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Specific methods applied in investigation on the long term land use development in Czechia

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Significance of land use and land cover articles/key words 1970 – 2010 (Balej 2012)

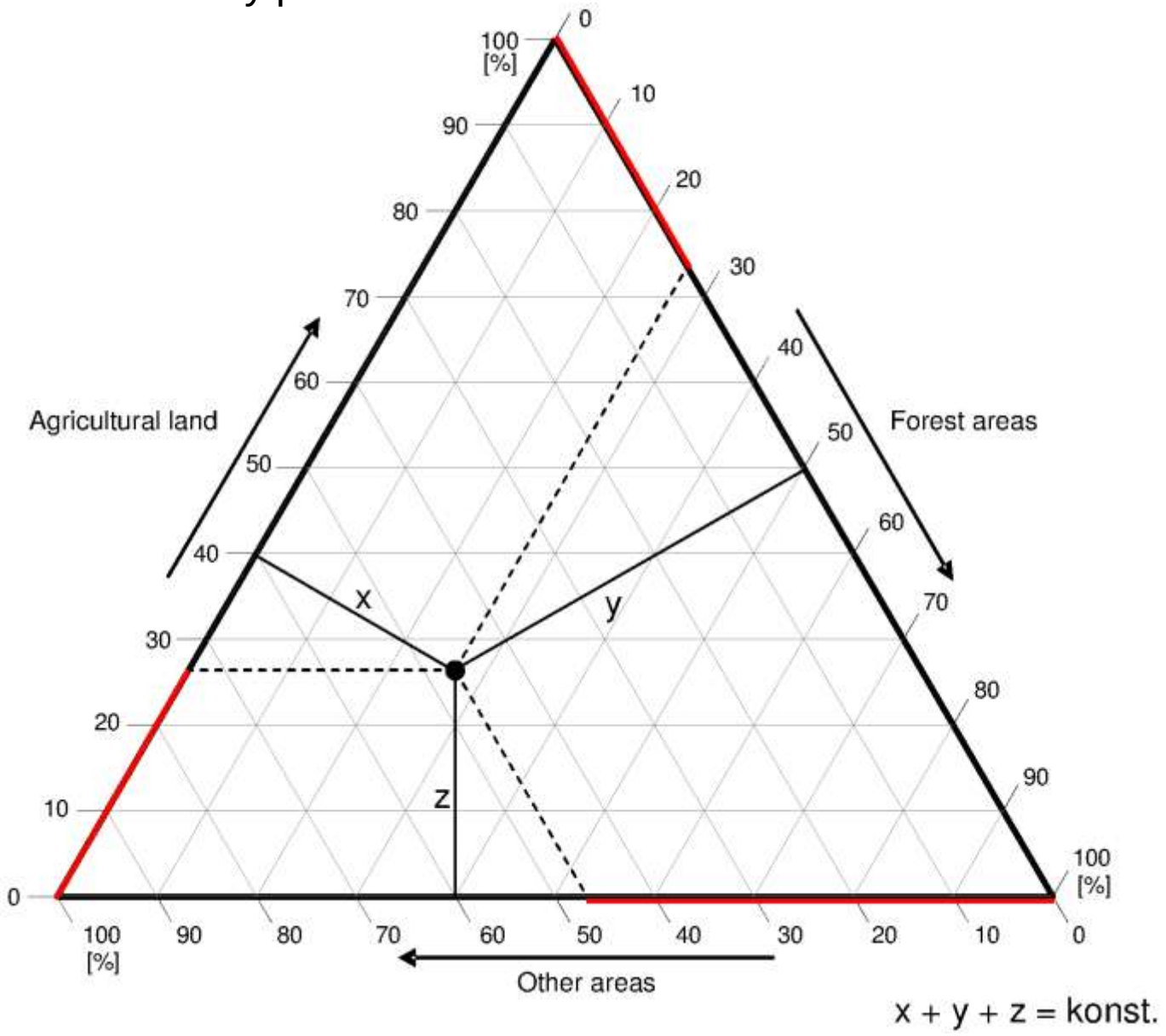
- **Term land use** in database Web of Science (as a key words or name of cited article) rose up from 1970 till 2010: **65x – 4335x;**
- Term land cover was cited in 1980 only **3x** and in 2010 **1267x!;**
- The same terms in database Scopus in the same years:
  Land use from 1970 only **19x** and 2010: **4102x;**
  Land cover from 1980 only **1x** and 2010: **1119x;**

- **Investigation and publication in land use and land cover is today one of the most frequented in different branches of Science;**
- **There were developed many new methods of investigation, our main aim of this speech is presentation two developed by our team**

Data

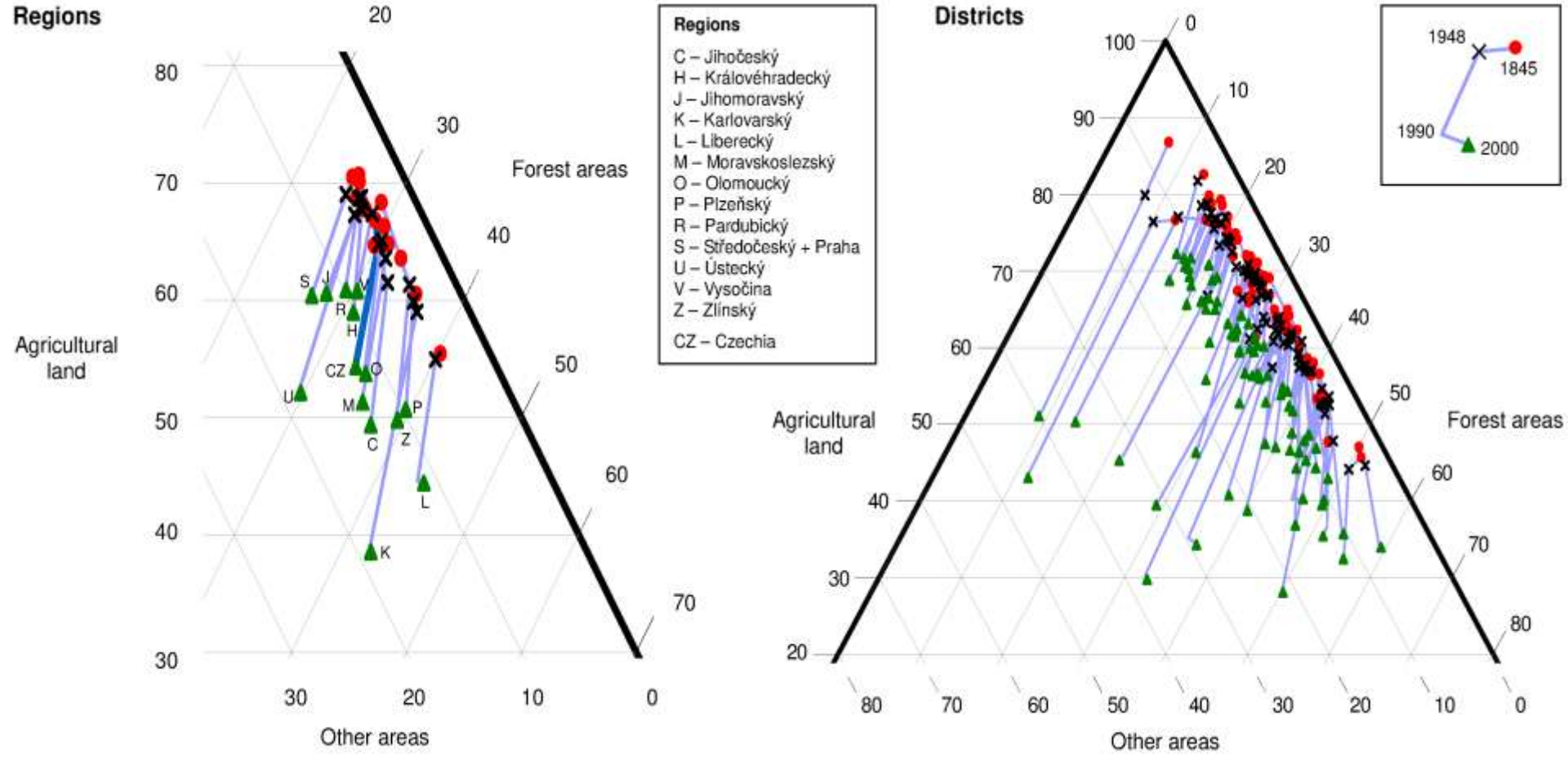
- Franciscan mapping (in Czechia: 1826–1843) was realized in the scale 1:2880 and later derived numerical data for more then 50 categories of land use for 13 000 cadastre units;
- Other years: 1948 from archive, actual data from 1990 and 2000 are from Cadastral office, now newly added data from 1896 and 2010;
- LUCC Czechia Database - developed at the Faculty of Science, Charles University in Prague; = www.lucc.ic.cz
- About 9 000 comparable basic territorial units (BTUs) were created for covering the whole territory of Czechia;
- Basic categories: arable land, permanent cultures, meadows, pastures (= **agricultural land**), **forest areas**, water areas, built-up areas and remaining areas (= **other areas);**
- Summary categories are bold;
- From several specific methods prepared by our team will be presented here **ternary plots** and **H index**

Construction of the ternary plot



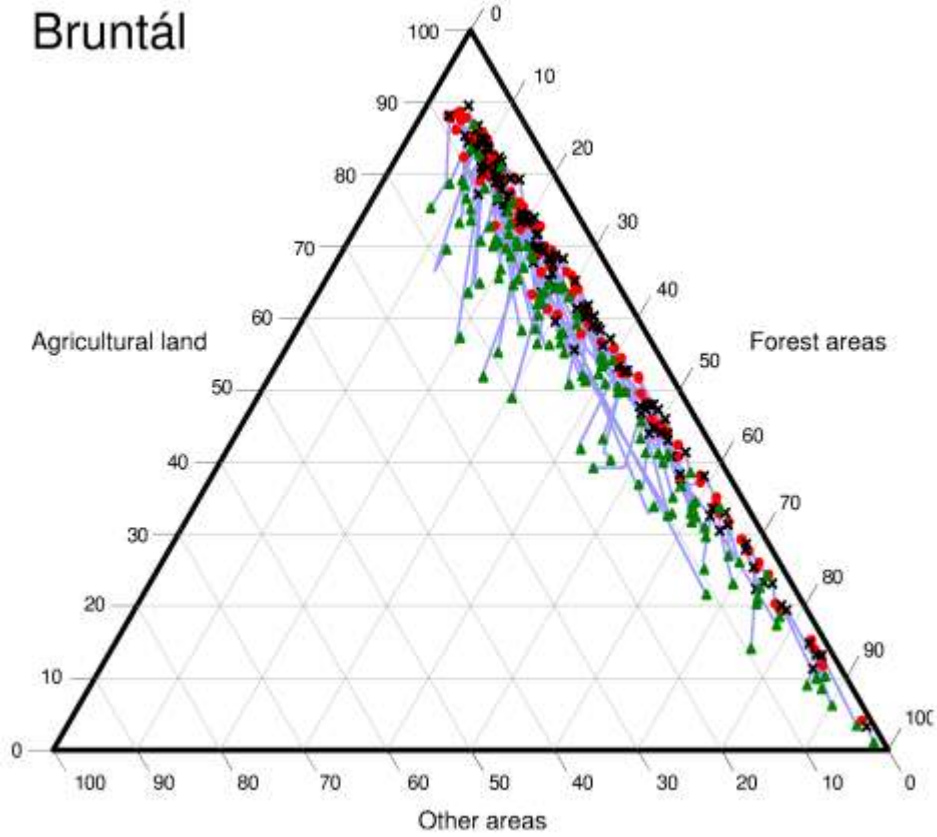
Source: adjusted by Brázdil et al. (1981)

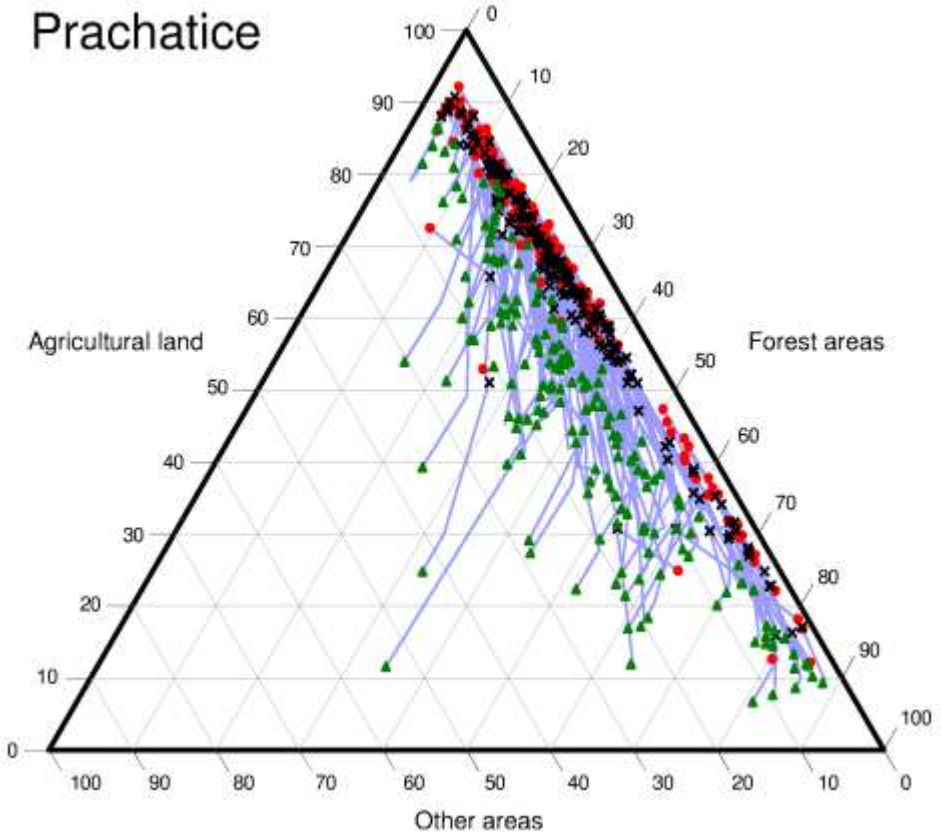
Land use structure and its development (the extent and direction of change) in the Czech administrative regions and districts in 1845-1948-1990-2000



Source: LUCC Czechia (2001)

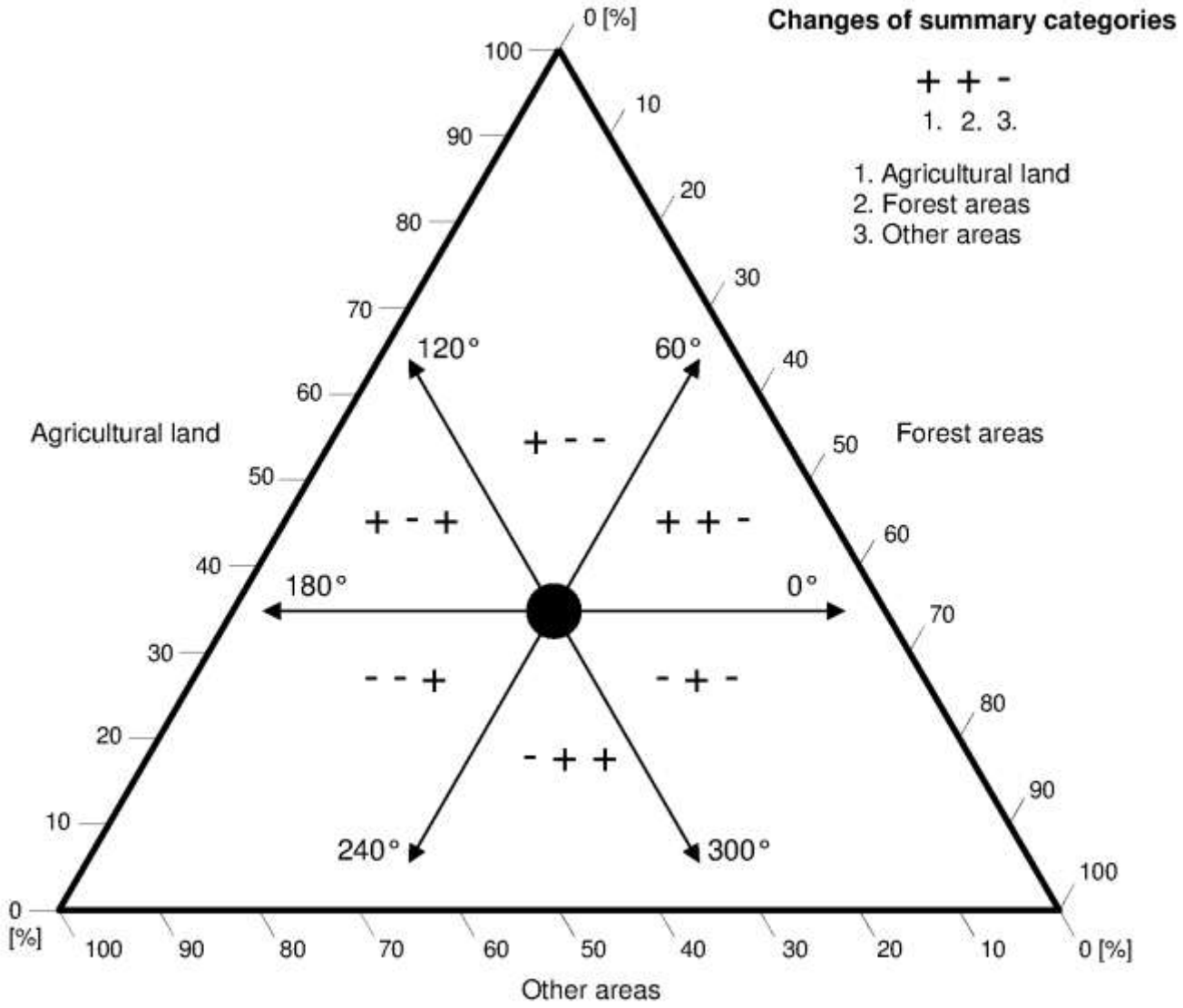
Land use structure and its development in BTUs of Bruntál and Prachatice districts in 1845-2000





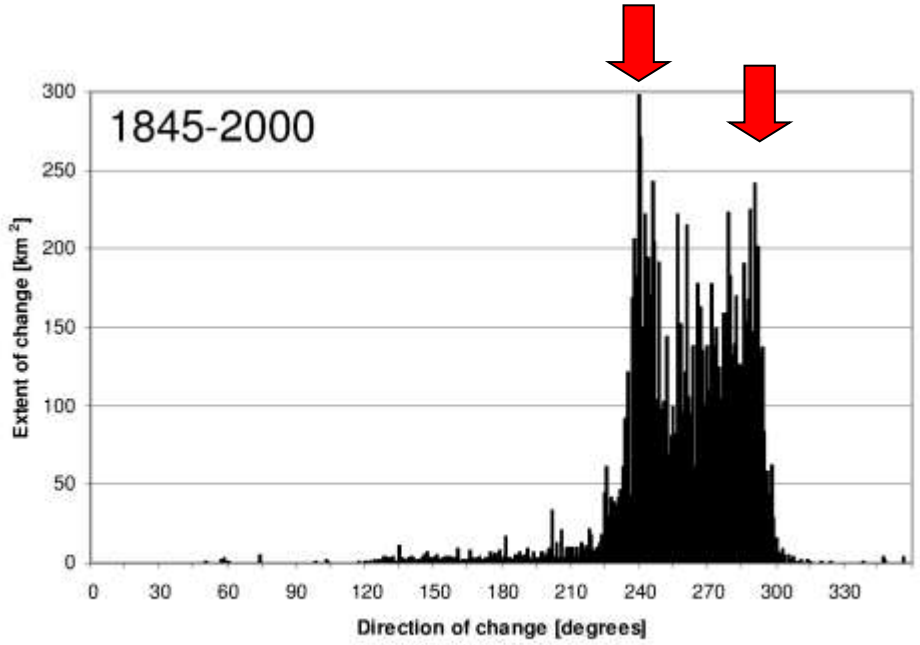
Source: LUCC Czechia (2001)

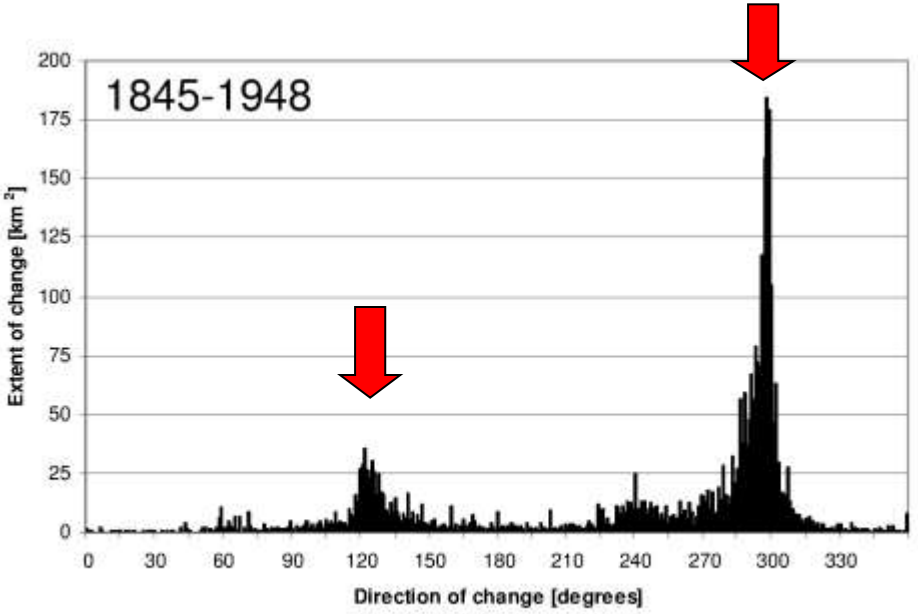
Possible directions of changes in the ternary plot and corresponding changes of summary categories

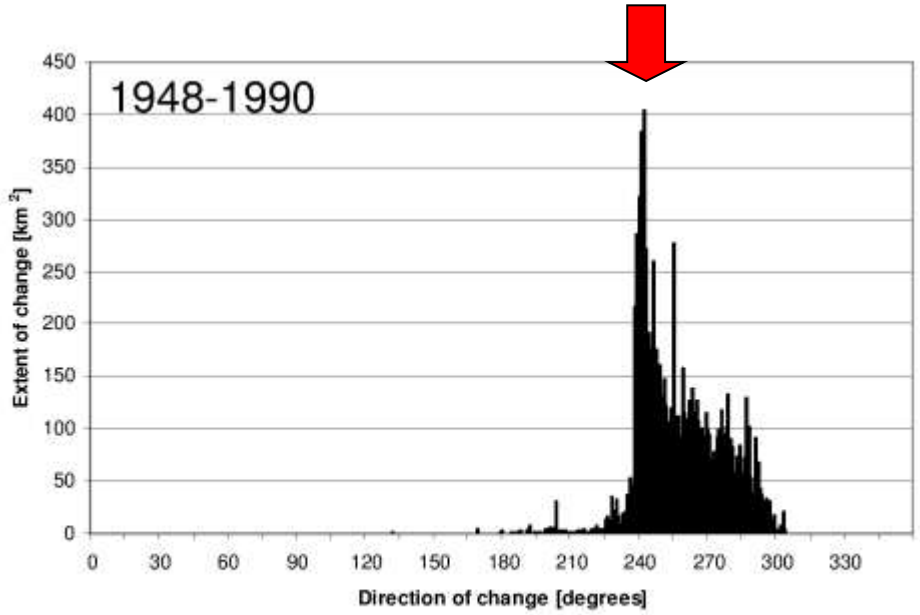


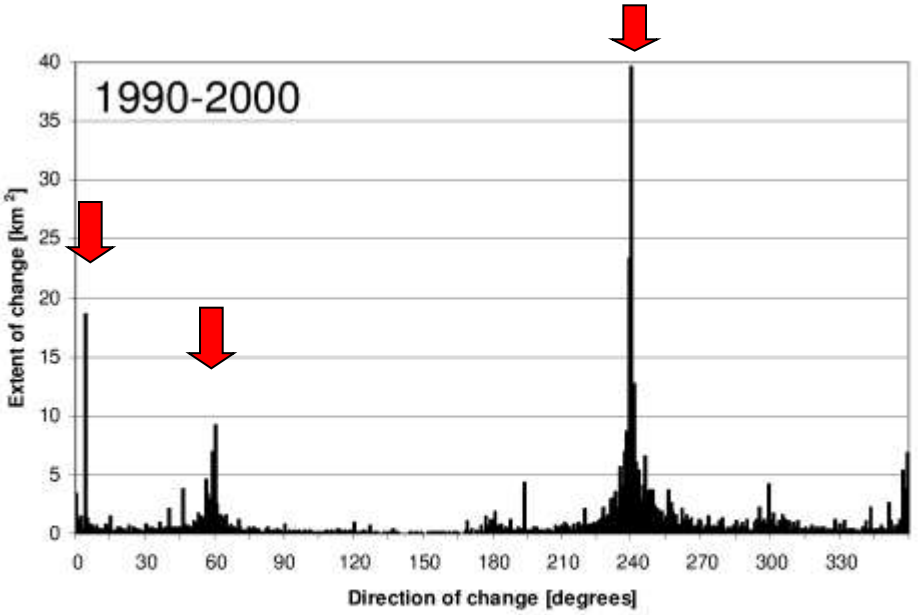
Source: Janoušek (2011)

The direction and extent of land use changes in BTUs obtained from ternary plots









Source: LUCC Czechia (2001)

Usefulness of ternary plots

+ Show the values of three variables at once (though interdependent);
+ Illustratively depict both the state and the development (i.e., the extent and direction of change) of land use across different time periods (as opposed to basic development indicators);
+ Suitable for initial (coarse) identification of territorial units with similar land use structure (i.e., clusters of points on the graph), or units with similar land use development (i.e., the same direction vectors);
+ Possibility of different structuring (for example forest + water areas as ecologically asked categories);

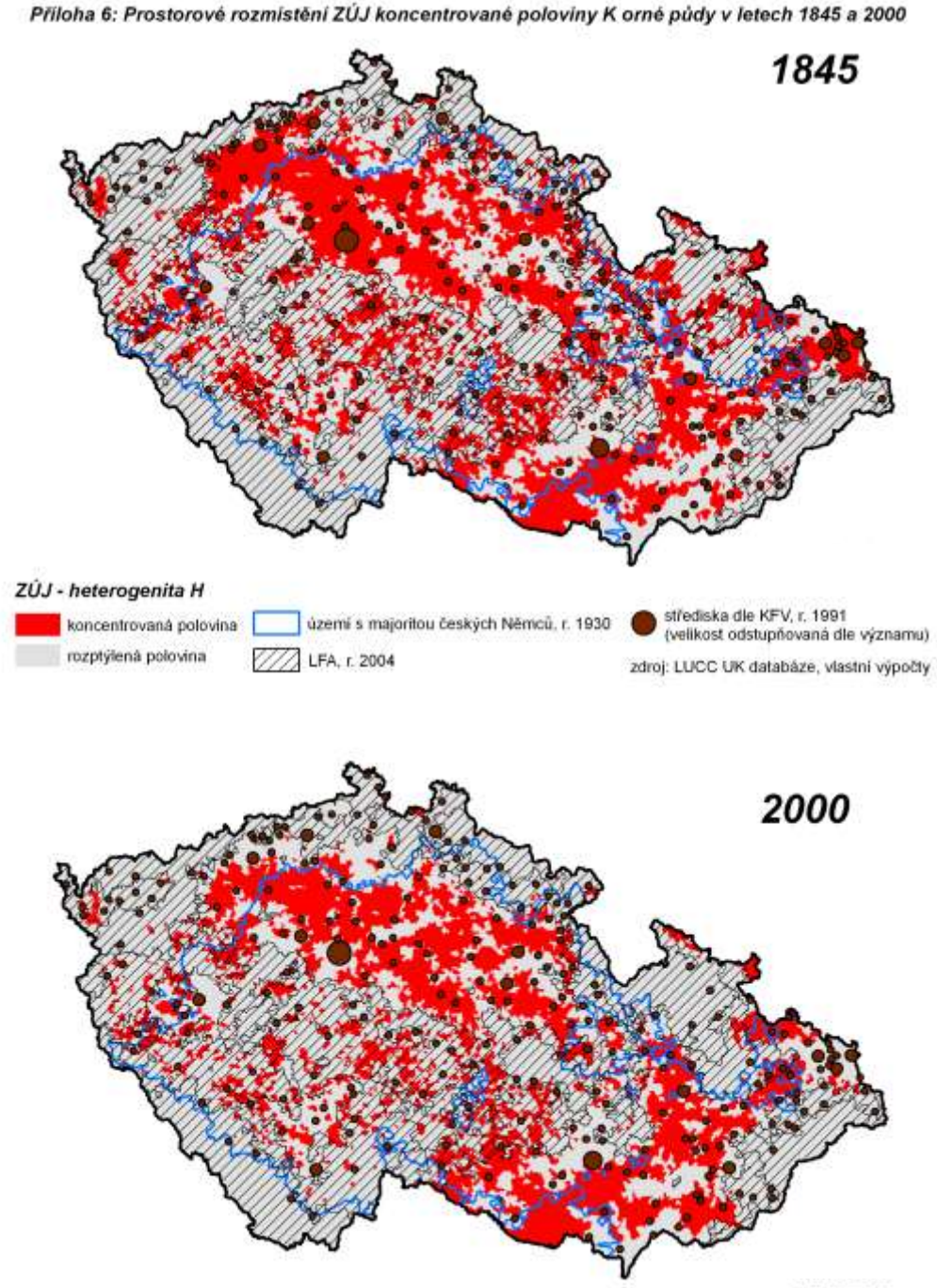
- The need for data reduction of the eight basic categories of land use into three categories (e.g., summary categories), their sum must be constant (100%);
- Pay attention to the extreme and specific values;
- Lack of clarity if there is depicted a large number of territorial units;
- The absence of spatial information on the extent and location of the above mentioned clusters;

Conclusion

- Confirmation of growing differentiation of the Czech territory in terms of land use at all scale levels (see Bičík 1995);
- Creating of bigger regions with similarity of BTU creating them, growing up in the differentiation among this typological regions;
- Recognition of the dominant trends in the land use development in observed territorial units. The most important changes in the overall land use structure occurred mainly in the period 1948-1990;
- In most of ternary plots in 1845 is a clear link between growth in the share of agricultural land and increase of the share of other areas, which in other time periods disappears. This fact can be explained by locally organized Society (selfsufficient agriculture dominated) and limited means of transport (including food transportation) at the beginning of the studied period.

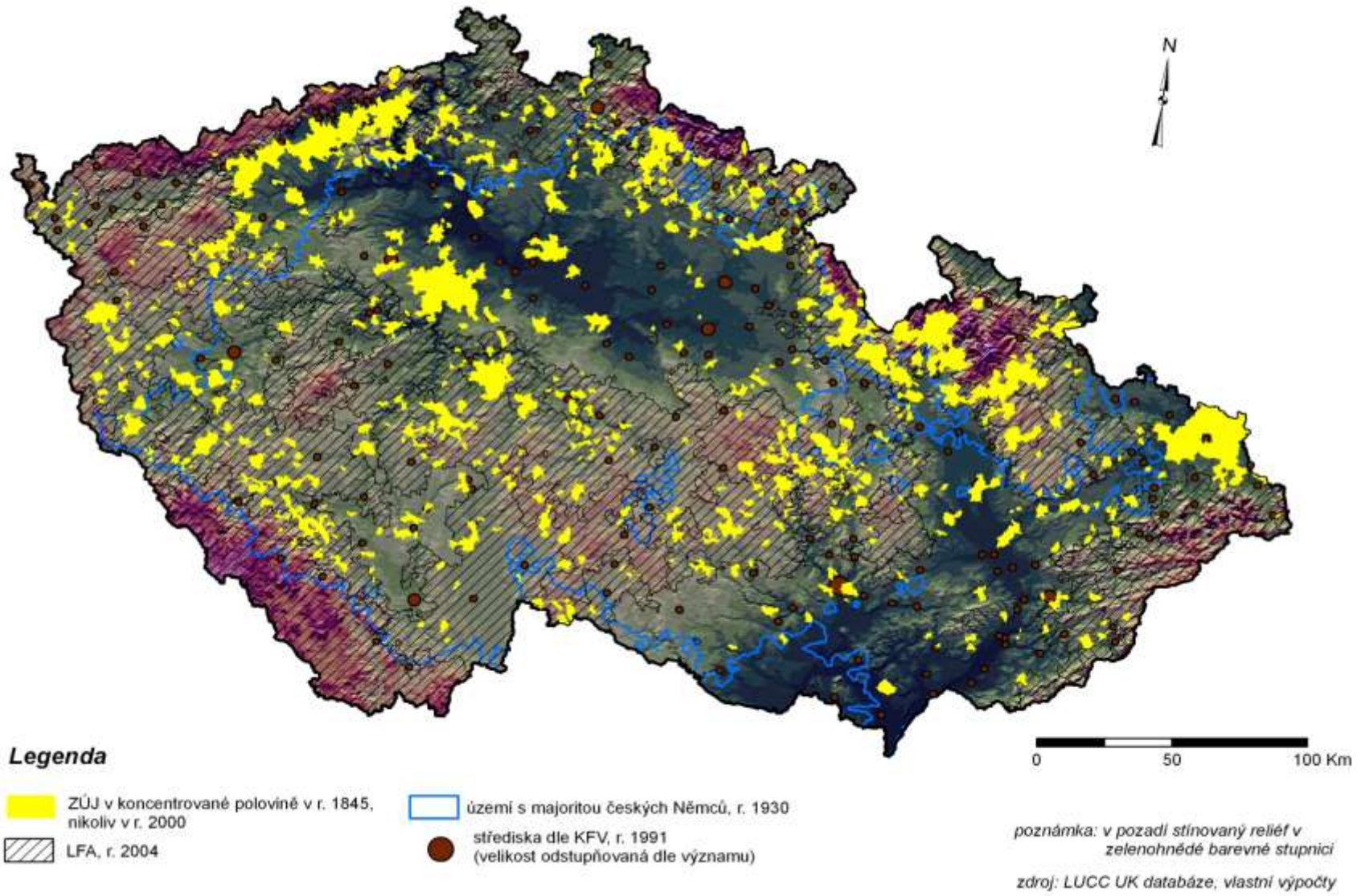
Utilization of Heterogeneity index

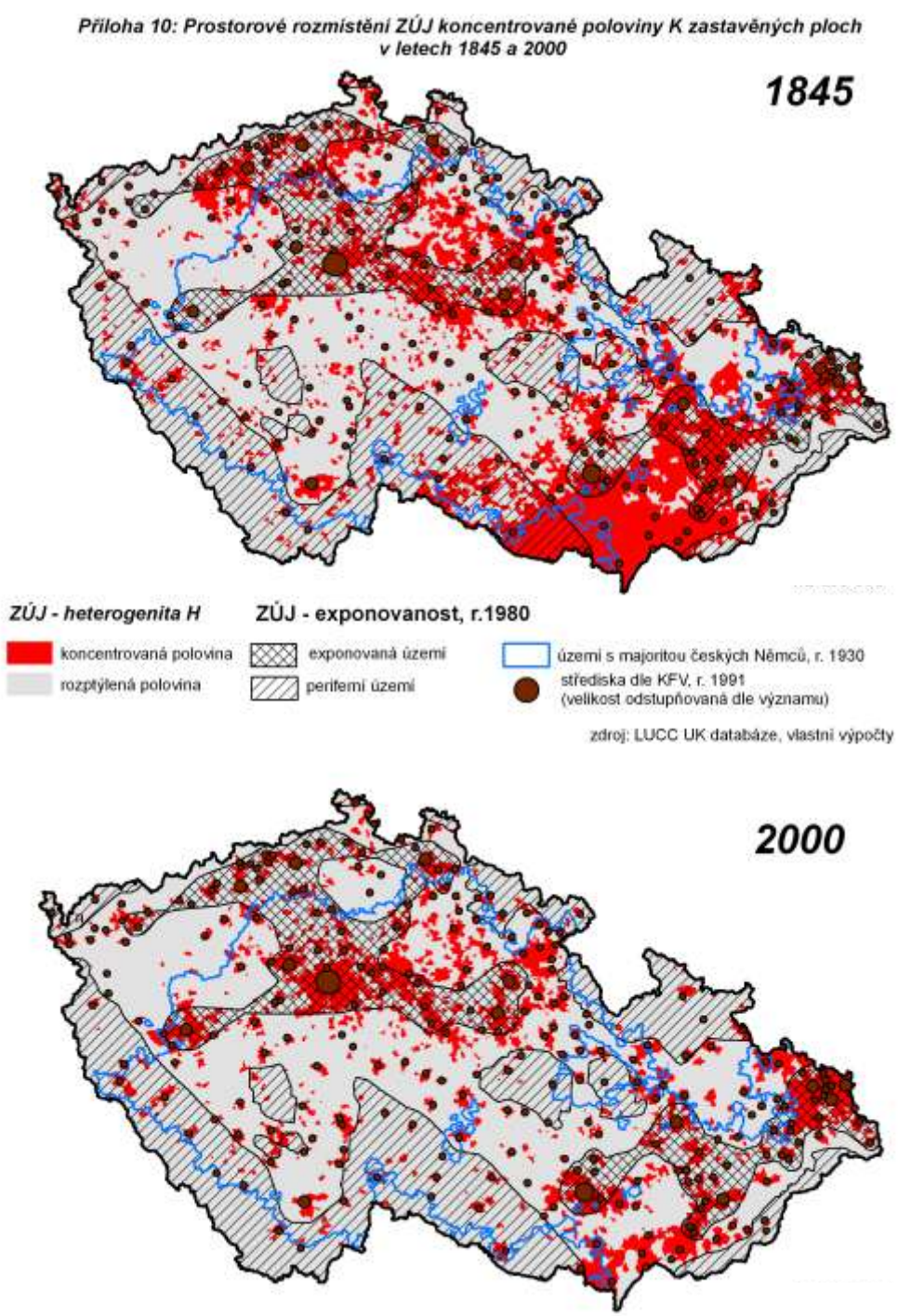
- Index of heterogeneity shows share of Czech territory on which is concentrated just half of observed characteristic;
- Characteristic (for example arable land) is ordered by basic territorial units along the share of arable land on their territories;
- Aim of this investigation is evaluation of territorial localization of this concentrated half of characteristic (arable land);
- We used development of four characteristics in following time horizons: 1845, 1948, 1990, 2000
- There are: heterogeneity index, average altitude, slope, official price of agricultural land (= quality of natural condition for agriculture);



BTU with half of arable land of Czechia in 1845 and 2000

BTU in 1845 in concentrated half of arable land, but in 2000 are out = yellow colour





BTU with half of built-up areas of Czechia in 1845 and 2000

Characteristics of the concentration areas of selected land use categories in Czechia

Arable land

Year	*1845*	*1948*	*1990*	*2000*
Heterogeneity index (%)	34.99	34.49	30.32	28.78
Altitude (m a.s.l.)	382.72	371.92	368.86	362.84
Slope (degrees)	2.00	1.90	1.60	1.55
Mean official price of AGL (CZK/m²)	5.56	5.74	5.99	6.12

Permanent grassland

Year	*1845*	*1948*	*1990*	*2000*
Heterogeneity index (%)	30.97	28.05	24.27	22.22
Altitude (m a.s.l.)	504.37	531.39	523.26	533.92
Slope (degrees)	2.95	3.23	3.85	4.06
Mean official price of AGL (CZK/m²)	3.53	3.06	2.82	2.61

Built-up areas

Year	*1845*	*1948*	*1990*	*2000*
Heterogeneity index (%)	30.85	25.64	21.26	20.78
Altitude (m a.s.l.)	351.58	323.53	326.01	327.57
Slope (degrees)	2.17	1.94	2.00	2.03
Mean official price of AGL (CZK/m²)	6.05	6.31	6.18	6.10

Sources: LUCC Czechia, Štych (2007)
Note: AGL = agricultural land

Conclusions – changes in Czechia 1845-2000

- **Arable land**:
  Decrease of ca. 10% of the size in 1845,
  concentration of half size in 2000 in more productive regions,
  in lower average altitude and lower slope;

- **Permanent grassland**:
  Decrease of extent from 18 to 11% of Czechia,
  concentration in low natural quality regions (from 31 to 22% of state territory),
  increase of average slope and altitude,
  strong decrease of AGL price;

- **Built-up areas**:
  Increase of category extent ca 3x
  concentration on 20% of state territory (decrease from 31%!),
  lower average altitude, only small changes in slope and AGL price;


Thank you for attention