Providing Key Spatial Data and Services in Serbia

Republic Geodetic Authority

"Earth Observation"

INSPIRE Conference 2015, Lisbon, 28th May 2015

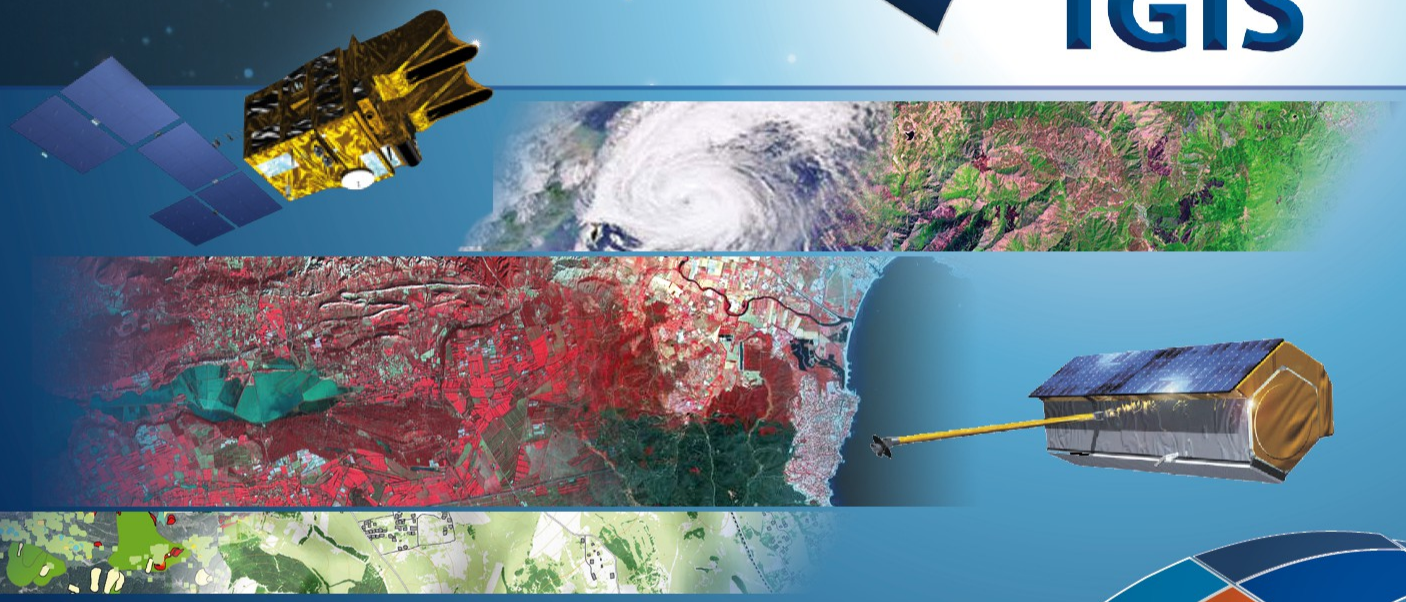
Competences of RGA

By the official Law on state survey and cadaster (adopted on 11th of September 2009) RGA, as a special governmental organization, is a national provider and administrator of cadastre and geo information and it is incharged for :

- Geodetic Reference Sytem;
- State Survey;
- Real-estate cadastre;
- Utillity cadaster;
- Administartive Units Registry;
- Addresses Registry;
- Topographic Mapping;
- Real-estate Mass Appraisal;
- Geographic Names Registry;
- Geomagnetism;
- NSDI;
- Etc...

IGIS project implementation in Serbia

SERBIA IGIS



National Spatial Data Infrastructure and Remote-Sensing Centre for the Republic of Serbia based on IGIS (Integrated Geo-Information Solution)

IGIS project

Title	**National Spatial Data Infrastructure and Remote-Sensing Centre for the Republic of Serbia based on IGIS (Integrated Geo-Information Solution)**
Funding	French government loan
Timing	2010 – 2013 + maintenance 1 year
Partners	
Objective	★ RGA aims at implementing an sustainable NSDI. The IGIS project is carrying out as an extensive cooperation program setting-up services capability in Serbia through the use of high technology components. The project includes high-level know-how and expertise transfer so that national geoinformation capability is enhanced and strengthened. The objective is to build up a capability in conformance with the EU SDI specified standards. ★ The aim of this Remote Sensing Centre and NSDI is to produce, organise and distribute mapping data for citizens, as well as services for the public and private sectors.

IGIS project planning

- System design
- Site recommendations
- Infrastructure Customization
- Training planning
- Data delivery planning

- First Dataset deliveries
- Parameter setting
- Adaptations
- Tests & assembly
- Validation

- Following Data sets delivery
- Maintenance
- Support
- Training & know how transfer

IGIS Design and Customisation → Factory Integration → Operational deployment

3 years project

IGIS project concept

The IGIS concept is comprised of two core components:

1)**Data**: provides the content of the SDI and the corresponding data that describe the dataset;

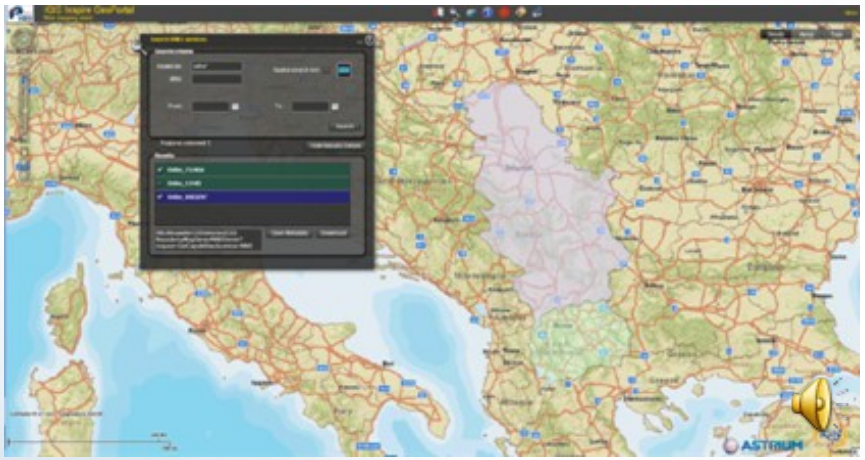
2)**Services**: enable access to and use of the data.

Data

- Satellite and aerial imagery;
- LIDAR acquisition;
- Remote sensing: environmental and agriculture maps;
- Stereo plotting: production of 3D vector topographic data base;
- Map editing: digital and hardcopy maps;

Services

- Technical infrastructure:
  - Archiving and hosting capabilities
  - Central Data Repository
- Web Portals for data and service dissemination
  - METIS
  - INSPIRE compatible
  - WebBoutique/DataDoors



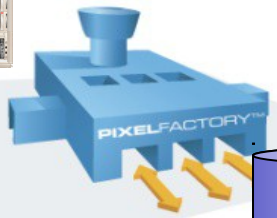
Integrated SDI for capability building

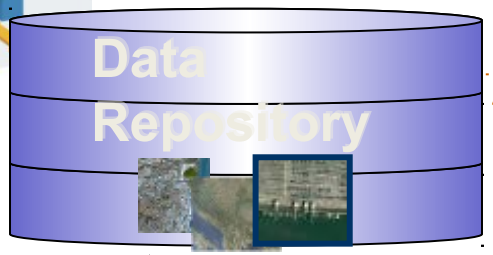
SPOT 5

Geoeye

Airborne (ADS80, Ucx/xp)

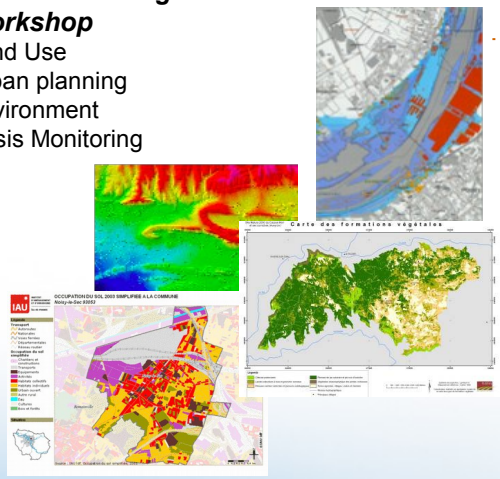
TM acquisition
In Toulouse
Geometric Corrections (orthophotos)

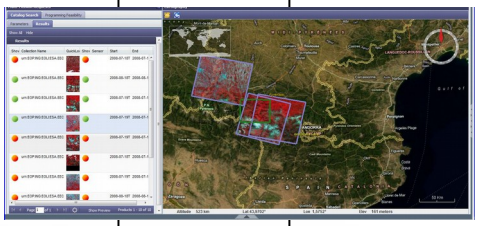




Stereo & plotting
(3D restitution)
Vector Database
-
Maps edition
Digitised and plotted

Remote Sensing Workshop
Land Use
Urban planning
Environment
Crisis Monitoring



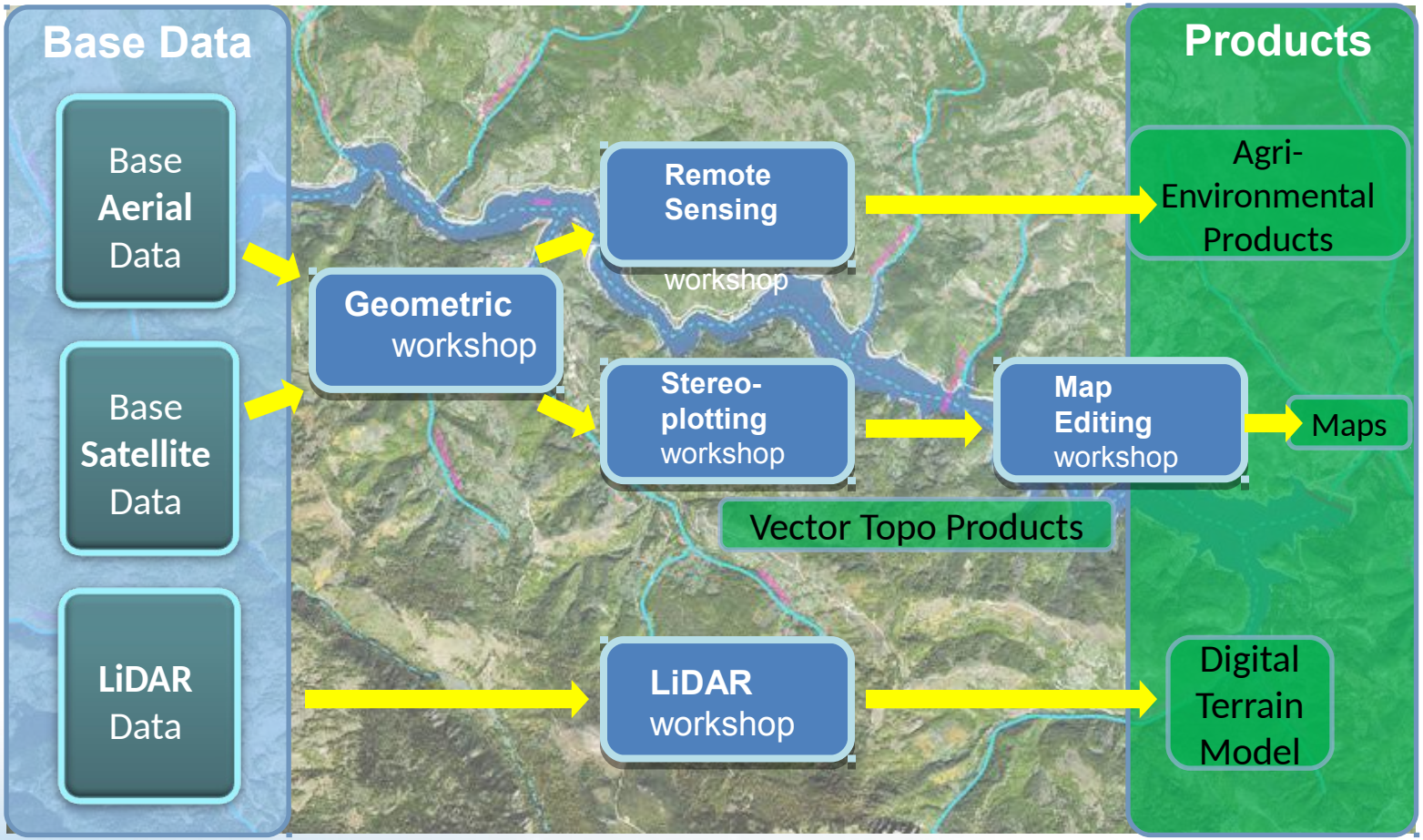


PORTAL

Intranet

Internet

Workshops in IGIS project



Geometric WS-concept

The Geometric workshop is designed to support:

- Acquistion of base aerial data and procurement of base satellite data, as well as data verification;
- Generation of specific topographic products (DTM,DSM, *ground*-ortho, *true*-ortho, mosaics etc.) through Pixel Factory software solution;
- Provision of elementary data for Remote Sensing (single ortho-scenes), Stereo Plotting (absolutely oriented stereo pairs) and Map Editing workshop (digital terrain model);

Geometric WS-aerial data acquisition

Aerial data acquisition from 2011 till 2013:

- **National coverage (~ 74 400 km²)**

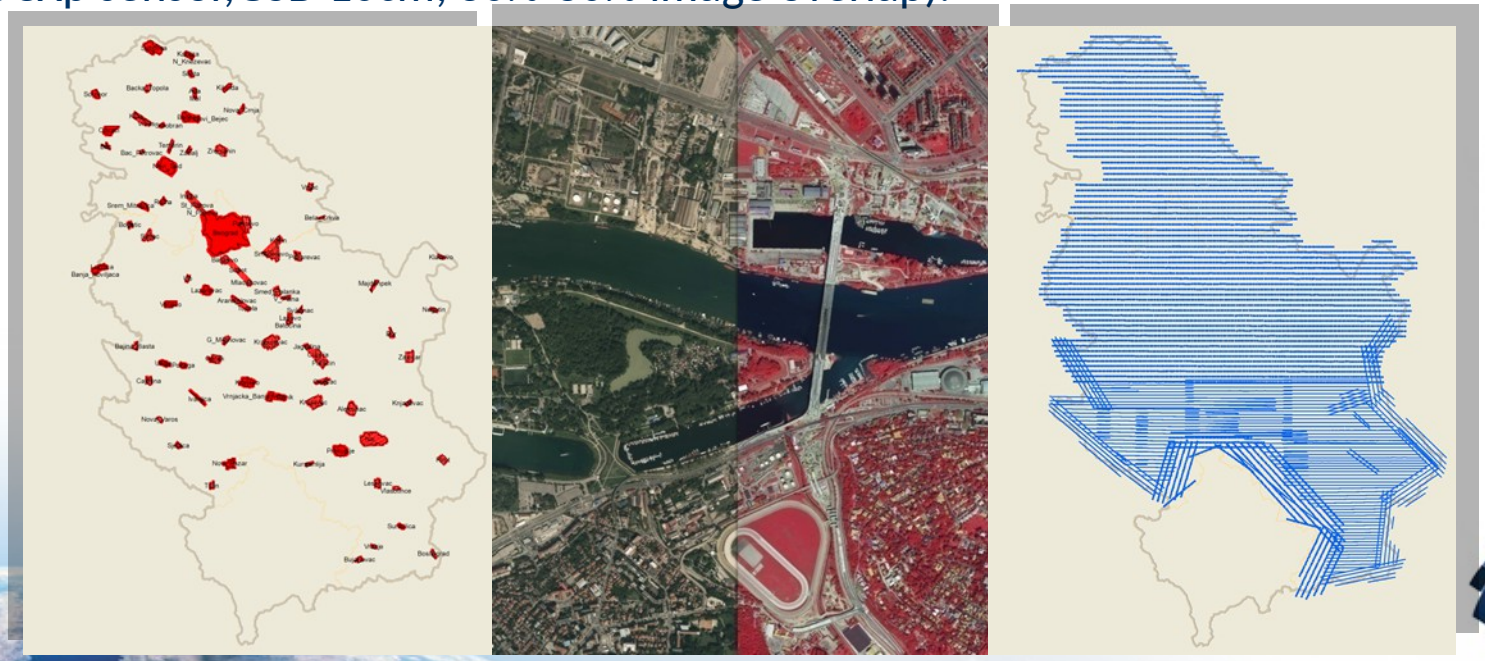
(ADS80 & UCXp sensors, GSD 40cm, 60%-30% image overlap);

- **90 urban areas (~ 2000 km²)**

(UCX, UCXp & ADS80 sensors, GSD 10cm, 60%-30% image overlap);

- 2 main urban areas: **Belgrade and Novi Sad (~ 880 km²)**

(UCXp sensor,GSD 10cm, 80%-80% image overlap).



Geometric WS-satellite data procurement

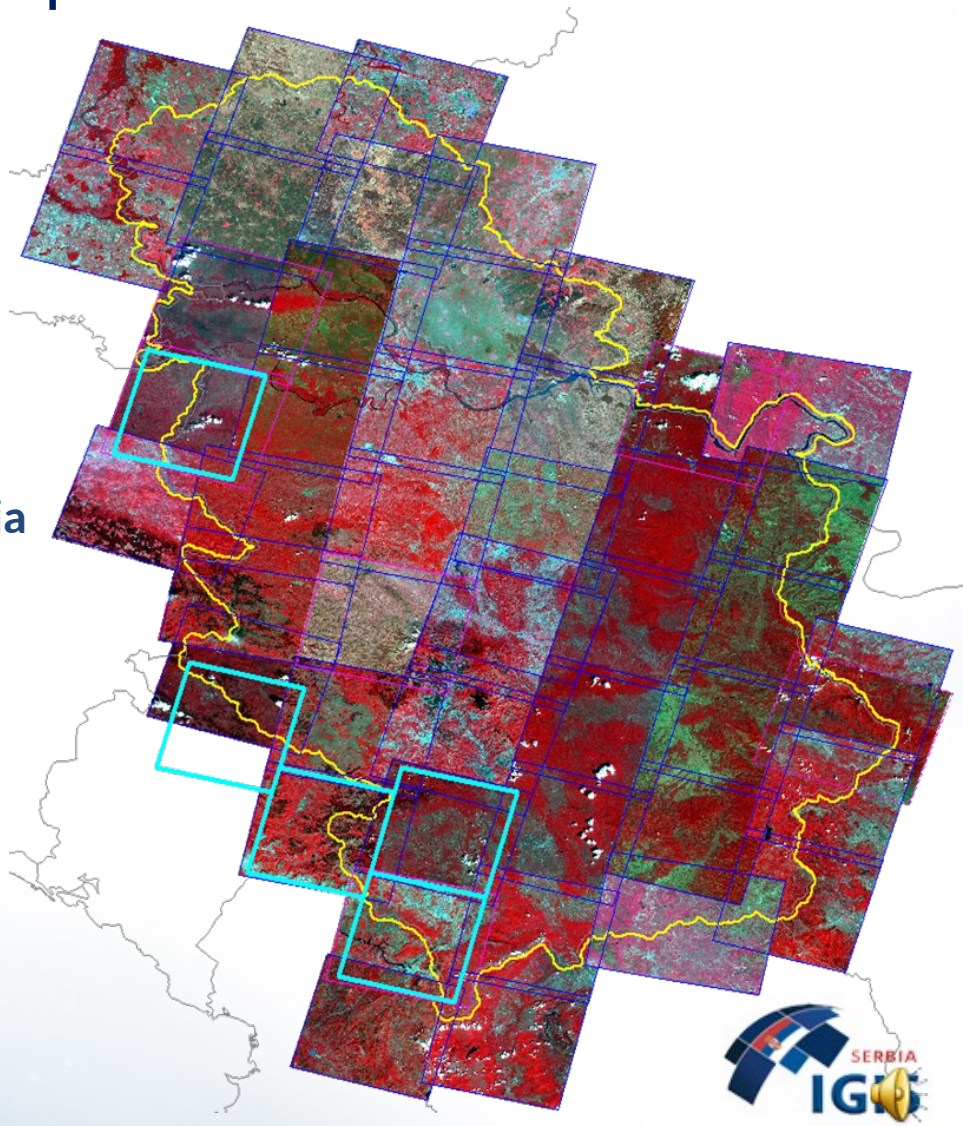
- **National coverage**
  (SPOT5, pan 2.5m/ms 10m
  SPOT6:pan 1.5/ms 6m);

- **Area of AP Kosovo and Metohia**
  (GeoEye, RGBI 0.5m);

- **Areas in Vojvodina,central and south Serbia**

(SPOT 4: pan 5/ms 20m,
SPOT5: pan 2.5/ms 10m,
SPOT6:pan 1.5/ms 6m);

- **Scenes for urgent purposes in 2014 for the areas affected by floods**
  (TerraSAR-X: 8.25m;
  SPOT6:pan 1.5/ms 6m;
  Pleiades: pan0.5/ms 2m).

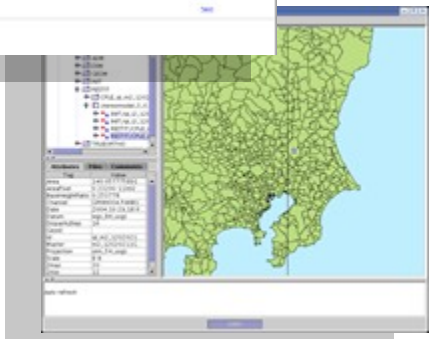


Geometric WS-implemented system

Pixel Factory Framework

Project Administration

Project Explorer

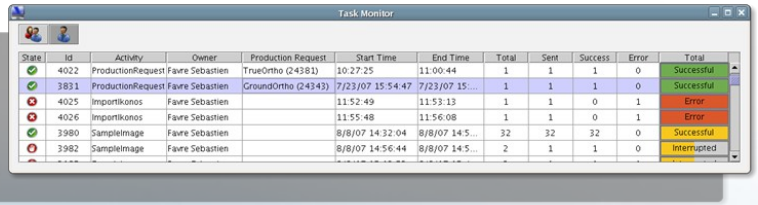


Pixel Factory™ Central Server

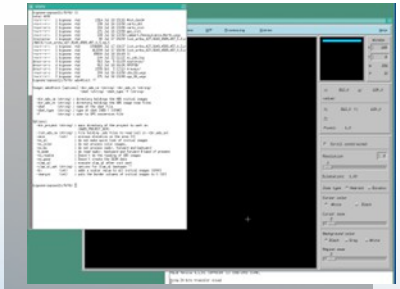
- Production Server & Nodes
- Central Project & Data Management

User interface

Production activity interface

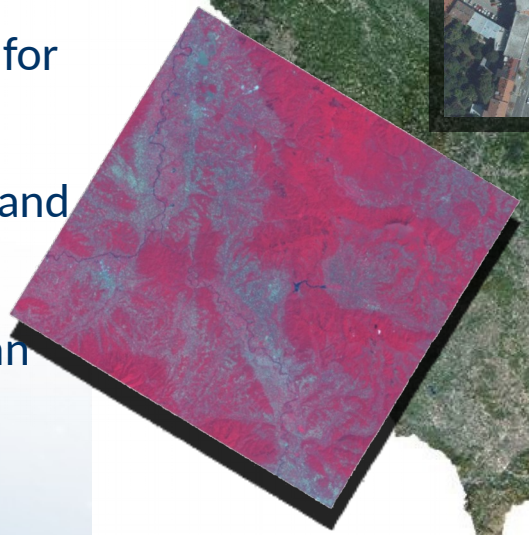


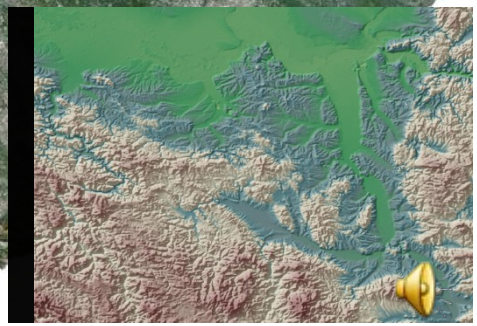
Low-level Access



Geometric WS-products

- Satellite mosaics on the national level of 2.5m GSD;
- Satellite mosaic of 0.5 m GSD for the area of AP Kosovo and Metohia;
- Orthorectified satellite scenes for Remote Sensing purposes;
- DTM (5m grid on national level, 1m grid for urban areas);
- DSM of 0.4 m grid for areas of Belgrade and Novi Sad;
- DOP and true-DOP of 0.1m GSD for urban areas.



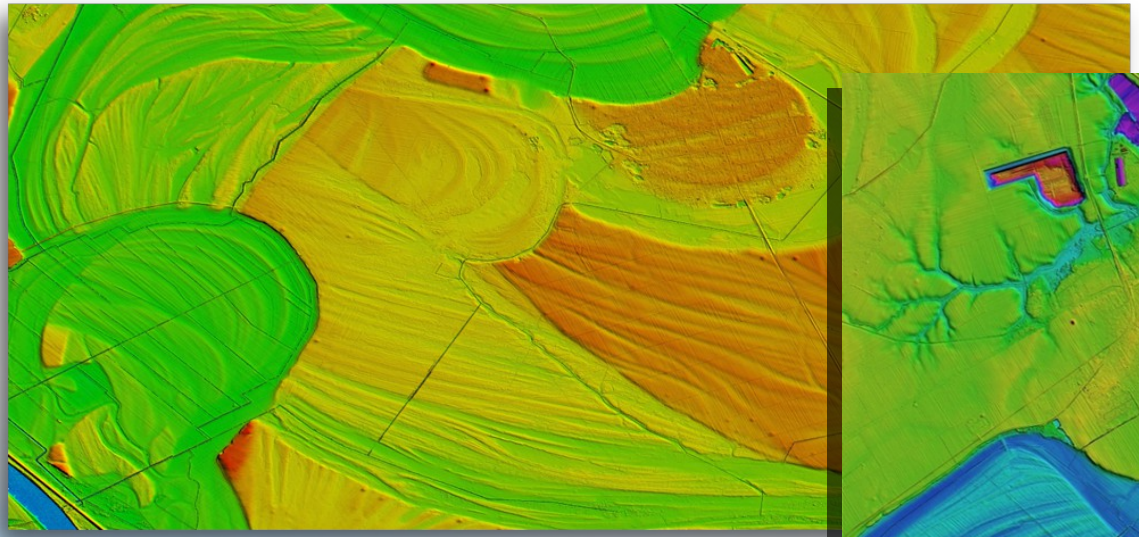


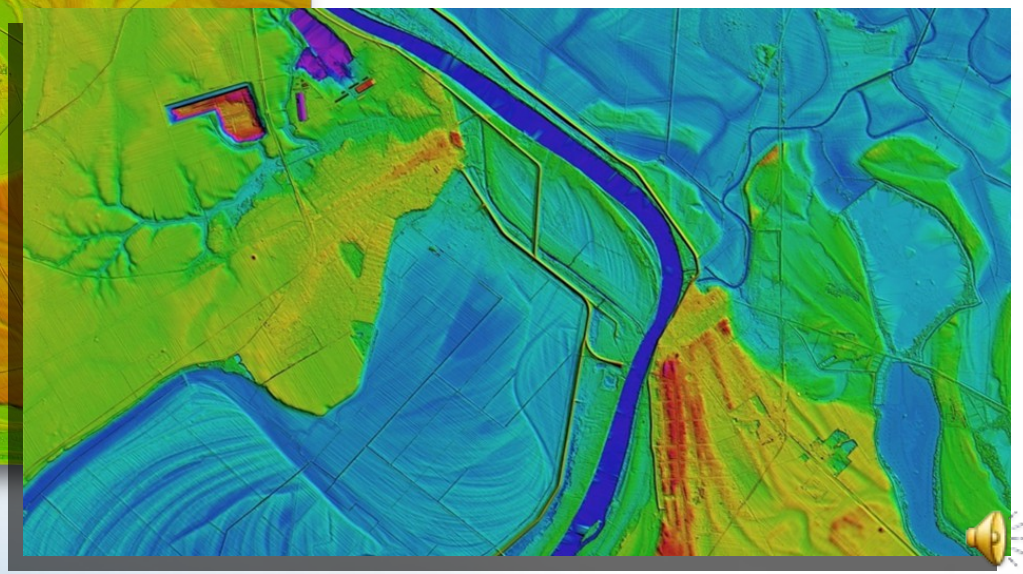
LiDAR WS-products

The LiDAR workshop is designed to support:

- Acquisition of LiDAR data and its verification;
- Generation of high accurate DTM/DSM;

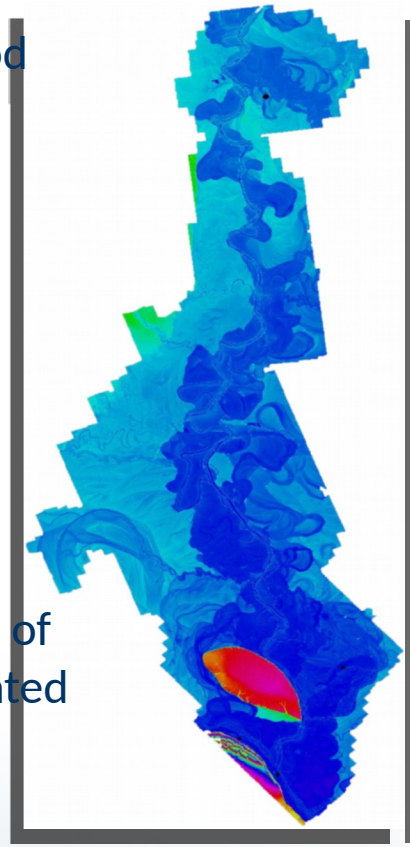
Implamented software: Bentley Microstation V8i / TerraSolid.

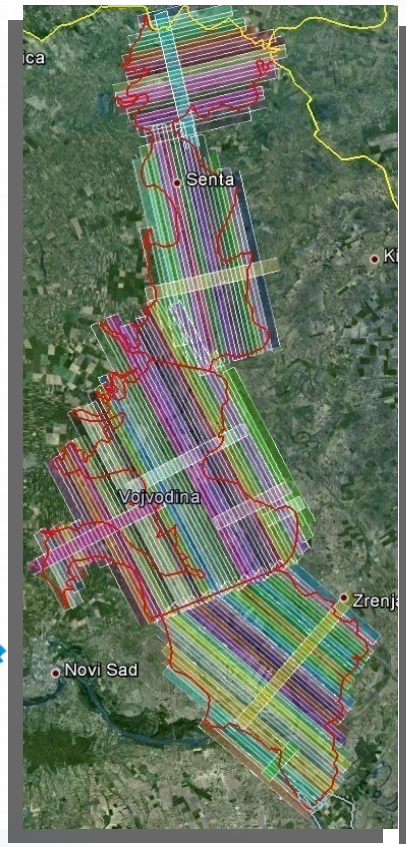


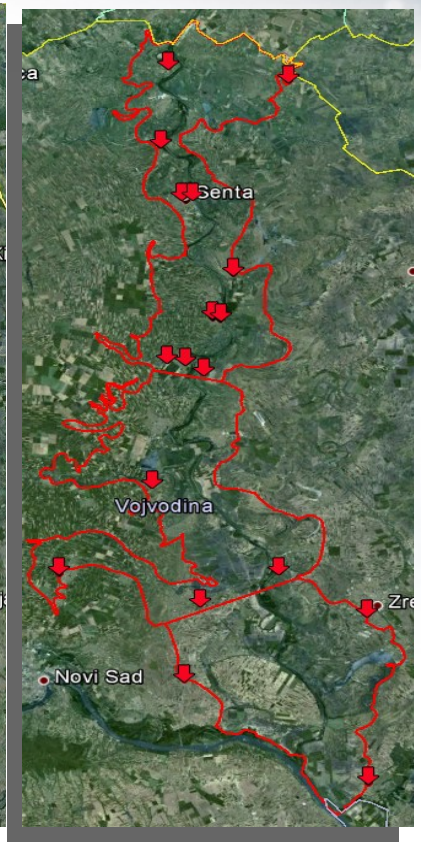


LiDAR WS-products

- Highly accurate DTM of 15cm average height accuracy for flood prone area of Tisa River (around 3000 km2);
- ALS70-HP sensor;
- Average point density in nadir 2.6 pnts/m2;
- Measurement (GPS/leveling) of reference grids for the purpose of control of initial data and generated DTM;
- Reference altutude surface -SQM_2011;

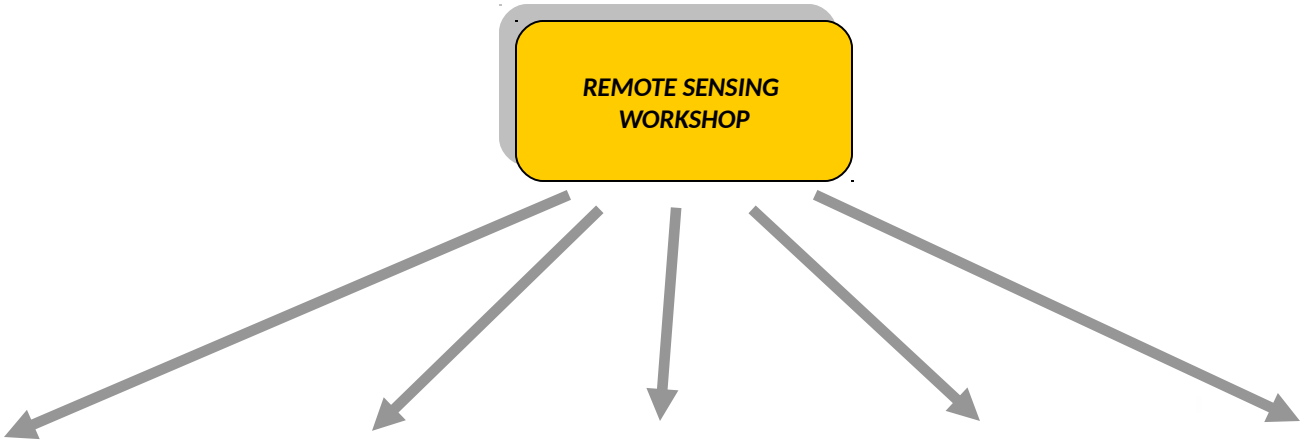






Remote Sencing WS - concept

The **Remote Sensing workshop** is designed to support production of:



Land cover

10 classes according to EUNIS European standard

Agricultural Land cover

15 classes

Natural habitats

33 classes according to EUNIS European standard

Landscape fragmentation

Main barriers limiting wildlife movement across the landscape

Drought impact map

Risk management

Remote Sencing WS – demonstration products

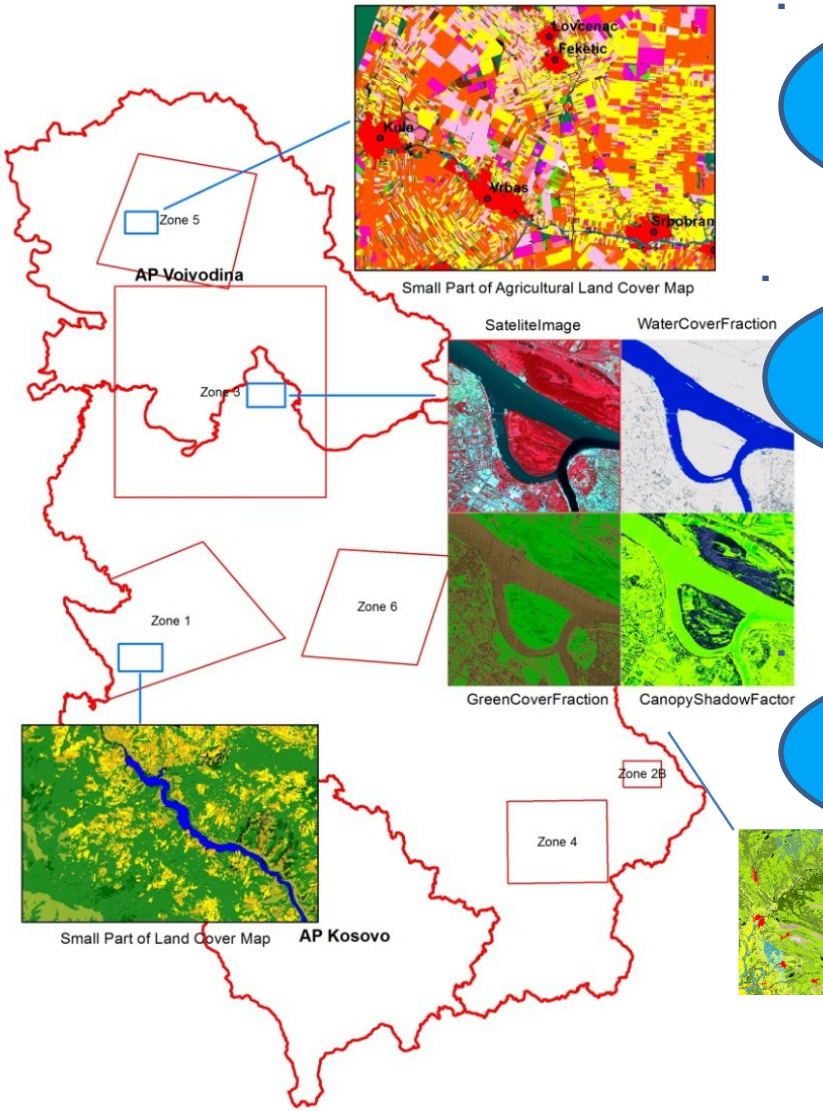
Landscape fragmentation maps (1 zone)

Agricultural maps (2 zones)

biophysical parameters

Landcover maps (4 zones)

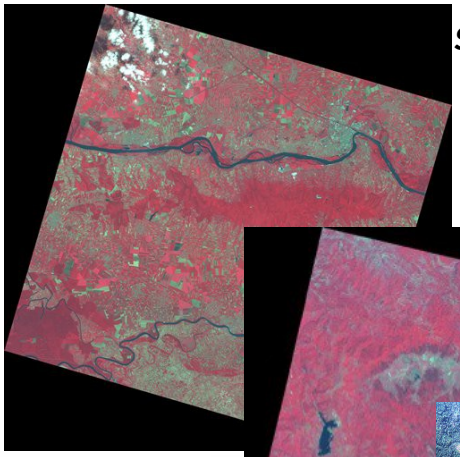
Natural habitats maps (3 zones)



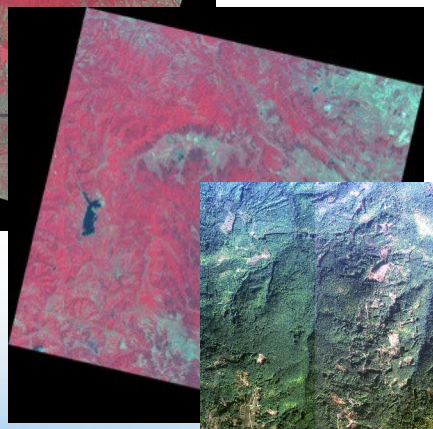
Remote Sensing WS – available input datasets

Acquisition data:

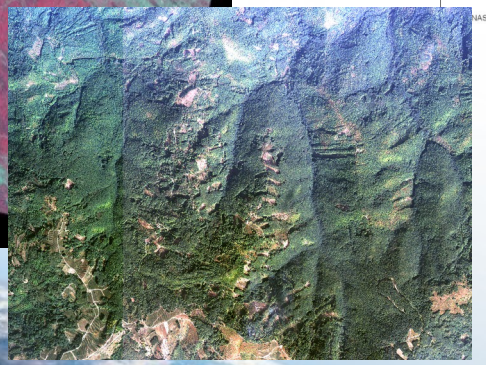
- **Satellite images**
  - Spot4 – 5 m pan and 20 m XS
  - Spot5 – 2.5 m pan and 10 m XS
  - Spot6 – 1.5 m pan and 6 m XS
- **Airborne images**
  - ADS80 – 0.4 m



Spot4



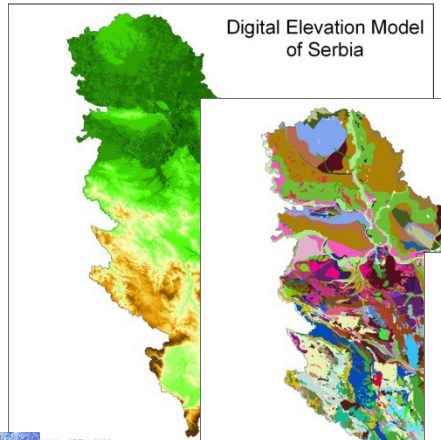
Spot5

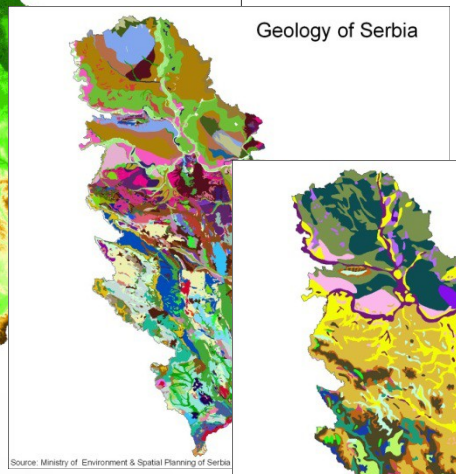


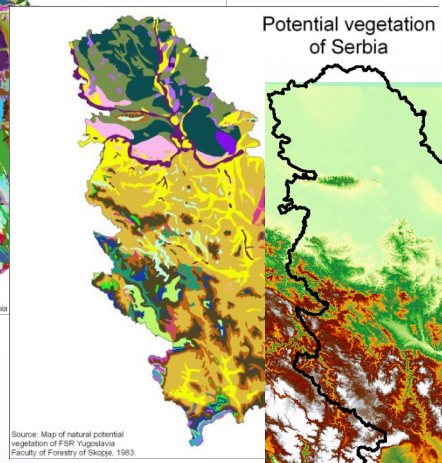
ADS80

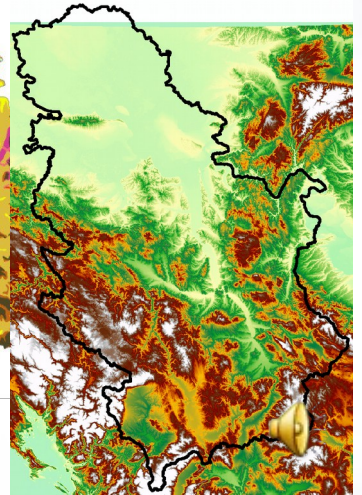
Auxiliary data:

- **Administrative data**
- **Infrastructure data**
- **Hydrographic data**
- **Soil data**
- **Ecological data**
- **Digital Terrain Model**
- **DOP**









Remote Sensing WS – production flow

satellite images

biophysical parameters

Overland

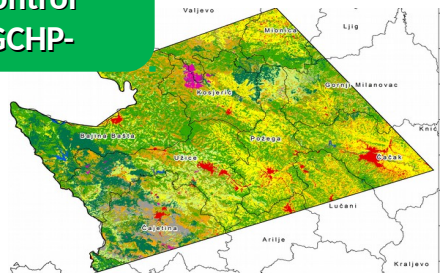
Landcover tool

eCognition

Creating Mosaic

ArcMap 10

Quality Control -GCHP-



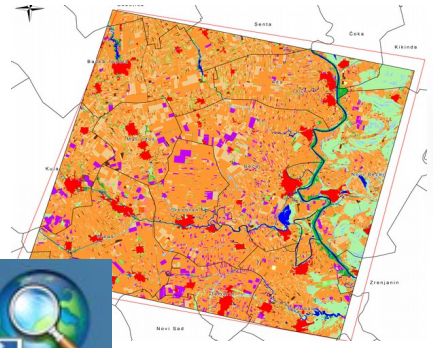
Agricultural Landcover tool

eCognition

Creating Mosaic

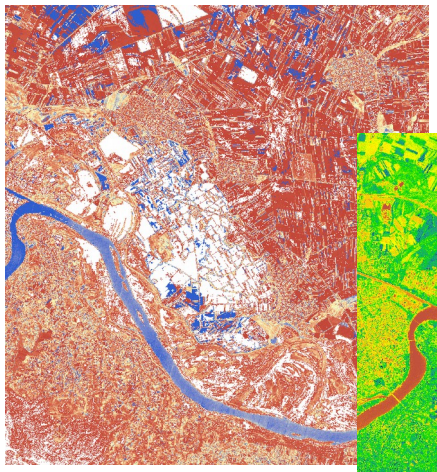
ArcMap 10

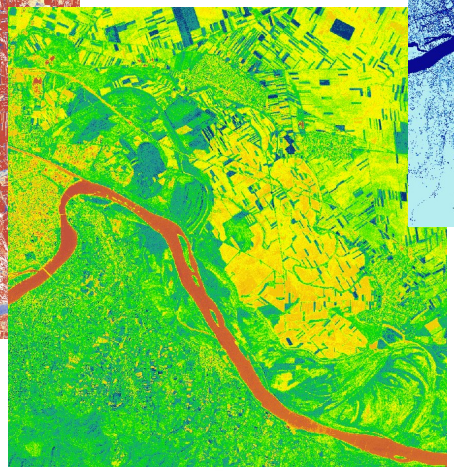
Quality Control -GCHP-



Remote Sensing WS – Biophysical parameters

***Brown cover fraction*[2]**





Chlorophyl content

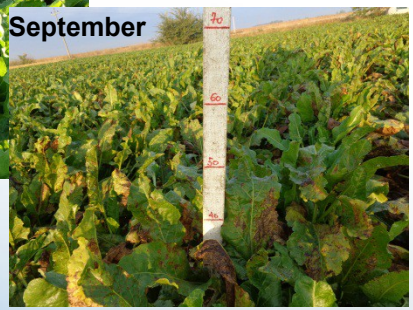
***Water cover fraction*[3]**

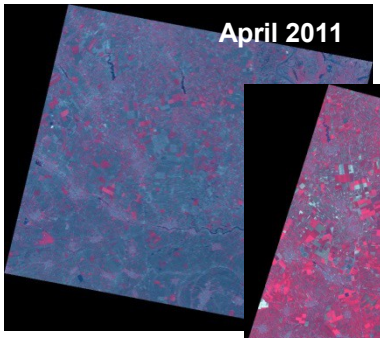
***Green cover fraction*[1]**

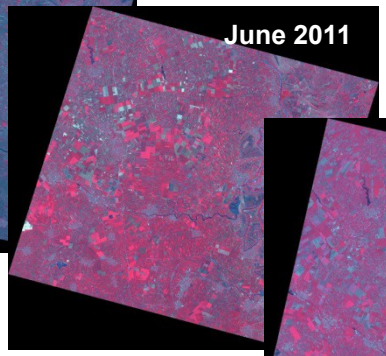
1) Green Cover Fraction - percent of green vegetation inside each pixel,
2) Brown Cover Fraction - percent of brown or dry vegetation inside each pixel,
3) Water Cover Fraction - percent of water area within a pixel.

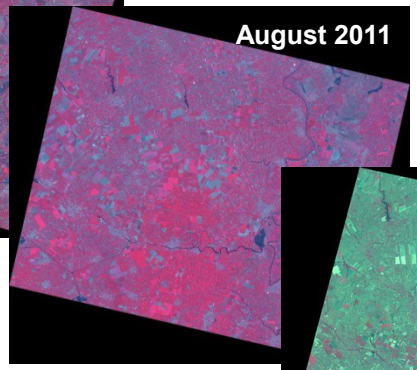
Remote Sensing WS – focus on agricultural landcover

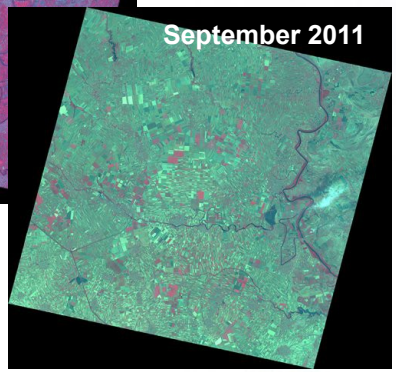
- **Multi-temporal approach** is essential in the process of making these maps because it uses images from different time periods that follow the phenological development of crop (April to September), and which cover the same geographic area.



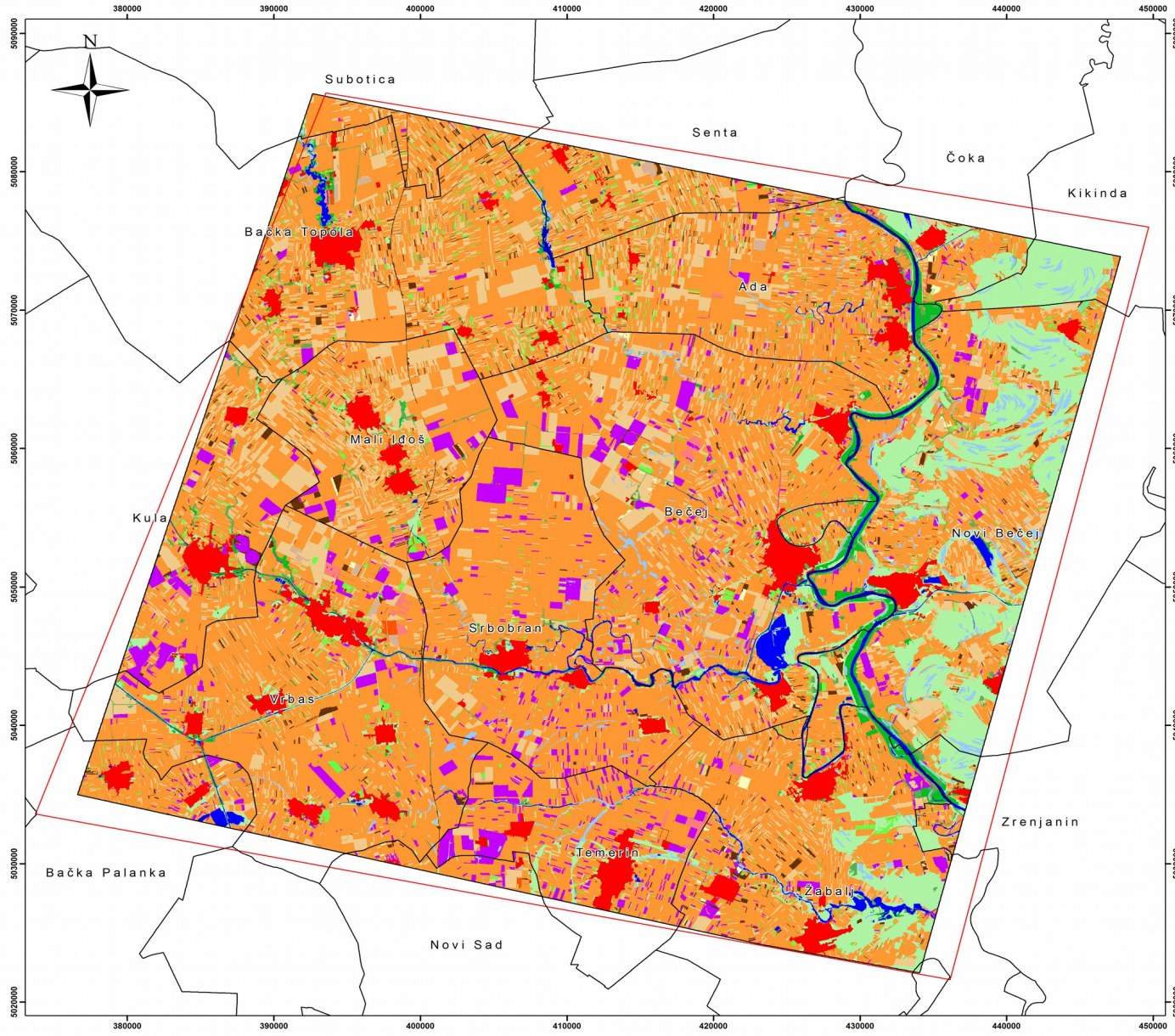






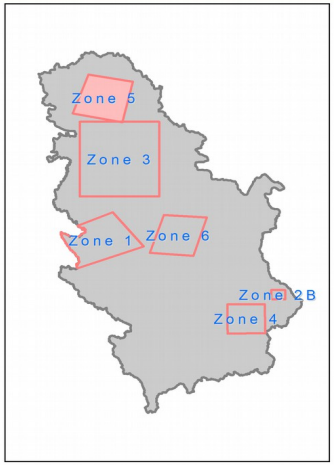


Agricultural Land Cover Map



IGIS Project - Serbia
TM02 - Agriculture Land Cover
Zone 5, Year 2011

Location

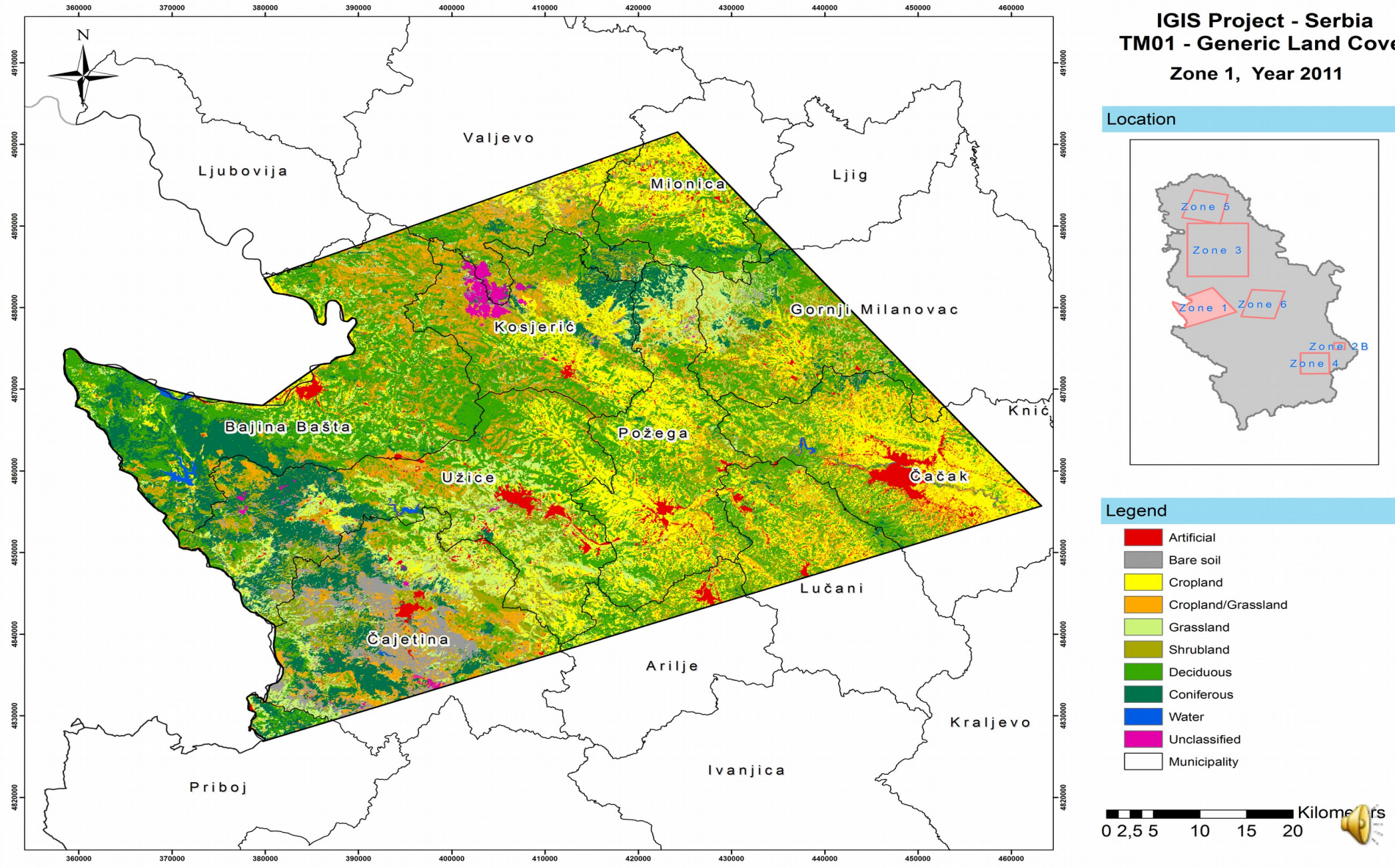


Legend

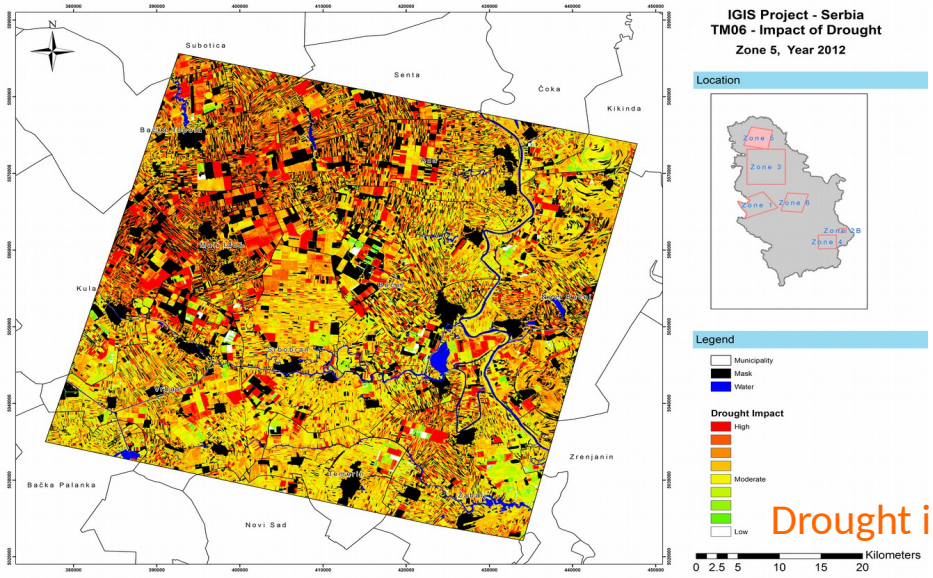
- 10 - Urban areas
- 20 - Bare Soil
- 31 - Winter Crops
- 32 - Winter Crops + Nitrate Fixing Crops
- 40 - Spring Crops
- 51 - Maize and Sunflower
- 53 - Sugarbeet and Potatoes
- 55 - Double Crop Winter-Summer
- 56 - Double Crop Summer-Summer
- 61 - Fodder Crops
- 63 - Other Crops
- 70 - Grassland
- 80 - Shrubland
- 90 - Forest
- 100 - Wetland
- 110 - Water
- Municipality

0 2,5 5 10 15 20 Kilometers

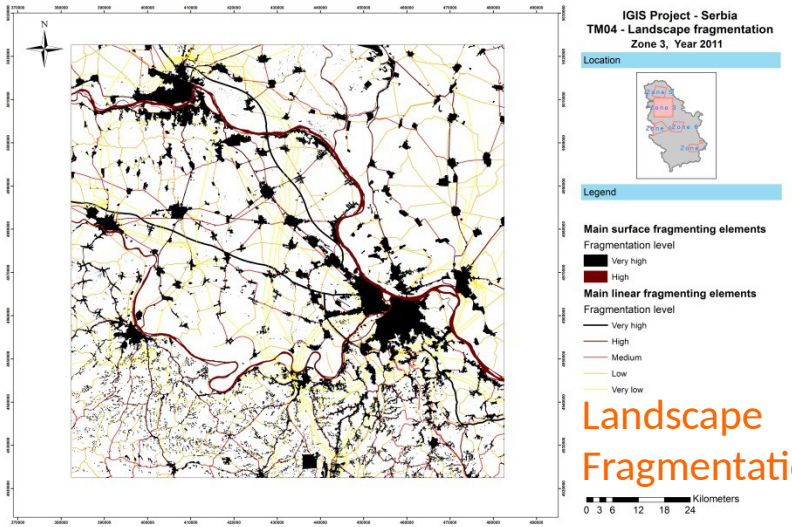
Land Cover Map



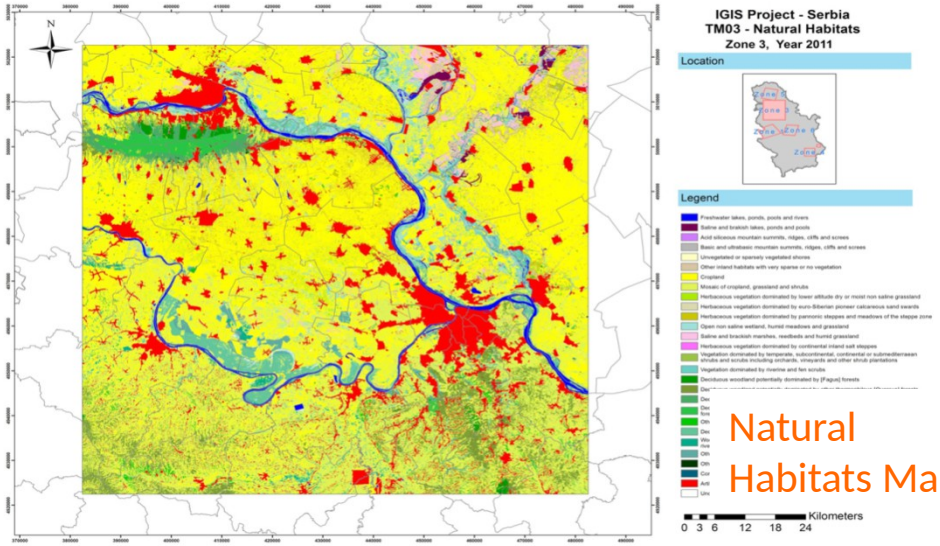
Additional Products



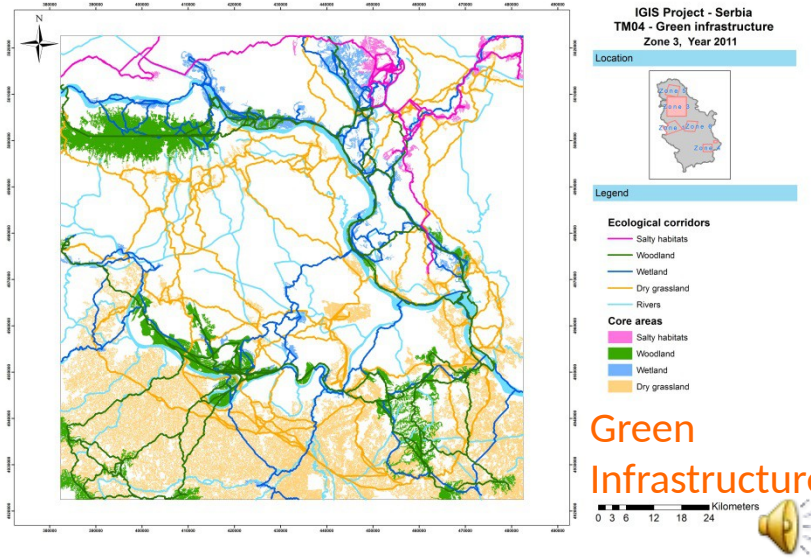
Drought impact



Landscape Fragmentation



Natural Habitats Map



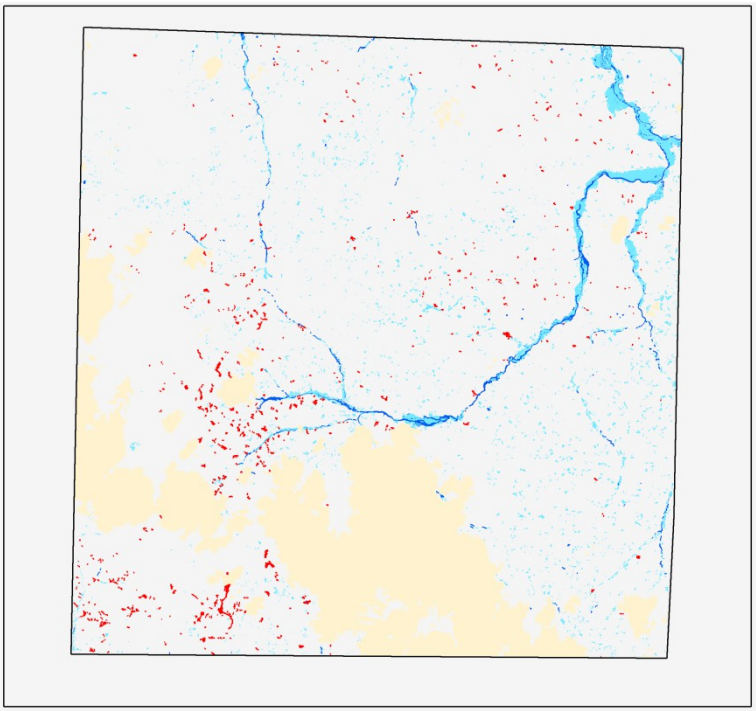
Green Infrastructure

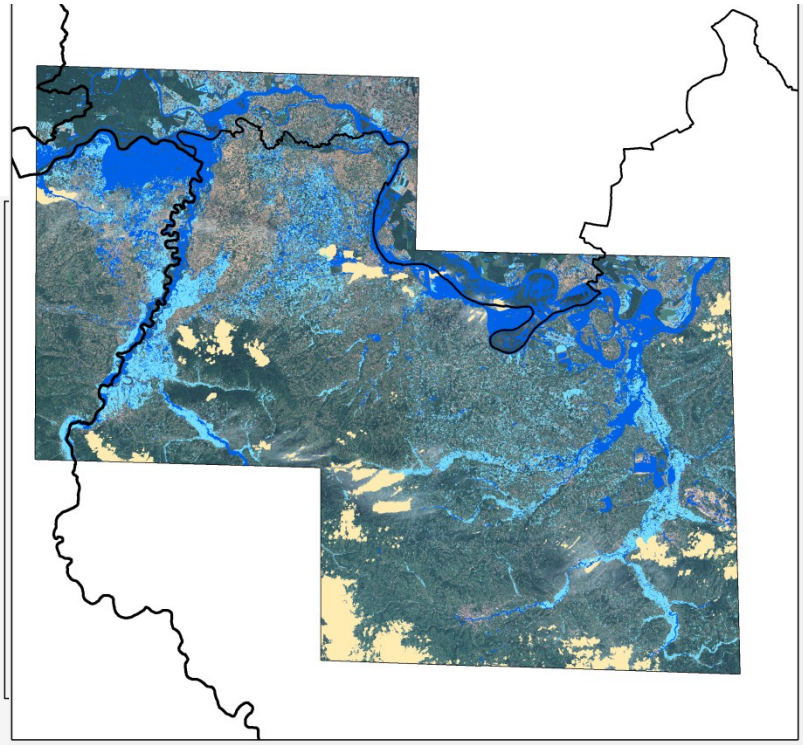
Additional Products

Remote sensing analysis of areas affected by floods in may 2014 (part of Western Serbia):

- Areas covered by water and areas where soil is saturated by water
- Locations of potential landslides

Data are used for the **Recovery Needs Assessment Report.**





Карта поплава

Облаци и сенке облака

Вода

Земљиште засићено водом

Карта поплава и потенцијалних клизишта

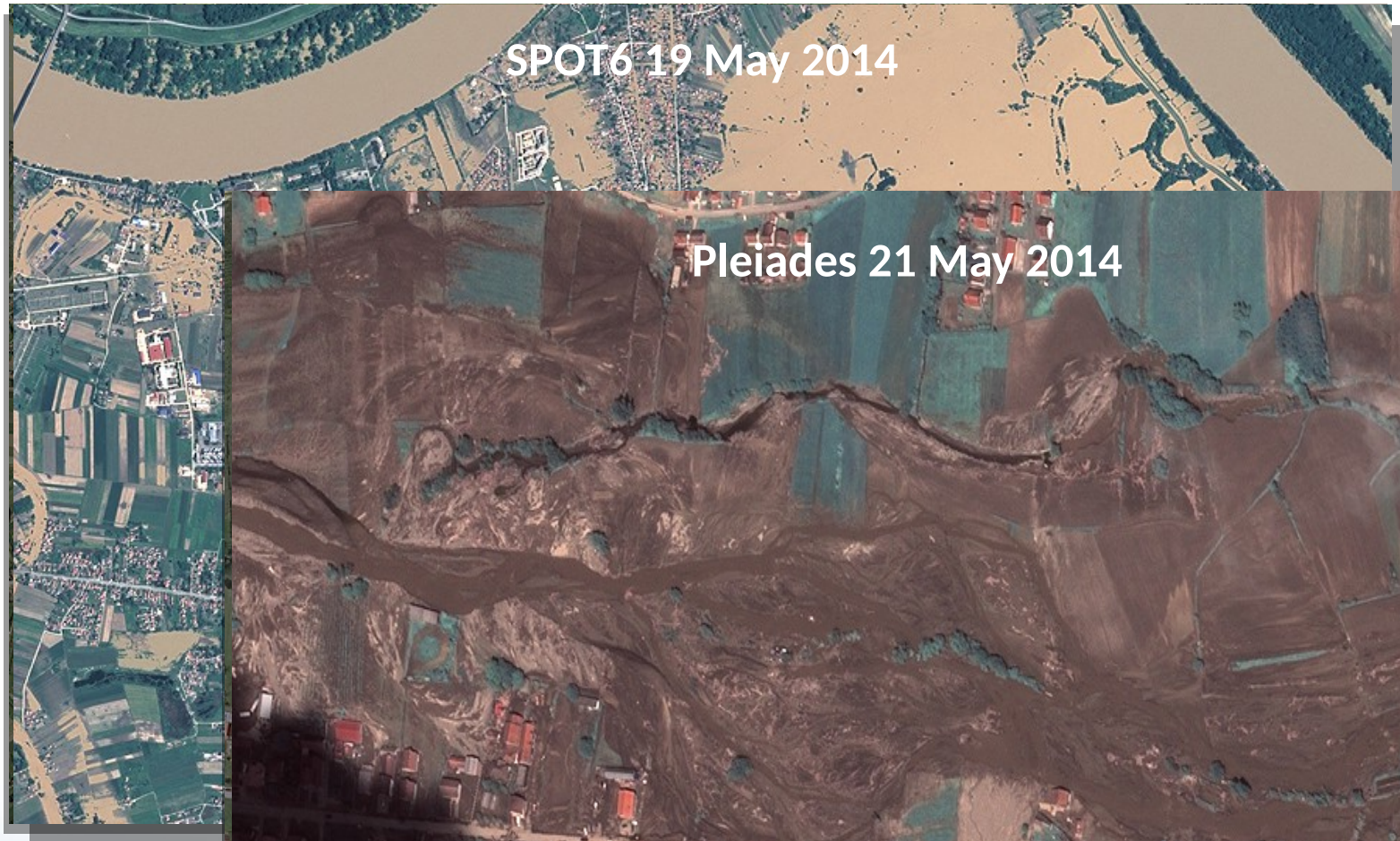
Облаци и сенке облака

Потенцијална клизишта

Вода

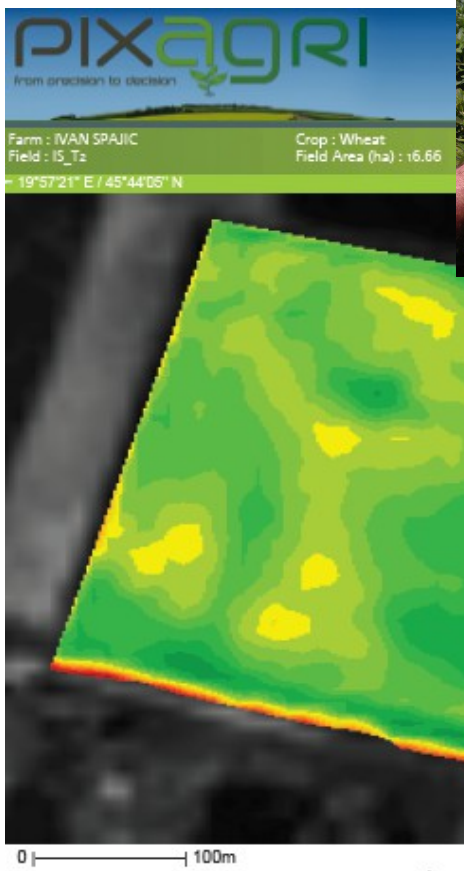
Земљиште засићено водом

Additional Products-flood analysis



Additional Products

- Omplementation of **PiXAgri service** at municipality of Becej in 2014;
- Cooperation with company AIRBUS Defence & Space;
- Maps GLCV byophisical parameters and maps of zoned GLCV byophisical parameters and customer service;
- PixAgri is a decision making tool in agriculture:
  - ✓ **crop condition and development;**
  - ✓ **locating problems and surface estimation;**
  - ✓ **optimizing inputs and adjusting field operations** (sampling, fertilising, irrigation etc.);
  - ✓ **crop management** etc.

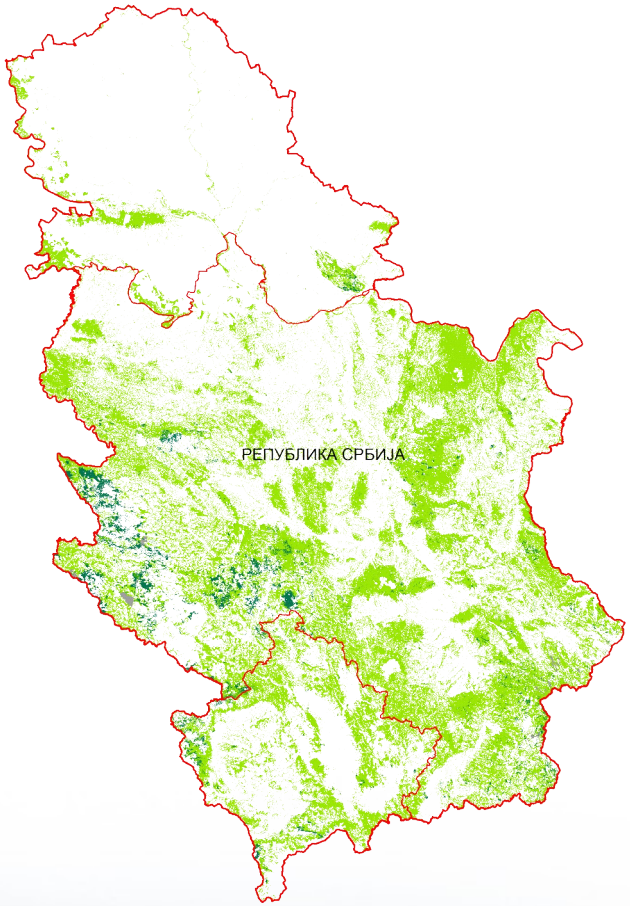


Green cover fraction	% Area
0.00 - 0.120	0.00
0.120 - 0.240	0.90
0.240 - 0.360	1.10
0.360 - 0.480	1.20
0.480 - 0.600	1.80
0.600 - 0.720	20.30
0.720 - 0.840	59.90
0.840 - 0.960	14.80

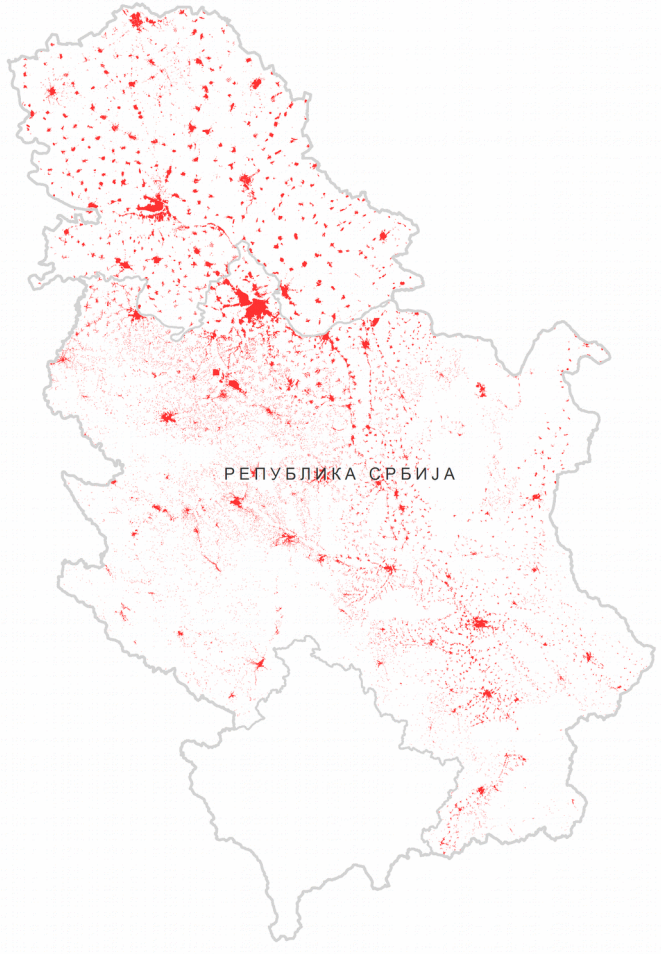
AIRBUS DEFENCE & SPACE

SERBIA IGI

Additional Products



Map of forest cover



Map of urban areas

(SPOT5, epoch 2011)

Established institutional links

Provincial Secretariat of Agriculture, Water Management and Forestry

Faculty of agriculture
University of Belgrade

Agriculture

Faculty of civil-engineering
University of Belgrade

Remote sensing

Ministry of agriculture and environment protection

IGIS RS Workshop

Environment

Forestry

Serbian Environmental Protection Agency

Faculty of biology
University of Belgrade

Institute of Forestry

Institute for nature conservation of Serbia

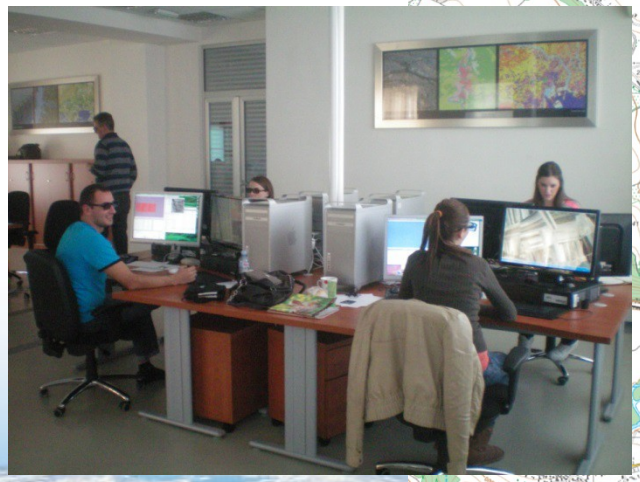
Stereo Plotting WS – concept and system

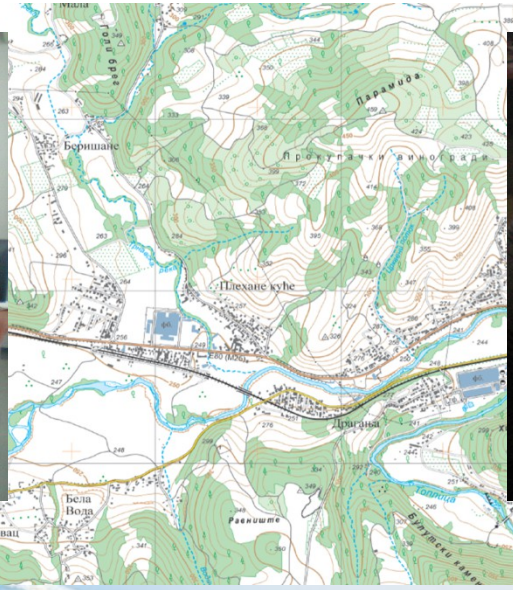
The Stereo Plotting workshop is designed to support:

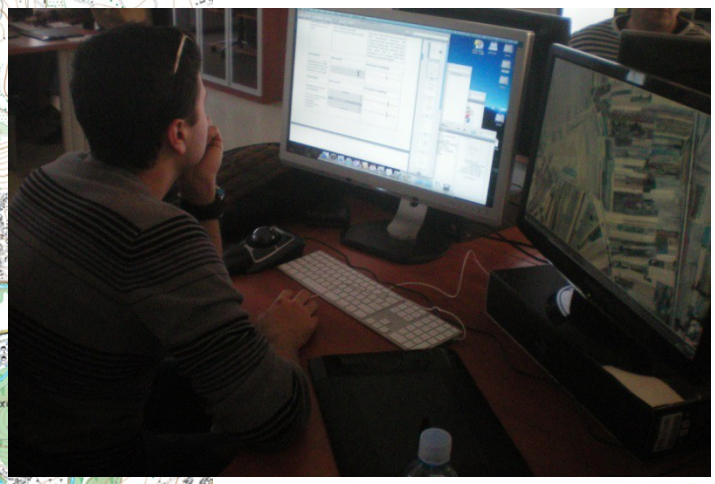
- The production of 3D vector topographic layer from aerial stereo pairs for production of Topographic Map of scale 1:20 000;
- GIS unit to structure a vector data base from 3D digitising;

Tools:

- GeoView software with 3D visualisation capabilities
- Spatial data base (ArcGIS geodata base; PostGreSQL/PostGIS server data base)



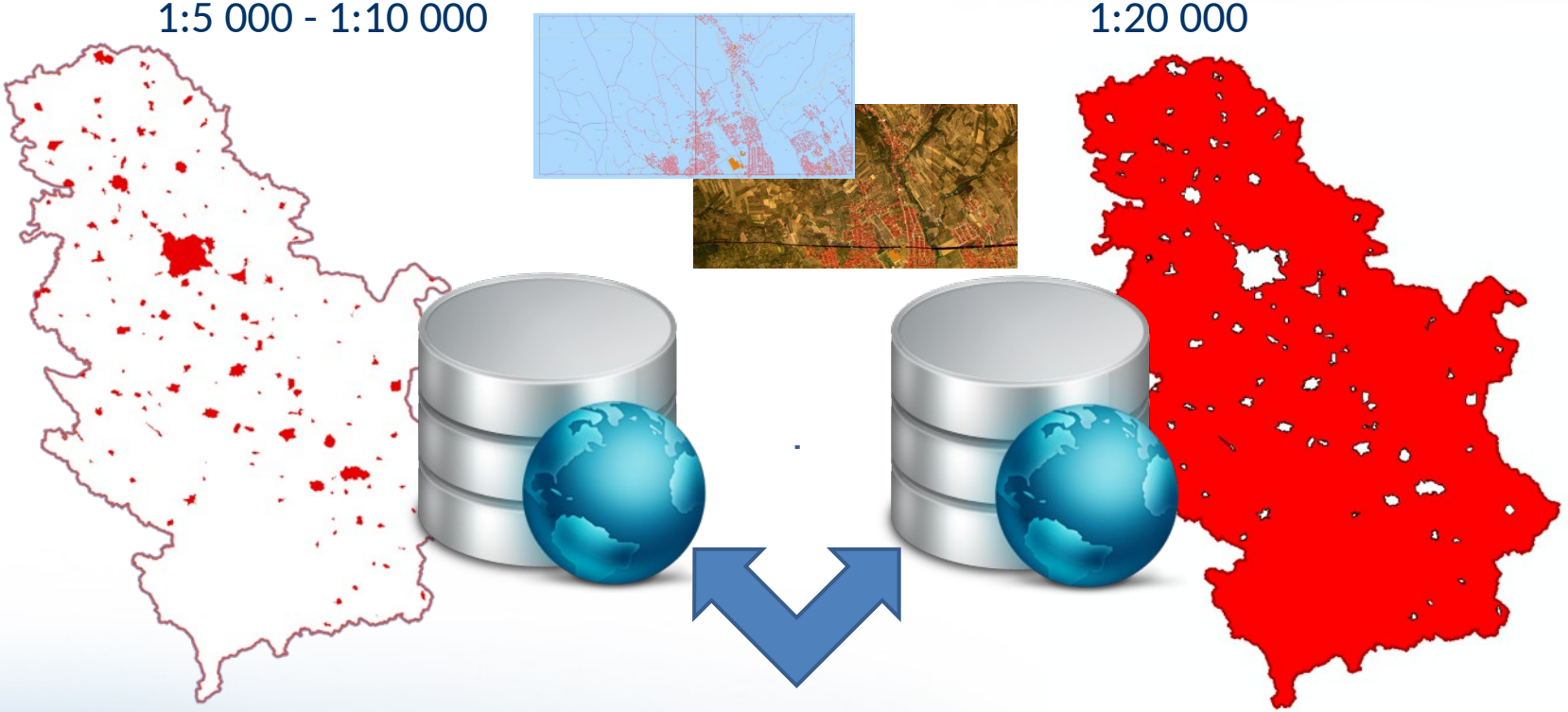




Stereo Plotting WS – topographic databases at RGA

Topographic Database
1:5 000 - 1:10 000

Topographic Database
1:20 000



Harmonized Data Models → Possibility of data exchange between Databases

Stereo Plotting WS – topographic database 1: 20 000

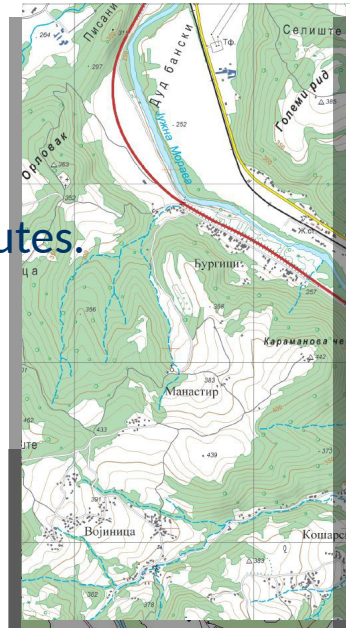
Contains :

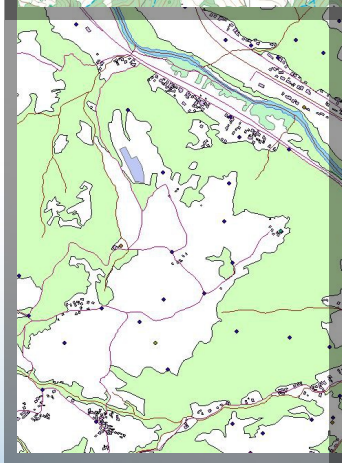
- 3D vector data: points, lines, polygons;
- Text data with various belonging attributes.

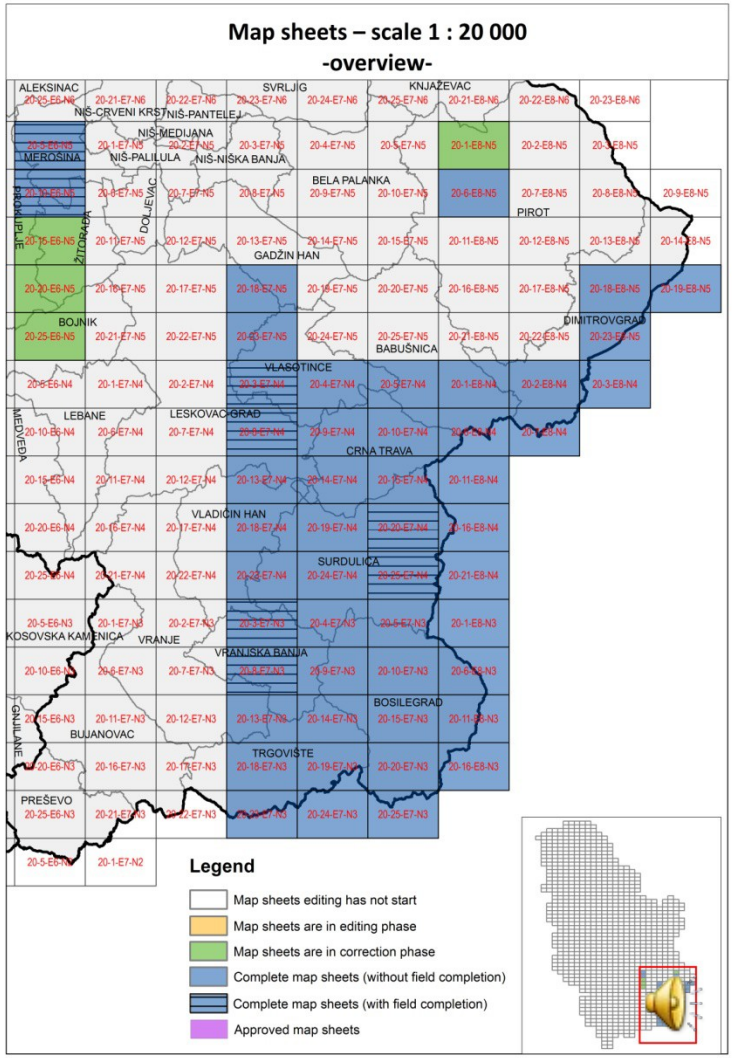
Topographic themes in line with

INSPIRE data models for domains:

- Geographical Names
- Transport Network
- Hydrography
- Land Cover
- Elevation
- Buildings







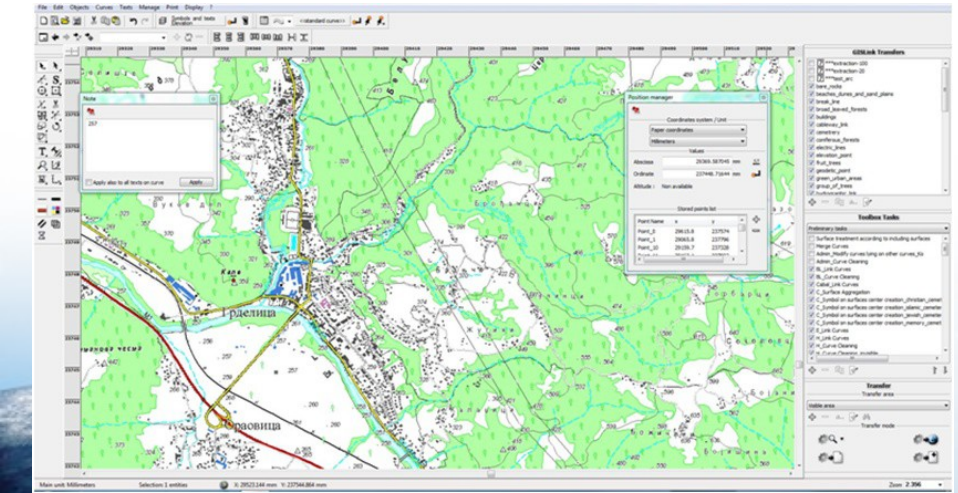
Map Editing WS – concept

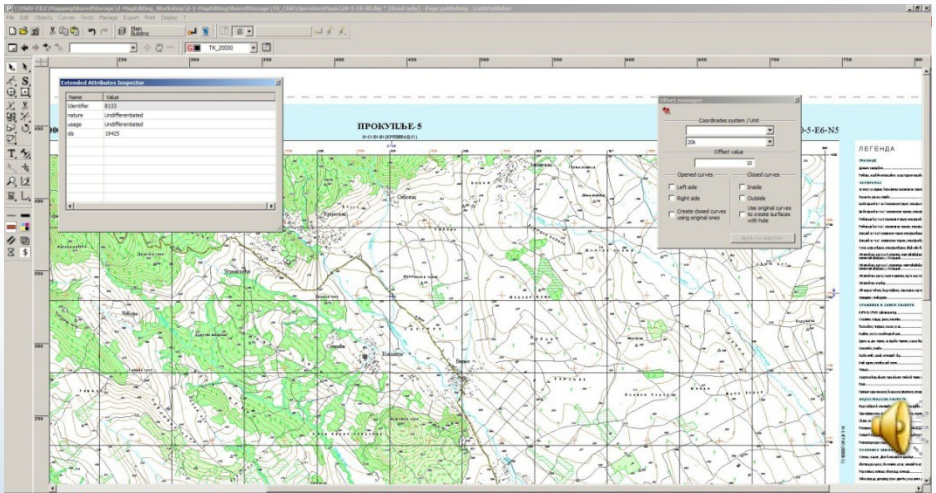
Map Editing Workshop is designed to support:

- The generation of digital and hardcopy maps (with assigned symbology and design) from vector data automatically;
- The design of any derived maps as per customised requirement.

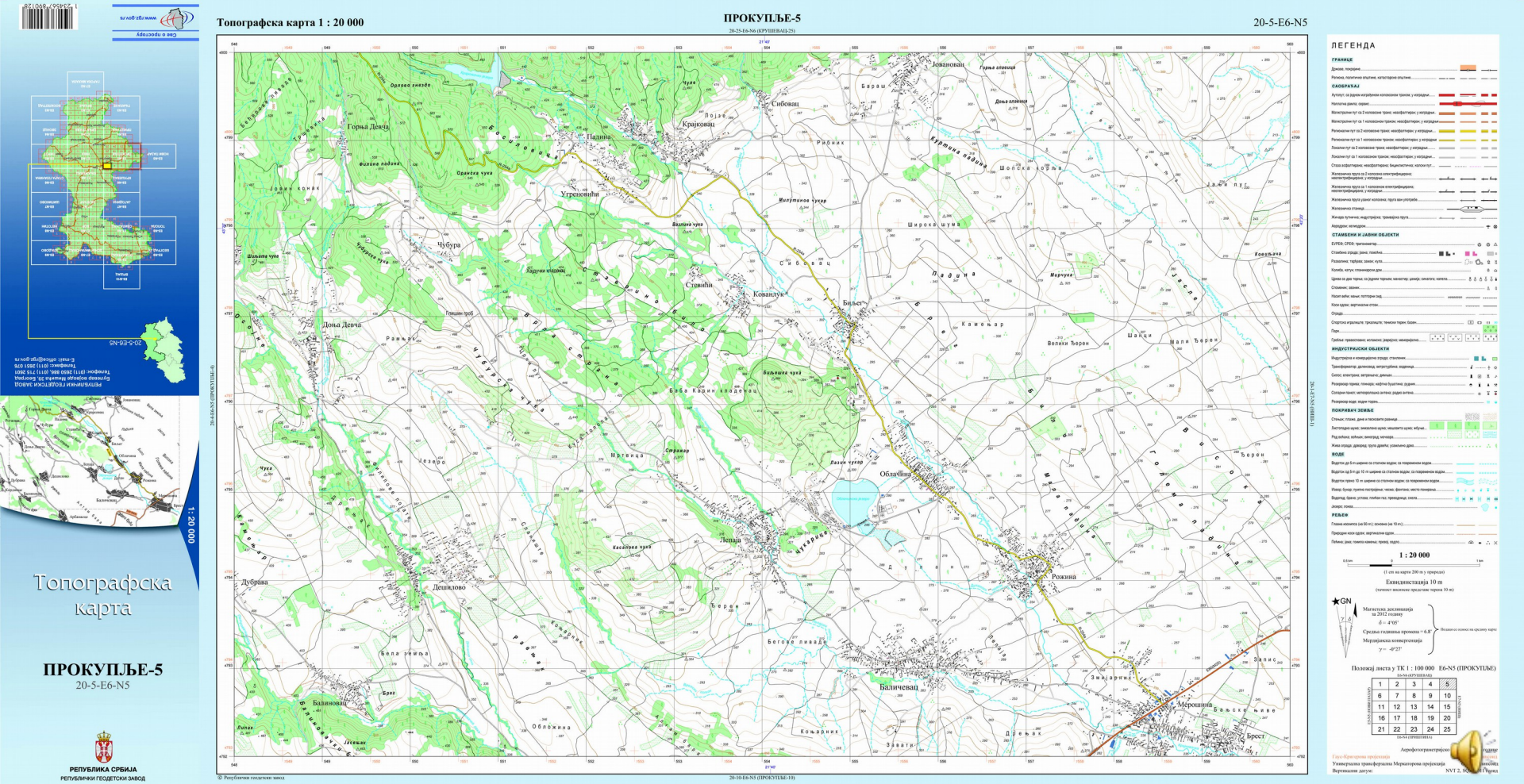
Production process :

- Definition of templates
- Automatic map generation from the Data Base (LorikGIS Mapper);
- Design of on-demand products for any scale (LorikPublisher).





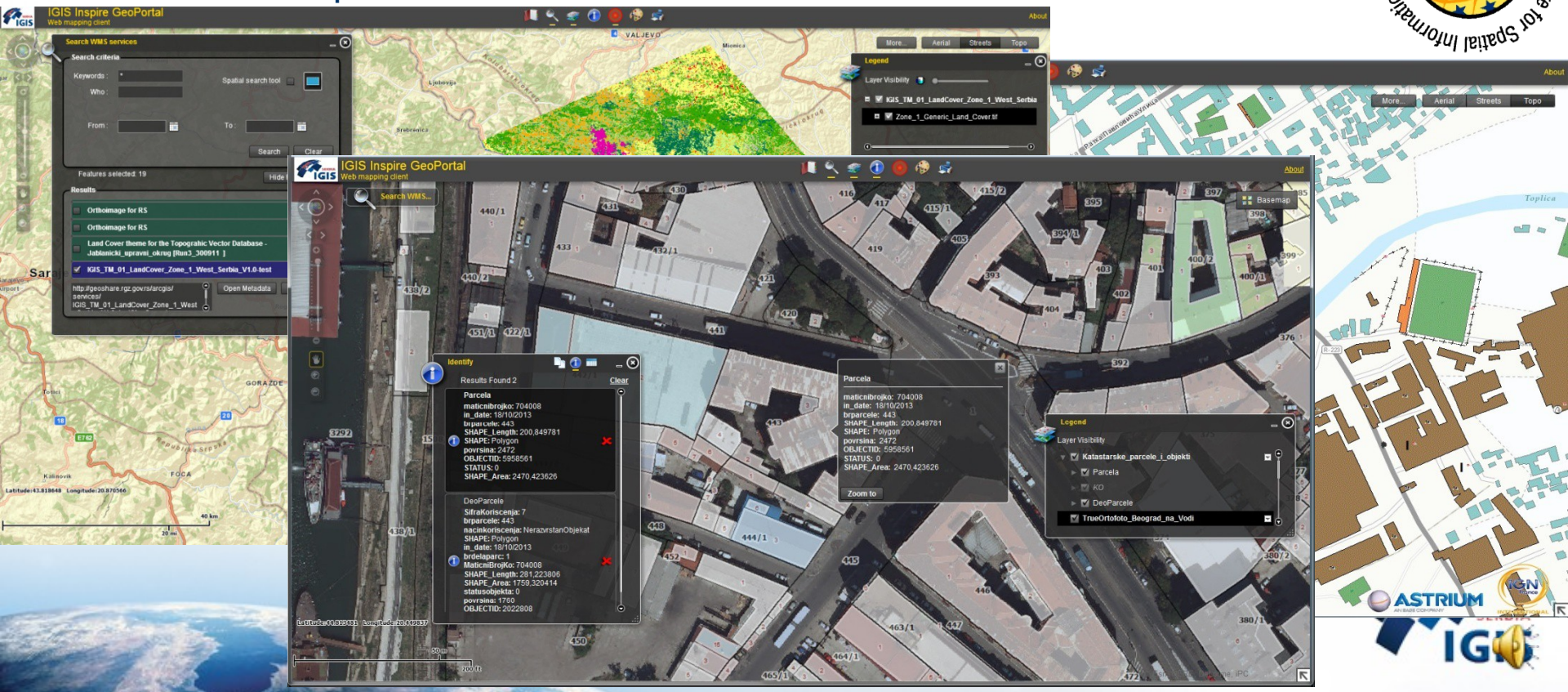
Map Editing WS – product: TM 1:20 000



INSPIRE Web Portal/Partner portal

[www.geoshare.rgz.gov.rs]

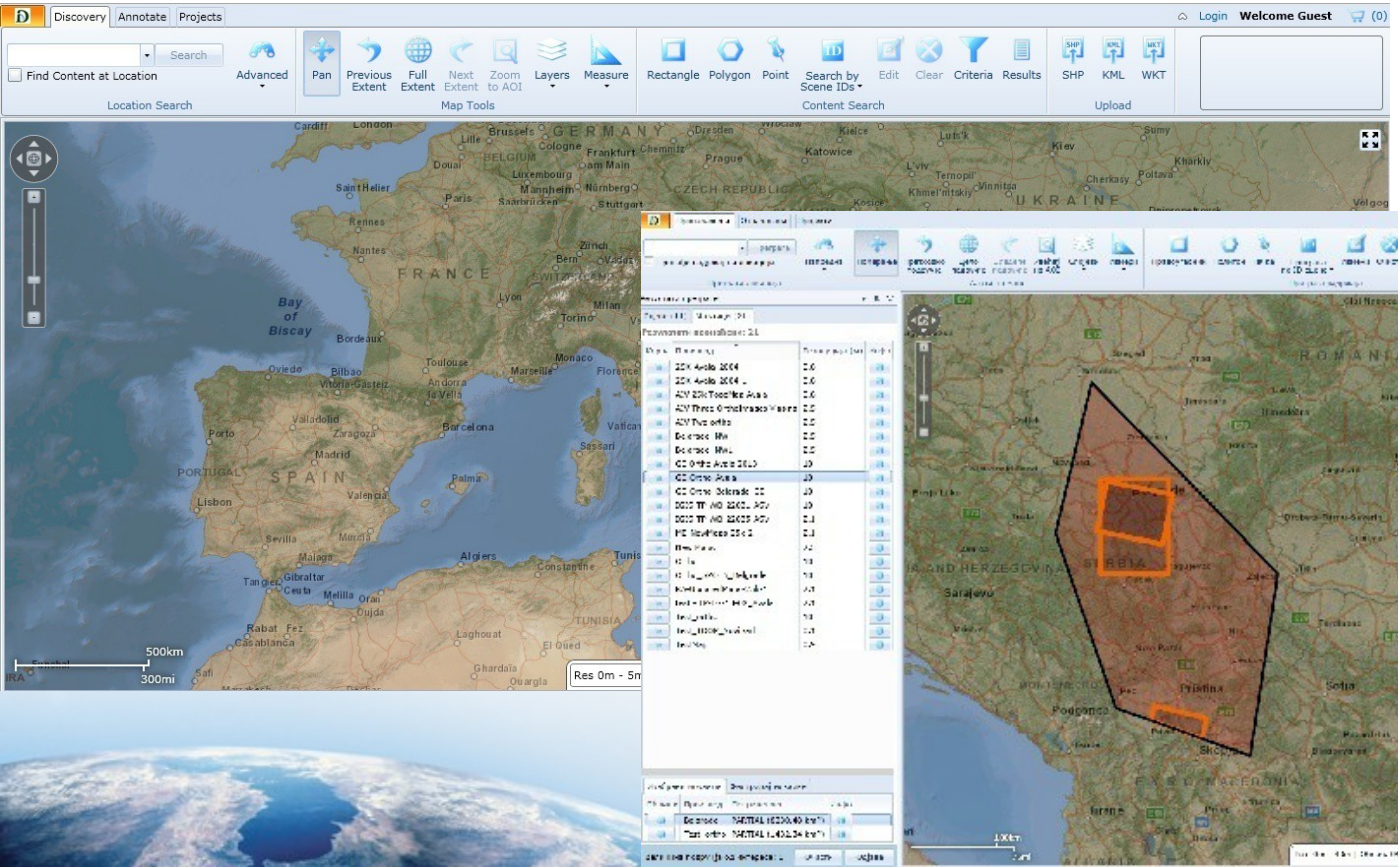
- Allow RGA partners to **discover, view and optionally order published products**.
- Provide a first step to **INSPIRE network services** (metadata, discovery and view services in line with OGC standards for WMS and CSW).
- Internal and partners - extranet access with authentication.



DataDoors/Web Boutique web portal

[www.geoshop.rgz.gov.rs]

- **Storage** of data from different data providers on well structured way;
- **Distribute/sell** geodata to Internet users (partners, citizens …);
- Support for **e-payment** via e-government portal.



Outcomes of IGIS project

- ✓ Realisation of **cyclical aerial image capturing** on national level;
- ✓ Introduction of the **new technologies** and services;
- ✓ Development of **capabilities** for production, update and dissemination of geoinformation for the benefit of Serbian citizens, as well as the public and private sectors;
- ✓ Efficient and optimised process to maintain the **spatial data up to date;**
- ✓ Production of new databases within the RGA is in progress according to **INSPIRE** Annex I data models;
- ✓ Access to metadata, spatial data and **services** via the Internet;
- ✓ Improved and efficient **communication** as well as geoinformation exchange between the **public authorities.**

IGIS project as a precondition....

- ✓ **NATURA2000 project** – Ministry of agriculture and environment protection, Agency for environmental protection (SPOT6 data on national level, epochs 2014 and 2015, generation of **national mosaic** and **Landcover map)**;

- ✓ A**griculture programm** in the AP of Vojvodina – Province secretariat for agriculture (SPOT6 data for area of AP of Vojvodina , generation of **Agriculture land cover maps);**

- ✓ **AD: Assistance to flood recovery,** (IPAII, Sector of environment protection) – Government of Serbia (LiDAR data for priority sub-basins, epoch 2015, **highly accurate DTM**);

- ✓ I**mplemenation of LPIS in Serbia -** Ministry of agriculture and environment protection, Directorate for agrarian payments (procurement data of **DOP, DTM and DCP** on national level and **technical assistance**);

- ✓ **Project of rural development – efficient land management** (component 2: land consolidation, component 4: combating abandoned land, Ministry of agriculture and environment protection, Directorate for agriculture land (procurement data of **DOP, DTM and DCP** on national level and **technical assistance**).

- ✓ **National Disaster Risk Management Program** – adopted in 2014 (supply of spatial data and services on national level for the purpose of efficient disaster management).


IGIS SPACE TRAIN
-BRIDGING PEOPLE-
STEREO-PLOTTING AND TOPOGRAPHIC DATABASE WORKSHOP
MAP EDITING WORKSHOP
REMOTE SENSING WORKSHOP
GEOMETRIC AND LIDAR WORKSHOP
SYSTEM ADMINISTRATION
THE WEB PORTALS