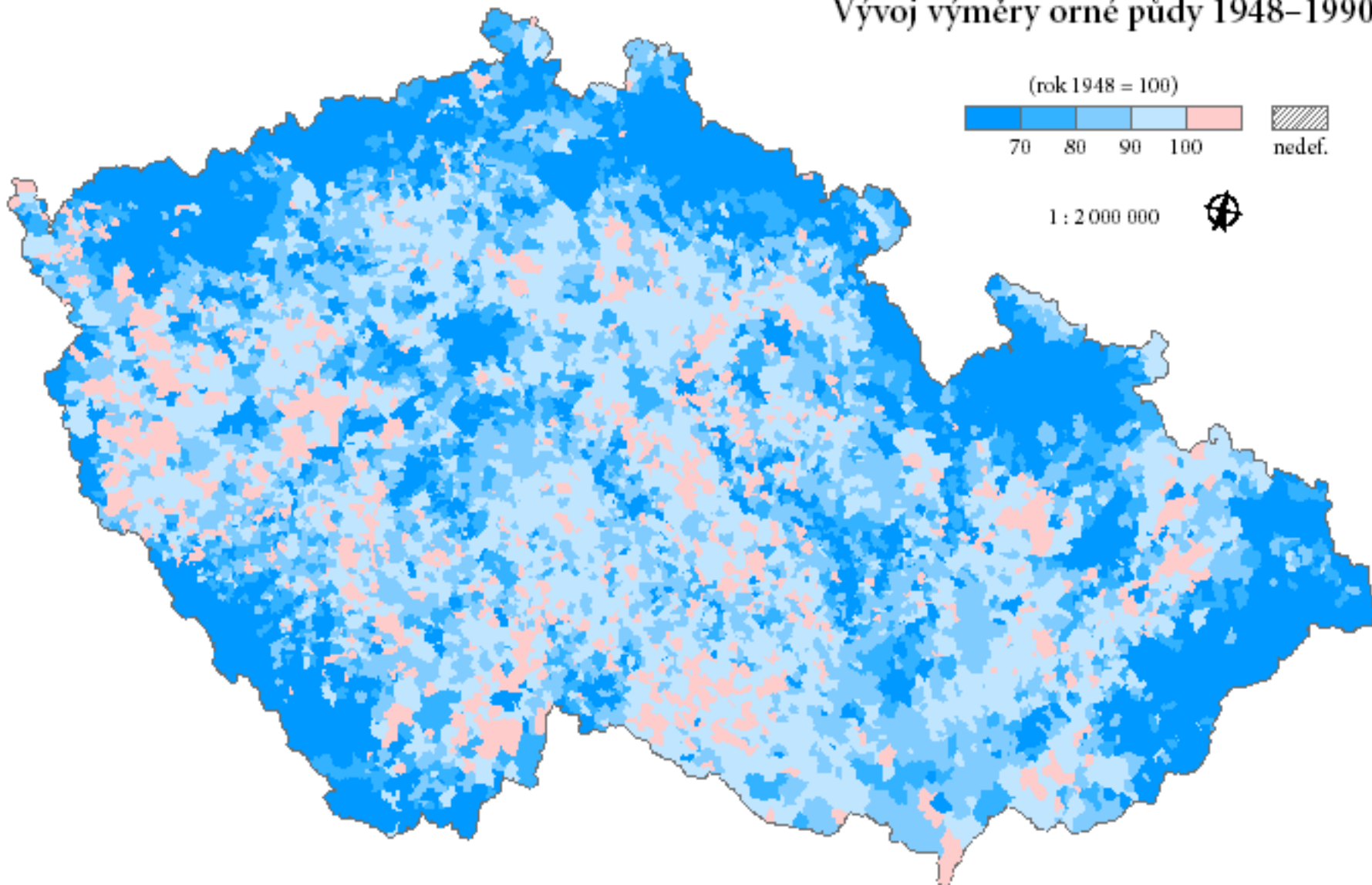
# Development of arable land size in 1845 – 1948 (1845 = 100%)





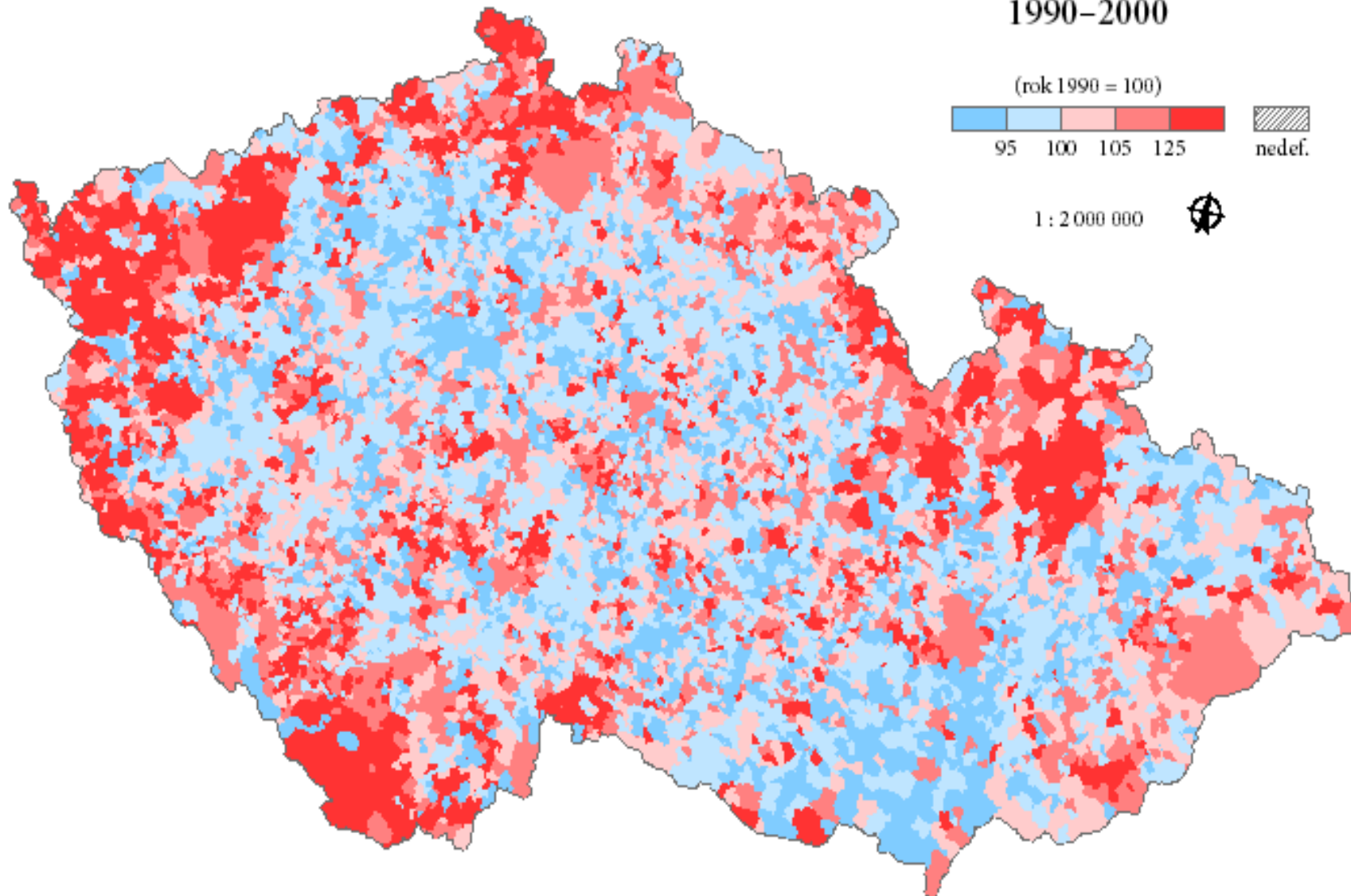
# Development of arable land size in 1948 – 1990 (1948= 100%)

Vývoj výměry orné půdy 1948–1990



# Development of grassland size in period 1990 – 2000 (1990= 100%)

Vývoj výměry trvalých travních porostů  
1990–2000



# Development of land use macrostructure

- Share of agricultural land size, forests and other area (three basic components of the landscape)
- Specific methods for expression of land use macrostructure:
- Triangle graphs are suitable for expression of the structure ( as a **point**) and also for development between two or more time horizons ( as a **vector(s)**)
- Method of evaluation of size increases or stabilization (+) and size decrease of specific category (-). Combination of „+“ and „-“ gives in evaluation of agricultural land, forest and other areas six combinations. What type of land use structure development was most important in different periods 1845 – 2000?

# Typology of the macrostructural categories development

Agricultural land, Forest, Other areas (built up, water, the rest)  
 (+ increase of the size, - decrease of the size)

TYPE	1845 – 1948			1948–1990			1990–2000		
	number BTU	% BTU	% area	number BTU	% BTU	% area	number BTU	% BTU	% area
<i>Hlučínsko</i>	18	0,20%	0,33%						
+++	3	0,03%	0,01%	1	0,01%	0,00%	141	1,58%	0,69%
++-	272	3,06%	2,53%	7	0,08%	0,01%	1 904	21,39%	19,03%
+ - +	1 608	18,06%	16,64%	12	0,13%	0,07%	490	5,50%	5,30%
+ - -	721	8,10%	7,80%	2	0,02%	0,00%	1 234	13,86%	11,48%
- + +	4 053	45,52%	46,64%	8 062	90,55%	89,84%	2 543	28,56%	30,03%
- + -	1 286	14,44%	13,20%	47	0,53%	0,42%	905	10,17%	12,00%
- - +	942	10,58%	12,85%	772	8,67%	9,64%	1 686	18,94%	21,48%
<b>Total number of BTU</b>	<b>8 903</b>			<b>8 903</b>			<b>8 903</b>		

# Evaluation of Nature – Society impact

## Coeficient of anthropogenic influence (CAI):

**Example:** arable land: 180 ha, permanent cultures: 2, grassland: 18, forest area: 85, water area: 2, built up: 4, remaining areas: 9, **Total: 300 ha**

$$\text{CAI} = \frac{\text{arable} + \text{built up} + \text{remaining}}{\text{grassland} + \text{water} + \text{forest}} = \frac{180+4+9}{18+85+9} = \frac{193}{122} = 1,58$$

# Coefficient of anthropogenic influence 2000 (CAI = arable+built up+ remaining areas)/(forest+meadow+pasture+water areas)

ID\_2011 Míra antropogenního ovlivnění krajiny (2000)

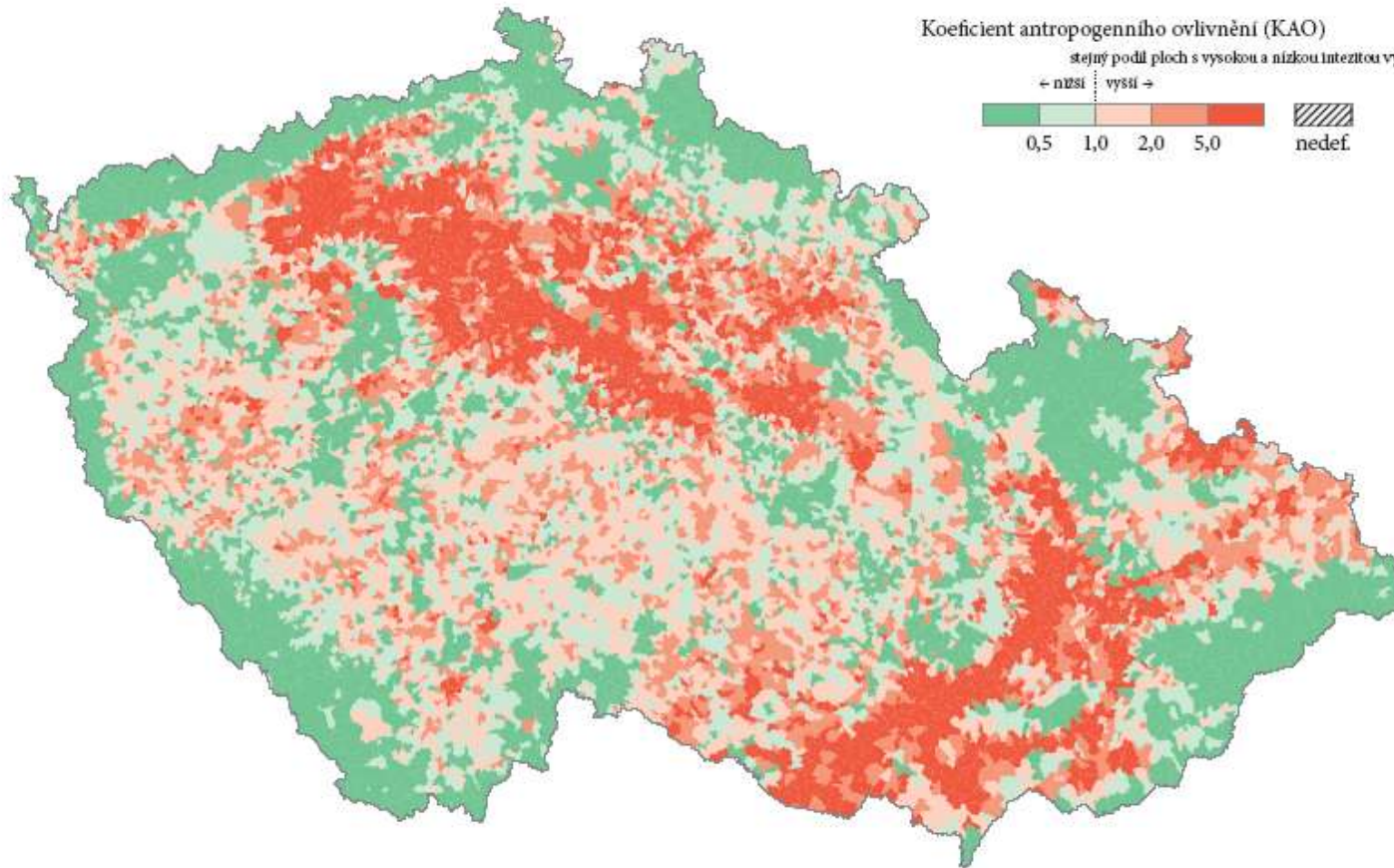
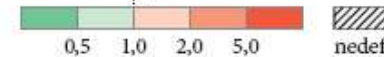
RNDr. Lucie Kupková, Ph.D.

$$KAO = \frac{\text{orná půda} + \text{zastavěné plochy} + \text{ostatní plochy}}{\text{lesy} + \text{louky} + \text{pastviny} + \text{vodní plochy}}$$

Koeficient antropogenního ovlivnění (KAO)

stejný podíl ploch s vysokou a nízkou intenzitou využití

← nižší → vyšší →



Hodnota za Česko: 1,04

Průměr za katastrální území: 7,61

Zobrazované jednotky: katastrální území

Zdroj dat: Databáze LUCC Czechia PfF UK v Praze

1 : 2 000 000





# Idea and construction of main landscape processes

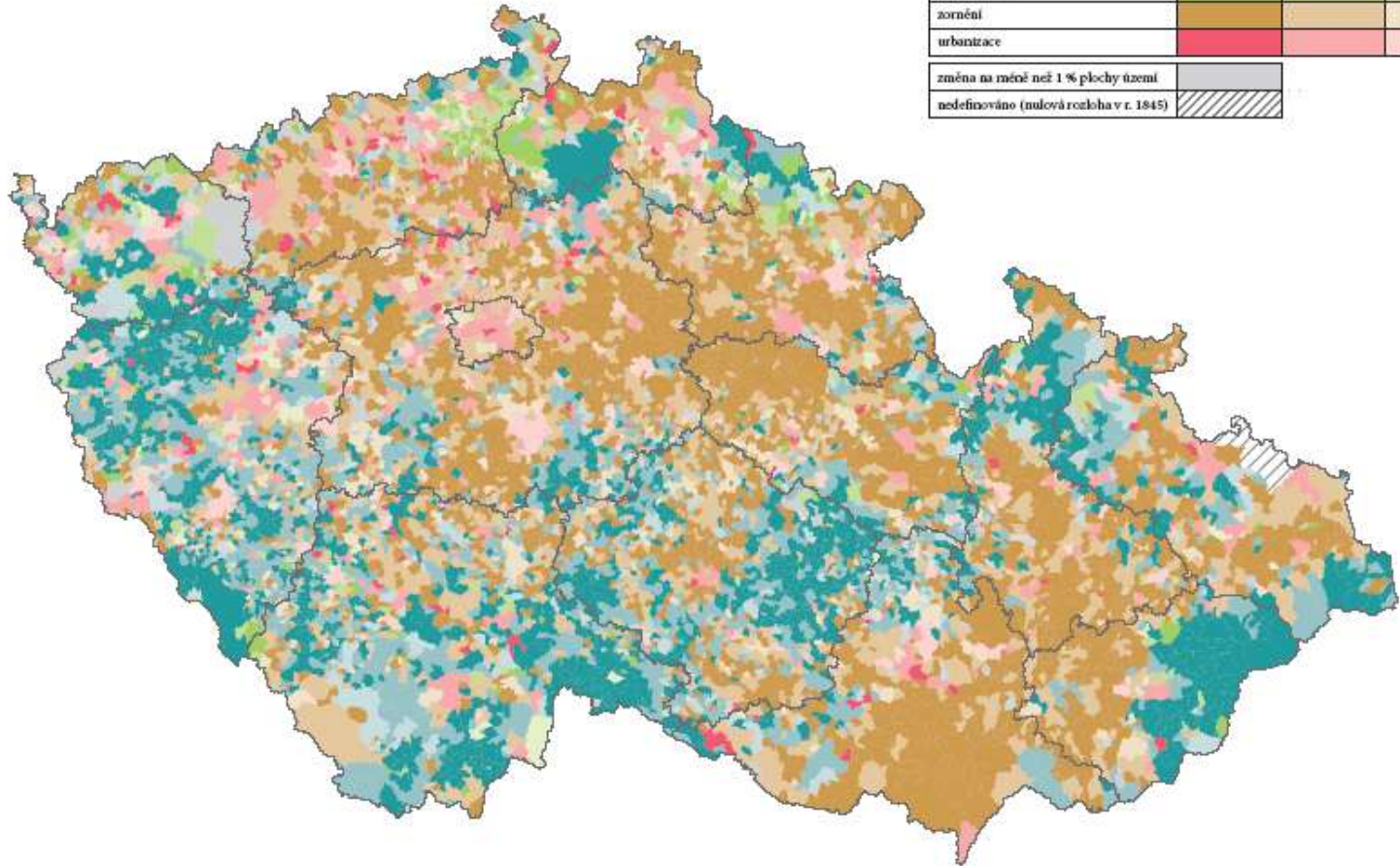
- Developed by Slovenian geographers (Kladnik, Gabrovec, Petek)
- Construction from the size of 4 main categories of land use structure:
  - arable land+permanent cultures
  - grassland (meadow + pasture)
  - forest areas
  - built up + other areas
- Calculation of the increased categories sum between two time horizons
- Calculation of the biggest category share on this sum
- **three levels of intensity in %:** weak – 50 – medium - 75 – high
- **Four main processes:**
  - **Intensification of farming**
  - **Grassification**
  - **Afforestation**
  - **Urbanization**

# Principal landscape processes in the period 1845-1948

## ID\_865 Hlavní procesy změny krajiny (1845–1948)

doc. RNDr. Ivan Bičík, CSc.; RNDr. Lucie Kupková, Ph.D.

	vysoká míra	střední míra	nízká míra
zalesňování			
zatravňování			
zornění			
urbanizace			
změna na méně než 1 % plochy území			
nedefinováno (nulová rozloha v r. 1845)			



1 : 2 000 000



Zobrazované jednotky: ZÚJ (základní územní jednotky)

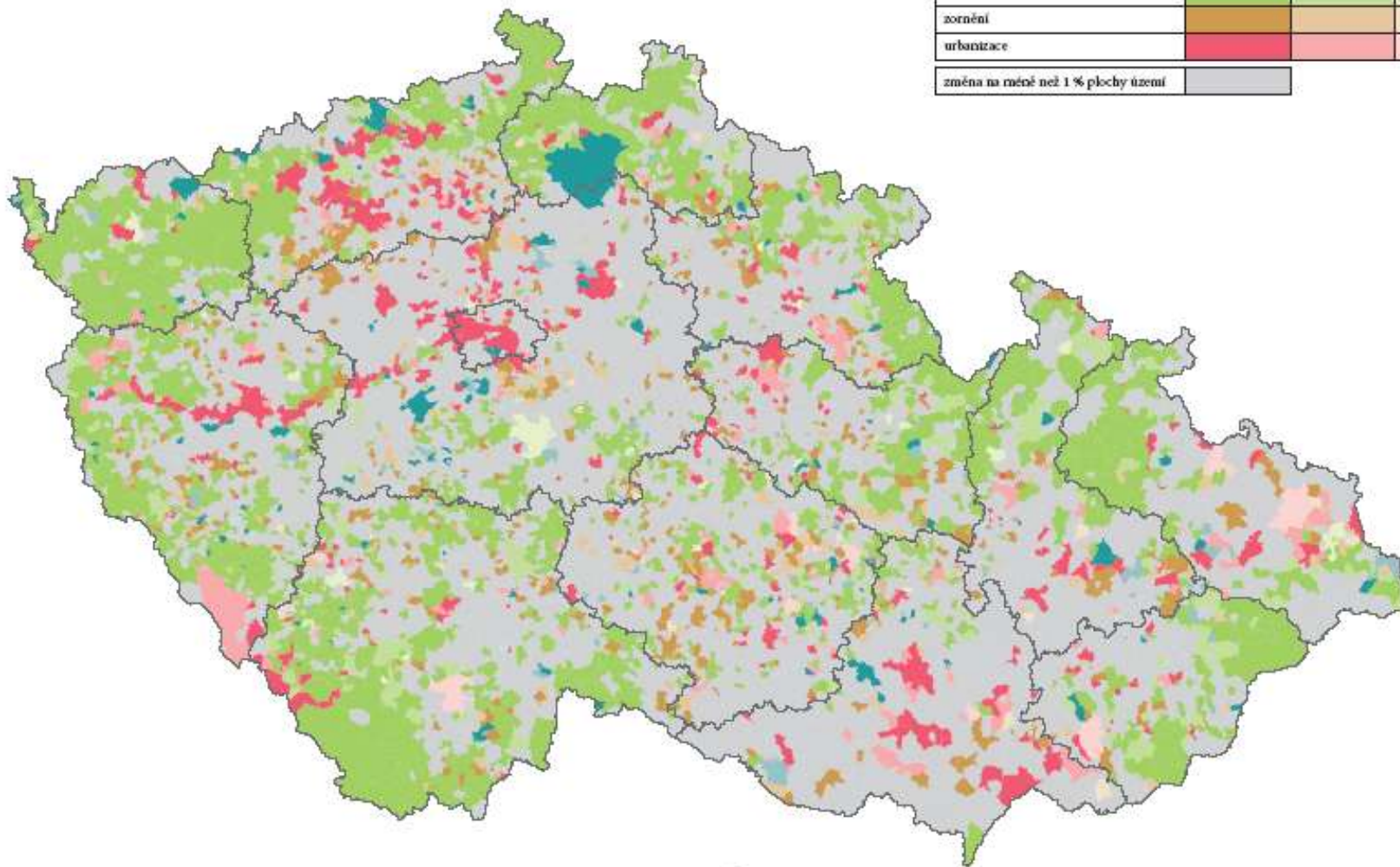
Zdroj dat: Databáze LUCC Czechia PfF UK v Praze

# Principal landscape processes in the period 1990-2000

## ID\_867 Hlavní procesy změny krajiny (1990–2000)

doc. RNDr. Ivan Bičík, CSc.; RNDr. Lucie Kupková, Ph.D.

	vysoká míra	střední míra	nízká míra
zalesňování			
zatravňování			
zornění			
urbanizace			
změna na méně než 1 % plochy území			



1 : 2 000 000



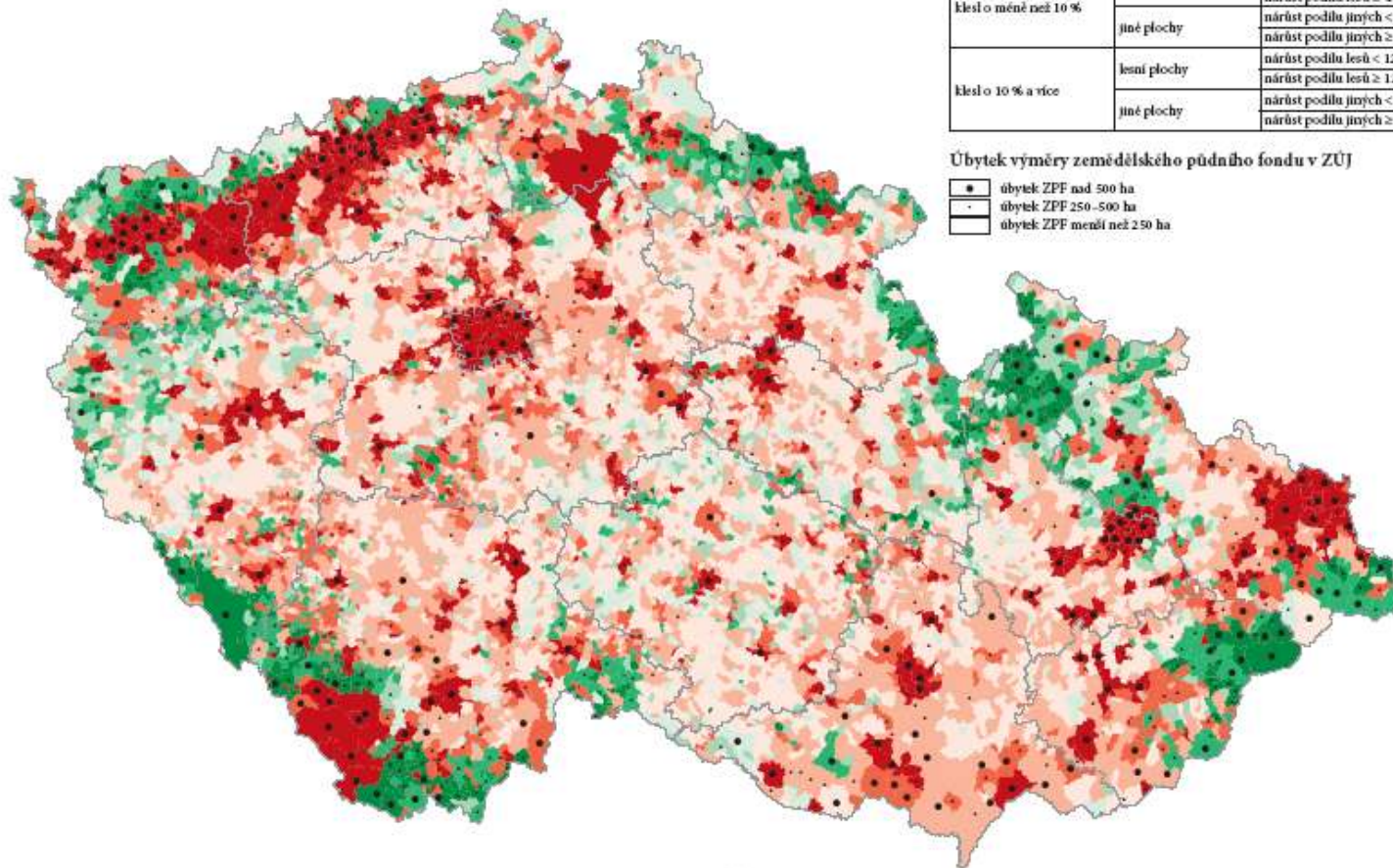
Zobrazované jednotky: ZÚJ (základní územní jednotky)



# Change of land use 1948-2000. Types of changes.

## ID\_863 Změna využití krajiny (1948–2000)

RNDr. Lucie Kupková, Ph.D.; doc. RNDr. Ivan Bičík, CSc.



1 : 2 000 000



Zobrazované jednotky: ZÚJ (základní územní jednotky)

Zdroj dat: Databáze LUCC Czechia PřF UK v Praze

Pozn.: rozloha ZÚJ (základní územní jednotky) = ZPF + lesní plochy + jiné plochy  
 ZPF (zemědělský půdní fond) = orná půda + trvalé kultury + trvalé travní porosty  
 jiné plochy = vodní plochy + zastavěné plochy + ostatní plochy  
 Porovnání je stav 2000 vůči roku 1948.  
 V případech, že relativní nárůst lesů a jiných ploch byl stejný (tj. se celkem 4 ZÚJ),  
 o zařazení do typu rozhoduje větší absolutní nárůst výměry.

# Conclusions I

- Database gave us chance to compare special processes realized in different regions and localities in 170 years.
- Evaluation of database gave general information about processes realized in landscape, **in regional and state levels**. For local level must be used other especially environmental methods of evaluation.
- Maximal size of agricultural land as arable land were reached in the end of 19th century, from this time both classes are in permanent decrease. **In second half of 20th century decrease reached 18 and 20 % of size in 1948.**
- Grassland were important on the beginning of observed period, then lost its function. But increase of **grassland size is visible almost in half of BTU after 1990!** Main reason: economy of farming and effort to reach multifunctional landscape.
- Forest area is from the beginning of 20 century in slow increase permanently, especially in mountain, hilly and worse soils regions. Area in Czechia rose up from 30-34 %. Czechia is in the Mather's conception in the **phase of forest conversion.**
- We could recognize creation of bigger areas of similar land use structure and its development (hundreds of the BTU). **There is influenced by economic reasons and there are created regions with one dominant function (- similar land use structure and its development).** But our effort is creation of multifunctional landscape.

# Conclusions II

- **Increase of built up areas and other areas reached 200 and 300 % of their size in 1948.**
- After 2000 year started be too big differences in land classes size in cadastral survey and in the field (especially in arable land and grassland). Differences reached **5 – 7 % of total size** in arable land and a little more in the case of grassland.
- Differences are influenced by deep changes in owners structure after 1990 (3,5 millions owners!) and **differences between owners and users structures!**
- We could recognize main driving forces in last two centuries influencing land use changes. There are **especially political and economic reasons different in all observed periods (Bičík, Jeleček: 2009)**