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

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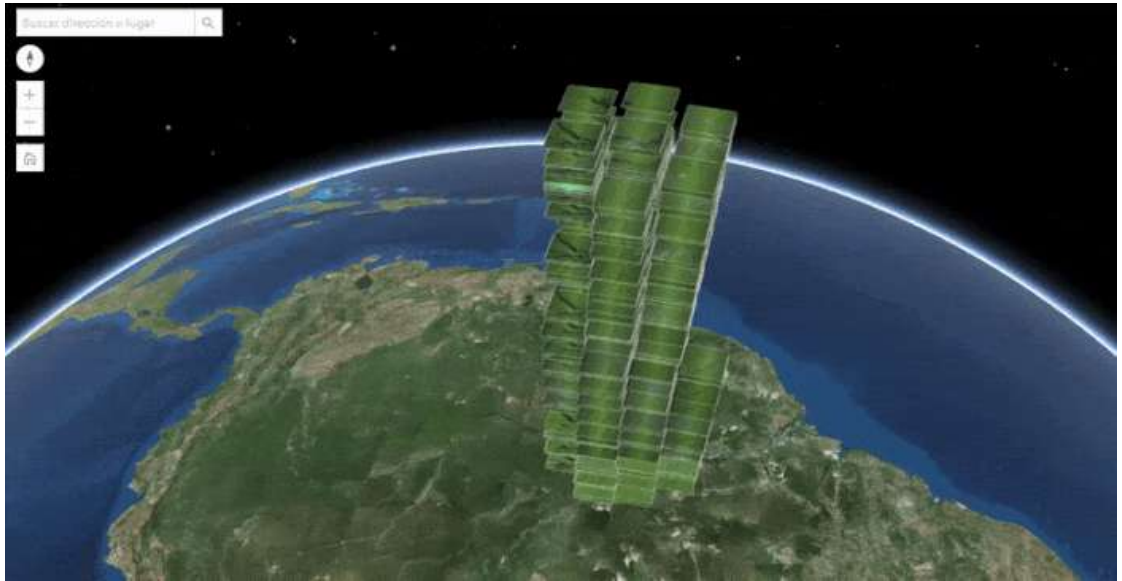
Faculty of Forestry Univeresity of Zagreb, Croatia



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 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

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

Faculty of Forestry

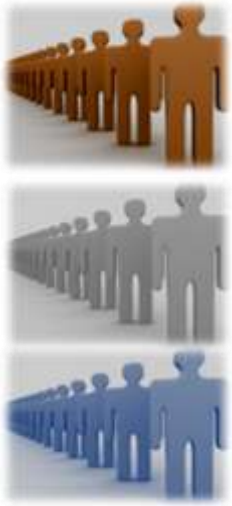
The mission of the Faculty of Forestry of the University of Zagreb is the **implementation of scientific development and professional research**, especially programs of strategic importance for Croatia based on: undergraduate, graduate and postgraduate education.

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 Univetsity of Zagreb is to **achive 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:



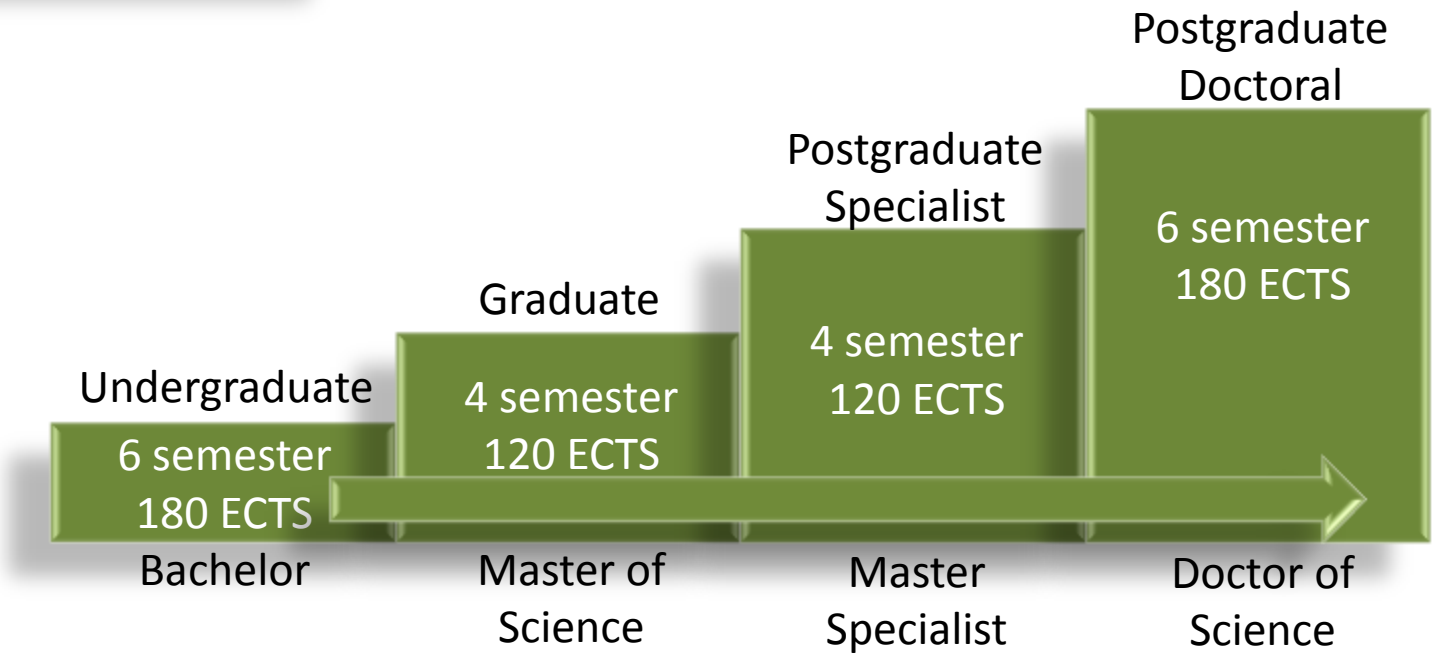
127 – Teaching staff

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:


Undergraduate
6 semester
180 ECTS
Bachelor
Graduate
4 semester
120 ECTS
Master of Science
Postgraduate Specialist
4 semester
120 ECTS
Master Specialist
Postgraduate Doctoral
6 semester
180 ECTS
Doctor of Science

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

Organizational Units of Forestry 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

Where we are?

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:

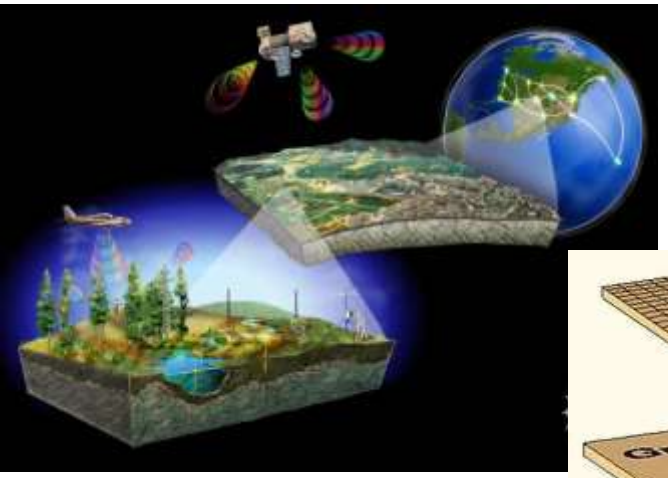
Associate Professor Ante Seletković Ph.D.

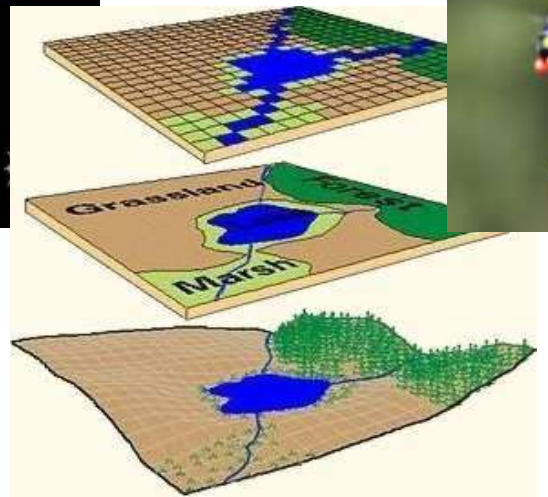
Assistant Professor Mario Ančić Ph.D.

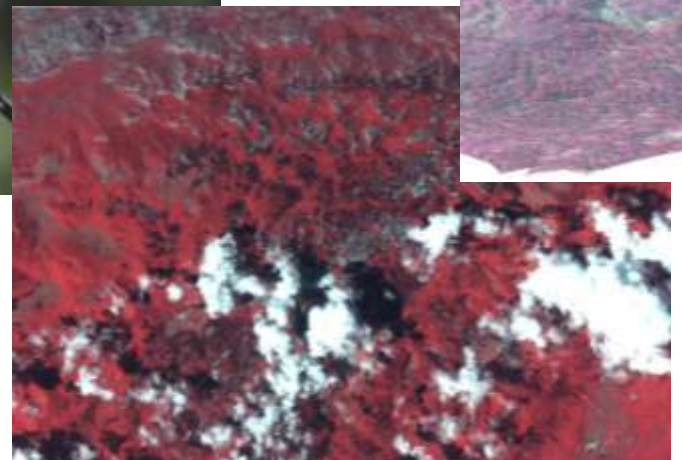
Research Assistant Jelena Kolić Ph.D.

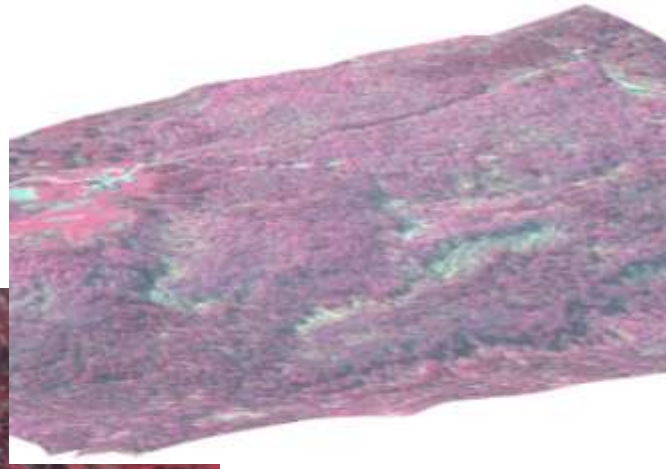
Activities

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

stereoscope

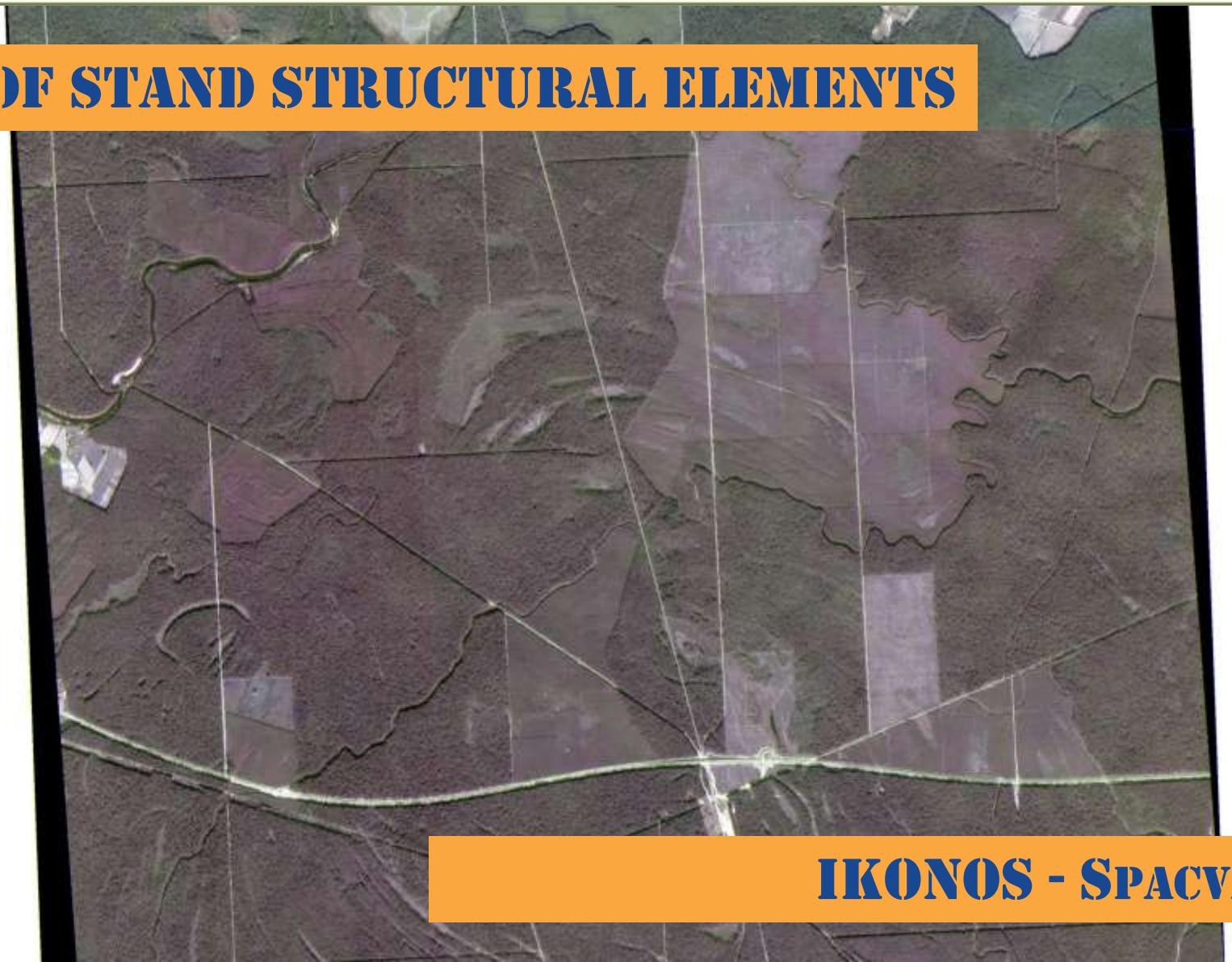
digital photogrammetric WS

- 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



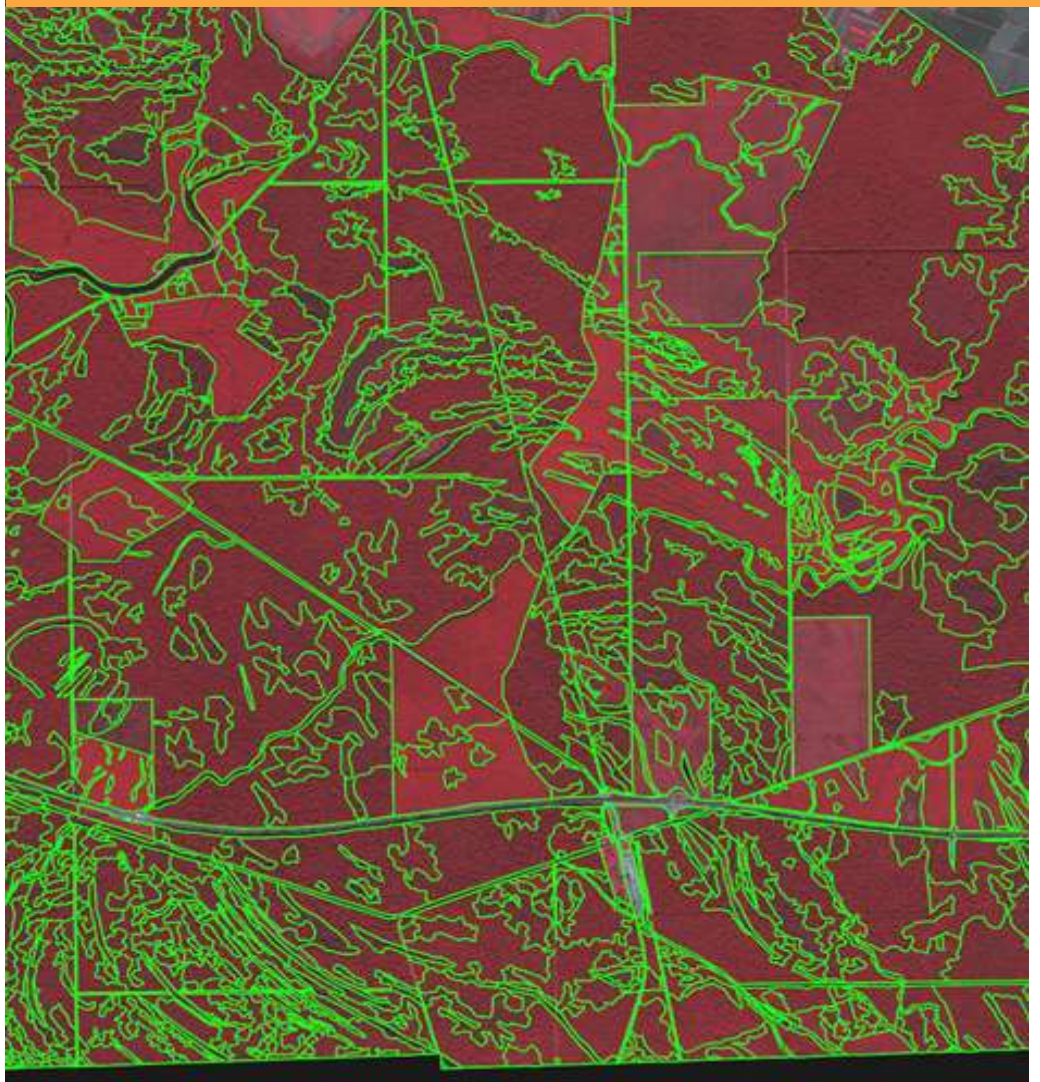
IKONOS - SPACVA

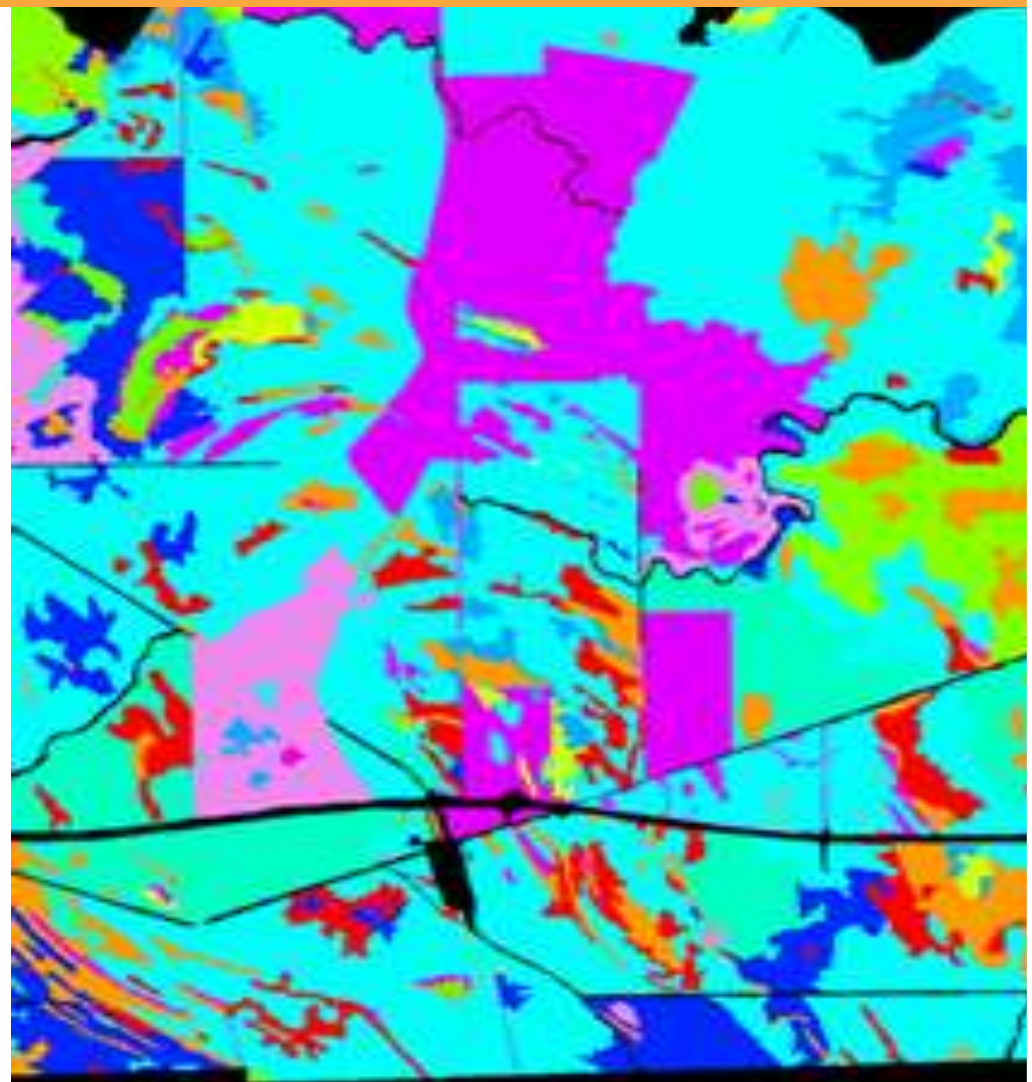
COMPARISION OF VISUAL AND DIGITAL INTERPRETATION

IKONOS – Spacva (RGB)

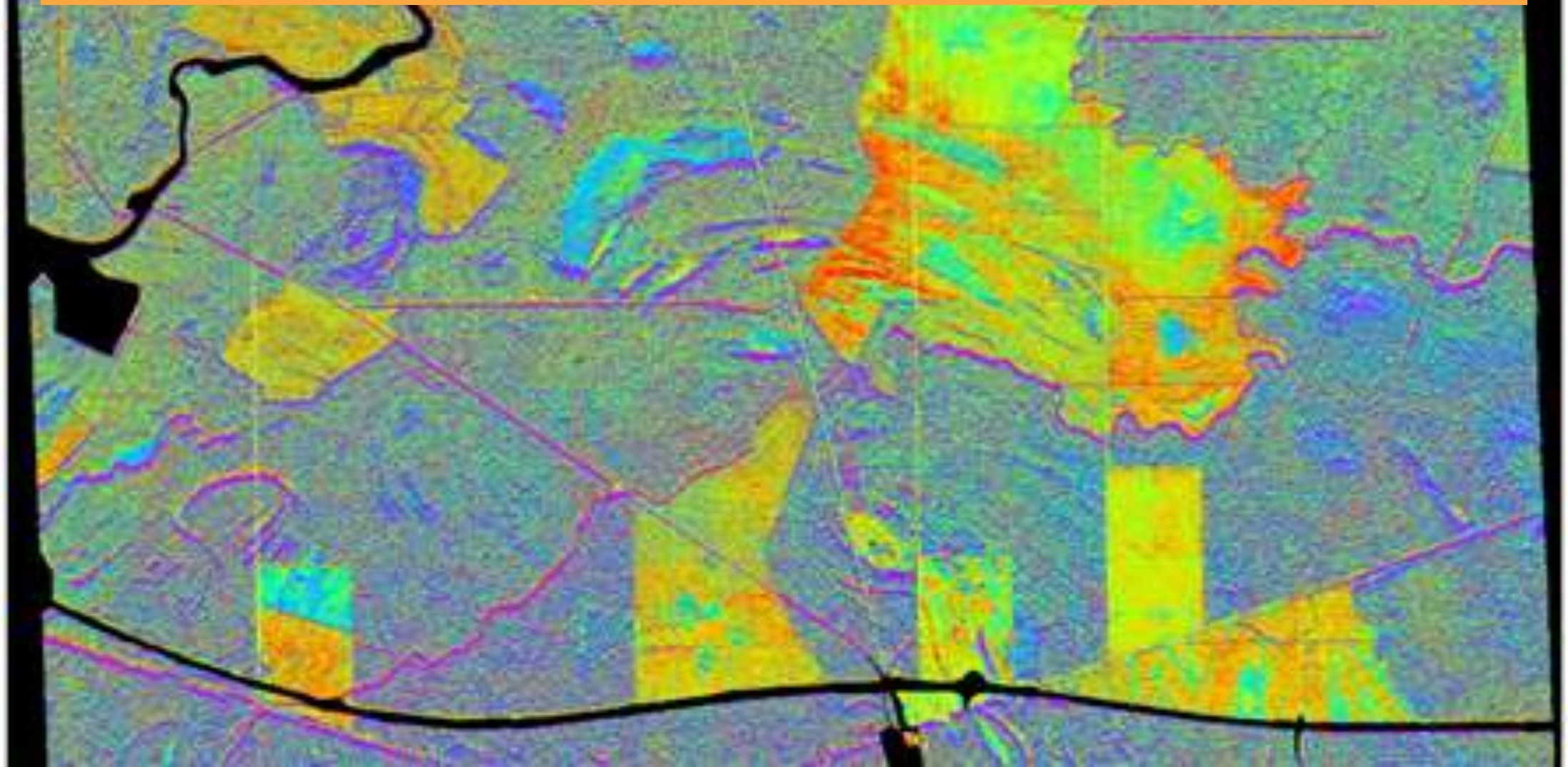
IKONOS – Spacva (NIR)

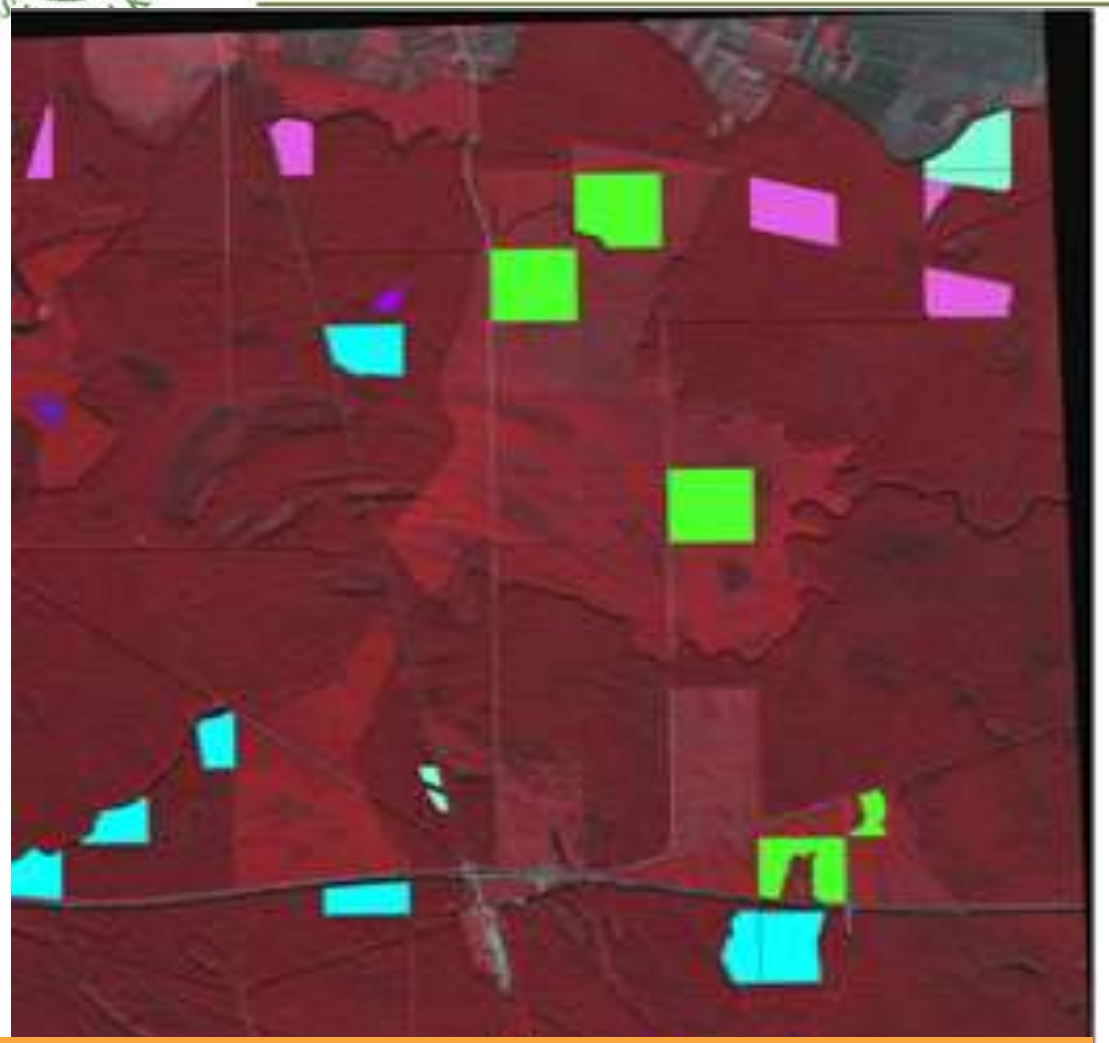
COMPARISION OF VISUAL AND DIGITAL INTERPRETATION



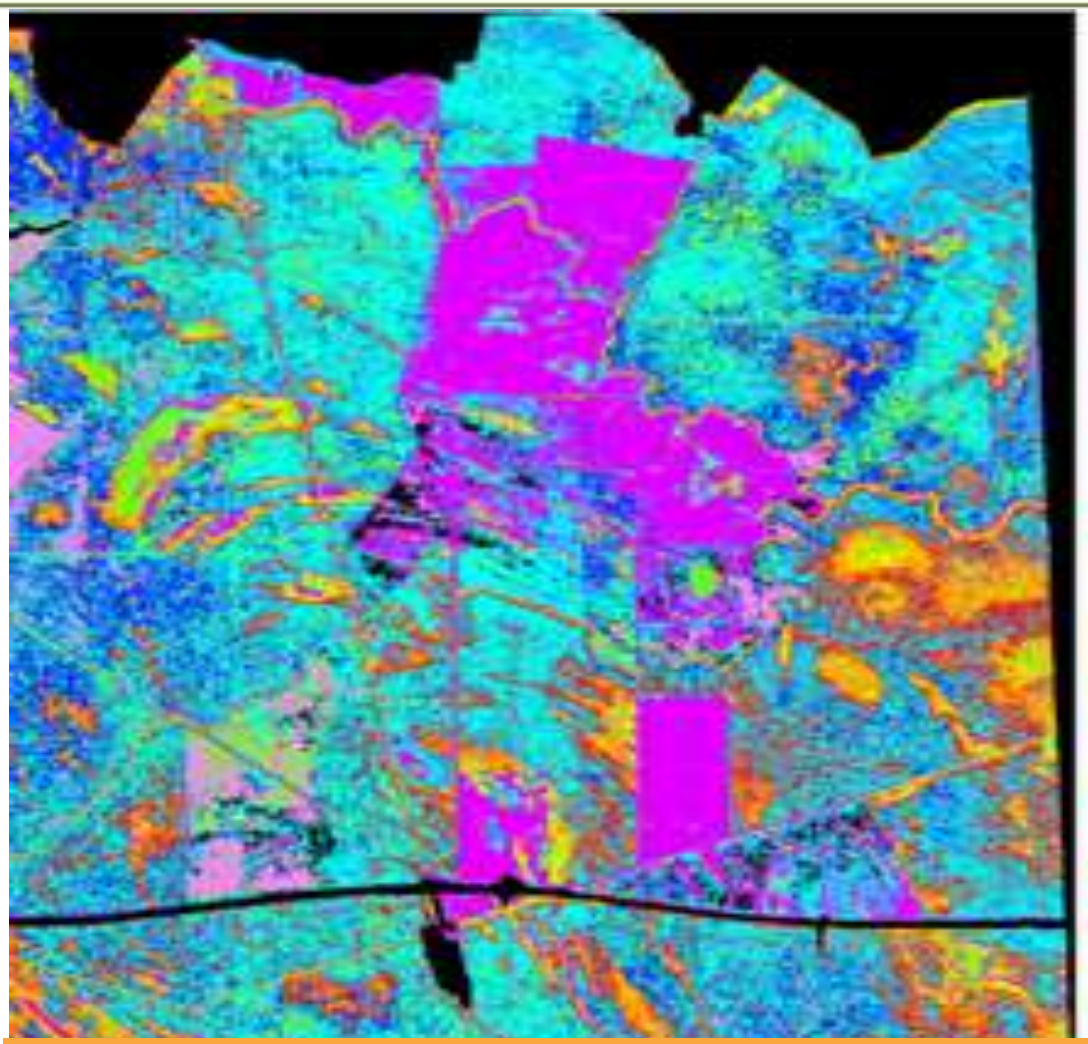


UNSUPERVISED CLASSIFICATION





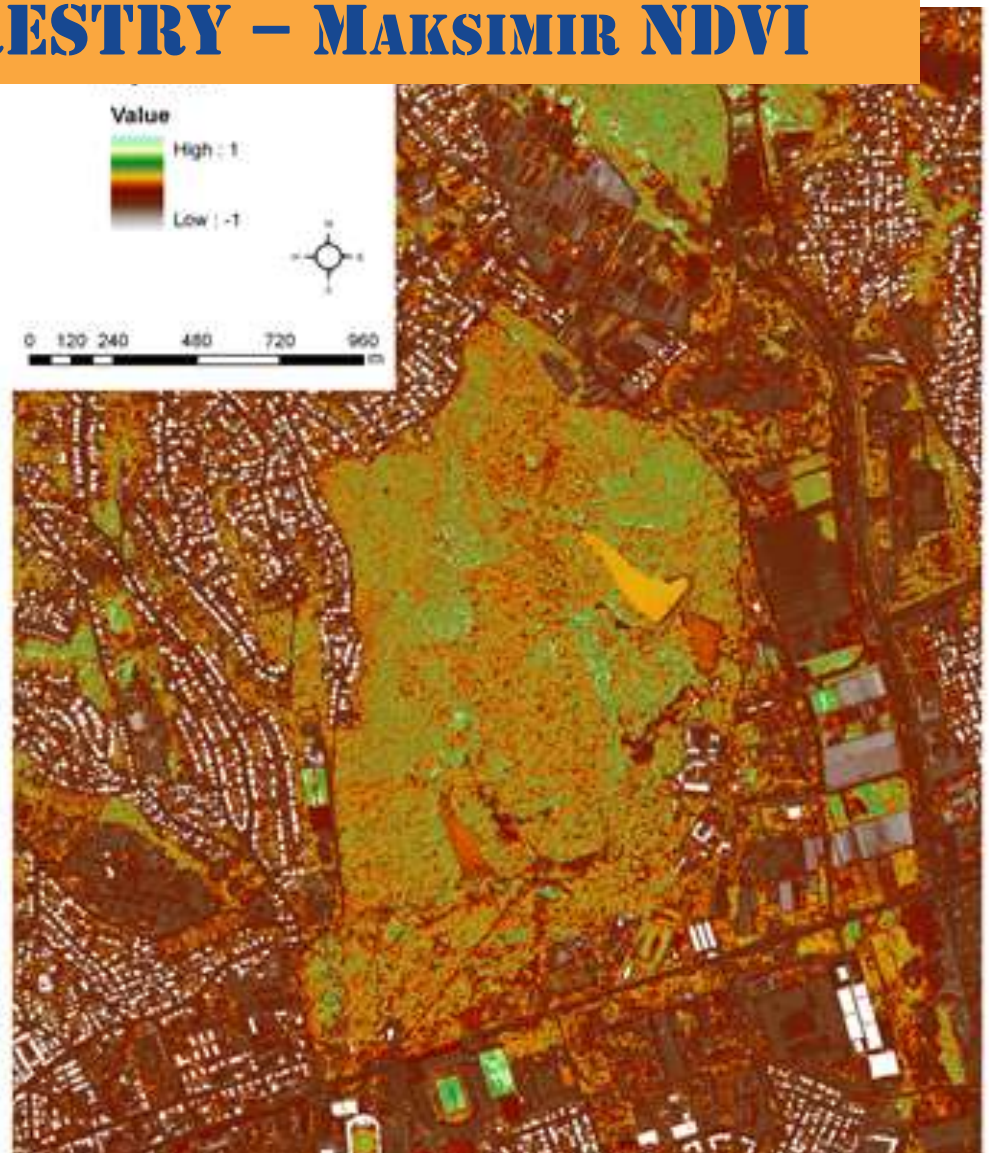
Training data for supervised classification



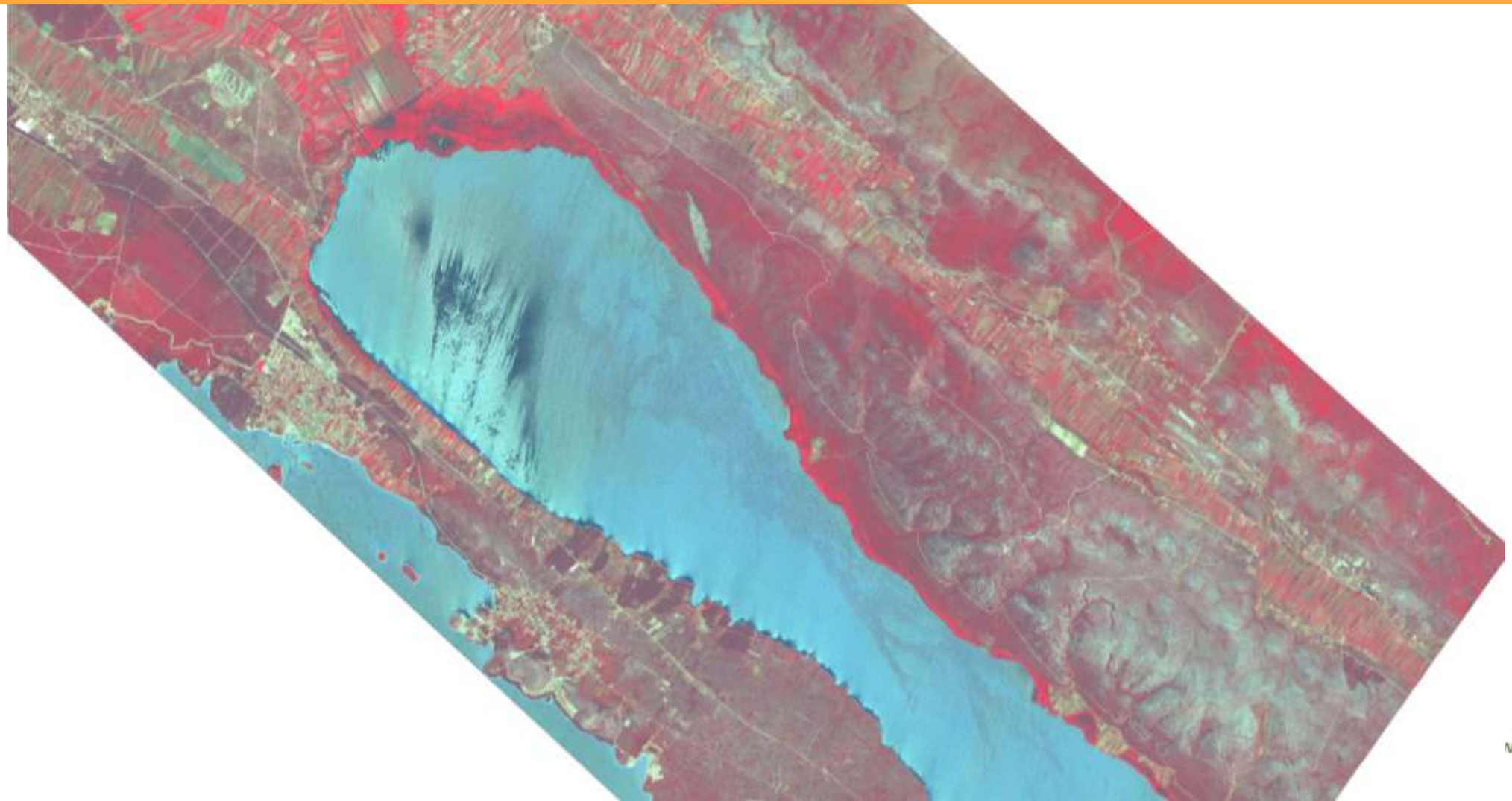
Supervised classification

HEALTH STATUS OF URBAN FORESTS - WORLDVIEW2 ZAGREB

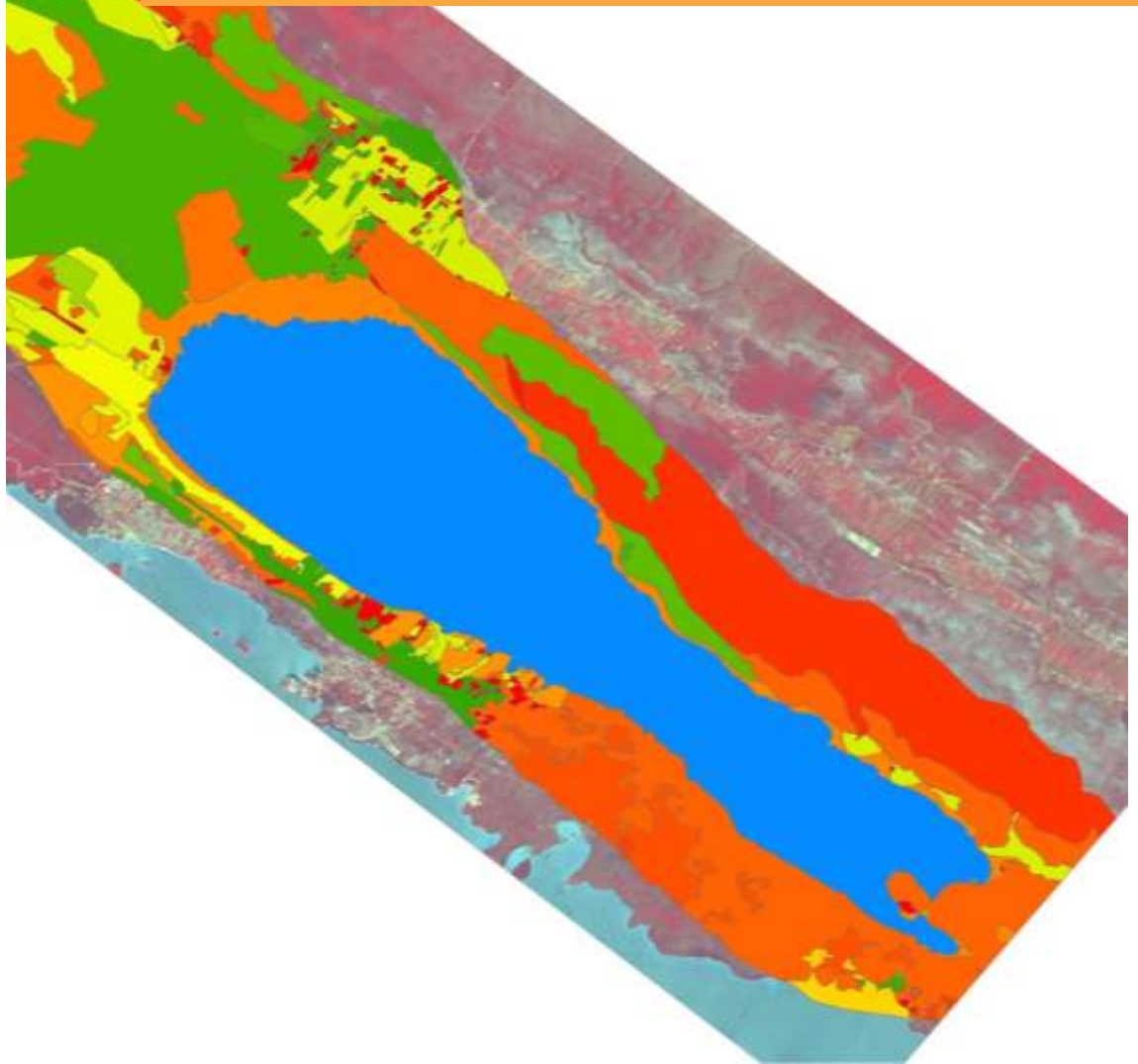
HEALTH STATUS OF URBAN FORESTRY – MAKSIMIR NDVI

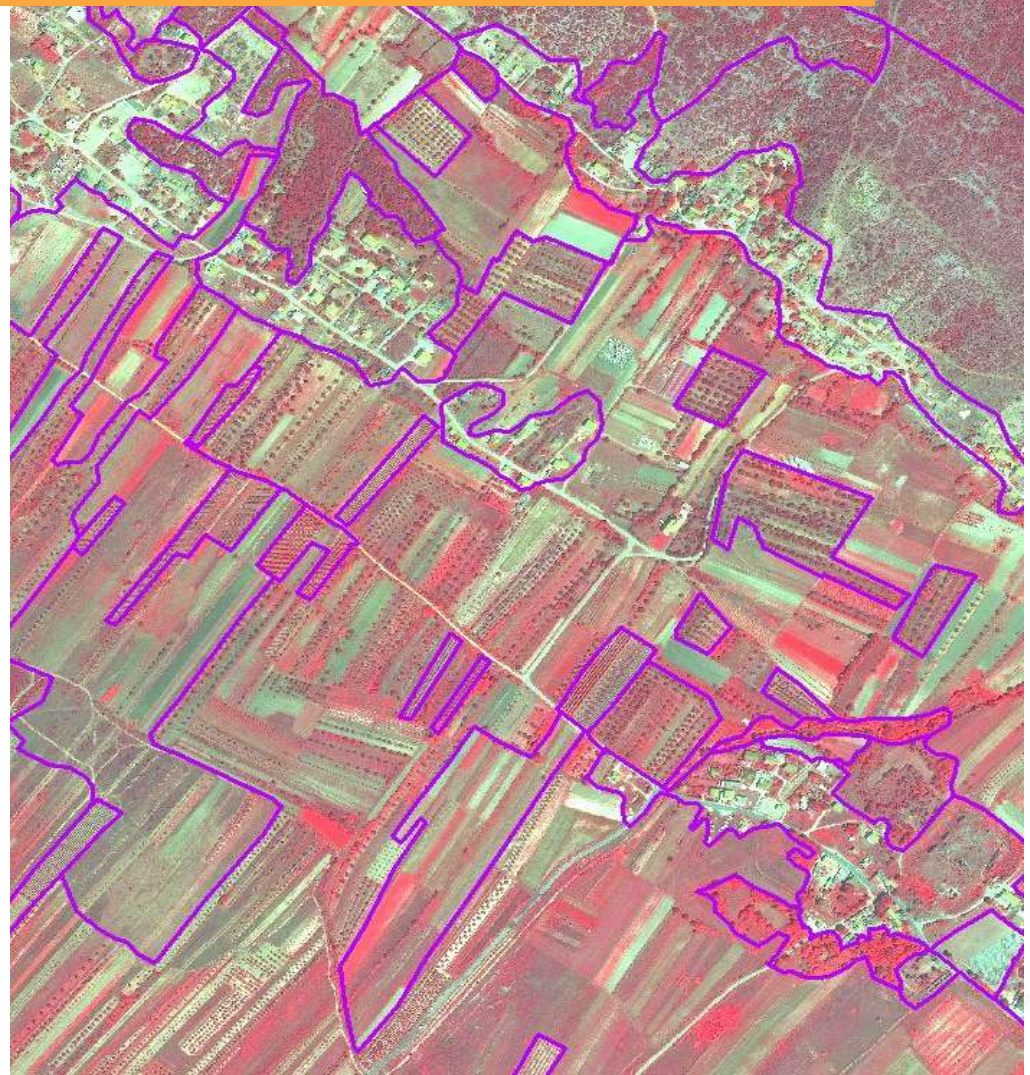


LAND USE/COVER – QUICKBIRD VRANSKO LAKE

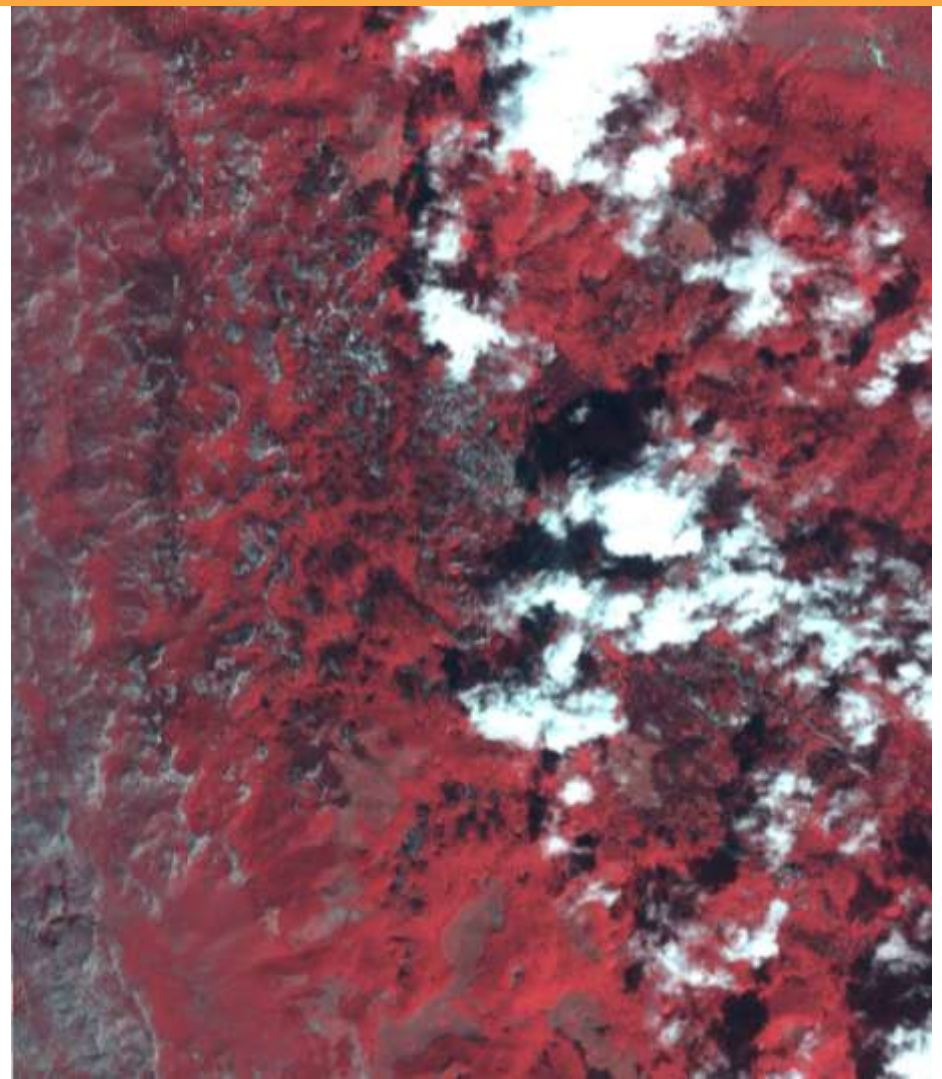


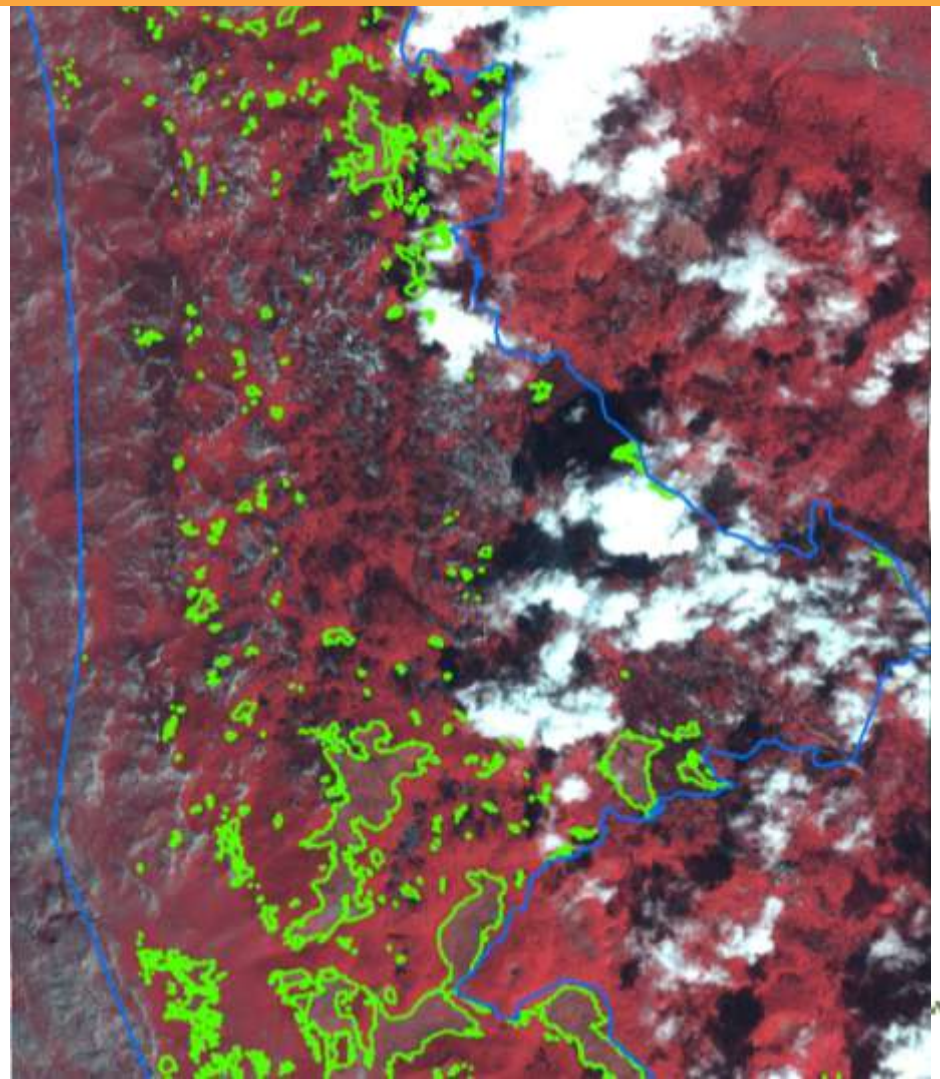
CORINE LAND COVER (CLC) – QUICKBIRD VRANSKO LAKE





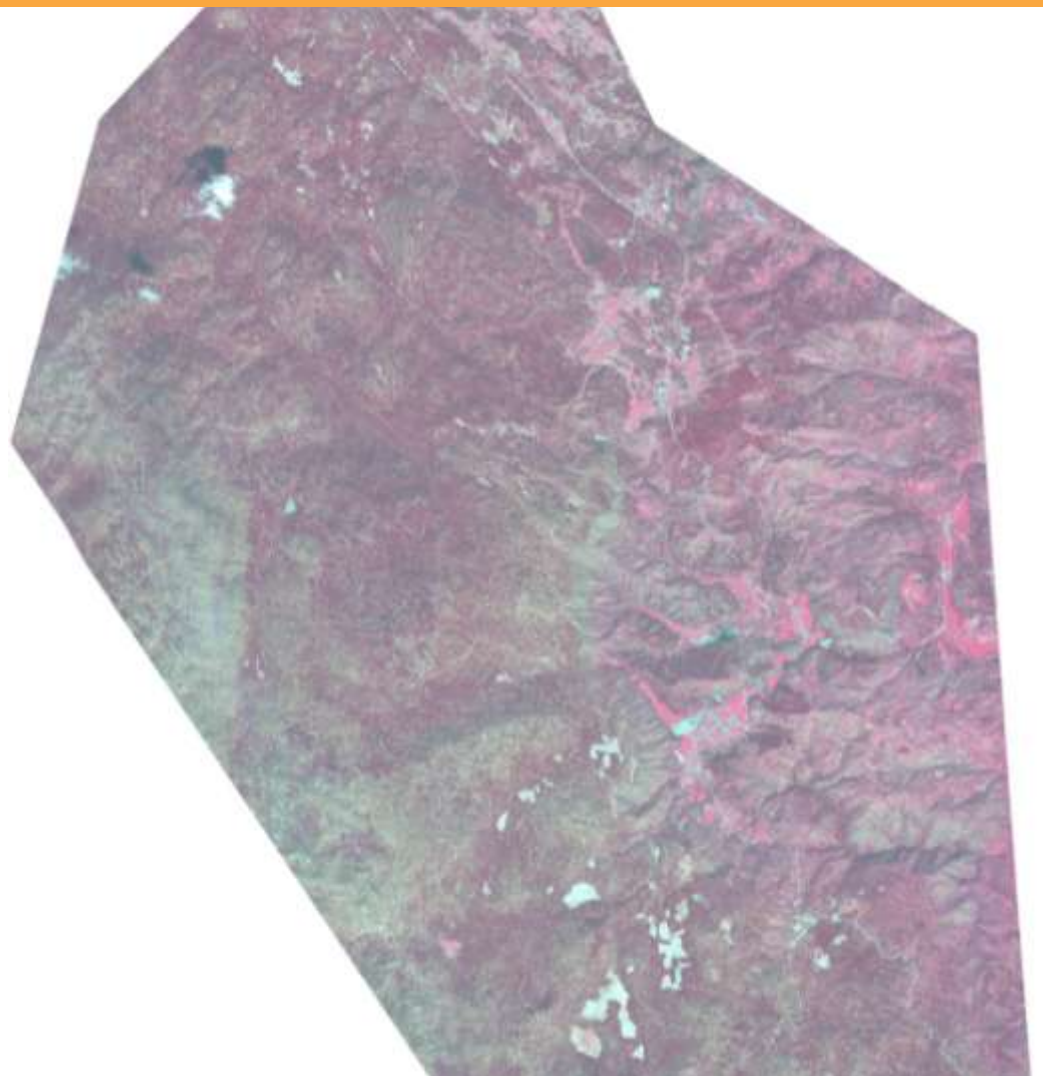
SUCCESSION OF VEGETATION ON GRASSLANDS – IKONOS VELEBIT

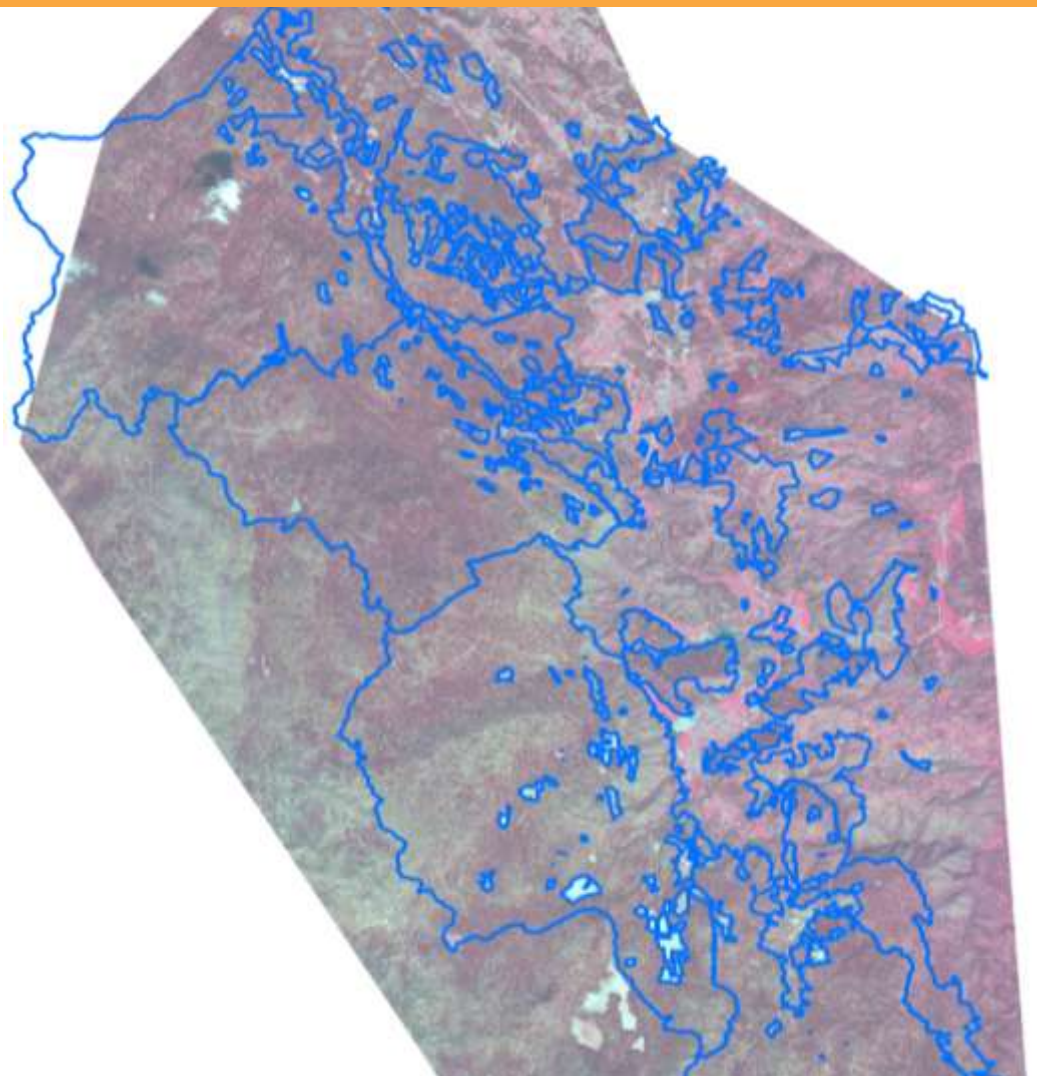




NATURAL DISASTERS – WORLDVIEW2 GORSKI KOTAR

FOREST DAMAGE ASSESSMENT (ICE BREAK)– WORLDVIEW2 GORSKI KOTAR





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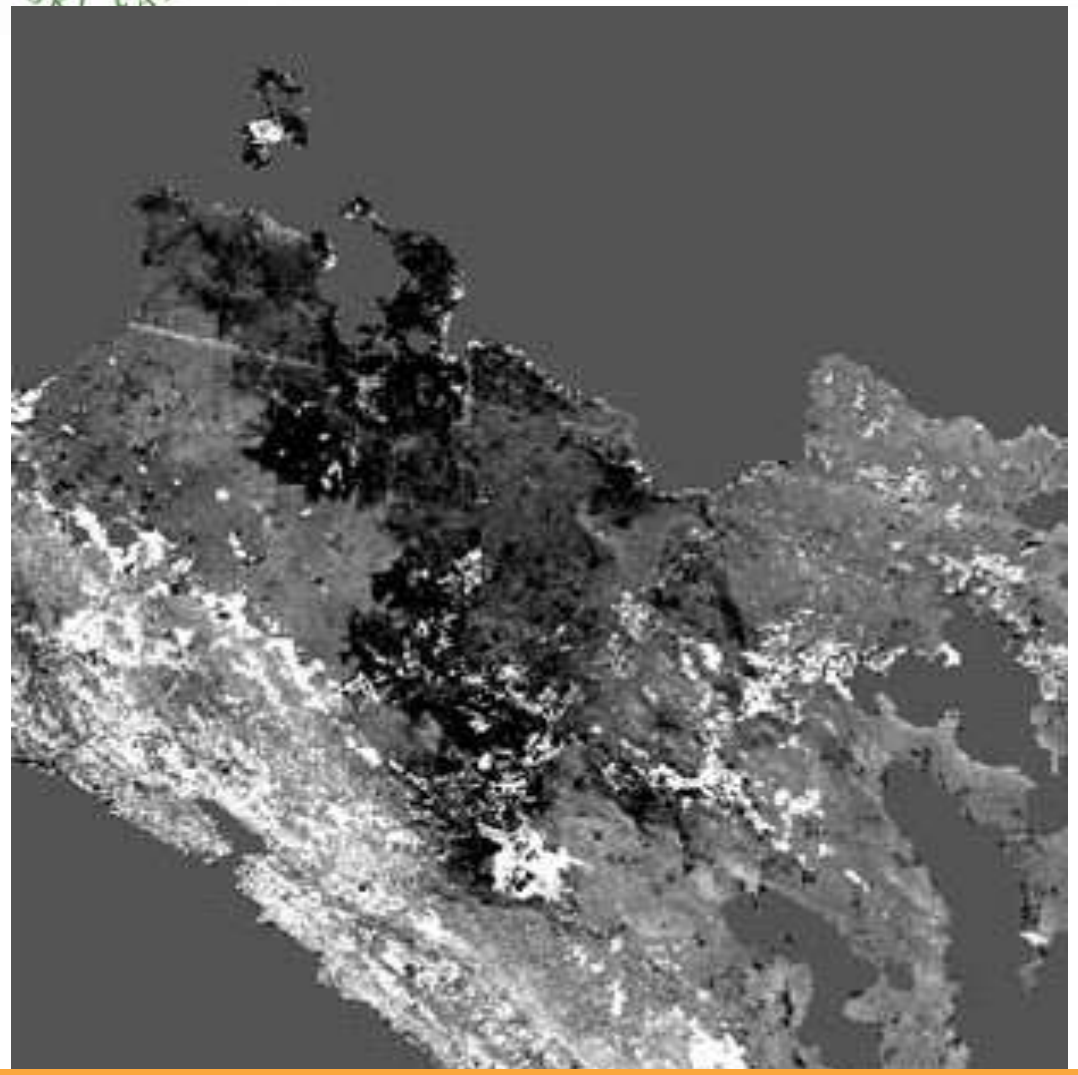

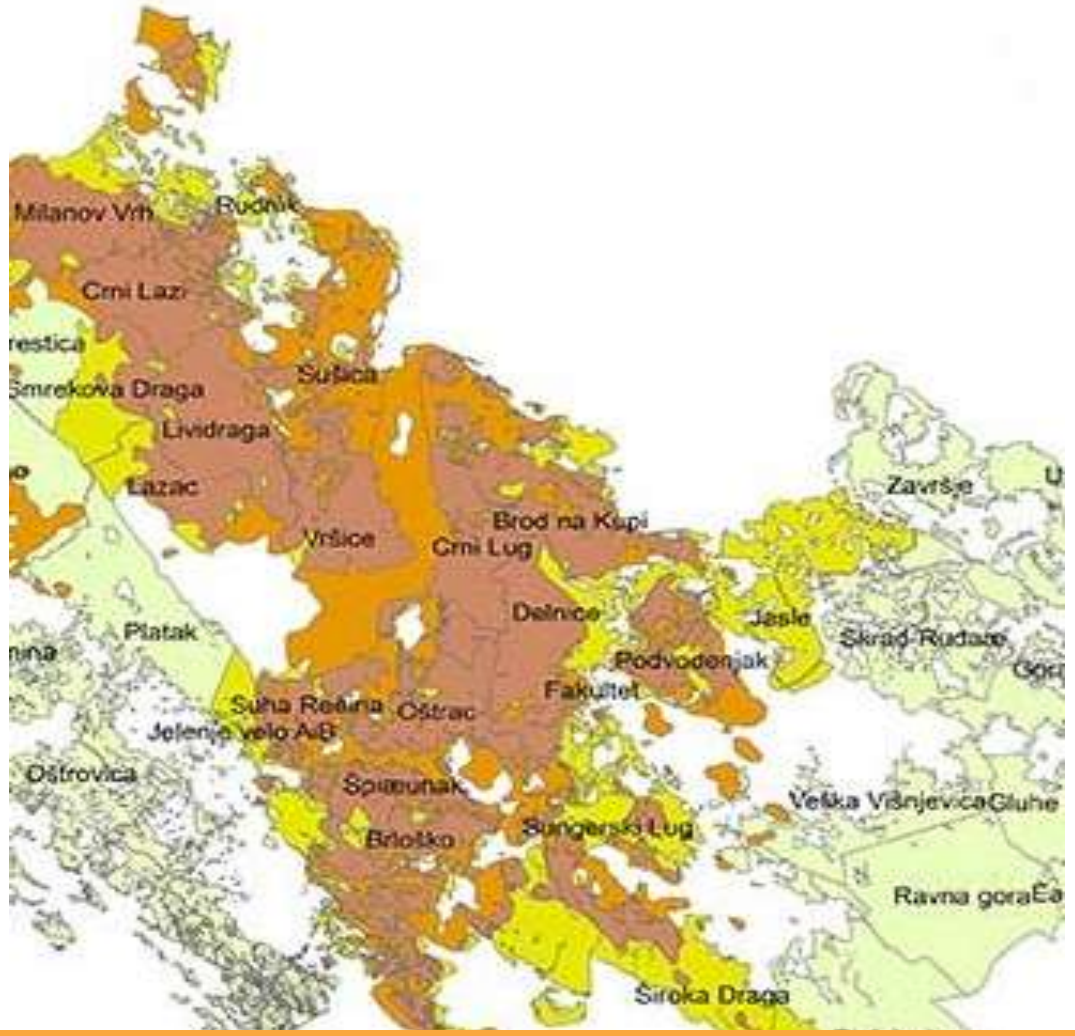

LANDSAT 8 - NDVI

TOTAL FOREST DAMAGED AREA

NATURAL DISASTERS (FLOODS)

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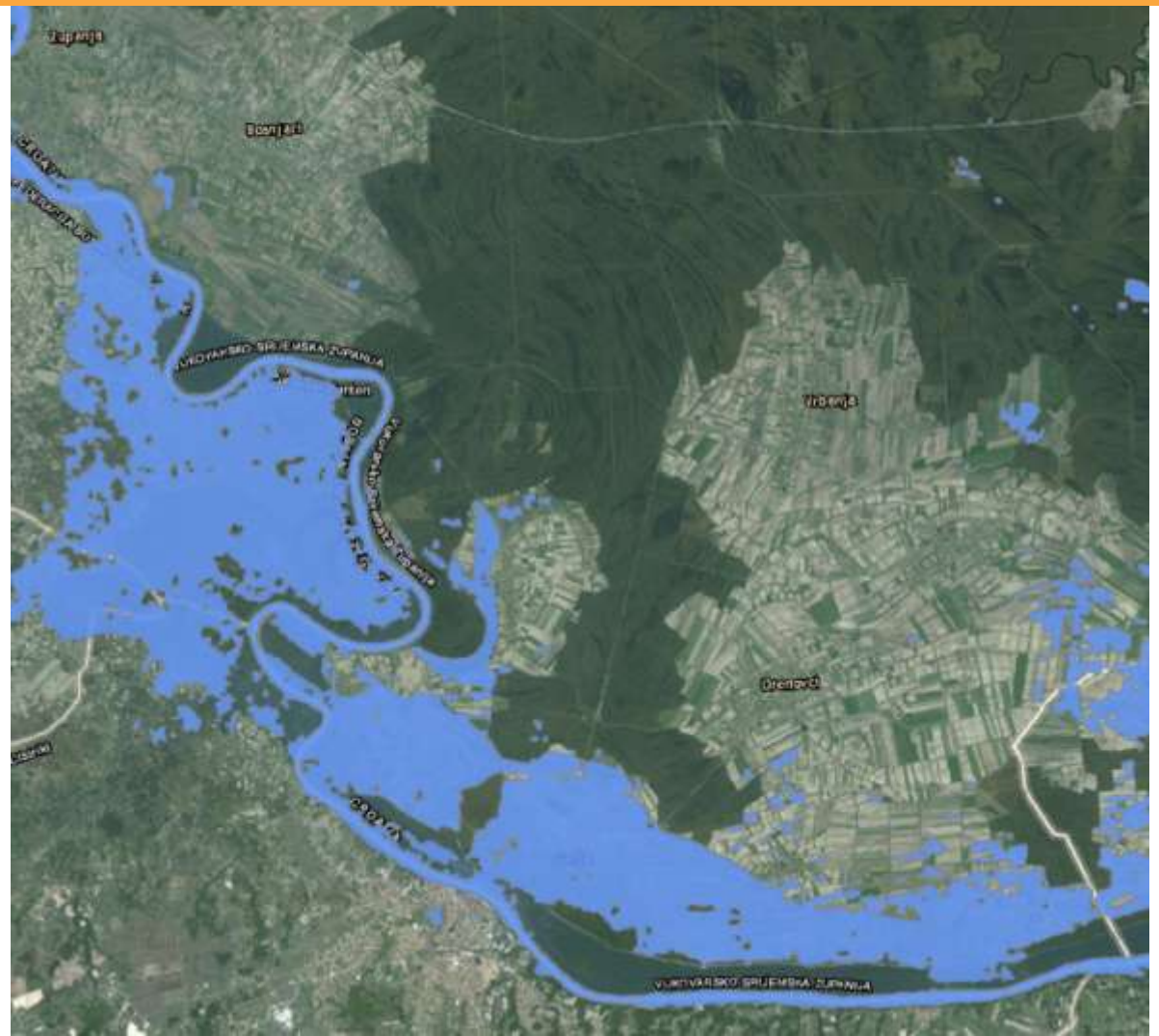
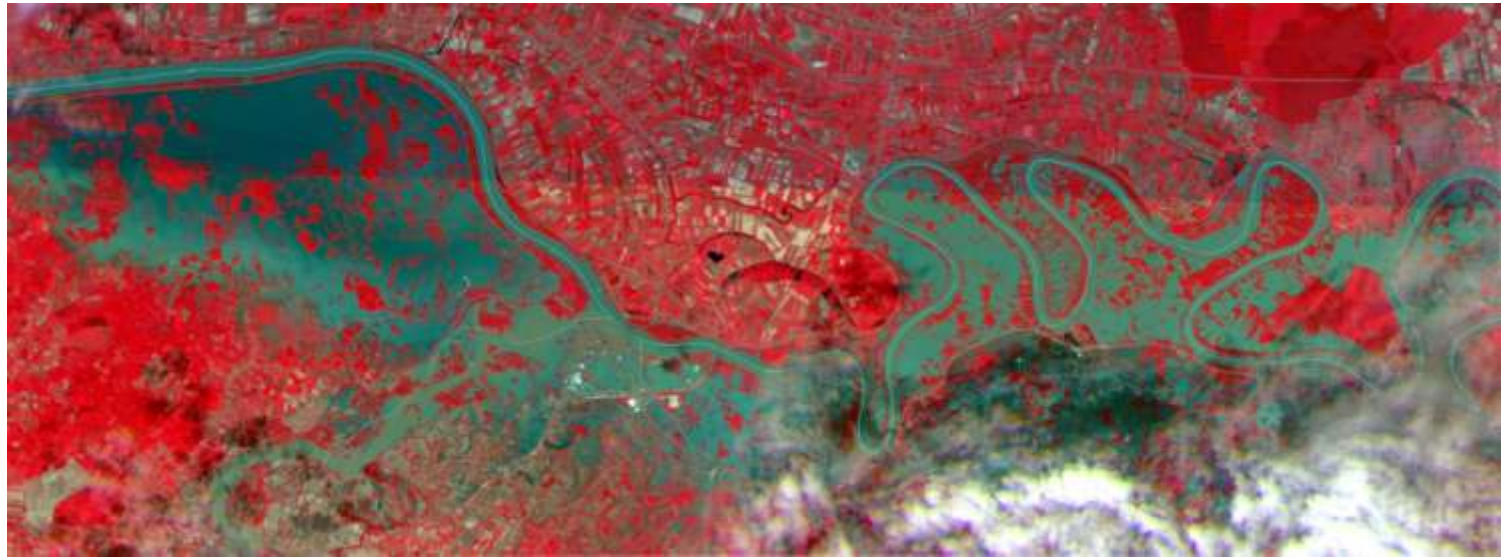
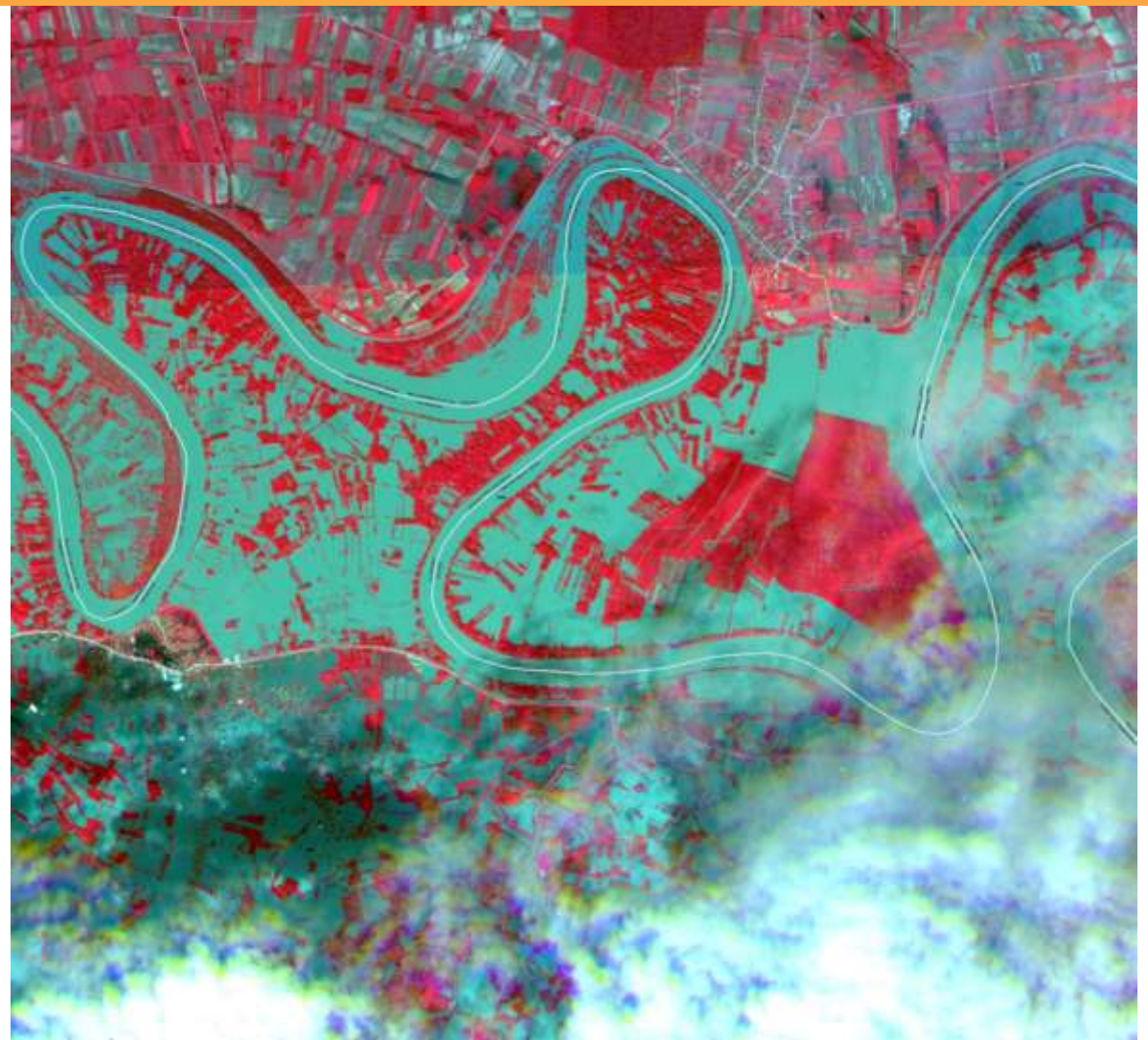


NATURAL DISASTERS (FLOODS)



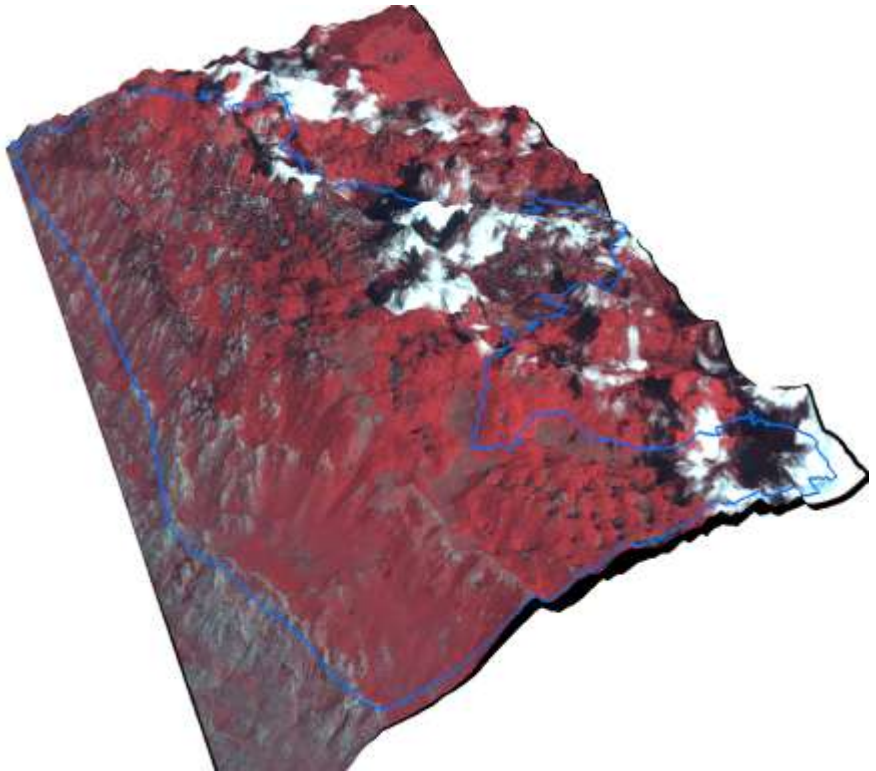
NATURAL DISASTERS (FLOODS)



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.
- **Klobučar, Damir**: Artificial neural networks in remote sensing used for the forest management. 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.
- **Kolić, Jelena:** Crown damage assessment using analog and digital color infrared (CIR) aerial photographs with optimal sample size determination. 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