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Land use changes in Czechia based on data from cadastral evidency

(1845 - 1896 - 1948 - 1990 - 2010).

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Nature – Society dynamic relations

- Our investigation is oriented on the land utilization id different time horizons. Information about land use/land cover is picture of interaction between Nature and Society

- Generally: this interaction has three main phases (Hampl 2002):

  Traditional and preindustrial landscape – Determination
  Society could to survive only using local/microregional sources and outer sources are very small;

- Industrial landscape – Competition
  Society started be step by step one of the most strong power changing landscape and Nature on the local - regional – macroregional and global levels;

- Postindustrial landscape – Cooperation
  Rich Society is able to preserve and reconstruct Nature in some parts of landscape; only some most rich states are in this level; only in the part of their territory this policy is applied

Topics in contemporary investigation

Choosen terms in abstracts and key words in articles in 2 databases (1970 – 2010); source Balej (2012)

	key words	1970	1980	1990	2000	2005	2010
web	lanscape ecology			21	114	119	177
of	lanscape metrics				15	57	74
Science	land use	65	132	228	1350	2563	4335
	land cover		3	28	361	810	1267
scopus	landscape ecology			15	159	174	408
	landscape metrics				13	60	73
	land use	19	48	256	1456	2373	4102
	land cover		1	9	295	603	1119

Historical/dynamic LULCC

- Some authors as ideological background:
  Worster, D.; Turner, B., II.;, Mather, A.; Himiyama, Y.; Geist, H., Aspinall, X.; Gabrovec, M; Krausmann, F. and others….; Czech and Slovac authors:
  Žigrai, F.; Růžička, J., Lipský, Z.; Kolář, J.; Kolejka, M.; Feranec, J.; Otahel, J.; Jelecek, L.;

- Dynamic/ historical land use is a tool for studying landscape changes and interaction Nature - Society using data of land use/land cover;

- What kind of changes were realized? What kind of driving forces were applied? Why? Where? By whom?

- Society gave to parts of landscape some function(s) in different level of societal development;

- The change of the LUCC was influenced by different location, natural conditions, historical, economic and social conditions; we can not find only one influencing factor, there is multifunctional influence!!!!

Historical Land Use/land cover changes (LULCC)

- Three basic ways of investigation LULCC:
- 1. Comparison of old maps (mapping 1826 - 1843) with contemporary field mapping or orto-foto maps; usually only small territory with application geo-ecological methods;

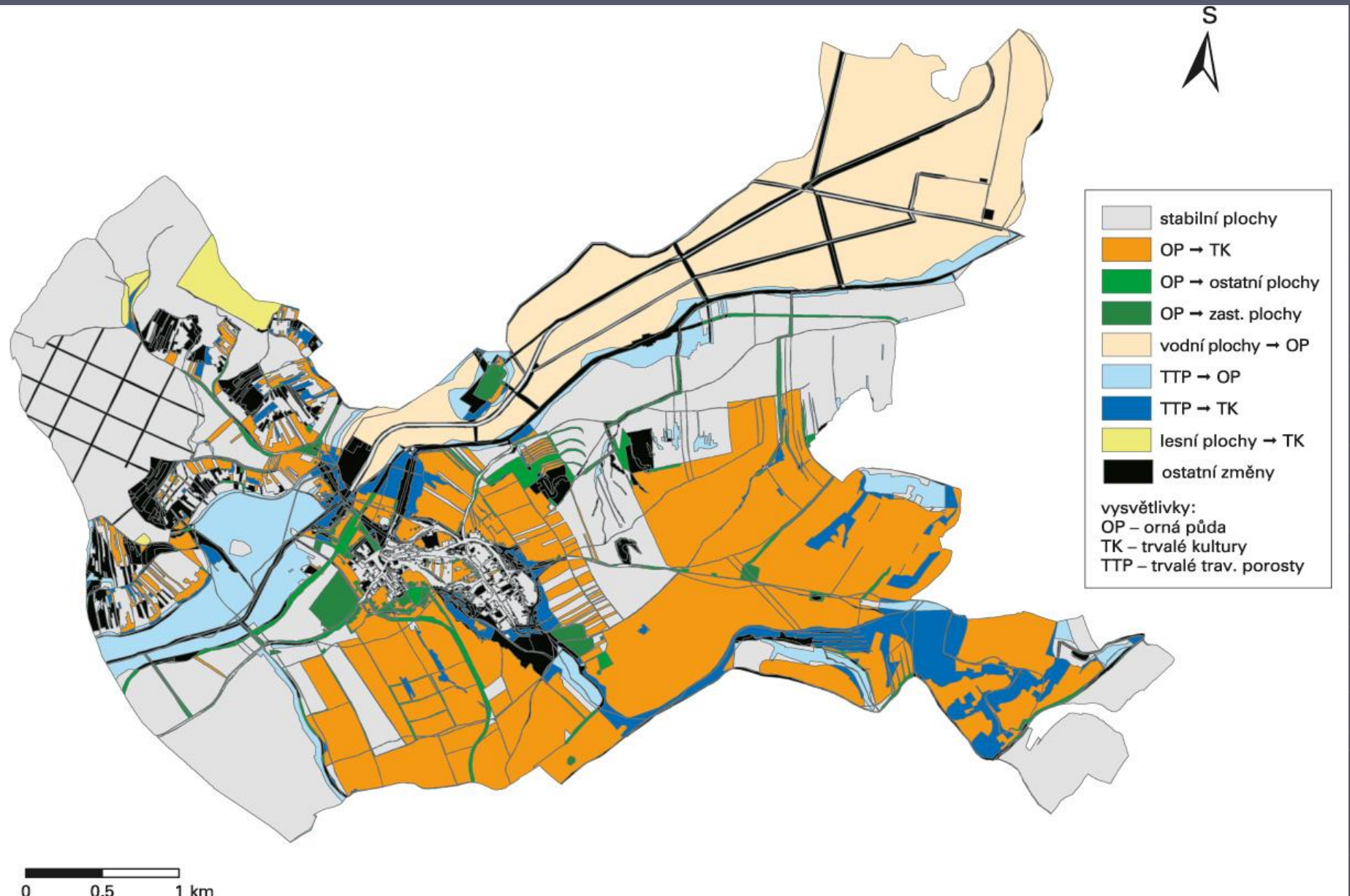
- 2. Statistical data covering all territory in Czechia on the base 13 000 cadastres or ca. 9 000 (basic territorial units =BTU); Database has data from: 1845, 1948, 1990, 2000 (newly filled up 1896 and 2010

- 3. Land cover change covering in utilization as local as regional as macro-regional scale, but only in the last 20 – 30 years in remote sensing and 40-70 years in the case of aerophotography;

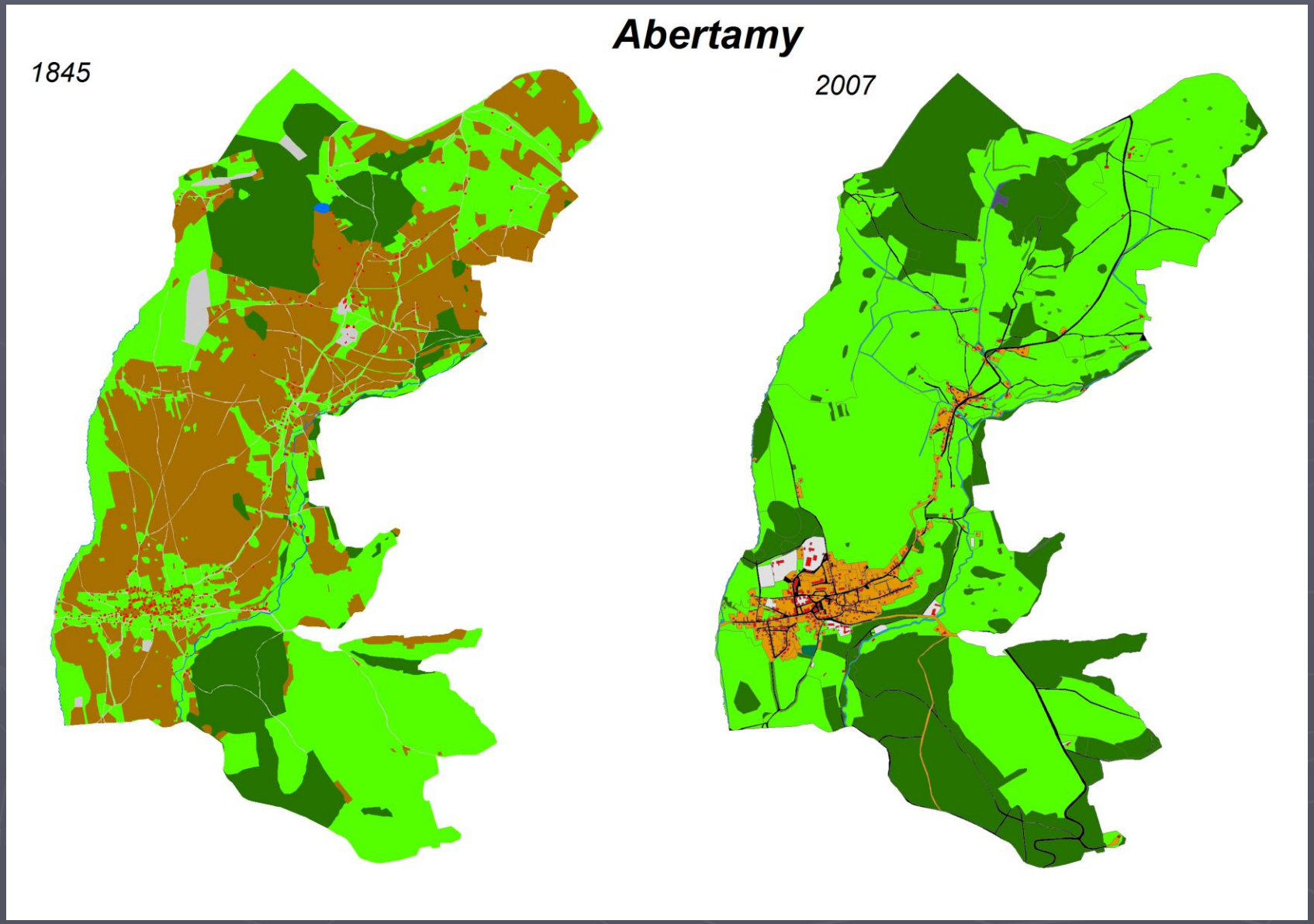
Comparisson of maps from different time horizons

- Old maps are from Franziscan cadastral mapping in years 1826 – 1843; Scale 1: 2880;
- Modern mapping 1: 10 000 (1998 – 2010);
- Transformation into comparable scale 1:15-30 000 in GIS;
- Evaluation of stable and unstable areas of individual categories of land use = index of change;
- Localization of critical places, lines, hot pots, which influenced local changes; question of changing functions in comparable time horizons; Other concepts: Driving forces, concept DPSIR, social metabolism etc……

Changes of land use in Kobylí: 1840 - 2003



Comparisson of two detailed maps:
Change of land use in Abertamy (Krušné hory: 600 – 900 m a.s.l.)



Change of categories size from 1842 (1st column) into different categories in 2000 (rows in ha)

Total area 857,5 ha	arable	perm. cult.	grass-land	bulit up areas	forest	water area	remai-ning	Total
arable	0	9,78	248	2,1	27,7	2,3	13,4	339,3
perm. cultures	0	0	0	0	0	0	0	0
grassl.	0	13,8	211,5	3,4	91	3,3	13,7	125,2
built up area	0	0,9	1,5	1,5	0,3	0	0,5	3,2
forest area	0	0	23,4	0	115,8	0,2	3,3	26,9
water area	0	0	1,7	0	0,3	1,6	0,2	2,2
remainin	0	1,9	14,5	0,4	5,7	0,3	7,5	22,8
Total	**0**	**26,4**	**325,1**	**5,9**	**124,9**	**6,2**	**31,1**	**519,7**

Conclussions of method applying map comparissons

- Abertamy is excellent example of big changes in land use;
- Territory was influenced very deeply by Czech Germans displacement after WW II and following closing this area from the reason of Uranium ore mining (also with political prisoners work);
- There is also visible realization of forest transition (Mather´s theory), forest land are in progress as here as in all Czechia (20th century from 29 to 34 % in the CR);
- There are in the field many rests of mining activity (from 15th to 20th century, ores: Zn, Sn, Ar, Fe, U) old mines, new water drainage, open pits, tunnels in the ground (more then 50 km!), old ways etc.;
- Abertamy was influenced by wave of depopulation after 1989, when finished support of agriculture and small industrial plants were closed.
- This type of detail long – term land use changes evaluation can be applied in some works concern on the Nature preservation and reconstruction and also in so called „complex parcels reconstruction" realized now in Czechia.

Upper Abertamy in winter today (ca 850 m a.s.l.): new function after 5 centuries of mining = recreation

Dynamic/historical land use

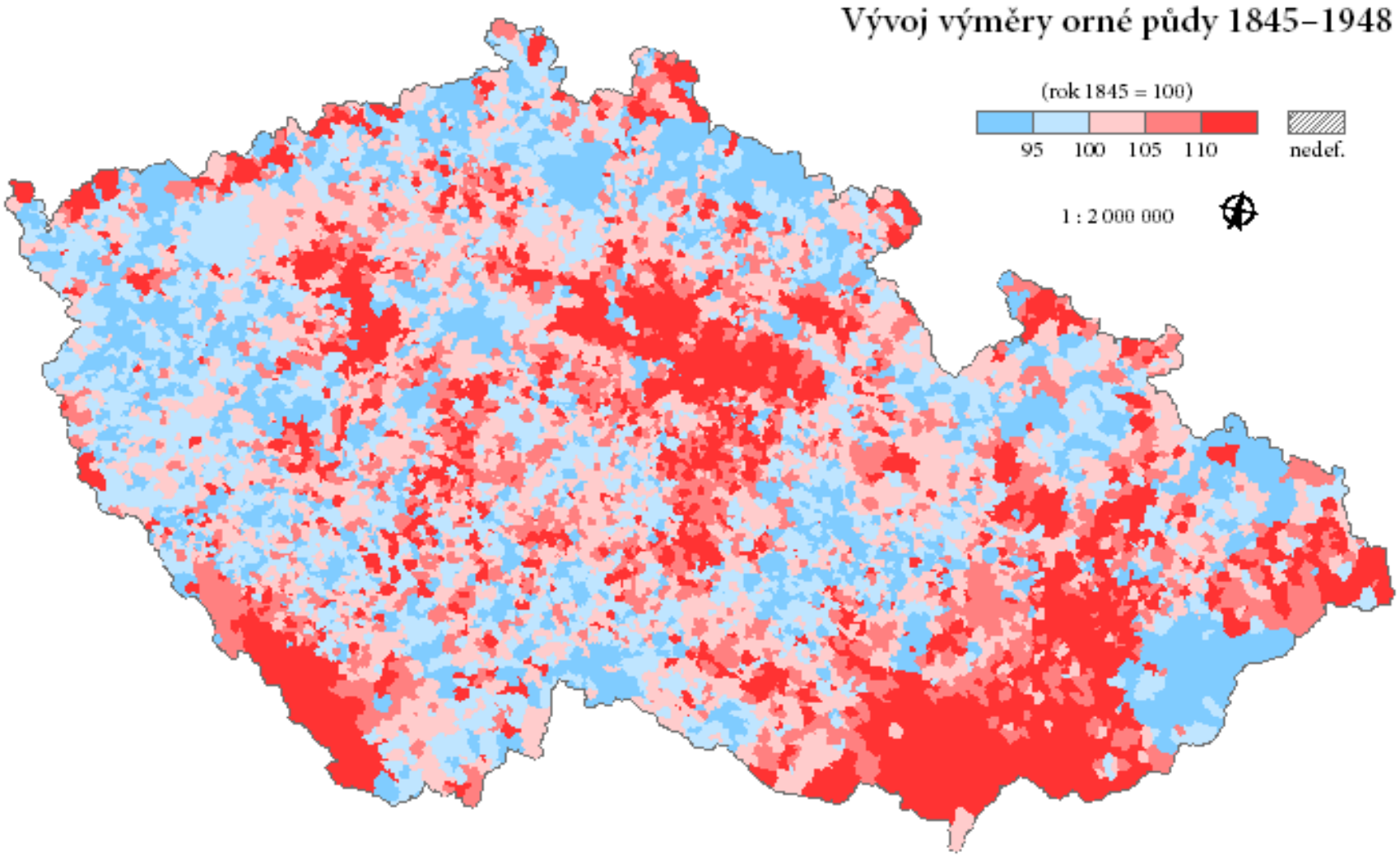
Data from 13 000 of cadastres covering all Czechia were transformed into ca 9000 BTU;

1845= ca 50 categories, 1948=ca 20 categories, 2000=12

Remaking of archives data on 8 categories comparable in all time horizons

Basic structure	macrostructure
arable land	
permanent cultures	
meadows	**= Agricultural land**
pastures	
forest area	**= Forest area**
water areas	
built up areas	**= Other areas**
remainining areas (unproductive)	

Development of arable land size in 1845 – 1948 (1845 = 100%). Example: Database gave possibility to study more then 50 cartograms of different categories in 6 periods



Typology of the macrostructural categories development Agricultural land, Forest, Other areas (built up+ water+ the remaining);
+ increase of the size, - decrease of the size)

	period 1845 – 1948			period 1948–1990			period 1990–2000		
TYPE	Number of BTU	% BTU	% area	number of BTU	% BTU	% area	number of BTU	% BTU	% area
Hlučínsko	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**
Total number of BTU	8 903			8 903			8 903		

Principal landscape change process

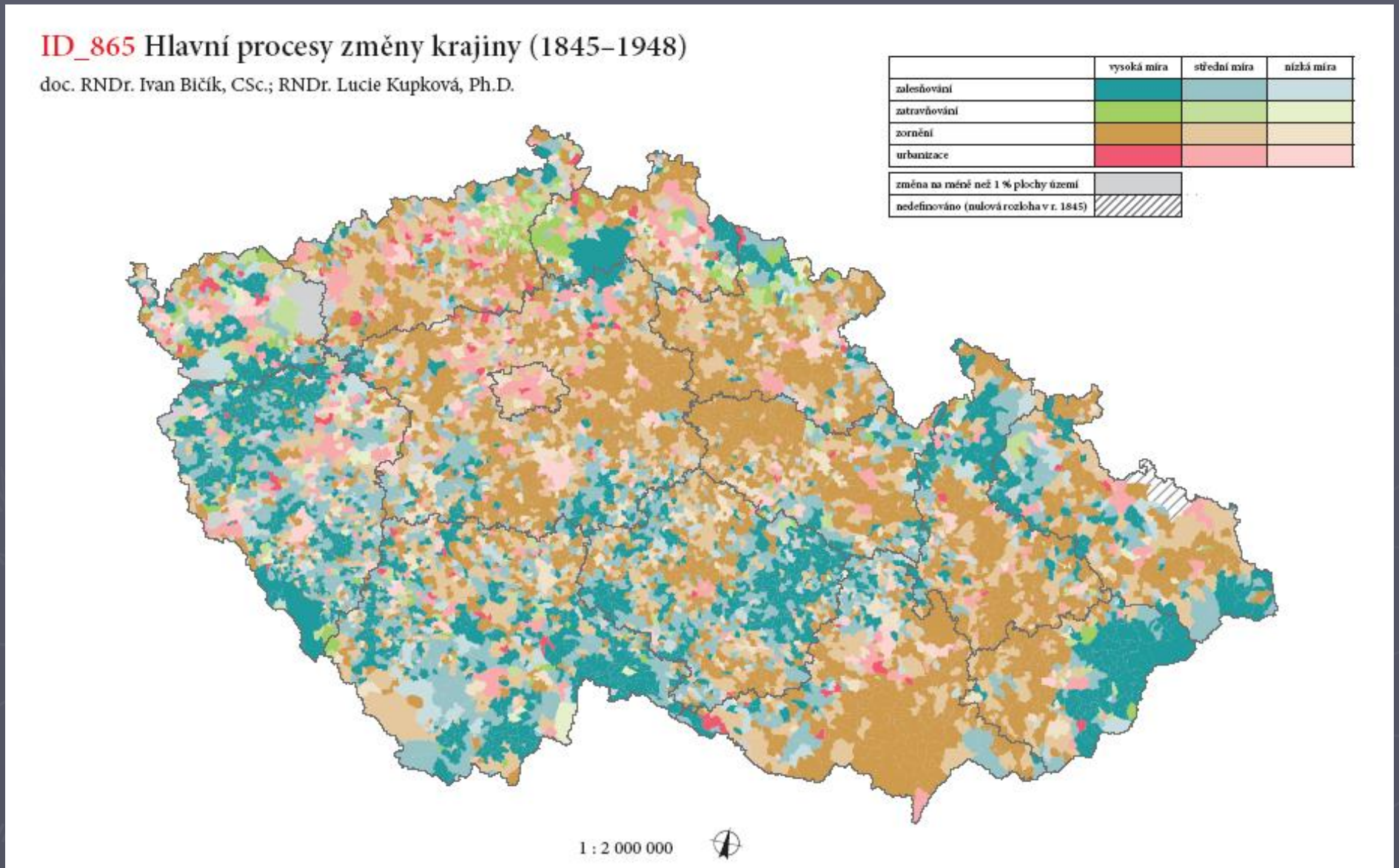
- Method was derived by Slovinian authors - Gabrovec, Kladnik, Petek):
- Observed structure of land use is composed only from 5 categories: arable + permanent culture, meadow + pasture, forest land, built up + other areas, water bodies.
- Size of most increasing category is shared by the sum of all increased categories
- three levels of intensity weak medium high

Increase of arable land + perm. cultures (intensification of agriculture)	in %		
Increase of grassland (grassification)	25-49,9	50-74,9	75+
Increase of forest areas (afforestation)			
Increase of built and other a. (urbanization)			

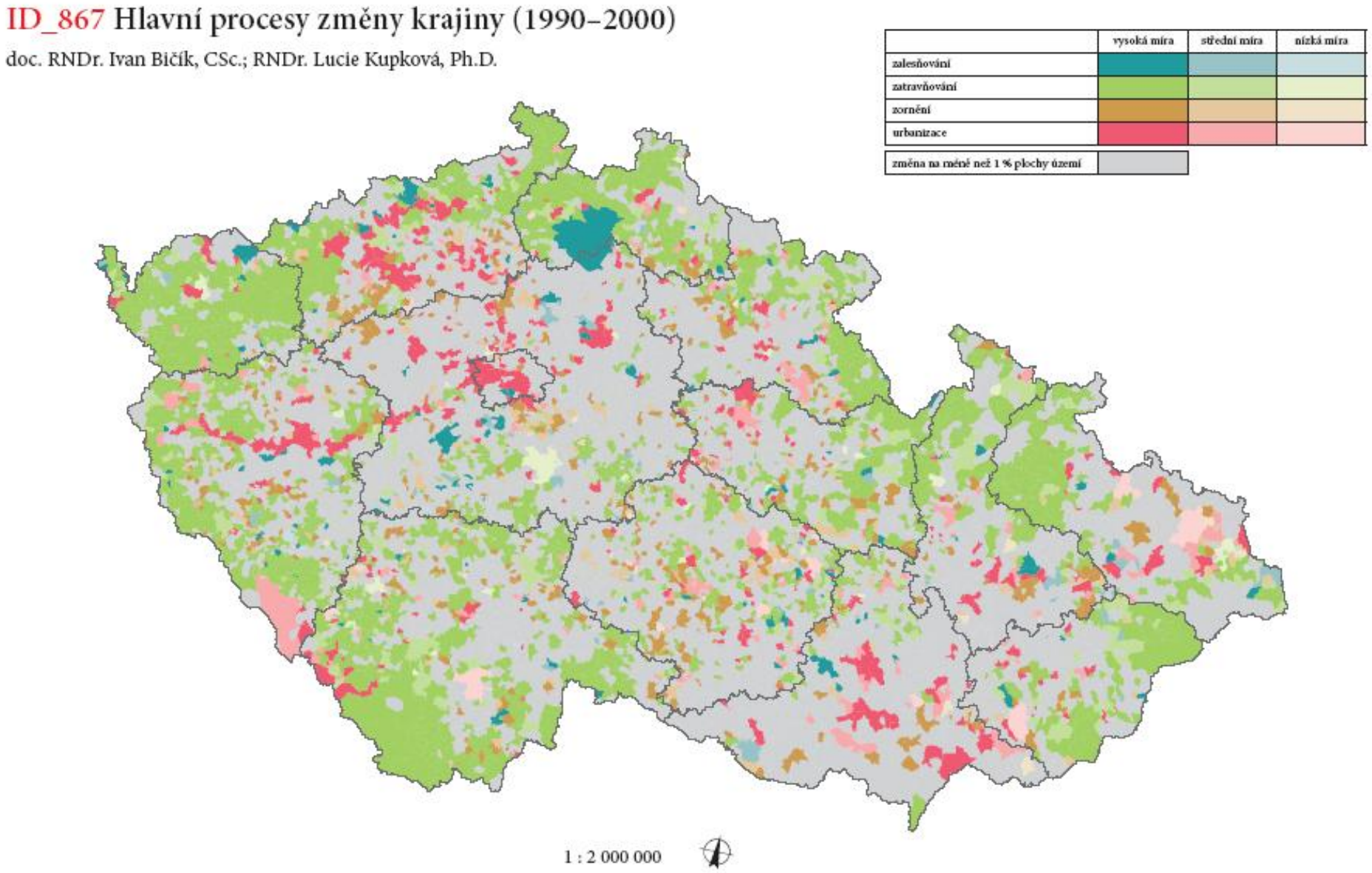
Slovinian evaluation – main landscape processes

TYPE	intensity	1845-1948		1948-1990		1990-2000	
		number	%	number	%	number	%
Intensification 1	strong	1664	18,68	348	3,91	314	3,52
2	medium	1266	14,21	1012	11,36	251	2,82
3	weak	254	2,85	475	5,33	62	0,7
Grassification 4	strong	167	1,87	138	1,55	2710	30,42
5	medium	219	2,46	664	7,45	527	5,91
6	weak	75	0,84	445	4,99	80	0,9
Urbanization 7	strong	139	1,56	1594	17,89	926	10,39
8	medium	372	4,18	2428	27,24	489	5,49
9	weak	153	1,72	900	10,1	75	0,84
Afforestation 10	strong	2812	31,55	177	1,99	1338	15,02
11	medium	1520	17,06	456	5,12	516	5,79
12	weak	252	2,83	266	2,99	59	0,66
No Change		17	0,19	7	0,08	1563	17,54
Total		8910	100	8910	100	8910	100

Principal landscape processes in the period 1845-1948



Principal landscape processes in the period 1990-2000



Conclussions

- Long term development of land use in Czechia is characterized by transition of land use structure from local self-supplying level when all village had to have all categories for surviving;
- Two centuries of the societal acceleration led to creation of typological regions with similar LUCC structure and its development; Among these typological regions is relatively high differentiation of LUCC;
- Official contemporary policy of multifunctional landscape would have accept these typological regions of different LUCC by creating special type of multifunctional policy and applied rules!
- Four break points in land use changes in last two centuries in Czechia:

-1. last 10-15 years of 19th century (first wave of technical revolution in agriculture); end of size increase of agricultural and arable land!

- 2. 1948 „socialization" and central state planning: impact on landscape - second and third wave of technical and technological revolution; depopulation of the Czech rural landscape; biggest looses of arable land;

- 3. 1990 wave of restitutions and privatization; deeper care given to landscape and Nature, process of suburbanization, opening border and joining the EU – very differentiated impact on the landscape; agro-brownfields, „new wilderness …

- 4. 2013 ? Opening of agricultural land market in Czechia? New CAP?

IGU/LUCC

- IGU/LUCC commission is working from 1996 – headed by Himiyama, Mather, Bičík (2006-);
- Newsletter is prepared each year with information about past and future news and events (www.lucc.prague.cz);
- Activity in this year:

  - seminars and conferences June: **Prague**, August: **Kjoto**

  - **Atlas IGU/LUCC Volume VIII and IX,**

  - collaboration with other commissions of IGU (hazards and risks: Kjoto, sustainable rural systems Tel Aviv, Brisbane etc.);
- Perspectives: Creation of regular meetings covering this topics in Europe; Collaboration with NASA and ESA ?; following Volumes of the Atlas LUCC.

Thank you for your attention