



# Public-private partnership in support of the development of the municipality of Bečej



**Republic Geodetic Authority**

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**JRC EC, Enlargement and Integration Workshop**

*Spatial Data Infrastructures for Sustainable Growth*

*Lisbon, 28<sup>th</sup> May 2015*





## Key partners



- Republic Geodetic Authority - **Special governmental organization** responsible for production, maintenance and administering of **spatial data on national level**);

**Competences:** geodetic works, RE cadastre, Address registry, Registry of spatial units, topographic-cartographic activities, NSDI establishment etc.



- **European company** - Global leader in defence and aerospace products and services (aircrafts, satellite systems, **geo-intelligence services**);

• **Provides:** satellite imagery, base maps, data management, monitoring services, platforms and software, support of development projects all over the world.

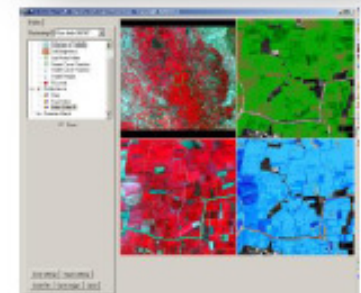


- Municipality of Bečej – located in the Autonomous Province of **Vojvodina** and covers the area of 487 sq km;
- **90%** of the territory is comprised of **arable land**;
- local-government put strong efforts in **promotion of economic development** due to unfavorable conditions in country in last decades.



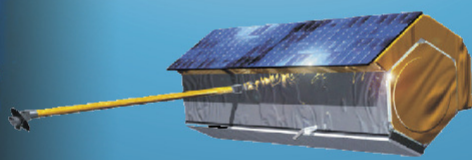
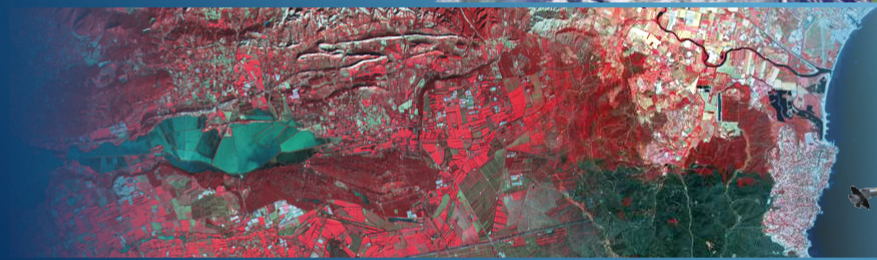
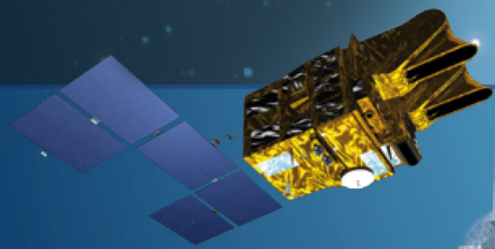
## Background for cooperation

- From 2010 till 2014 RGA implemented comprehensive development **IGIS project** with French partners: Airbus D&S and IGN-France International;
- In 2013 signed Memorandum of understanding between Municipality of Becej and RGA;
- In 2014 continuation of cooperation with Airbus D&S (**IGIS project** maintenance and upgrading of implemented system in the field of remote sensing);





# IGIS project






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







# IGIS Project

<b>Title</b>	<b>National Spatial Data Infrastructure and Remote-Sensing Centre for the Republic of Serbia based on IGIS (Integrated Geo-Information Solution)</b>
<b>Funding</b>	French government loan
<b>Timing</b>	2010 – 2013 + maintenance 1 year
<b>Partners</b>	  
<b>Objective</b>	<ul style="list-style-type: none"> <li>★ 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.</li> <li>★ 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.</li> </ul>





# IGIS project concept

The IGIS concept is comprised of two core components:

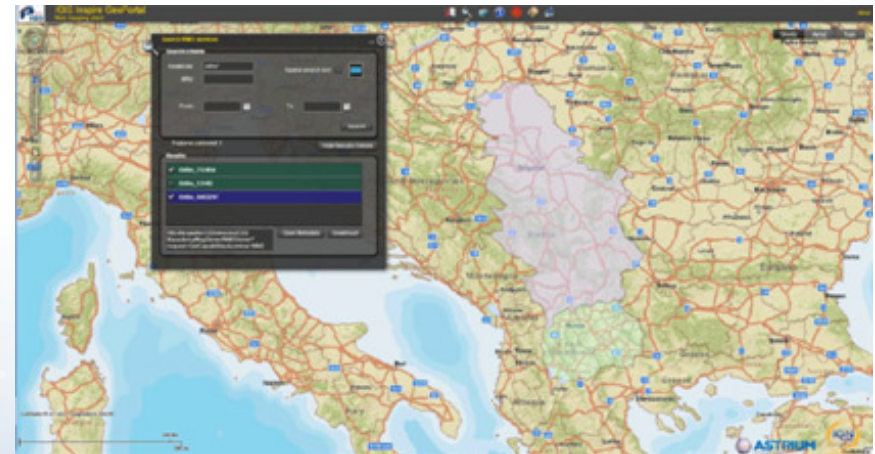
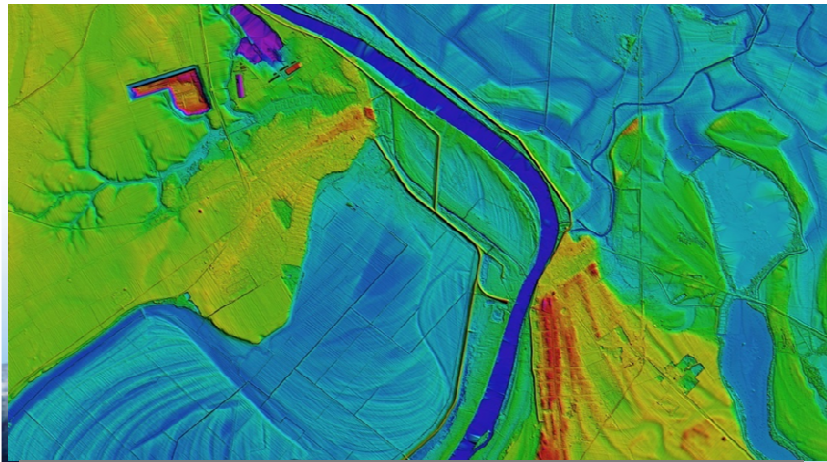
- 1) **Data:** provides the content of the SDI and the corresponding data that describe the dataset;
- 2) **Services:** enable access to and use of the data.

## Data

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

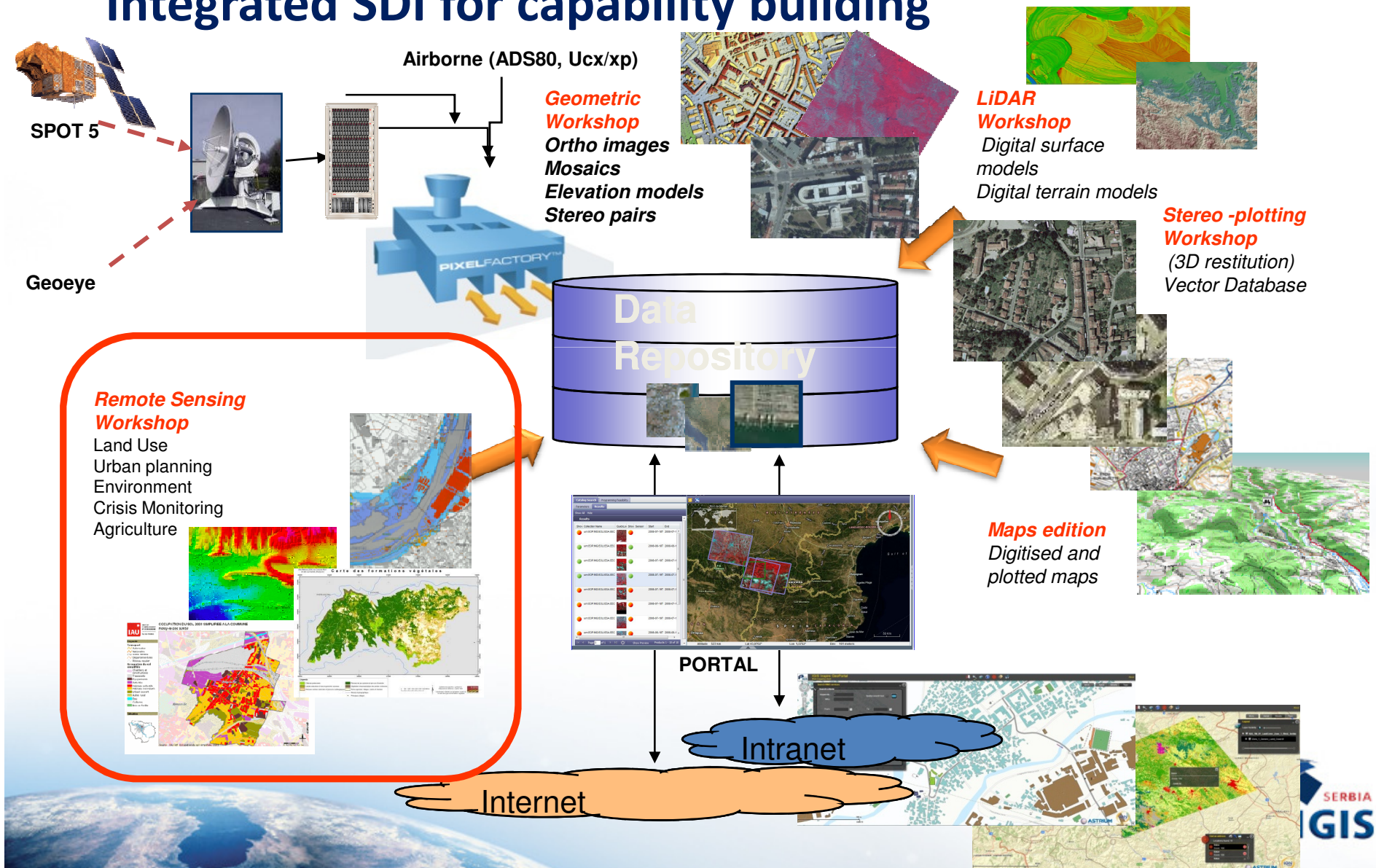
## Services

- ★ 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





## Remote Sensing

- **Economic, fast and efficient** technology for obtaining the data over **large area**;
- Practical way to **obtain data** from **inaccessible regions**;
- **Sophisticated method** for acquiring data for different purposes / generation of **thematic maps**;
- Easy to manipulate and **combine** with **other spatial data**.

Enables

### Operational activities in:

- Agriculture – CwRS, precise farming;
- Environment;
- Forestry;
- Water management;
- Emergencies (fires, floods, droughts, landslides etc.)
- Regional and local planning.

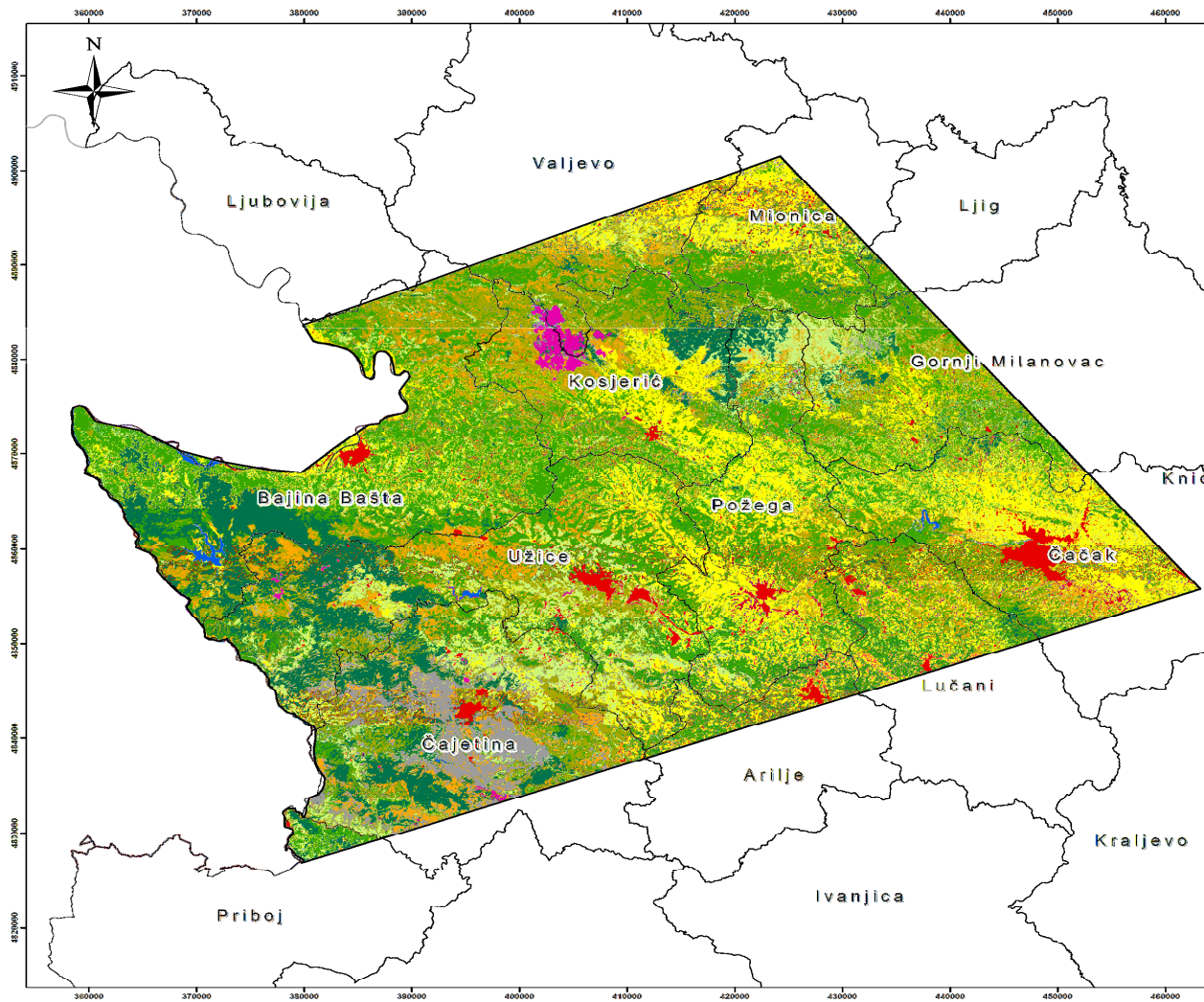
**TO SUPPORT AND ACCELERATE  
ECONOMIC GROWTH**





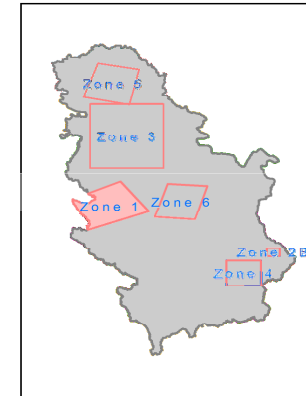
# Remote Sensing WS

Established RS unit within RGA capable to produce: **Land Cover Map**



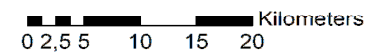
**IGIS Project - Serbia**  
**TM01 - Generic Land Cover**  
**Zone 1, Year 2011**

**Location**



**Legend**

- Artificial
- Bare soil
- Cropland
- Cropland/Grassland
- Grassland
- Shrubland
- Deciduous
- Coniferous
- Water
- Unclassified
- Municipality

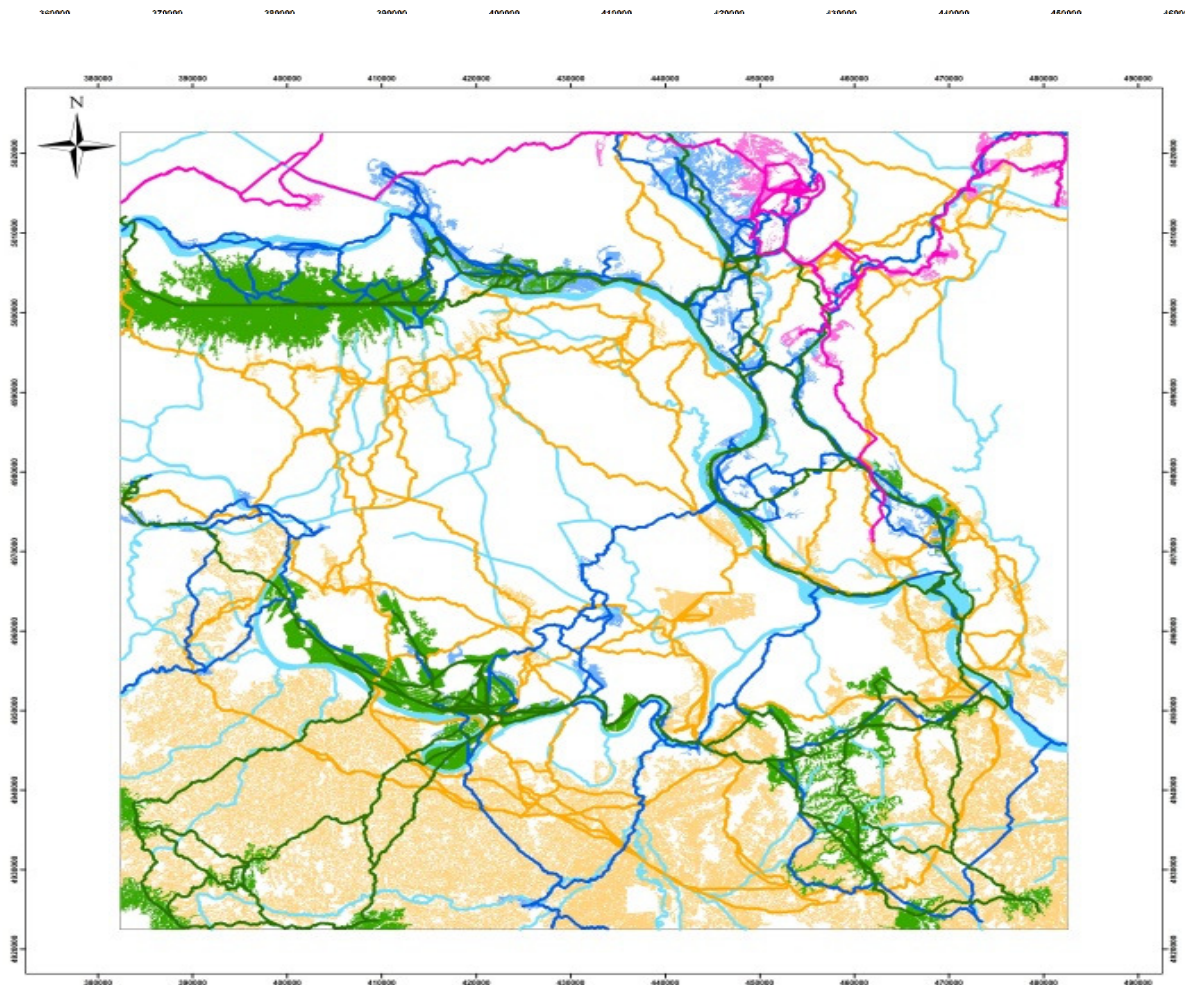




# Remote Sensing WS

Established RS unit within RGA capable to produce:

**Green  
infrastructure Map**



**IGIS Project - Serbia  
TM04 - Green infrastructure  
Zone 3, Year 2011**

**Location**



**Legend**

**Ecological corridors**

- Salty habitats
- Woodland
- Wetland
- Dry grassland
- Rivers

**Core areas**

- Salty habitats
- Woodland
- Wetland
- Dry grassland





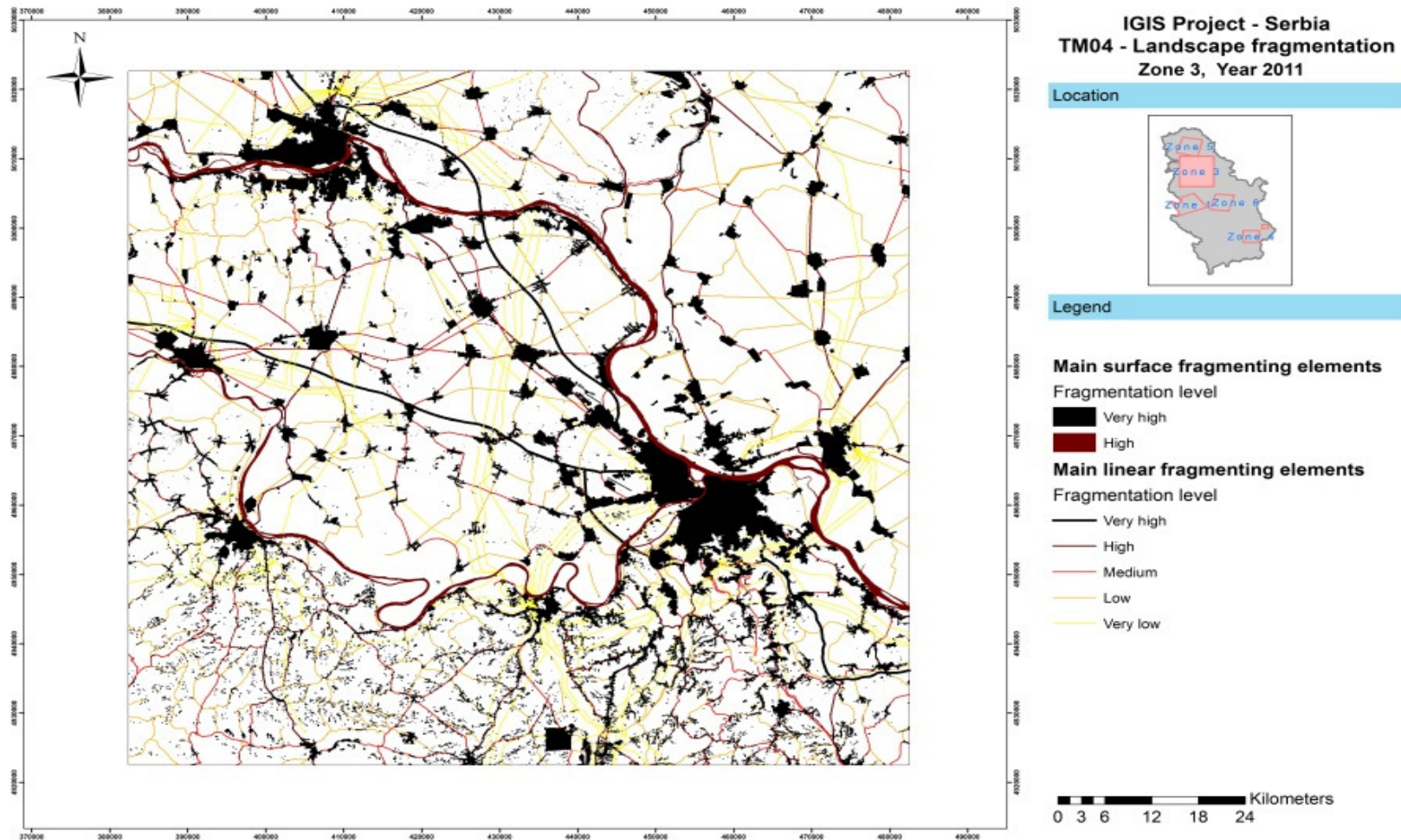


# Remote Sensing WS

Established RS unit within RGA capable to produce: **fragmentation Map**

**Landscape**

**fragmentation Map**



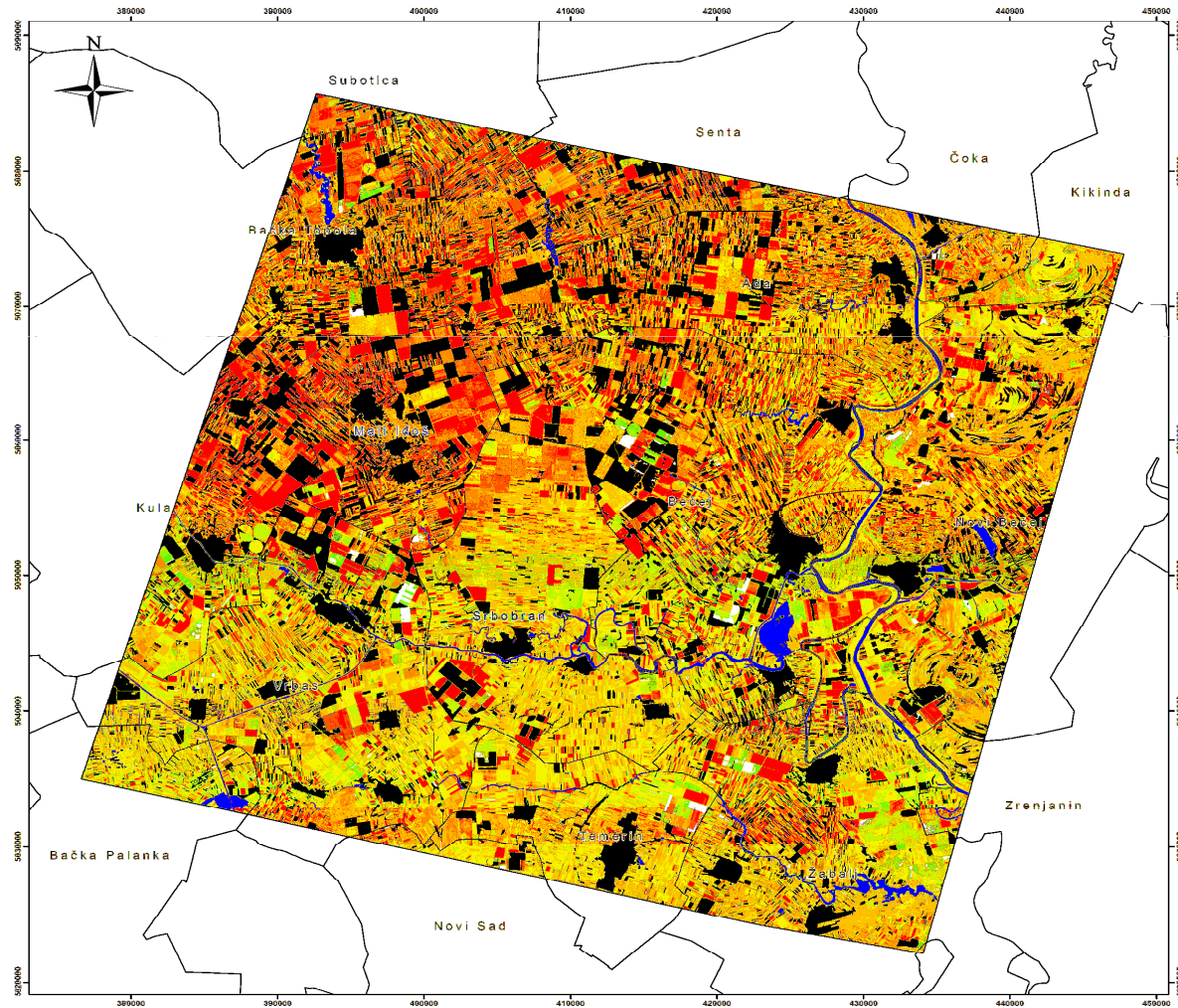


# Remote Sensing WS

Established RS unit within RGA capable to produce: **impact Map**

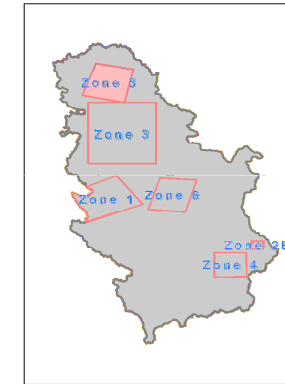
**Drought**

**impact Map**



**IGIS Project - Serbia  
TM06 - Impact of Drought  
Zone 5, Year 2012**

**Location**

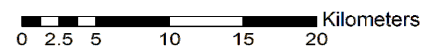


**Legend**

- Municipality
- Mask
- Water

**Drought Impact**

- High
- 
- 
- Moderate
- 
- Low



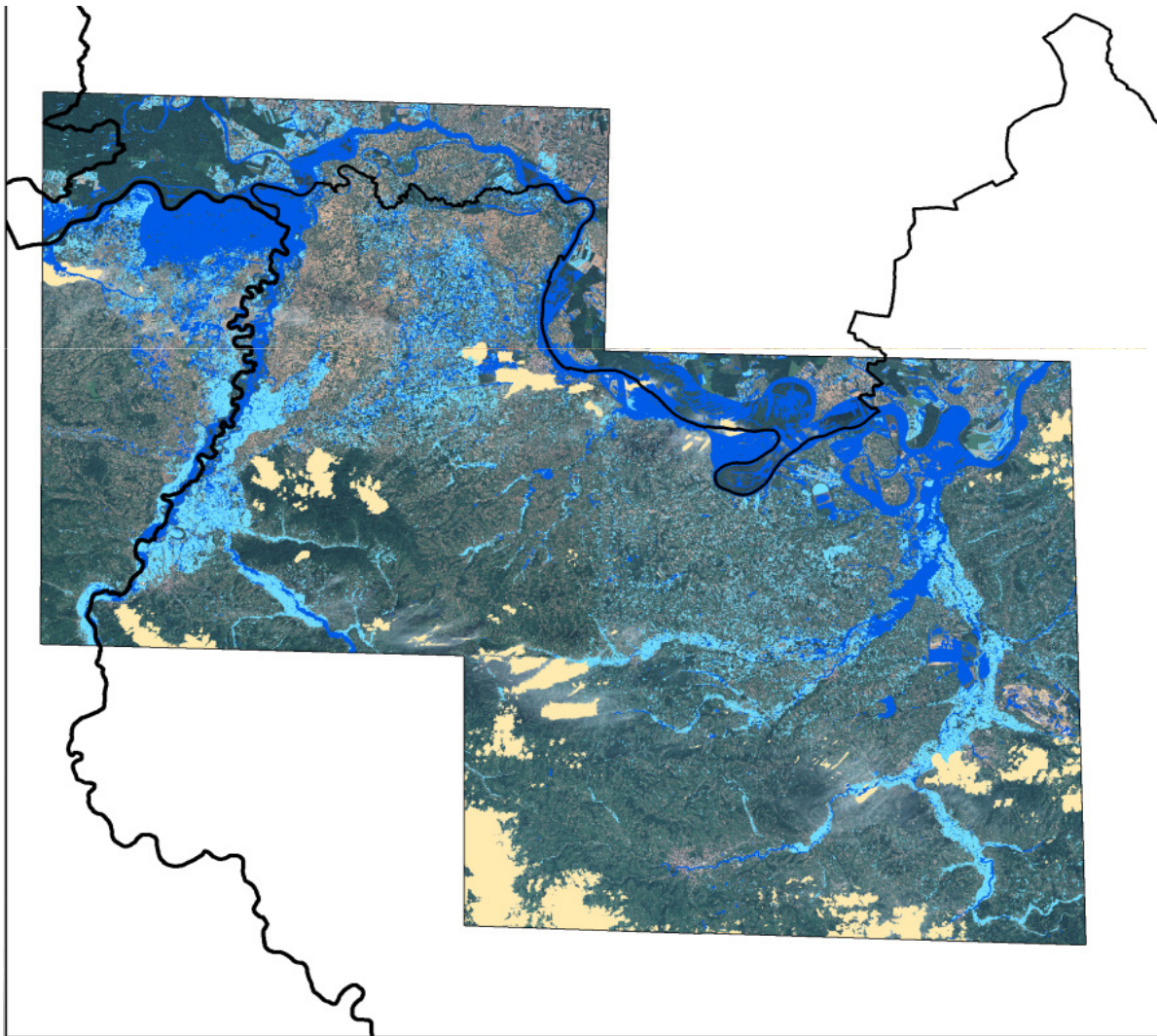







# Remote Sensing WS

Established RS unit within RGA capable to produce: **Flood Hazard Map**

**Flood Hazard Map**



### Карта поплава

-  Облаци и сенке облака
-  Вода
-  Земљиште засићено водом





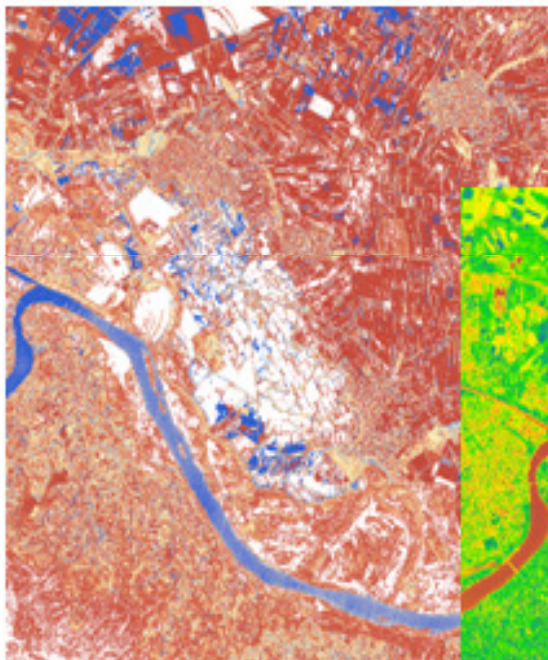


# Remote Sensing WS

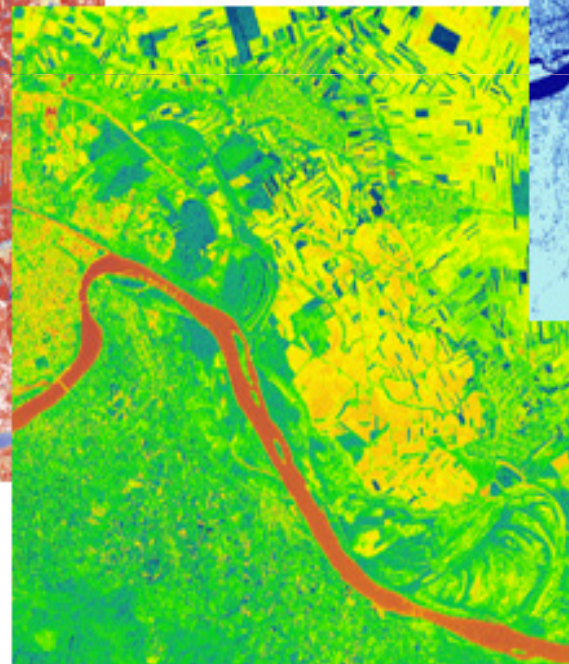
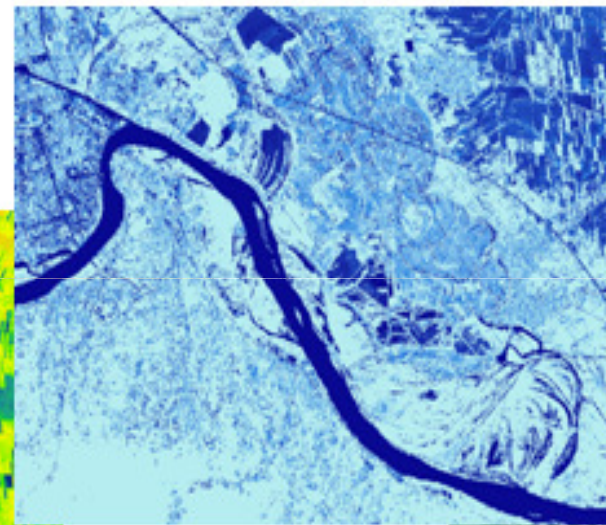
Established RS unit within RGA capable to produce:

**Biophysical parameters**

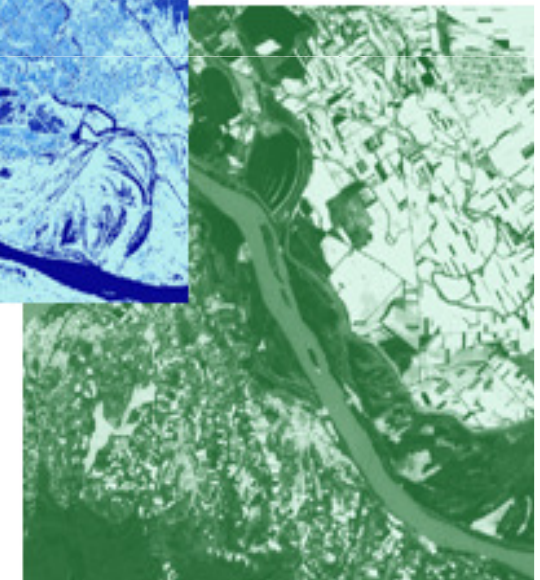
*Brown cover fraction*



*Water cover fraction*



*Chlorophyll content*



*Green cover fraction*





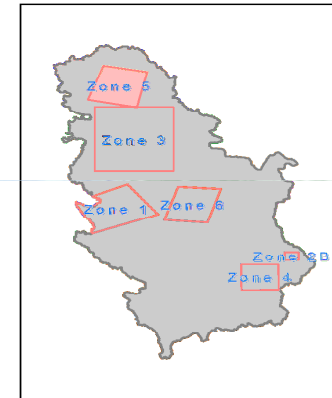
# Remote Sensing WS

Established RS unit within RGA capable to produce:

## Agriculture Land Cover Map

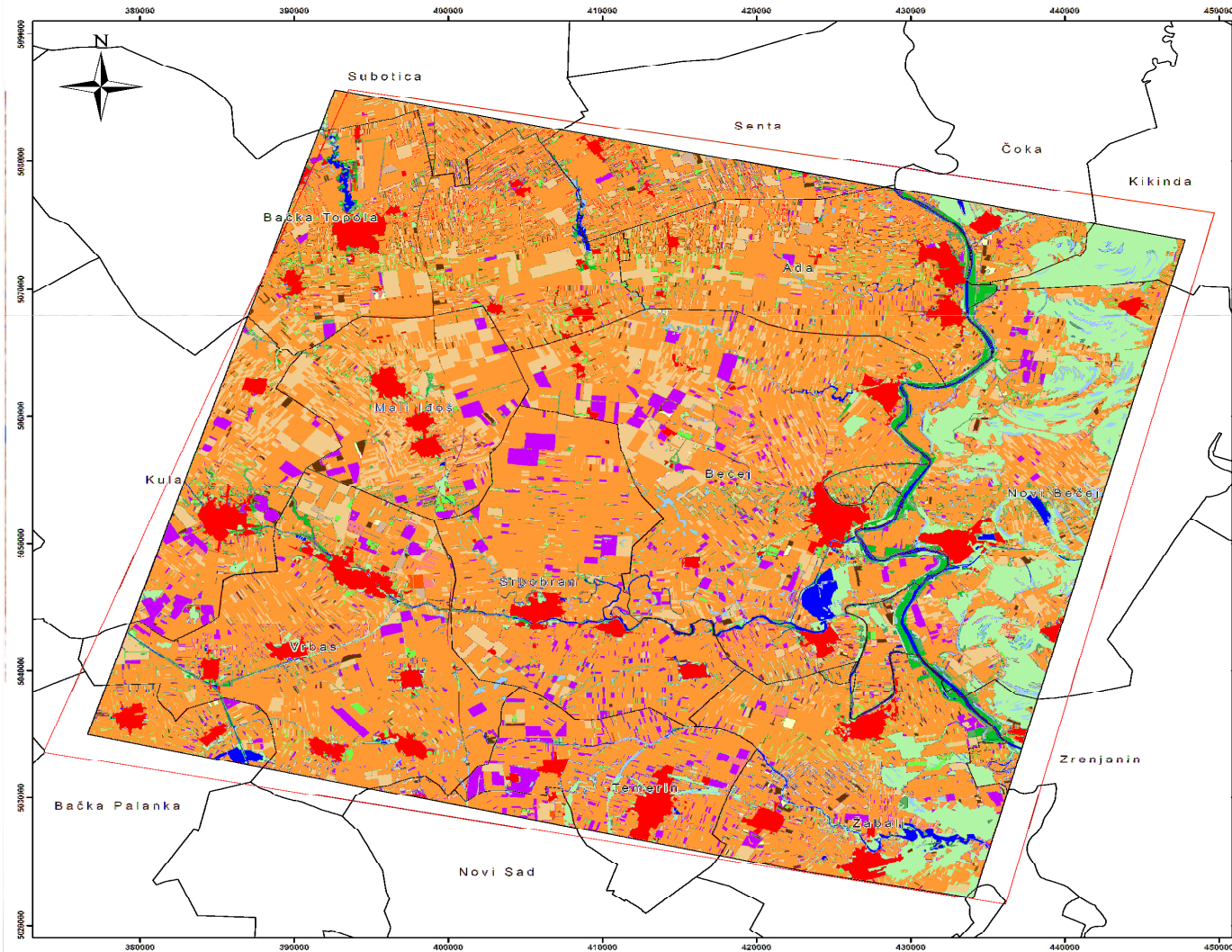
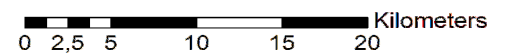
**IGIS Project - Serbia  
TM02 - Agriculture Land Cover  
Zone 5, Year 2011**

### Location

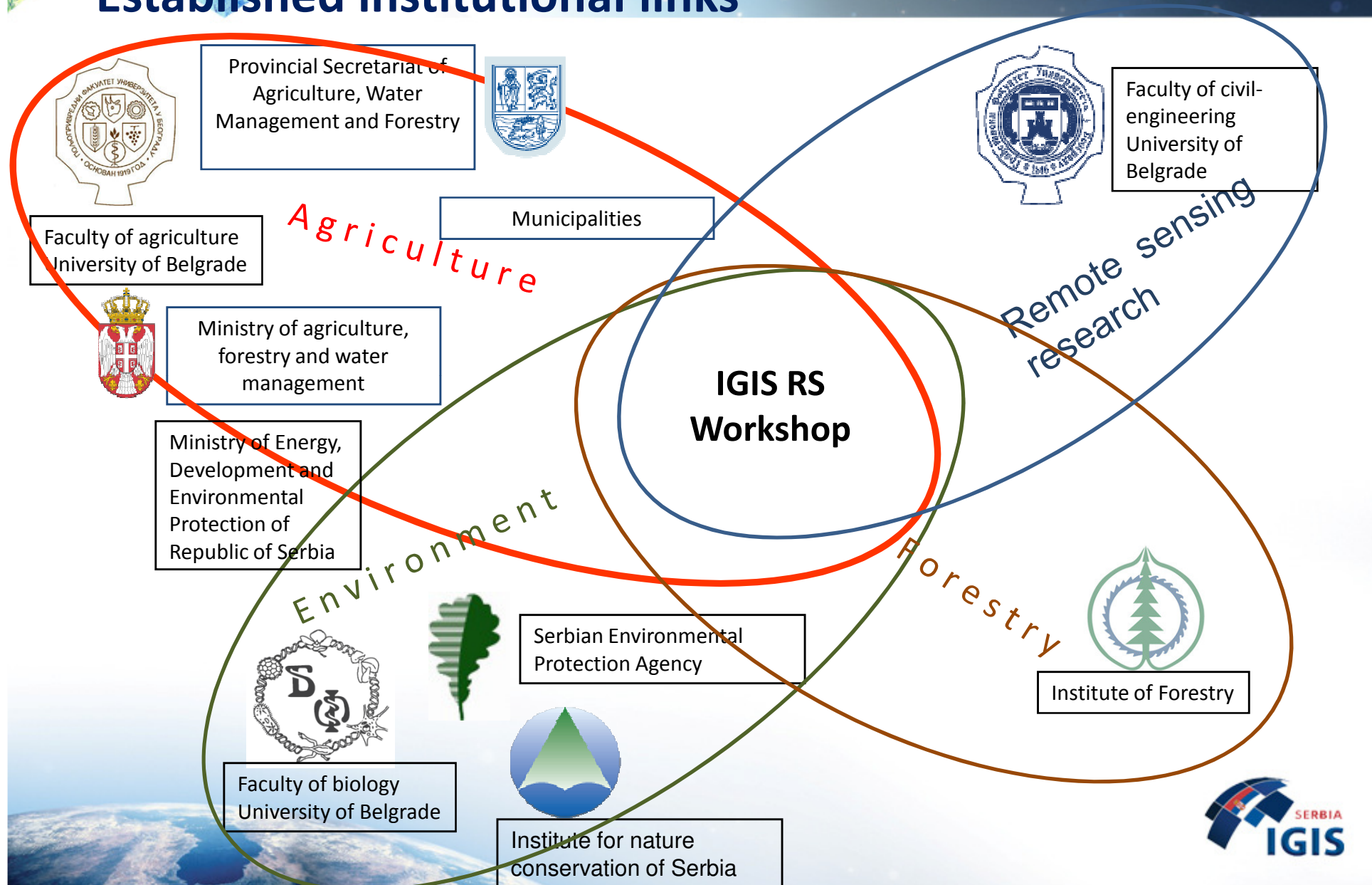


### Legend

- 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



# Established institutional links





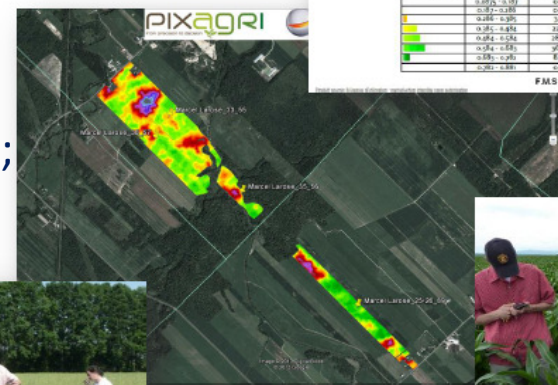
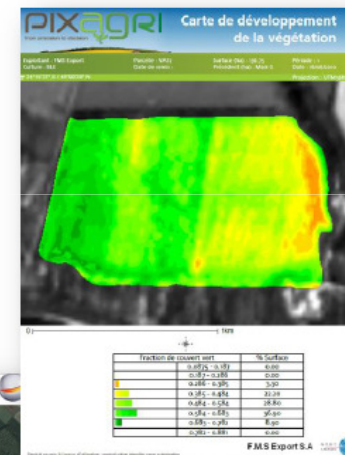


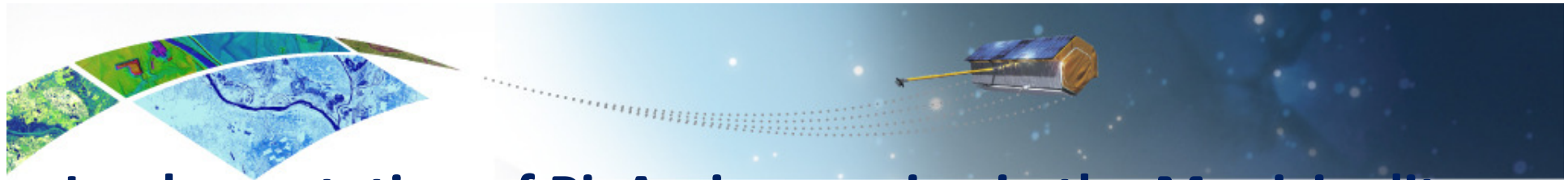
# Implementation of pilot project based on IGIS concept- PixAgri system

**PixAgri** is a comprehensive service, developed by Airbus D&S, available worldwide, that gives farming professionals more control over practices and inputs to achieve maximum profitability, by delivering field-level maps providing crop status information to help **farmers make the right decisions**.

**PixAgri provides :**

- **crop development maps** at key decision stages;
- **customer service** on hand throughout the campaign;
- a **personal web access** to the available maps.





# Implementation of PixAgri campaign in the Municipality of Bečej

## Introduction Phase:

- Getting farmers **familiar with Geo-Information** products and its applications in the field of agriculture;
- Getting farmers familiar with **Geo-Information services** for the management of agriculture;

## Design Phase:

- **Identification** of volunteer farmers and field **data collection**;
- Selection of **target fields**;
- Design of **acquisition calendar** and **operational campaign**.

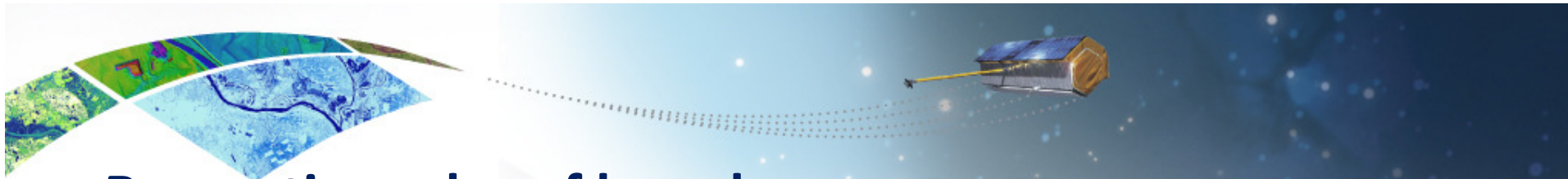
## Operational Phase:

- **Image acquisition** and **products** generation and **delivery**;
- **Transfer of knowledge and technology** to the key players and **networking** them.

## Review Phase:

- **Asses and confirm the needs** of the key players;
- **Customization of PixAgri service** and preparation of mid-term service **development plan**.





## Respective roles of key players

### Municipality of Bečej

- **Hosting** the demonstration project
- Providing local **agronomic expertise**
- In charge of **federating** volunteer farmers

### The Republic Geodetic Authority

- Application of **IGIS learning** in **practice**
- **Be trained** on the management of imagery-based agriculture service

### Volunteer farmers of Bečej

- **Testing** the PixAgri service
- Providing **farm information**
- **Exploiting** PixAgri products and provide **feedback**

### Airbus D&S

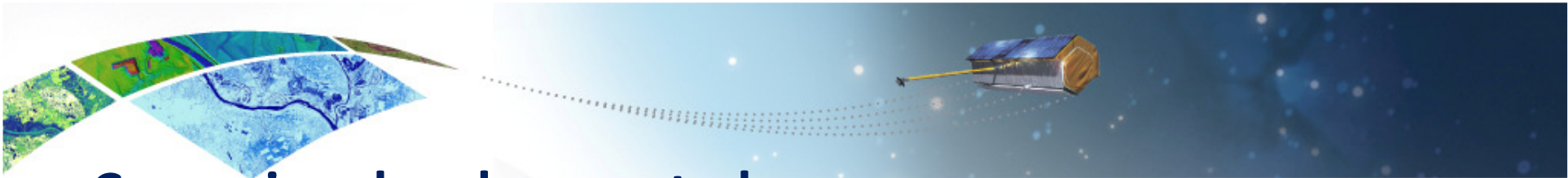
- **Managing** the demonstration project
- **Operating** the PixAgri service
- **Transferring know-how** to other project players

AGRO PROMET

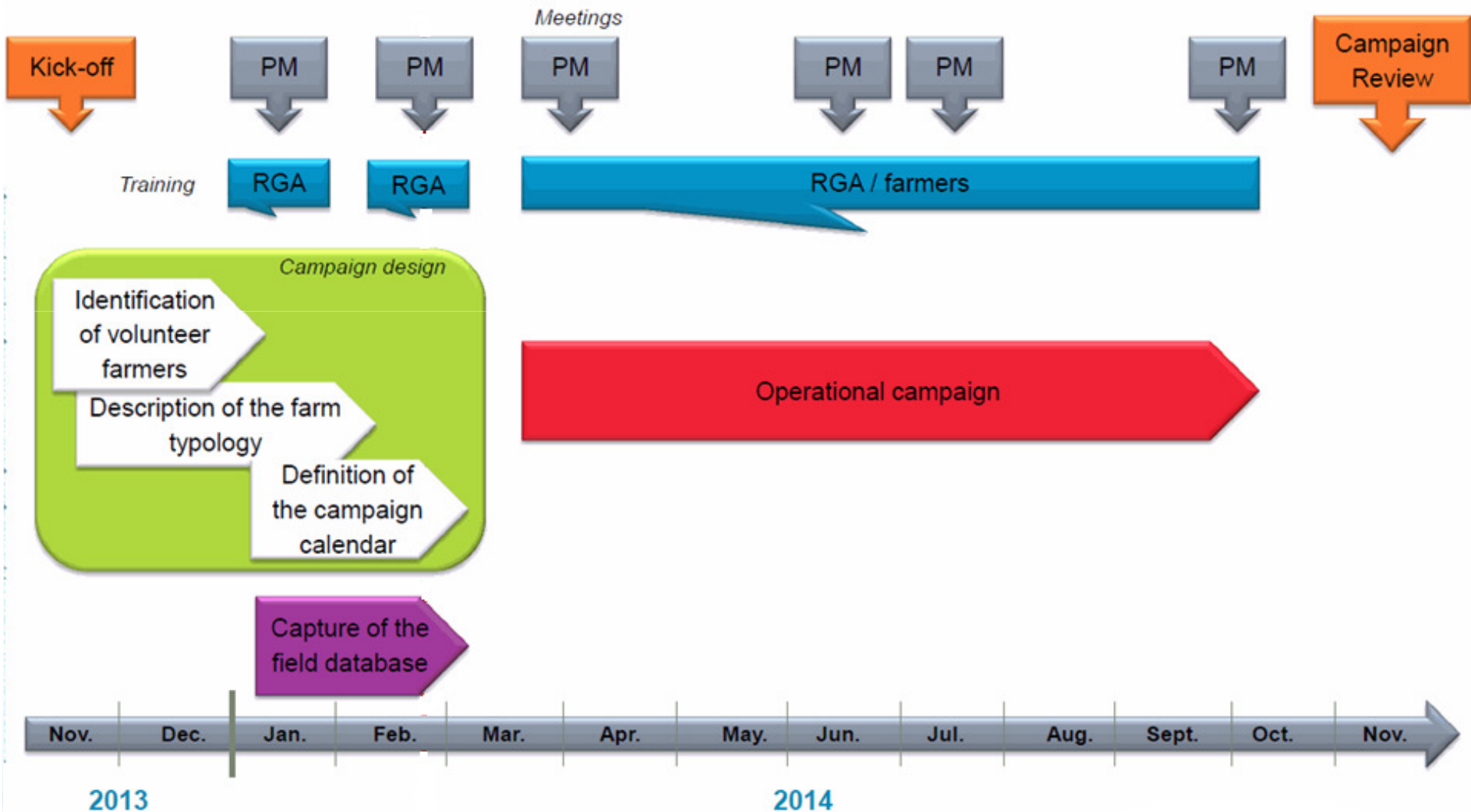
PIK-BEČEJ

SPAJIC farm

A network of **complementary** and **dynamic** players all contributing to success



# Campaign development plan







# The campaign design

- Identification of **3 volunteer farms**:

Farm	Whole farm		Fields selected for the project	
	Area (ha)	Crops	Area (ha)	Crops
AGRO-PROMET	950 ha	Annual industrial crops Fodder crops	950 ha	Annual industrial crops Fodder crops
PIJ-BEČEJ	8 600 ha	Annual industrial crops Fodder crops Fruit & vegetable	580 ha	Annual industrial crops Fodder crops Vegetable
SPAJIĆ farm	80 ha	Annual industrial crops	80 ha	Annual industrial crops
		<b>Total</b>	<b>1 610 ha</b>	

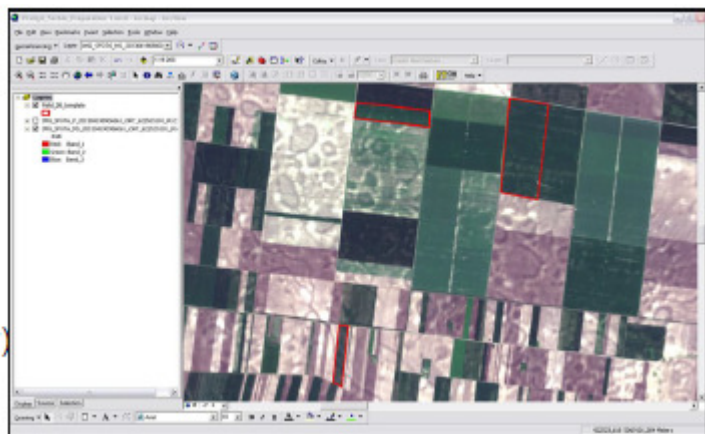
- Collection of **input data** through questionnaires or
  - farm typology, agronomic issues, needs;
  - fields / crops;
  - farming practices.





## The campaign design

- Definition of **field boundaries and field data base**:
  - area  $\geq 1$  ha;
  - consultation with farmers / valid documents/ valid GPS data;
  - used: cadastral plans, digital orthophotos and satellite ortho-images;
  - excluded areas which are not used for cultivation.



FIELD ID	CROP	VARIETY	SOW DATE	AREA HA
Field_1	Wheat	Wheat-a	30/09/2013	39,95
Field_2	Oat	Oat-2	15/09/2013	13,95
Field_3	Soybean	Soy-x	15/08/2013	6,21

Record: 0 Show: All Selected Records (0 out of 3 Selected)

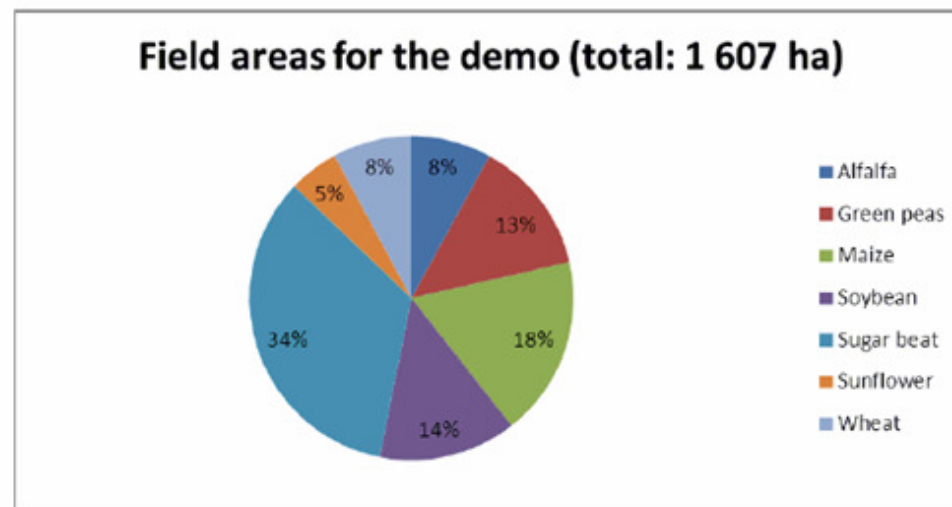
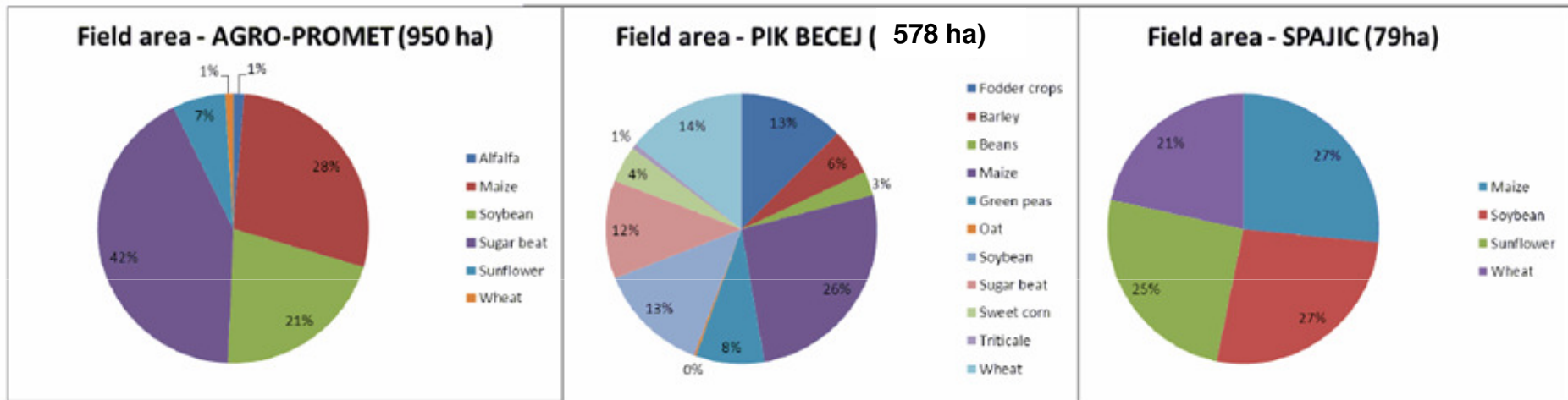






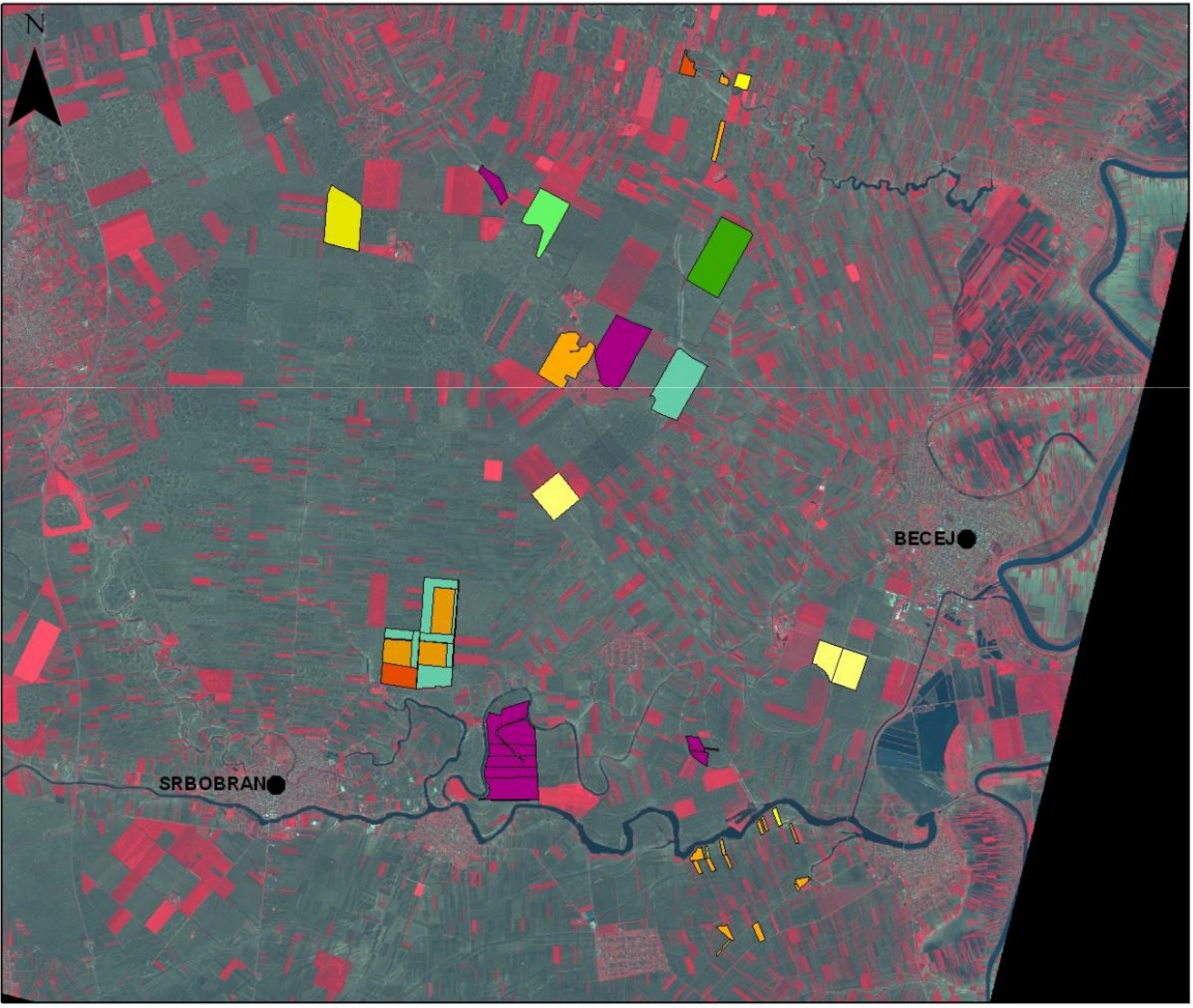
## The campaign design

- **Farm typologies and fields selected** for the campaign:

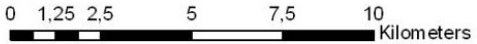
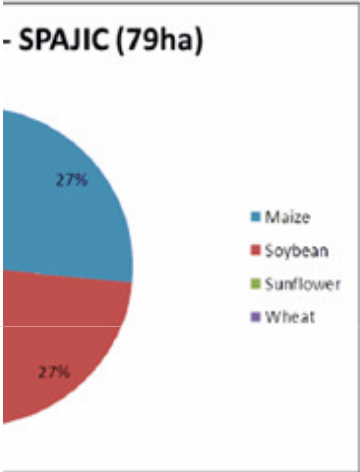




# The campaign design



- Fields\_per\_crop**
- | CROP        | Color        |
|-------------|--------------|
| Alfalfa     | Light Green  |
| Barley seed | Yellow       |
| Maize       | Orange       |
| Maize seed  | Light Orange |
| Pea         | Green        |
| Soya bean   | Light Blue   |
| Sugar beet  | Purple       |
| Sunflower   | Dark Orange  |
| Wheat       | Yellow       |
| Wheat seed  | Light Yellow |







## The campaign design

- Collection of **crop-specific farming practices**

Such kind of calendars were used to define the **calendar of the campaign** and in particular the **calendar of the satellite acquisitions**.



### Maize

	Year n-1			Year n											
	October	November	December	January	February	March	April	May	June	July	August	September	October	November	
Stages	Sowing						Sow								
	Max. dev							Max. dev							
	Harvest												Harvest		
Inputs	Fertilizer	NP - 200 - 280 kg/ha					Spring - Urea 46% - 170 kg/ha								
	Water									H2O: 100 - 150 mm/ha					
	Herbicides						Herbicides								
	Insecticides								Insecticides						
Diseases	Red disease									Phytoplasma					
	Pests									Ostrinia nubilalis					
Weather	Frost						Frost - 5%								
	Flood						Flood - 5%								
	Drought								Drought - 60%						
	Storm						Storm - 30%								





## The campaign design

- Collection of **crop-specific farming practices**

Such kind of calendars were used to define the **calendar of the campaign** and in particular the **calendar of the satellite acquisitions**.



Soybean

E		Year n-1			Year n											
		October	November	December	January	February	March	April	May	June	July	August	September	October	November	
Stages	Sowing							Sow								
	Max. dev							Max. dev								
	Harvest												Harvest			
Inputs	Fertilizer				Before sowing. NH4 / NO3 34% - 200 kg/ha											
	Water										H2O: 100 - 150 mm/ha					
	Herbicides							Herbicides								
	Acaricides										Acaricides					
Diseases	Fe-deficit								Fe deficit							
	Sclerotinia									Sclerotinia						
	Mites										Mites					
Weather	Frost							Frost - 5%								
	Flood							Flood - 5%								
	Drought										Drought - 60%					
	Storm							Storm - 30%								







# The campaign design

- Collection of **crop-specific farming practices**

Such kind of calendars were used to define the **calendar of the campaign** and in particular the **calendar of the satellite acquisitions**.



Wheat

		Year n-1			Year n										
		October	November	December	January	February	March	April	May	June	July	August	September	October	November
Stages	Sowing	Sow													
	Max. dev	Max. dev													
	Harvest										Harvest				
Inputs	Fertilizer	Before sowing - NP - 200 - 350 kg/ha					Spring - Urea - 200 - 250 kg/ha								
	Water														
	Herbicides							Herbicides							
	Insecticides								Insecticides						
Diseases	Fungicides							Fungicides							
	Leaf						Septoria								
	Leaf						Puccinia								
	Leaf						Blumeria								
	Ear							Fusarium							
Weather								Septoria tritici							
								Fusarium graminearum							
							Fusarium culmorum								
	Frost			Frost - 5%											
	Flood	Flood - 5%													
Drought	Drought - 60%														
Hail									Hail - 50%						
Storm							Storm - 30%								





## The campaign design

- design of **acquisition calendar**

### Objective:

- **Monitor** the growing calendars of **all crops**;
- Precisely characterize the **farming practices**;
- **Identify** the main parameters **limiting profitability**;
- Identify times when the **use of the information brought by the satellite imagery is the highest**.

The **acquisition calendar** was designed based on:

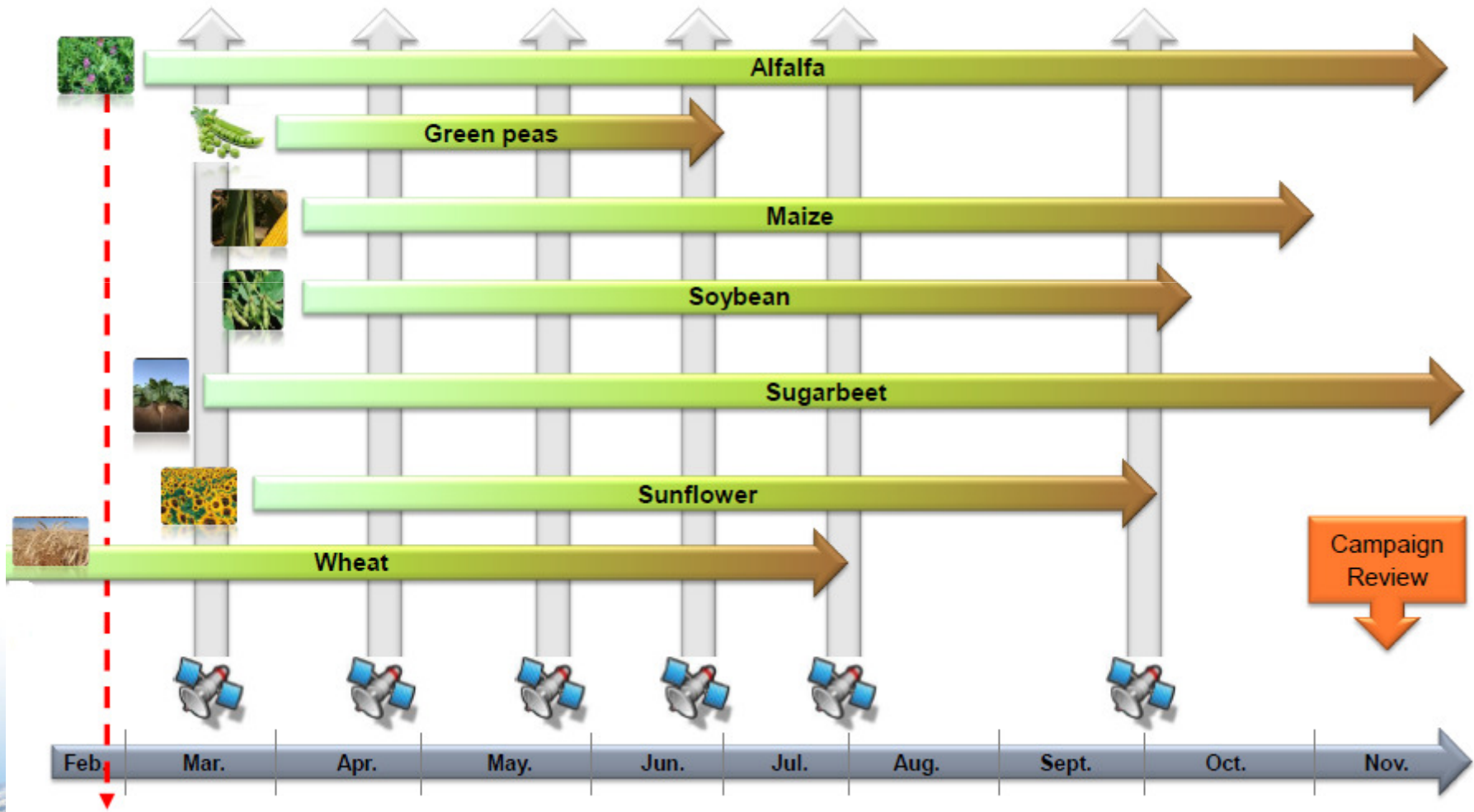
- Definition of a **higher number of satellite acquisitions** (6 -more numerous than for a mature commercial campaign);
- Mean climatic conditions;







# Acquisition calendar versus crop growing calendars



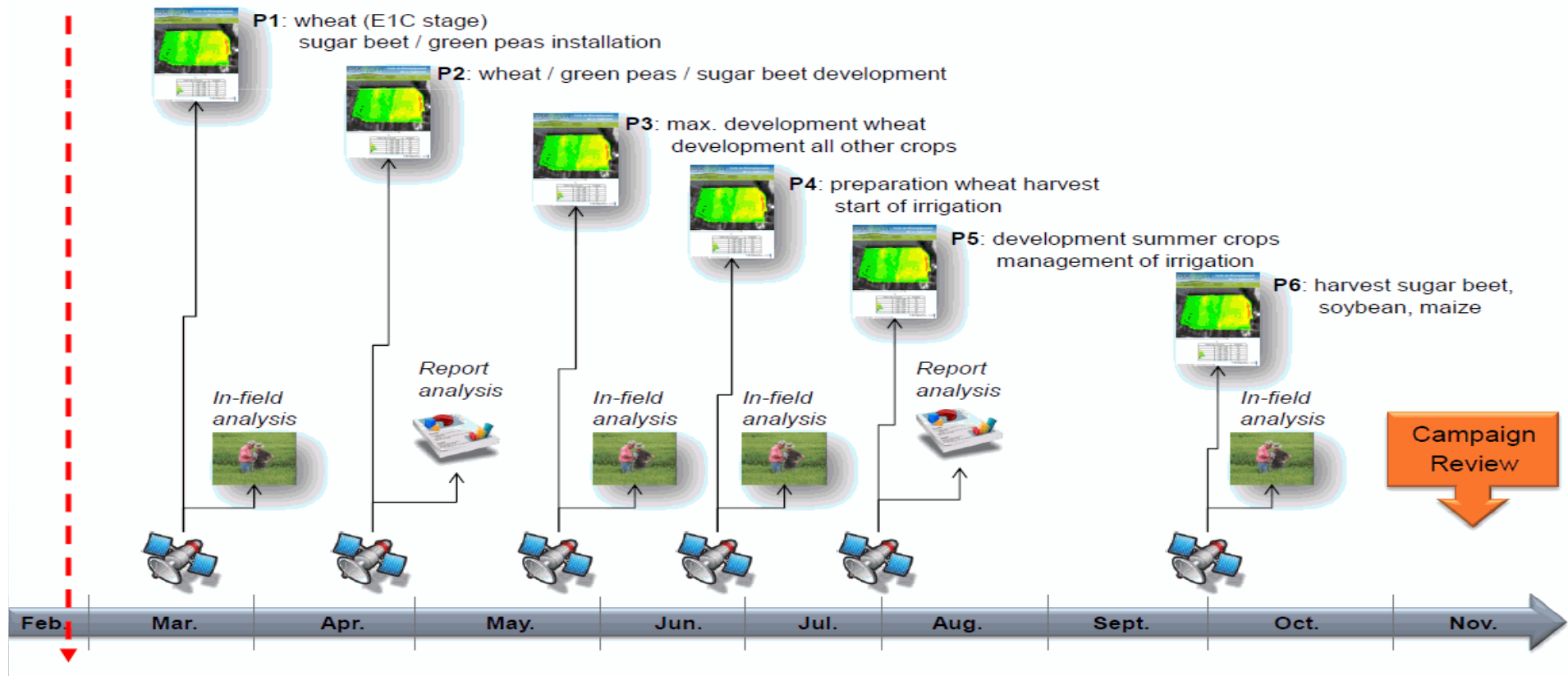


# Operational campaign and acquisition calendar

In-field visits by agronomist experts from Airbus DS was done for **4 satellite acquisitions for each volunteer farm:**

- Training on the **use and interpretation of mapping products;**
- **Analysis** of the mapping products;

**Two satellite acquisitions** was followed only by **analysis / interpretation reports.**



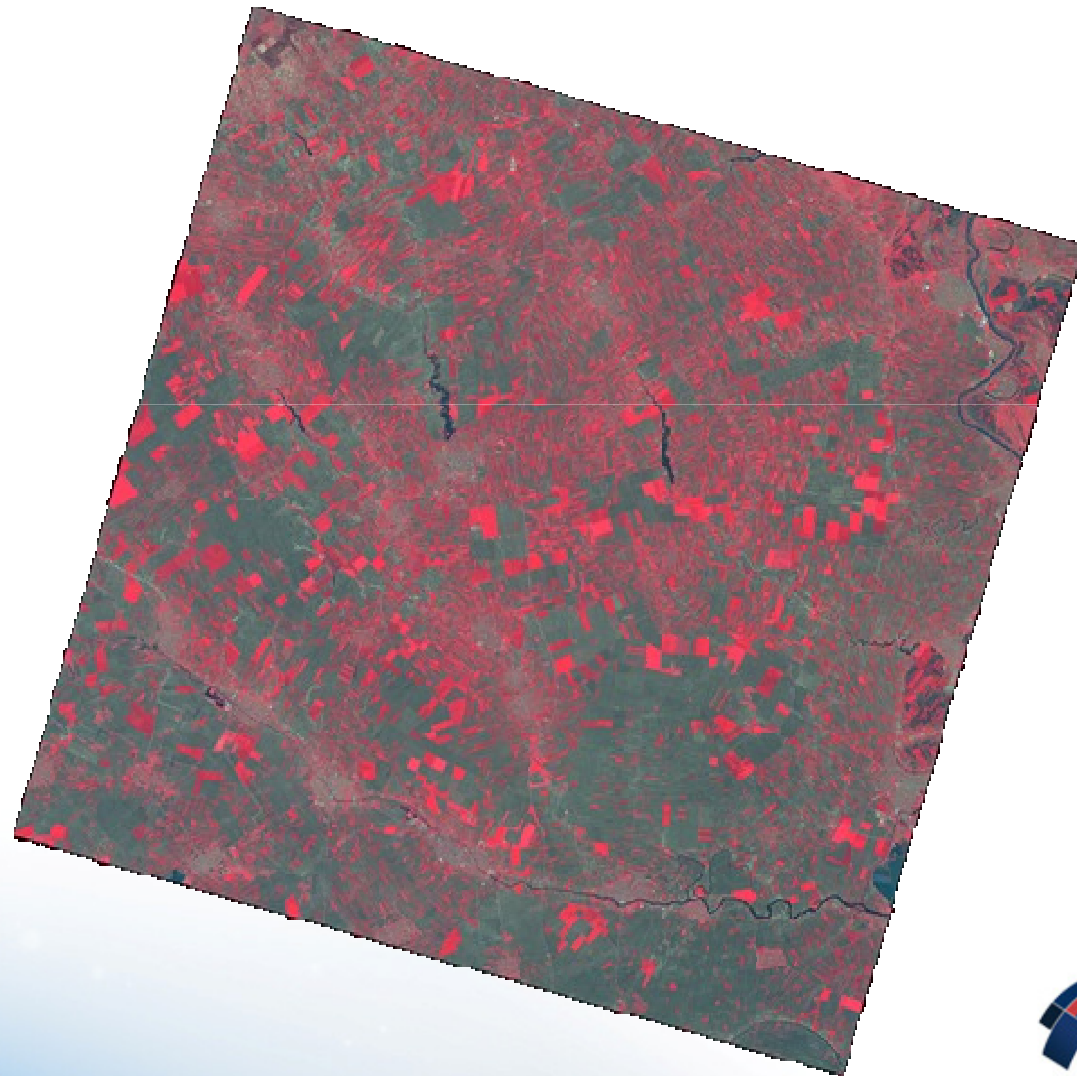




## Operational campaign - deliverables

### Satellite images

- SPOT5
- 60 x 60 km
- 10 m GSD

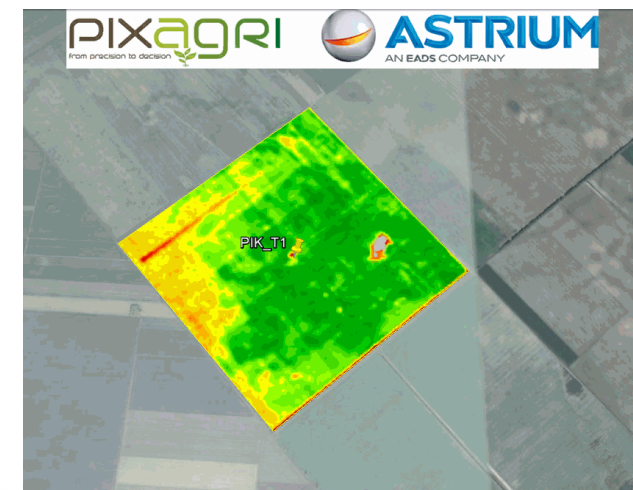
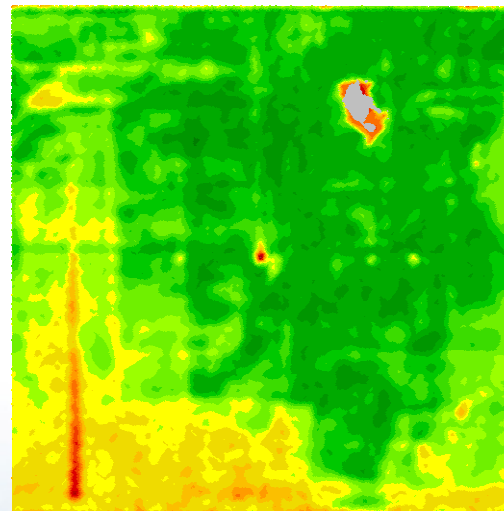
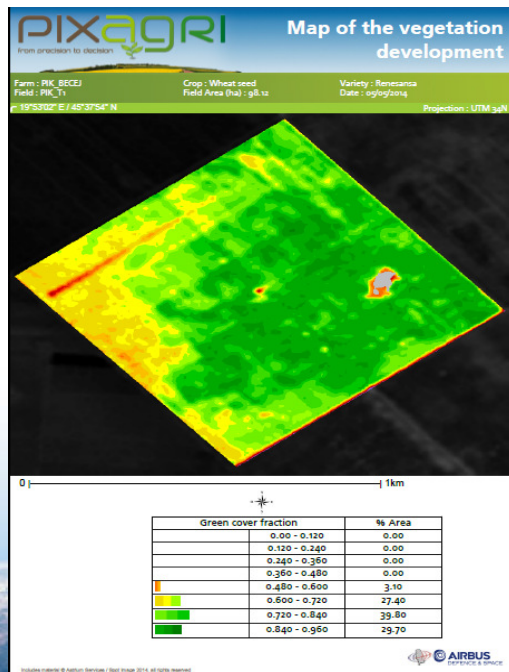




# Operational campaign - deliverables

## Crop Development Maps

**GLCV maps** – illustrate the spatial distribution of green cover fraction (*biophysical parameter that quantifies the area of green vegetation which can be observed above 1 m<sup>2</sup> of soil, varies between 0 - bare soil and 1 - full coverage of green vegetation*).



SUP_HA	CULTURE	VARIETE	DATE_SEMIS	TYPE_SOL	ANNEE	GROUP_CULT	NOPCL_UNIQ	DATE_ACQ	MEAN_GLCV	VARIANCE_GLCV	PCT_TRAITE	PCT_VALIDE
57.18	Wheat seed	Simonida	20131020		2014	CEREALES HIVER	PIK T7	5/5/2014	0.844132	0.00980053	0.995446	0.995446
74.64	Wheat seed	Zvezdana	20131030		2014	CEREALES HIVER	PIK T8	5/5/2014	0.849285	0.01121	1	1
152.11	Barley seed	Nectarica	20130910		2014	CEREALES HIVER	PIK T9	5/5/2014	0.608817	0.0153113	0.996582	0.996582



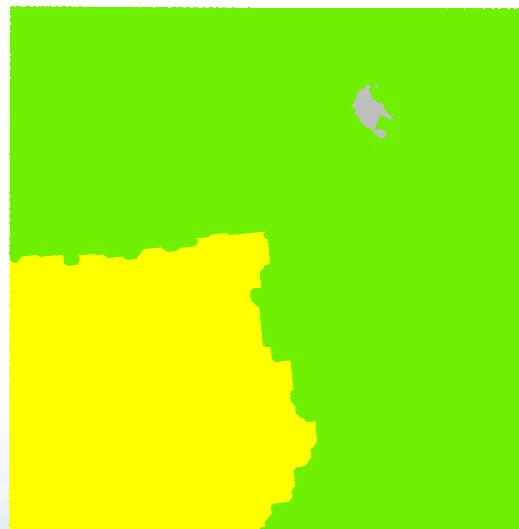
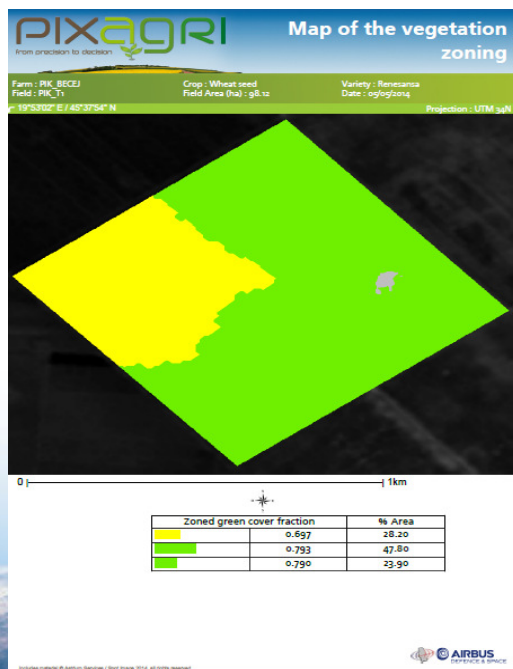




# Operational campaign - deliverables

## Crop Development Maps

**ZGLCV maps** – illustrate the spatial distribution of zoned green cover fraction (biophysical parameter results from a segmentation of the pixel maps of green cover fraction (GLCV). The zoning maps allow to identify homogeneous zones inside the fields.)





## Operational campaign – field visits

- **Interpretation and analysis** of mapping products;
- **Identification of causes** on low vegetation development;
- Collect info on **terrain, soil** and soil sampling practices;
- Collect **add info on cultivating practices**, fertilizer usage, irrigation etc.
- Collect the **feedback on needs** from farmers.







## Outcomes of project

- Introduction of the **new technologies and services**;
  - **Development capabilities** for production of a new geo-information product for the benefit of Serbian citizens;
  - **Networking, improving communication and exchange of expertise** among institutions;
  - **Positive feedback** from farmers and municipality representatives:
    - informed on **crop condition and development** at key decision stages,
    - informed on **location and surface estimation** on crop condition,
    - capable to **optimize inputs, supply and adjust field operations and practices** with cost effectiveness;
    - able to adopt a **dynamic, effective approach to crop management** based on spatially and temporally reliable, comparable data.
- 
- Local-self government and volunteer farmers supports the **continuation of activities in 2015**;
  - **New volunteer farmers** are introduced;
  - **Customization of agriculture services** planned (yield packs, economic maps, detailed agronomist advising...).



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Thank you for your attention!

