USE OF REMOTE SENSED DATA FOR LANDSCAPE FUNCTIONALITY ASSESSMENT

Ing. Johana Zacharová

Czech University of Life Sciences Prague
Faculty of Environmental Sciences

Czech University of Life Sciences Prague

Faculty of Environmental Sciences - Department of Applied Ecology

Landscape Ecology & Research

- Concept of landscape

- American x European

  spatial heterogeneity application-oriented

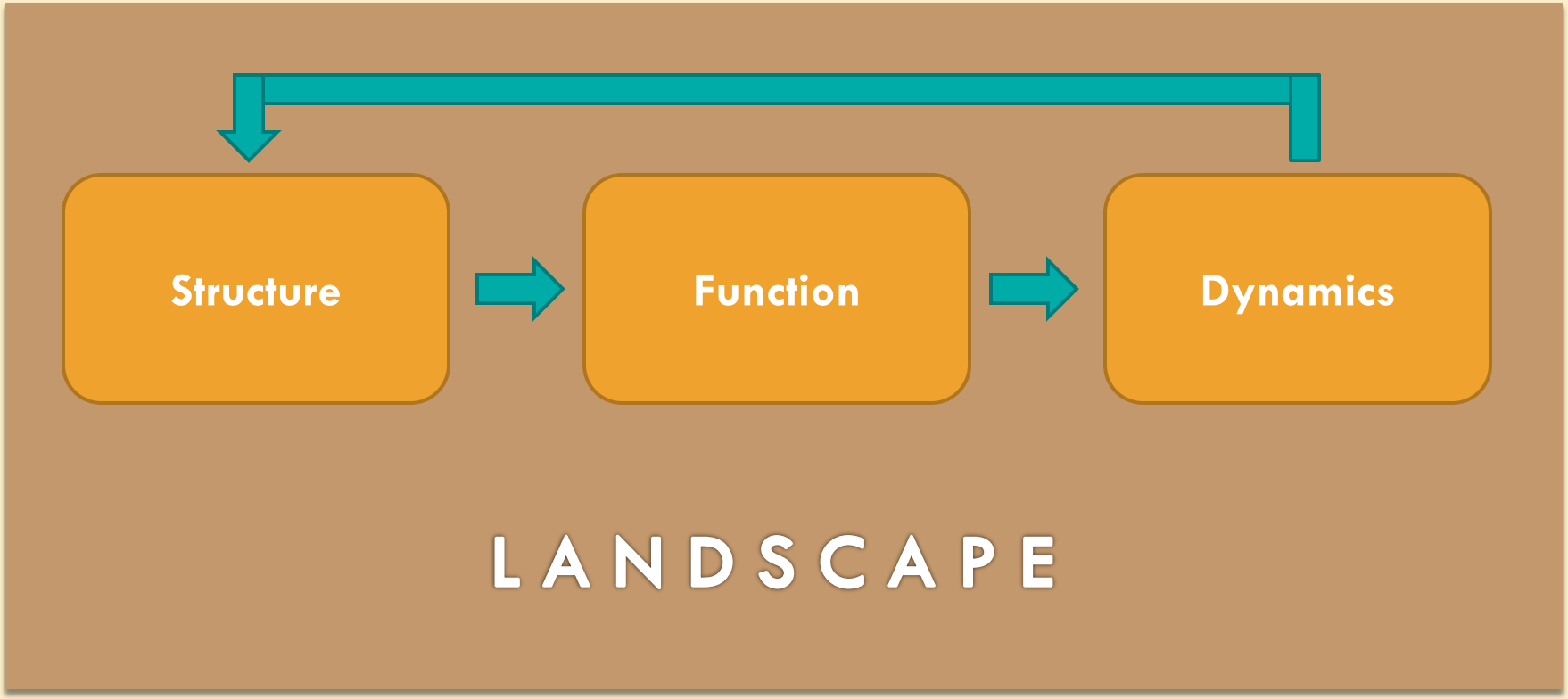
- Holistic concept

  "Landscape ~ an open system which communicates with the environment by fluxes of energy, matter and information."

(Naveh, 2001)

Landscape & Landscape ecology & Research

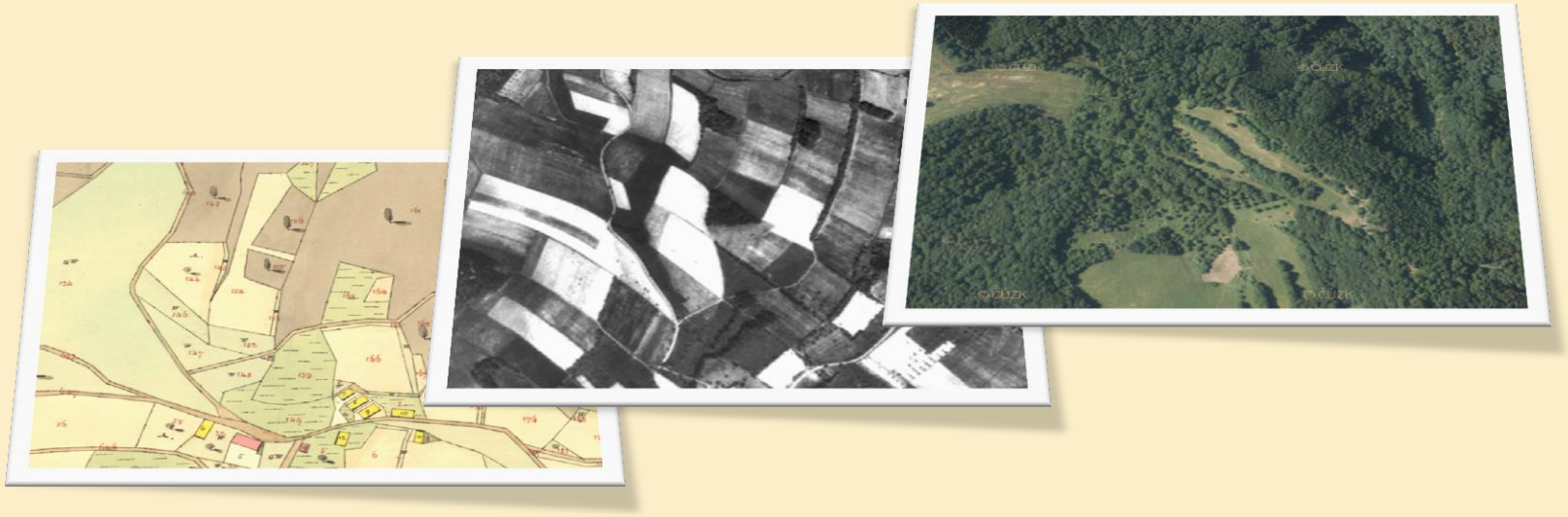
- Landscape is not only a summarisation of its parts



(Forman & Godron, 1986)

Landscape Change Science

- Land Use / Cover Change (LUCC) studies
- Historical cartographic materials, satellite imagery
- Calculation of landscape metrics by softwares



LUCC studies & Landscape Functioning

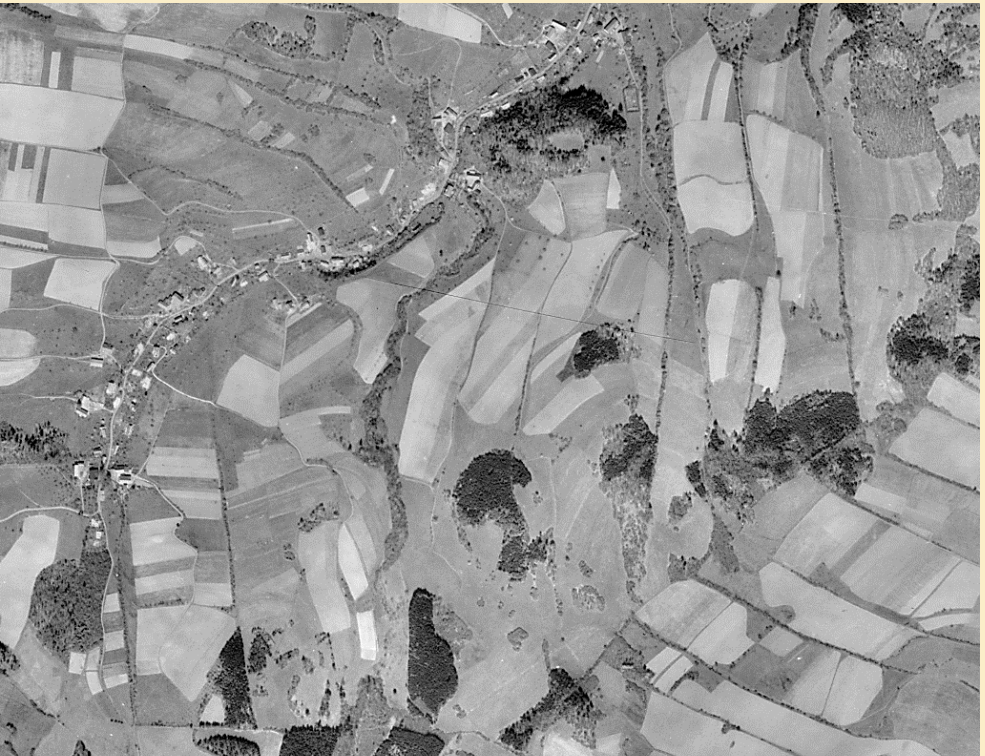
- **Skokanová & Eremiášová (2013)**
  - Comparison of landscape functionality in protected and unprotected sites
- **Skaloš et al. (2014)**
  - Parametrization of land cover data by use of LWP (= landscape water potential) indicator
- **Wang et al. (2006)**
  - Use of landscape function characteristics (biological productivity, soil nutrient content, water source conservation capacity)

Remote Sensed Data in Landscape Research

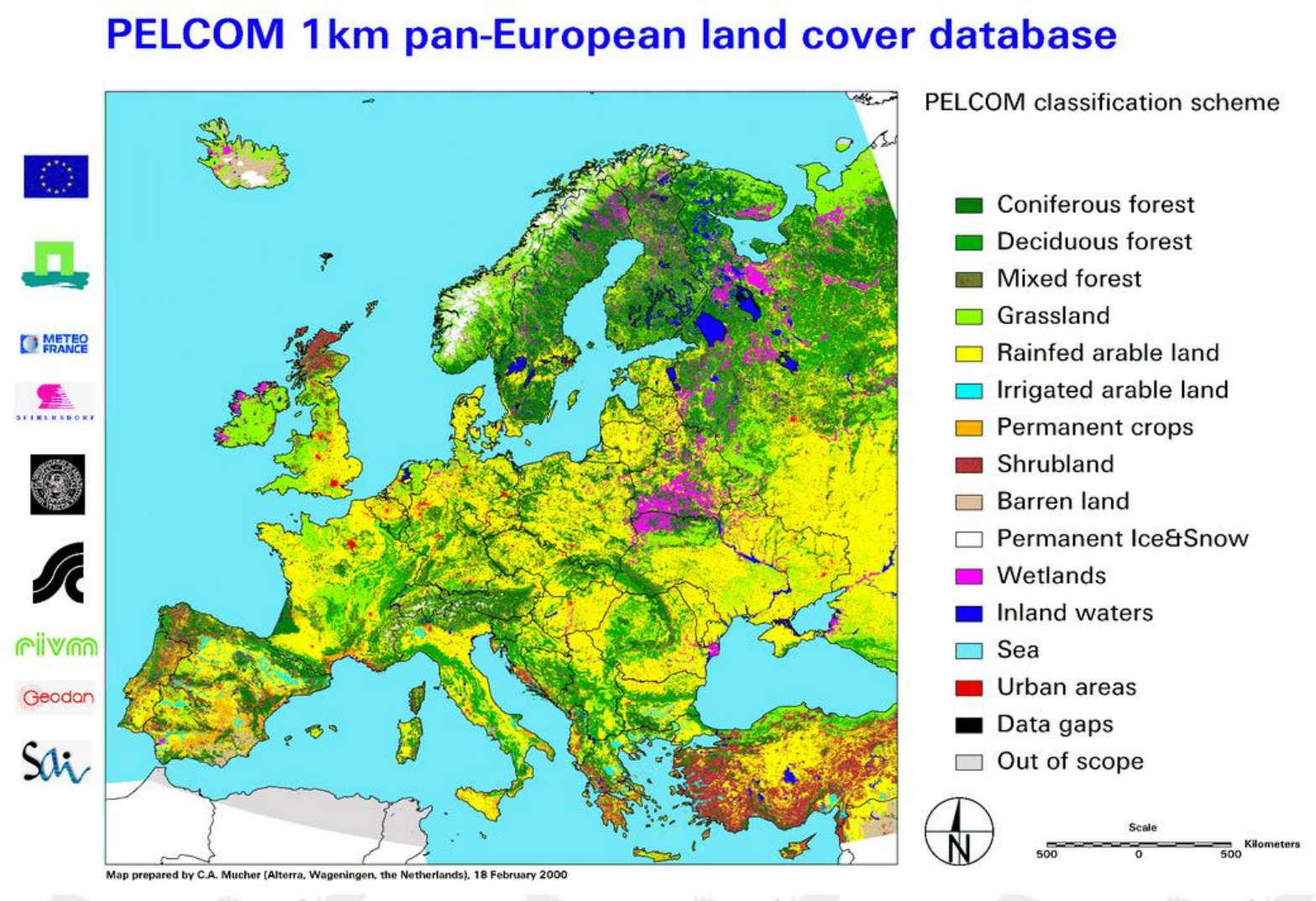
historical aerial photographs

ortophotomaps

satellite imagery

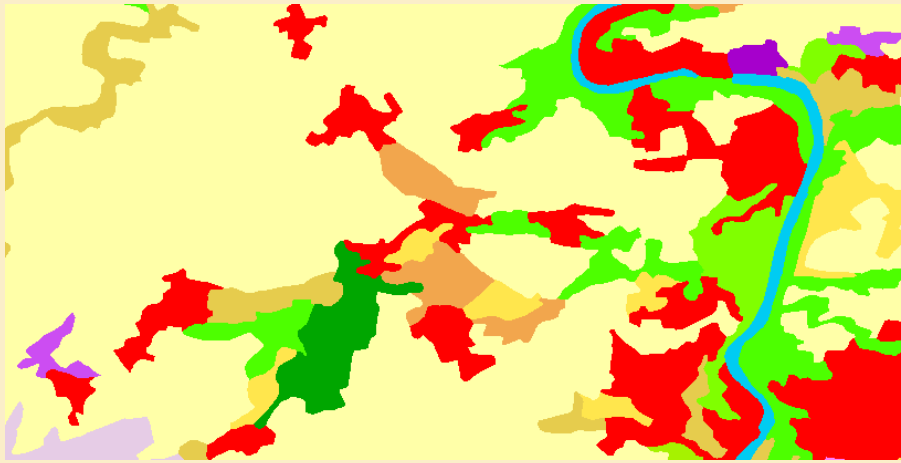


Remote Sensed Data in Landscape Research



Remote Sensed Data in Landscape Research

- **LANDSAT**
  - Global Landsat Survey
  - CORINE Land Cover (CLC) - 1990 and 2000
- **ASTER**
  - better spatial resolution
- **MODIS**
  - NASA Earth Observation System - MODIS Land program



Remote Sensed Data in Landscape Research

- **SPOT**
  - transition between LANDSAT and data of a very high resolution, CLC 2006
- **IRS** (Indian Remote Sensing Satellites)
  - Resourcesat-1 (IRS P6)
  - CLC 2012, tropical forest fragmentation in India
- *High spatial resolution, hyperspectral, radar imagery*
  - Specialized applications

Principles of Landscape Functionality

- Landscape services vs. Landscape functioning
- Biophysical indicators
- “Healthy” ecosystems
- Forman & Godron (1986) – landscape function
- Ripl (1995, 2003) – Energy-Transport-Reaction model

Landscape Functionality Studies

- Procházka et al. (2011) – surface temperature (T) and humidity monitored in relation to vegetation cover
- Bodlák et al. (2012) – surface T and WI (= wetness index) combined with field measurements of surface water conductivity to monitor stability of landscape segments
- Brom et al. (2012) – surface T, NDVI, NDMI as indicators of vegetation influence on water cycle and microclimate of dump

Landscape Functionality Studies

- Brom et al. (2009) – surface T, WI, NDVI indicators to assess an energy dissipation of various land cover categories in Šumava region
- Hesslerová et al. (2012) – surface T and hydro-chemical parameters to monitor landscape management influence in watersheds in the Southern Bohemia

Landscape Functionality Studies

- Specific approach for landscape functionality assessment
- Based on interpretation of landscape parameters derived from LANDSAT imagery

Conclusions

- Role of LUCC assessments for understanding and modelling of landscape changes is irreplaceable.
- Application of RS data and GIS analysis for LUCC monitoring at all scale levels is very common.
- RS data from various sensors are applicable also in specialised landscape research.

Conclusions

- Level of landscape functioning can be derived from relations between the indicators of bio-physical state.
- RS data are well applicable for this approach of landscape functionality quantification.
- There is a research gap of landscape functioning quantification as it is an important topic for a sustainable landscape management.

References

- Bodlák, L.; Křováková, K.; Nedbal, V. & Pechar, L. 2012. Assessment of landscape functionality changes as one aspect of reclamation quality – the case of Velká podkrušnohorská dump, Czech Republic. Ecological Engineering. 43: 19–25.
- Brom, J.; Nedbal, V.; Procházka, J. & Pecharová, E. 2012. Changes in vegetation cover, moisture properties and surface temperature of a brown coal dump from 1984 to 2009 using satellite data analysis. Ecological Engineering. 43: 45–52.
- Brom, J.; Procházka, J. & Rejšková, A. 2009. Evaluation of Functional Properties of Various Types of Vegetation Cover Using Remotely Sensed Data Analysis. Soil & Water Res. 4 (Special 2): 49–58
- Corine Land Cover - Copernicus Land Monitoring Services. [online]. Accessible on: http://land.copernicus.eu/pan-european/corine-land-cover [2014-06-01]
- CORINE Land Cover 1990 and 2000 - http://geoportal.cenia.gov
- Forman, R.T.T, Godron, M. 1986. Landscape ecology. Wiley. 619 p.
- Hesslerová, P., Chmelová, I., Pokorný, J., Šulcová, J., Kröpfelová, L., Pechar, L. 2012. Surface temperature and hydrochemistry as indicators of land cover functions. Ecological Engineering. 49: 146-152.
- Naveh, Z. 2000. What is holistic landscape ecology? A conceptual introduction. Landscape and Urban Planning. 50:7-26.
- Procházka, J., Brom, J.; Šťastný, J., Pecharová, E. 2011. The impact of vegetation cover on temperature and humidity properties in the reclaimed area of a brown coal dump. International Journal of Mining, Reclamation and Environment. 25 (4): 350–366.
- Public Area of PELCOM. [online]. [2014-04-24]. Accessible on: http://www.geo-informatie.nl/projects/pelcom/
- Ripl, W. 1995. Management of water cycle and energy flow for ecosystem control: the energy-transport-reaction (ETR) model. Ecological Modelling. 78 (1-2): 61–76
- Ripl, W. 2003. Water: the bloodstream of the biosphere. Philosophical Transaction The Royal Society of London B. 358: 1921–1934
- Skaloš, J., Berchová, K., Pokorný, J., Sedmidubský, T., Pecharová, E., Trpáková, I. 2014. Landscape water potential as a new indicator for monitoring macrostructural landscape changes. Ecological Indicators. 36:80-93.
- Skokanová, H., Eremiášová, R. 2013. Landscape functionality in protected and unprotected areas: Case studies from the Czech Republic. Ecological Informatics. 14: 71-74.
- Wang, G., Wang, Y., Kubota, J. 2006. Land-cover changes and its impacts on ecological variables in the headwaters area of the Yangtze river, Chine. Environmental Monitoring and Assessment. 120: 361-385.

Thanks for Your attention!

Ing. Johana Zacharová zacharova@fzp.czu.cz