Applying the methods of remote sensing in forestry, urban forestry, nature protection and environment

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Faculty of Forestry Univeresity of Zagreb, Croatia
Foreword:

The Faculty of Forestry is an internationally recognized institution which offers a high level of education for careers in forestry, urban forestry, nature conservation and environmental protection, wood processing and furniture manufacture. It settles on East side of city of Zagreb, nearby Park Maksimir.
Education in forestry
Three years ago we were celebrate 250 years of Forestry in Croatia (1765-2015)

**Short history of high education in Forestry**

This year we will celebrate the 120th anniversary of high education in Forestry.

The High School of Agriculture and Forestry founded in Križevci in 1860.

The Faculty of Philosophy, Academy of Forestry founded in Zagreb in 1898.
## History of High Education in Forestry

<table>
<thead>
<tr>
<th>University / Faculty</th>
<th>Year</th>
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<tbody>
<tr>
<td>I. NEO-ACADEMIA ZAGRABIENSIS</td>
<td>1669</td>
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<td>II. REGIA SCIENTIARUM ACADEMIA</td>
<td>1776</td>
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<tr>
<td>1. Facultas theologica</td>
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<td>2. Facultas philosophica</td>
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<td>3. Facultas juridica</td>
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<tr>
<td>IV. UNIVERSITY OF ZAGREB</td>
<td>1874</td>
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<tr>
<td>1. Faculty of Law</td>
<td>1874</td>
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<td>2. Faculty of Philosophy</td>
<td>1874</td>
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<td>3. Faculty of Theology</td>
<td>1874</td>
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<td>4. Academy of Forestry at the Faculty of Philosophy</td>
<td>1898</td>
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<td>5. Faculty of Medicine</td>
<td>1917</td>
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<td>6. Faculty of Veterinary medicine</td>
<td>1919</td>
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<td>7. Technical Faculty</td>
<td>1919</td>
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Faculty of Forestry

The mission of the Faculty of Forestry of the University of Zagreb is the implementation of scientific development and professional research, especially programs of strategic importance for Croatia based on: undergraduate, graduate and postgraduate education.

Faculty ensures possibility of students and teachers mobility, the rational use of human and material resources, the development of multidisciplinary scientific-educational activities and supervision and constant increase of quality, competitiveness and international competitiveness in education, scientific and professional work.
Vision of the Faculty of Forestry of the University of Zagreb is to achieve scientific and research center of excellence in the field of FORESTRY and WOOD TECHNOLOGY science, with a clear research profile focused on learning outcomes and the concept of lifelong learning.

Active cooperation with companies, partnerships, community development, individual and indirectly (through the University of Zagreb) involvement in the European Research Area and the European Higher Education Area, and the highest level of organization and accountability.
Our human resources:

127 – Teaching staff

77 – Non-teaching staff

1082 – students

The management system University of Zagreb Faculty of Forestry has been assessed and certified as meeting the requirements of EN ISO 9001:2015 and EN ISO 14001:2015
STUDIES:

- Bachelor: 4 semester, 120 ECTS
- Master of Science: 4 semester, 120 ECTS
- Master Specialist: 6 semester, 180 ECTS
- Postgraduate Specialist: 4 semester, 120 ECTS
- Postgraduate: 6 semester, 180 ECTS
- Doctor of Science: 6 semester, 180 ECTS
Forestry Section

Undergraduate studies

Forestry

Urban Forestry, Nature Conservation and Environmental Protection
Forestry Section

Graduate studies

Forestry

- Silviculture and Management Planning with Wildlife Management
- Techniques, Technologies and Management in Forestry

Urban Forestry, Nature Conservation and Environmental Protection
Faculty of Forestry

Postgraduate doctoral study

Forestry and Wood Technology
Organizational Units of the Faculty of Forestry

- Forestry Section
- Wood Technology Section
Department of Forest Ecology and Silviculture
- Ecology and Pedology Laboratory
- Laboratory of Forest Seed and Nursery Production

Department of Forest Inventory and Management
- Laboratory for Measuring Forest Resources
- Laboratory for Remote Sensing and GIS

Department of Forestry Genetics, Dendrology and Botany
- Laboratory for Molecular Biology and Physiology of Plants

Department of Forest Engineering
- Laboratory for Technical and Technology Measurements in Forestry
- Laboratory for Forest Biomass

Department of Forest Protection and Wildlife Management
- Laboratory for Tree Pathology
- Laboratory for Forestry Zoology
Laboratory for Remote Sensing and Geographical Information System is a research laboratory within the Department of Forest Inventory and Management at the Faculty of Forestry University of Zagreb.
Department of Forest Inventory and Management
Laboratory for Remote sensing and GIS

Director:
Full Professor Renata Pernar Ph.D.

Members:
Associate Professor Ante Seletković Ph.D.
Assistant Professor Mario Ančić Ph.D.
Research Assistant Jelena Kolić Ph.D.
Activities

Research using the methods of RS (aero-satellite images, UAV, LIDAR), GIS, GPS and DTM in forestry, urban forestry, hunting management, nature conservation and the environment.
The specificity

- visual interpretation of aerial photographs (color, color infra red-CIR) in stereomodel (3D) - focus on identifying species and determining the health status of individual trees

- measuring photointerpretation (measuring tree heights, crown projection, determining crown closure, wood mass, etc.) is implemented in stereomodel (3D)
Capability

- research activities associated with digital interpretation (classification of supervised and unsupervised) on multispectral and hyperspectral satellite images and the images of high spatial and temporal resolution (IKONOS, QuickBird, WorldView2) for monitoring changes and biodiversity of forests, land use mapping, urban biotope mapping and wetlands, etc.
ASSESSMENT OF STAND STRUCTURAL ELEMENTS

IKONOS - SPACVA
COMPARISON OF VISUAL AND DIGITAL INTERPRETATION

IKONOS – SPACVA (RGB)  

IKONOS – SPACVA (NIR)
COMPARISON OF VISUAL AND DIGITAL INTERPRETATION
UNSUPERVISED CLASSIFICATION
Training data for supervised classification
HEALTH STATUS OF URBAN FORESTS - WorldView2 Zagreb
HEALTH STATUS OF URBAN FORESTRY – MAKSIMIR NDVI
LAND USE/COVER – QuickBird Vransko Lake
CORINE LAND COVER (CLC) – QUICKBIRD VRANSKO LAKE
FOREST DAMAGE ASSESSMENT (ICE BREAK) – WorldView2 Gorski kotar
NATURAL DISASTERS – WorldView2 Gorski Kotar
NATURAL DISASTERS – WorldView2 Gorski Kotar
LANDSAT 8 - NDVI

TOTAL FOREST DAMAGED AREA
NATURAL DISASTERS (Floods)
NATURAL DISASTERS (Floods)
NATURAL DISASTERS (FLOODS)
NATURAL DISASTERS (Floods)
NATURAL DISASTERS (Forest fire areas)
NATURAL DISASTERS (Forest fire areas)
Other areas of interest

- application of neural networks in remote sensing (detecting forest damage using a neural network and artificial neural networks in the assessment of stand parameters from satellite image),
- the application of GPS (monitoring trends and activities of wildlife telemetry methods),
- production of digital elevation models (DEM),
- digital orthophoto (DOP) for environmental modeling (raster-GIS analysis, spatial-temporal analysis, geostatistics),
- implementation of RS products in GIS.
Laboratory products

We create different thematic maps by applying the methods of RS and GIS:

- Land use/land cover,
- Forest fire area,
- Vegetation types,
- Stand damage,
- Wildlife distribution,
- Urban biotope,
- Wetlands,
- Flood dynamics,
- Monitoring changes and biodiversity of forests,
- Forest stand structural elements survey
- Inventory/monitoring/predicting health status of individual trees in forestry/urban forestry,
- National forest inventory,
- etc.
Projects

- Monitoring the forest health status using remote sensing methods (068-0681966-2786), Ministry of Science, Education and Sports.
- Methodology for assessing damage to forest stands in continental forests caused by major natural disasters (ice, snow, wind, floods, fires) – WV2.
- FAO & EC Joint Research Centre (JRC) - The global forest resources assessment (FRA 2010), remote sensing survey: Land use/cover classification and change detection.
- FAO technical cooperation programme-TCP/CRO/3101(A); CORINE classification and validation, spatial base and geodatabase structure.
- TP-06/0007-01- Multisensor Airborne System for Reconnaissance and Surveillance in Emergency and Environmental Situations, Ministry of Science, Education and Sports.
- EC FP5 - Airborne Minefield Area Reduction (ARC) - IST-2000-25300-ARC), The subjective interpretation of the scene of mine suspected area based on air photographs.
- EC FP5 - Space and airborne mined area reduction tools (SMART) - IST-2000-25044; Land-cover classification and validation.
- Mapping the habitats of The Republic of Croatia; Visual interpretation of satellite images; Ministry of Environmental and Nature Protection.
- Determination of forest damage and inventory of dry trees (snags) for M.U. Josip Kozarac- Lipovljani.
- Grassland mapping, determination of changes in grasslands and mapping of land cover in Northern Velebit NP (IKONOS).
- Determination of fir damage and detection of mistletoe on multispectral and hyperspectral images (Velebit).
- Assessment of the health status of Forest Park of the City of Zagreb by remote sensing methods (WV2).
- Possibilities of reducing field data collection in operational managing oak forests (LIDAR).
DOCTORAL THESIS

• Seletković, Ante: Comparison between digital and visual interpretation of high resolution satellite image. Zagreb: Faculty of Forestry. Mentor: Pernar, Renata.

• Štorga, Dalibor: Spatial analysis of the variability of state and private forests structure elements using GIS. Zagreb : Faculty of Forestry. Mentor: Pernar, Renata.


• Balenović, Ivan: Applying possibility of digital aerophotogrammetric images of different spatial resolution in forest management. Zagreb: Faculty of Forestry. Mentor: Seletković, Ante.

• Ančić, Mario: The application of multispectral and hyperspectral imaging on silver fir damage assessment (Abies alba MILL.) and mistletoe detection (Viscum album L. ssp. abietis /Weisb./Abrom). Zagreb: Faculty of Forestry. Mentor: Pernar, Renata.


• Berta, Alen: Forest biomass assessment by LIDAR technology in degraded forests of hilly and lowland vegetation area in central Croatia. Zagreb Faculty of Forestry. Mentor: Seletković, Ante.
Thank you for your attention