

Theme issues to FSE of Forestry, Water and Landscape Management

Obligatory subjects:

Water Resources Management

1. Hydrological cycle and water balance
2. Catchment and its physiographical characteristics
3. Precipitation, depth, duration, intensity and measurement, design rainfalls
4. Evaporation and evapotranspiration, measurement, methods for determination, models
5. Infiltration, measurement and computational techniques, modelling
6. Direct runoff, surface runoff, and its extremes, measurement and computer models
7. Significant rainfall-runoff events, computer models
8. Mitigation of harmful impact of floods
9. Mitigation of drought impacts
10. Physical properties of liquids, hydrostatic pressure, application to hydraulic structures
11. Fundamentals in hydrodynamics, losses in pressure, application in irrigation systems
12. Open water flow, Chézy equation, flow over hydraulic structures (spillways, outlets)
13. Groundwater flow, Darcy law, groundwater collection, wells
14. Groundwater recovery, delivery of water and its accumulation for drinking purposes
15. Basis of irrigation, water saving irrigation techniques
16. Basics drainage, drainage principles and applications
17. Water problems of wastes, design parameters of landfill internal drainage systems. Field methods to determine hydraulic conductivity.
18. Surface runoff and erosion processes, basic principles and simple formulas and relations, erosion control structures
19. Water management in agricultural areas, estimation and verification of the hydraulic efficiency of the erosion control structures
20. Infiltration ditch and open drain ditch as a protection against erosion processes and surface runoff
21. Principles of river meandering
22. Basic requirements on small rivers
23. River erosion and sedimentation, principles of river formation
24. Basic requirements on river revetments and hydraulic structures
25. Restoration principles and riparian vegetation

Forest Management

1. Data gathering and mensuration
2. Methods of determination of standing volume
3. Growth and increment
4. Empirical growth models
5. Mechanistic (process) growth models
6. Morphological (structural) and Functional-Structural growth models
7. Normal forest
8. Selection forest
9. Temporal arrangement of the forest
10. Spatial arrangement of the forest
11. Cutting control and allowable cut
12. Forest Management Plan and Forest Management Guidelines in Czech Republic
13. Optimization in forest management: general frameworks and background theory
14. Application of optimization in forest management: practical cases and examples

Optional subjects:

Forest Enterprise Economics

1. Basic principles of environmental and forestry policy. Instruments of the forest policy.
2. The most important taxes in forestry are income taxes, property taxes and death taxes. What are advantages and disadvantages these taxes?
3. Is forest economy unique? Why?
4. Forest enterprise goals.
5. Define production function of biological processes - relationship between inputs and outputs.
6. Negative externalities (forestry).
7. Importance of present value and net present value analysis in forestry.
8. Criteria for accepting or rejecting investment.
9. The forest and capital.
10. Timber demand and supply. Can the market provide enough timber?
11. Economics of Forestland Use and Even-Aged Rotations. Definition and use of Faustmann formula.
12. Optimal rotations and the interest rate.
13. Optimal rotation age for even-aged timber.
14. Nonmonetary values and the optimal rotation.
15. Optimal even-aged thinning regimes.
16. Uneven-aged management.
17. Risk free and risky revenues. Forestry and the risk-adjusted discount rate.
18. Valuing nonmarket forest outputs.
19. Simple betterness method. Principles and use in forestry.
20. Multiple use of forestry.

Ecology and Ecological Methods

1) Population ecology and management

Population size, dynamics and trends

Dispersal and spatial patterns

Metapopulation concept, nature reserves designing

2) Catching, marking and monitoring

Catching methods in birds, mammals and invertebrates

Marking and monitoring of birds and mammals

Radiotelemetry

3) Community ecology

Analysis of structures of plant / animal communities

Nature of predation, predator-prey relationships, ecological traps

Competition, niche concept, biological invasions

4) Quantitative ecology

Survival analysis, spatial pattern analysis

Indices of diversity and similarity

Ordination techniques, cluster analysis

Silviculture

- 1) Basic data on Czech forests and forestry (species composition, ownership structure, management types etc.).
- 2) Czech forest act No. 289/1995 Coll. – Initial provisions, Classification of forests, general use of forests, the main obligatory indicators of good management etc.
- 3) Ecological basis of silviculture (site qualifications, vegetation zones, natural species composition, target species composition).
- 4) Reproductive materials (RM) - (Reproductive material sources and their evaluations, certification of RM origin, RM transfer rules).
- 5) Collection and management of seeds – seed quality and its evaluation, seed handling and sowing.
- 6) Forest nursery – criteria, production of bare-root seedlings and containerized seedlings.
- 7) Quality of planting stock – criteria, handling of planting stock.
- 8) Reforestation – planting technology and care of planted area.
- 9) Management of young stands (tending and thinning, type of thinning, rule for young stand management).
- 10) Silvicultural measures to increase the stability of forest stands.
- 11) Methods of forest stand regeneration – silvicultural systems.
- 12) Natural regeneration – preconditions and care.
- 13) Criteria for reforested area and safely reforested area.
- 14) Target species composition for reforestation – ameliorative and stabilizing species.
- 15) Silviculture in urban forests.
- 16) Selection forest and target diameter silviculture
- 17) Close-to-nature silviculture.
- 18) Silviculture of introduced tree species (the most important species and their potential).
- 19) Silviculture of forests with a preferred nature conservation functions.
- 20) Silvicultural tools for adaptation of forests to change in the environment (climate changes).

Landscape and Ecological Application

1. **Ecological stability, landscape types and management** (definitions, economic, social-demographic and environmental factors, natural resources, broader relations)
2. **Assessment approaches, data sources** (ecological vs. environmental aspects, data reliability, monitoring, databases on national and international levels)
3. **Biological conservations** (species, ecosystem and nature conservation, approaches, examples, population, biodiversity, heterogeneity, biodiversity convention)
4. **Landscape protection and conservation** (landscape protection tools and measures, IUNC, UNESCO, Natura 2000, Ramsar Convention, territorial protection)
5. **Tools of planning** (relevant national and international documents, EU, OSN, WHO)
6. **Environmental policy and public involvement** (regional strategies, development plans, analytical documents, legislation frame, public claim on information)
7. **Environmental assessment (EA), cost-benefit assessment (CBA), multi-criteria assessment (MCA), SWOT analysis** (principles, differences, practical applications)
8. **Environmental impact assessment (EIA), strategic impact assessment (SEA)** (principles, differences, types of impacts, practical applications, examples)
9. **Life-cycle assessment (LCA), life-cycle costing** (principles, material and energetic flows, carbon and water footprints, practical applications)
10. **Risk assessment (RA), risks management, SEVESO** (definitions, priorities, risk assessment approaches, risk matrix, protective measures, risk management)
11. **Environmental management systems** (EMS, EMAS, principles, differences, key issues, the PDCA cycle, ISO 14001)
12. **Eco-labelling, environmental product declaration (EPD), eco-design** (principles, types of ecolabels, differences, practical applications, examples)
13. **Circular economy, cleaner production, environmental technology verification** (definition, principles, practical applications, the EU-ETV programme)
14. **Sustainability** (principles, key pillars, scenarios, practical applications, examples)
15. **Human well-being** (definition, assessment approaches, examples)

Literature:

GLASSON, J. et al. (2005): Introduction to Environmental Impact Assessment. Routhledge, U.S.A., 392 s. ISBN 0-415-33837-9.

BUCKLEY, G.P. (1989): Biological Habitat Reconstruction. Belhaven Press, U.S.A., 224 s. ISBN 1-852-93058-6.

ORR, D.V. (2002): Nature of Design, Ecology, Culture, and Intention. Oxford University Press, U.S.A., 237 s. ISBN 0-195-14855-X.

International Organization for Standardization (ISO), ©2010-2017: ISO 14000 Family - Environmental Management. Available at: < <https://www.iso.org/iso-14001-environmental-management.html>>.

Irrigation and Drainage

- 1) Irrigation Requirements
- 2) Basic Approach to Irrigation Projects Designing
- 3) Water Resources for Irrigation and Properties of Irrigation Water
- 4) Determination of Water Supply Requirements for Irrigation Projects
- 5) Supply and Distribution of Irrigation Water
- 6) Irrigation Water Losses
- 7) Types of Irrigation Systems
- 8) Technical Design of Irrigation Systems for Special Crops
- 9) Irrigation Pumping Plants
- 10) Special Uses of Irrigation Installations
- 11) Basic terminology of the drainage policy, basic design parameters of the drainage systems
- 12) Fundamental classification of the drainage processes and drainage structures, role of the drainage in the processes of the climate change
- 13) Hydraulic properties of the drained environment, selected characteristics and parameters, elementary formulas and laws
- 14) Fundamental principles of the groundwater flow to drains, drainage hydrology of the subsurface systems
- 15) Steady-state flow conditions, derivation of the basic equations and relates (Hooghoudt equation)
- 16) Non-steady state (transient) flow conditions, derivation of the basic equations and relates (Glover's equation, de Zeeuw-Hellinga model)
- 17) Land drainage practical cases
- 18) Drainage of the civil engineering structures, drainage of the landfills, drainage of the parkland and green areas (sport ground, golf)
- 19) Use and application of the drainage policy in the water engineering practice
- 20) Future development of drainage systems (post-flood drainage systems)