



Czech University of Life Sciences Prague

**Faculty of Environmental
Sciences**

Final State Examinations for Master Programmes – Thematic Areas

2016-2017

Land and Water Management

All thematic areas are compulsory.

WATER RESOURCES MANAGEMENT

1. Water management and hydrological cycle, water balance and its components, impacts of climate change on water balance.
2. Catchment and its characteristics, rainfall-runoff relations.
3. Hydrological processes: Precipitation, interception, evaporation, infiltration and soil moisture dynamics.
4. Modelling of hydrological processes, examples of simple models.
5. Hydro-meteorological monitoring and processing.
6. Basics of hydraulics: Hydrostatics, hydrodynamics.
7. Basics of river physics: Open water flow, meandering, sediment transport, river morphology, hydraulic structures.
8. River restoration, requirements and principles, riparian vegetation, water quality in rivers.
9. Reservoirs, fishponds, reservoir structures, basics of fishing.
10. Irrigation and drainage, principles, types and application.

LAND MANAGEMENT

1. Management of agricultural land - definition, types of land degradation, types of instruments to improve condition of agricultural land.
2. The history of the European landscape, historical landscape conservation within land management projects.
3. The history and design of land reform approach, the objectives to dismantle the large-scale corporate farms without creating excessive land fragmentation
4. Landscape, farmland and ownership fragmentation - main causes and consequences.

Examples how to mitigate the fragmentation.
5. Farmland rental market, land sales market and land consolidation in Europe in the connection with land management of agricultural land.

6. Common Agricultural Policy in EU, Land management approaches applied by different types of farms. Farmland structure in the Czech Republic and in Europe.
7. Types of data used to create the analyses for improvement of the conditions of landscape pattern (historical and current data and maps, documents used in land management).
8. The plan of common facilities (measures) in the project of land consolidation in the Czech Republic and in Europe (field road network, erosion control, water features, and ecological networks). The challenges in the implementation of this plan.
9. Ecological terrestrial networks in European and national contexts, integrating ecological networks in land management projects around Europe.
10. Protecting and enhancing visual quality of the landscape within land management projects
11. Erosion control within land management projects.
12. The role of land management in ensuring sustainable development, sustainable agriculture and soil protection.

GIS

1. Coordinate Systems (Geographic coordinate systems; Projected coordinate systems; Height measurements; Map projections)
2. Geographic data representations (Discrete object conceptualization; Continuous field conceptualization; Vector data model; Raster data model; Scale issues)
3. Geographic data display (Nominal, ordinal and numerical attributes; Classification methods; Display techniques)
4. Map design (Types of maps; Map design process; Visual hierarchy; Map elements)
5. Geographic data acquisition and sources (Data acquisition methods; Data sources; Open data)
6. Geo-databases (What is database?; Relational databases; SQL; Databases in ArcGIS)
7. Spatial Analysis – vector (attribute operations; overlay analyses)
8. Spatial Analysis – raster (Spatial interpolation; Digital terrain analysis; Map algebra, Logical operations)

HYDROLOGICAL MODELLING

1. Hydrological models, their classification, basic principles of hydrological systems, uncertainty of hydrological modeling
2. Calibration and validation of hydrological models
3. Calibration and validation statistics, AME, ME, NS, RMSE, MSE, NS, persistency index etc.
4. Black models, linear model for runoff forecasting, AR model for runoff forecasting, parameter estimation
5. Neural network models for forecasting of hydrological time series, parameter estimation, ANN architecture
6. Grey box models, linear reservoir, nonlinear reservoir, Q-S relationship, finite difference method for description of mass balance of reservoir oriented models
7. Lumped grey box models for the description of water balance: PDM model, HBV model, Bilan model
8. White box models their principles, hillslope overland flow models, St equations for overland flow models, finite difference methods
9. Optimization algorithms for calibration of hydrological models
10. Event based rainfall runoff models, components, effective rainfall, baseflow separation methods
11. Unit hydrograph theory, basic principles of unit hydrograph theory, S curve, type of unit hydrographs
12. Nash model of unit hydrograph, Diskin cascade, Clark unit hydrograph model
13. Linear time invariant transfer function model, izochron model, ordinary least squares and the estimation of discrete form of unit hydrograph, TA curve histogram of isochrones

Suggested Study Materials:

Falkenmark, M. et al., 2001: *Water, a Reflection of Land Use*, Unesco Press.

Lal, R., 2002: *Integrated Watershed Management*, CRC Press.

Bürgi, M., Hersperger, A.M., Schneeberger, N., 2004. Driving forces of landscape change – current and new directions. *Landscape Ecology*. 19 (8), 857–868. doi: 10.1007/s10980-005-0245-3.

Forman, R.T.T., Godron, M. 1986. *Landscape Ecology*. John Wiley & Sons, New York.

Goodchild, Michael F. (2011) *Scale in GIS: An overview*. *Geomorphology* 130: 5-9.

Laurie, M. 1986. *An Introduction to Landscape Architecture*. Elsevier, New York.

Olson, Judy M. (2006) *Map projections and the visual detective: How to tell if a map is equal-area, conformal, or neither*. *Journal of Geography* 105: 13-32.

Hartvigsen, M., 2014. Land reform and land fragmentation in Central and Eastern Europe. *Land Use Policy*, 36, 330–341. doi:10.1016/j.landusepol.2013.08.016

Jongman, R. H. G., 2002. Homogenisation and fragmentation of the European landscape: Ecological consequences and solutions. *Landscape and Urban Planning* 58 (2-4), 211-221. doi: 10.1016/S0169-2046(01)00222-5

Paul A. Longley, Mike Goodchild, David J. Maguire, David W. Rhind, 2015. *Geographic Information systems and science*. Fourth edition, Wiley, New York. ISBN: 978-1-118-67695-0

Primdahl, J., Kristensen, L. S., & Busck, A. G., 2013. The Farmer and Landscape Management: Different Roles, Different Policy Approaches. *Geography Compass*, 7(4), 300–314. doi:10.1111/gec3.12040

Sklenicka, P., Janovska, V., Salek, M., Vlasak, J., & Molnarova, K., 2014. The Farmland Rental Paradox: Extreme land ownership fragmentation as a new form of land degradation. *Land Use Policy*, 38, 587–593. doi:10.1016/j.landusepol.2014.01.006

Sklenička, P., Pixova, K., eds. 2003. *Landscape planning in the Czech Republic*. Czech University of Agriculture in Prague, Praha.

Sklenicka, P., Molnarova, K., Pixova, K. C., & Salek, M. E., 2013. Factors affecting farmland prices in the Czech Republic. *Land Use Policy*, 30(1), 130–136. doi:10.1016/j.landusepol.2012.03.005

Slocum, T. A., McMaster, R. B., Kessler, F. C., & Howard, H. H. 2009. Thematic cartography and geovisualisation. Prentice Hall, New Jersey, NJ.

Van Dijk, T., 2003. Scenarios of Central European land fragmentation. *Land Use Policy*, 20(2), 149–158. doi:10.1016/S0264-8377(02)00082-0

Web pages

Richard Knippers, Geometric Aspects of Mapping.

Link: <http://kartoweb.itc.nl/geometrics/index.html>

Intergovernmental Committee on Surveying and Mapping, Fundamentals of Mapping.

Link: <http://www.icsm.gov.au/mapping/index.html>

ESRI, Environmental systems research institute. Link: <http://resources.arcgis.com/en/help/>

Penn State University, Nature of Geographic Information.

Link: <https://www.e-education.psu.edu/natureofgeoinfo/>

Carlos A. Furuti, Map Projections.

Link: <http://www.progonos.com/furuti/MapProj/Normal/TOC/cartTOC.html>

Richard Knippers, Geometric Aspects of Mapping.

Link: <http://kartoweb.itc.nl/geometrics/index.html>