

SPOT 5 IN SUPPORT OF AGRICULTURAL AND ENERGY SECTOR MANAGEMENT - PREPARATION FOR SENTINEL 2

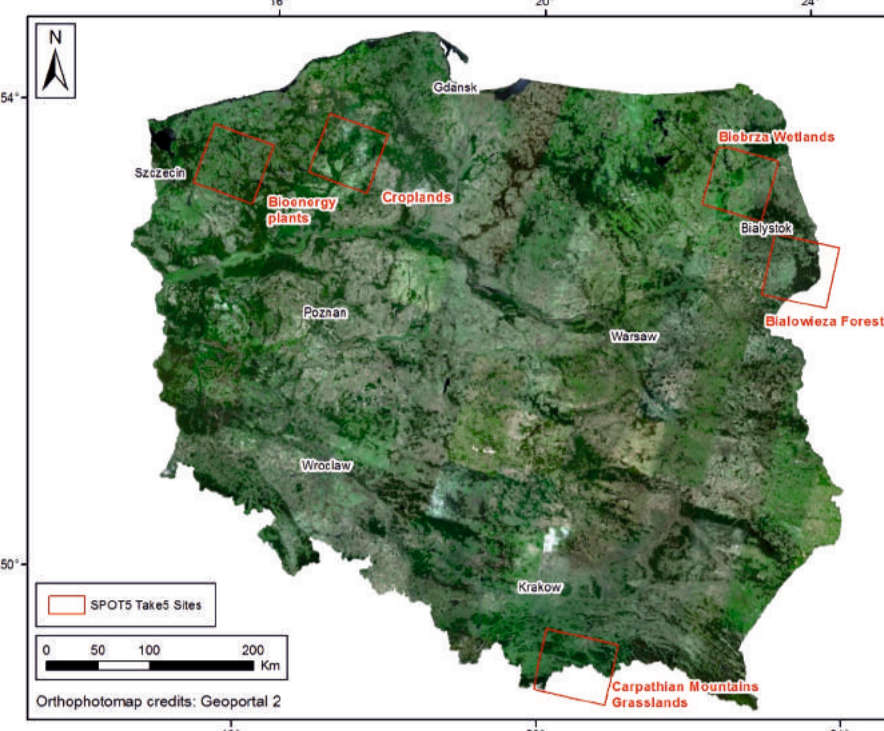


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5 cloudless SPOT 5 scenes from: April 12, 2015, June 11, 2015, July 01, 2015, August 10, 2015 and September 14, 2015 were applied for agricultural fields management within the ASAP ARTES 20 Project, entitled: **ASAP - Advanced Sustainable Agriculture Production - Satellitedata your tool in agricultural management (09.2015 - 08.2018)**. The ASAP Project aims at development of comprehensive Service for Agricultural Sector, delivering broad range of services to various Actors. The Service is develop to deliver products and services, based on multiple satellite data (various spatial and temporal resolution, optical and microwave) and navigation system (application of two space assets: satellite and navigation) and aerial but also in-situ and meteorological data, in a form adjusted to Customers' needs and requirements. The Service will cover the most actual needs of the Agricultural Market Actors and will fill the gaps which are not fulfilled by the competitive companies. ASAP Service is developing the ASAP GIS based Platform for maps demonstration and distribution on the Farmer.pl portal - most important portal in Polish Agricultural Market. ASAP Service is being developed at the moment but trial monitoring is delivered to over 20 farmers now and the number is still growing. Service Users are delivered the following information: actual crops condition and problematic zones on the basis of Landsat 8, Sentinel 2 and VHR satellite data (on demand) as well as information on Surface temperature, snow cover and drought on the basis of NOAA AVHRR. SPOT 5 data were used for delivering of the satellite data based vegetation indices and thus monitoring of the crops condition over the growing season. The application of SPOT 5 data within the ASAP Project was widely disseminated.



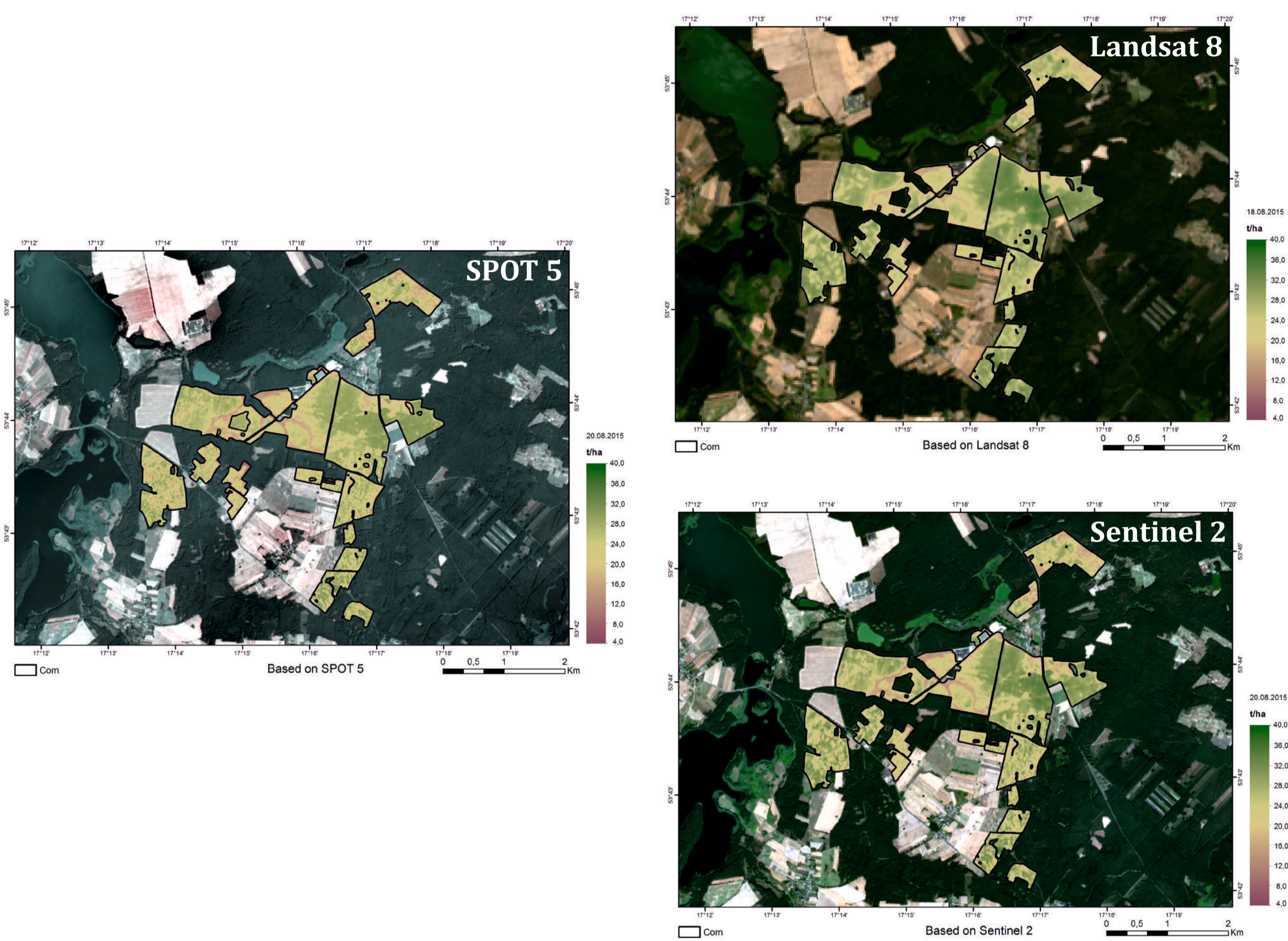
5 cloudless SPOT 5 scenes from: April 22, 2015, June 6 and 11, 2015, July 01, 2015, August 20, 2015 were applied for energy crops plantations monitoring and management within the **SERENE Project, entitled: SERENE - Bioenergy as the key to economic growth of the regions - EO based Service supporting energy crops cultivation (04.2014 - 03.2016)**.



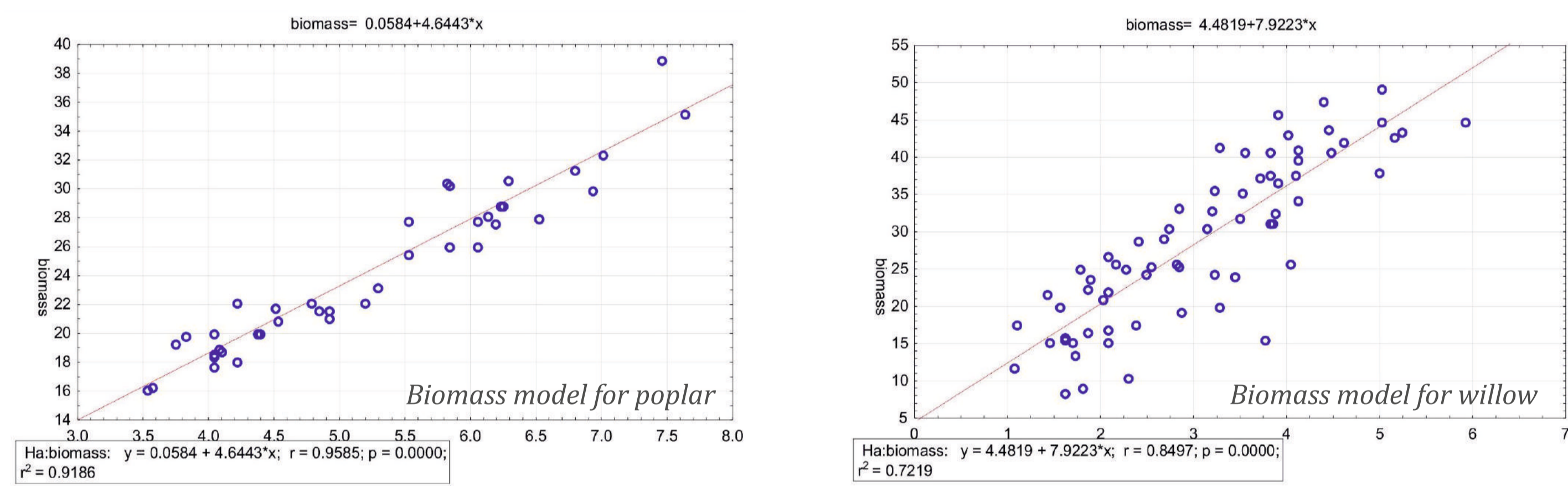
The SERENE is designed to develop the Advisory Service for the energy crops monitoring purposes, addressed to the actual and potential plantations owners as well as various Actors from the Renewable Energy Market. The aim of the Project is also to deliver information and maps which would support the extension of the area of energy crops plantations in Poland and therefore stimulate the economy growth in regions. During the two years of project conduction, the following products were delivered: the map of energy crops plantations location in Poland, the areas potentially useful for energy crops cultivation, regular maps of energy crops growth conditions such as: soil moisture, biomass and yield forecast. Since the Project has been successfully accomplished, the commercial Bioenergy Advisory Service, based on satellite data, is being set up. The Service will enable operational monitoring of energy crops plantations, delivering actual and reliable information on soil moisture, biomass potential and yield prognosis as well as prognosis of profits to the interested bodies. The Service will also delivered the Certificates of energy biomass source of origin which is consistent with the new Energy Policy in Poland. SPOT 5 data were used for delivering of the satellite data based vegetation indices and thus monitoring of the energy crops plantations condition over the growing season. Moreover the SPOT 5 satellite data were applied for delivery of the following maps: biomass maps, crops height maps, locations of the plantations and the maps of the areas potentially useful for energy crops cultivation. SPOT 5 satellite data were also used for validation purposes of the Landsat 8 satellite data based classification maps. The application of SPOT 5 data within the ASAP Project was widely disseminated.

APPLICATION OF SPOT 5 SATELLITE DATA FOR ENERGY MARKET IN POLAND

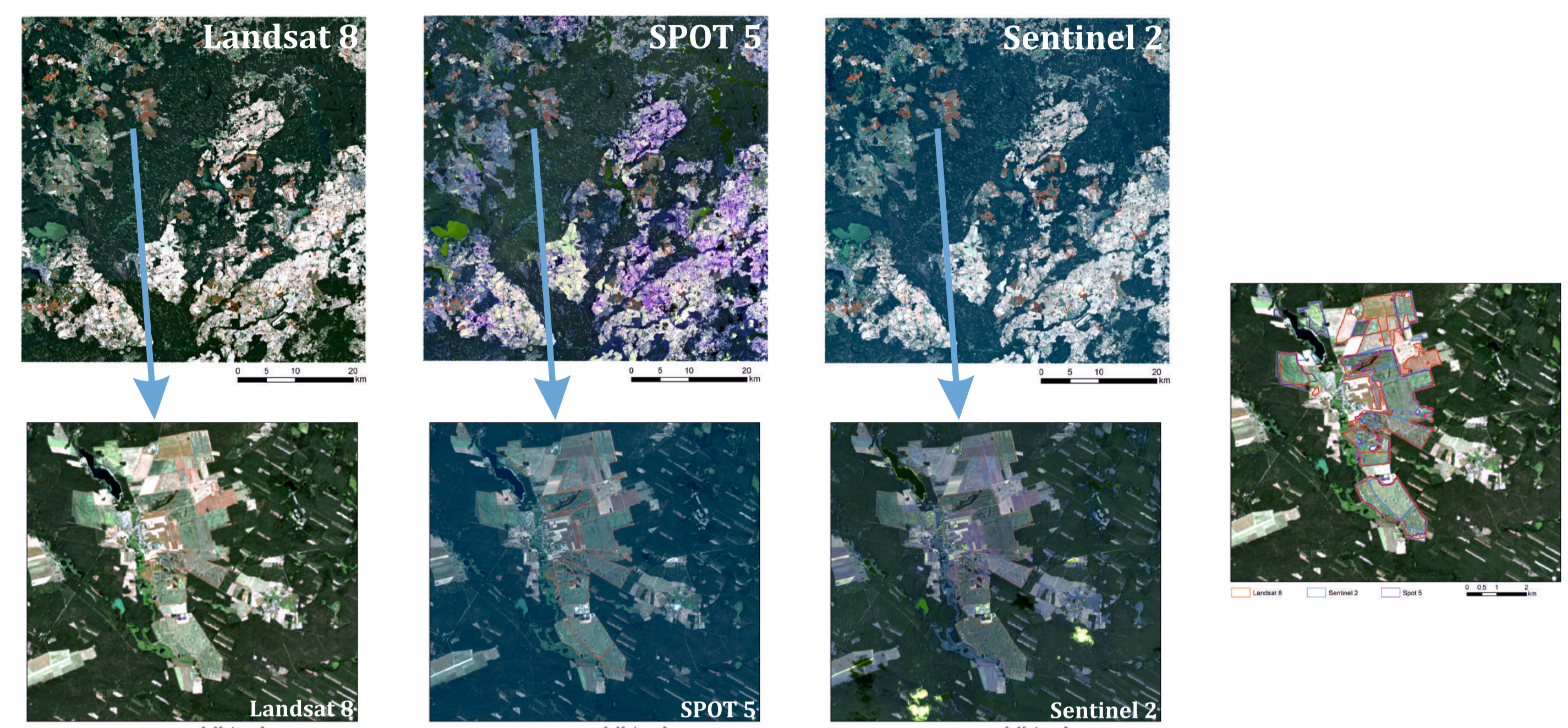
1 ESTIMATION OF THE BIOMASS FROM THE PLANTATIONS



The model of biomass estimation is based on the correlation of crop height measured in the field with the pixel value of NDVI, NDII as well as surface temperature, obtained from Landsat 8 satellite data. Several representative points in the field were selected for height measurement. On the basis of GPS measurements, pixel values of NDVI, NDII and ST were delivered and correlated. At the moment, in-situ measurements independent model is being developed in IGiK, applying Sentinel 2 and ALOS radar data.



2 LOCATION OF THE PLANTATIONS AND THEIR AREA BASED ON LANDSAT 8, SPOT 5 AND SENTINEL 2 SATELLITE DATA



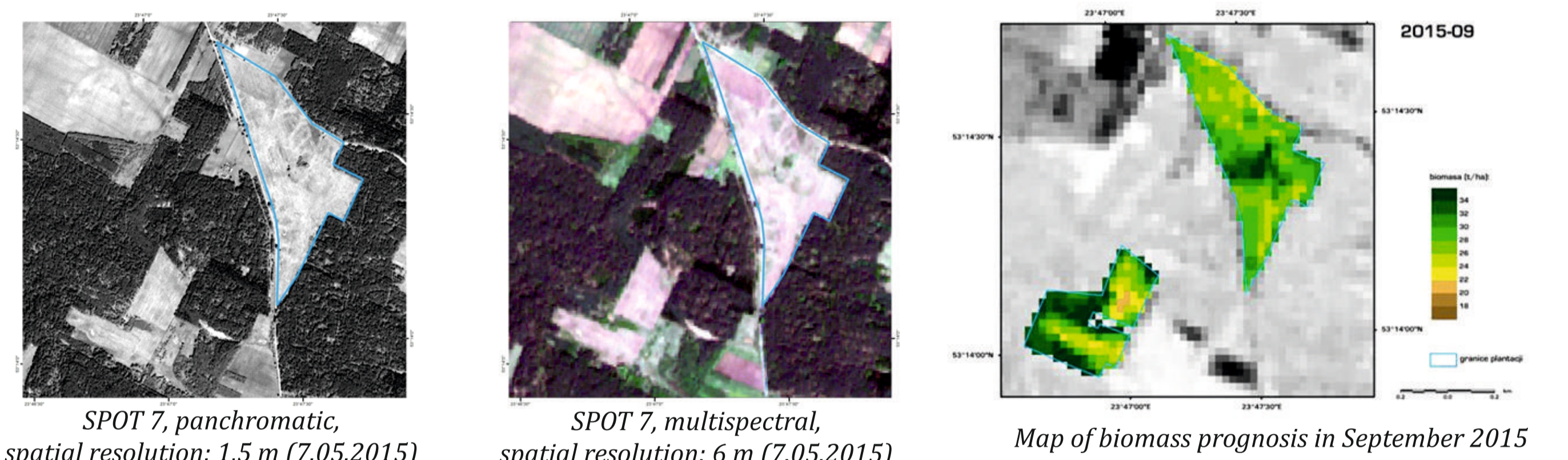
Landsat Classification (Mutual part for Spot 5 Scene)		Spot 5 Classification		Sentinel 2 Classification (Mutual part for Spot 5 Scene)	
Total Count	Total Area (ha)	Total Count	Total Area (ha)	Total Count	Total Area (ha)
109	5416,29	121	6064,98	121	6064,98

3 CERTIFICATION OF ENERGY BIOMASS

According to the Law on Renewable Energy Sources in Poland (*Ustawa z dnia 20 lutego 2015 r. o odnawialnych źródłach energii*), the energy producers are obliged to document/prove the source of origin of energy biomass with the "Fuel Card". The "Fuel Card" needs to be developed for each part of the energy biomass individually. The procedure of energy biomass source of origin authentication is very time and money consuming but on the other hand it is the only way to standardize the energy biomass production chain and on the other hand to regulate and control the illegal import of biomass from abroad. The fusion of achievements of ESA SERENE Project (Bioenergy as the key to economic growth of the regions - EO Based Service Supporting Energy Crops Cultivation, Contract Number: 4000110823/14/I-AM) and the experience possessed by the experts of Biocontrol is being developed now in order to deliver the simplified "Fuel Card" based exclusively on satellite data.

SGS Polska Sp. z o.o., Systems & Services Certification Department, approached to IGiK in order to prepare the analysis of status of the willow plantation located in the plot no. 83, precinct 13, Krynki commune in 2015. The SPOT 7 satellite data registered on 07/05/2015 was applied. The analysis of the SPOT 7 confirmed that the willow was re-growing after the harvesting, which was performed in winter. Estimated height of the willow on 07/05/2015 is 20-40 cm.

On the basis of models elaborated in IGiK, the biomass prognosis for September was elaborated.



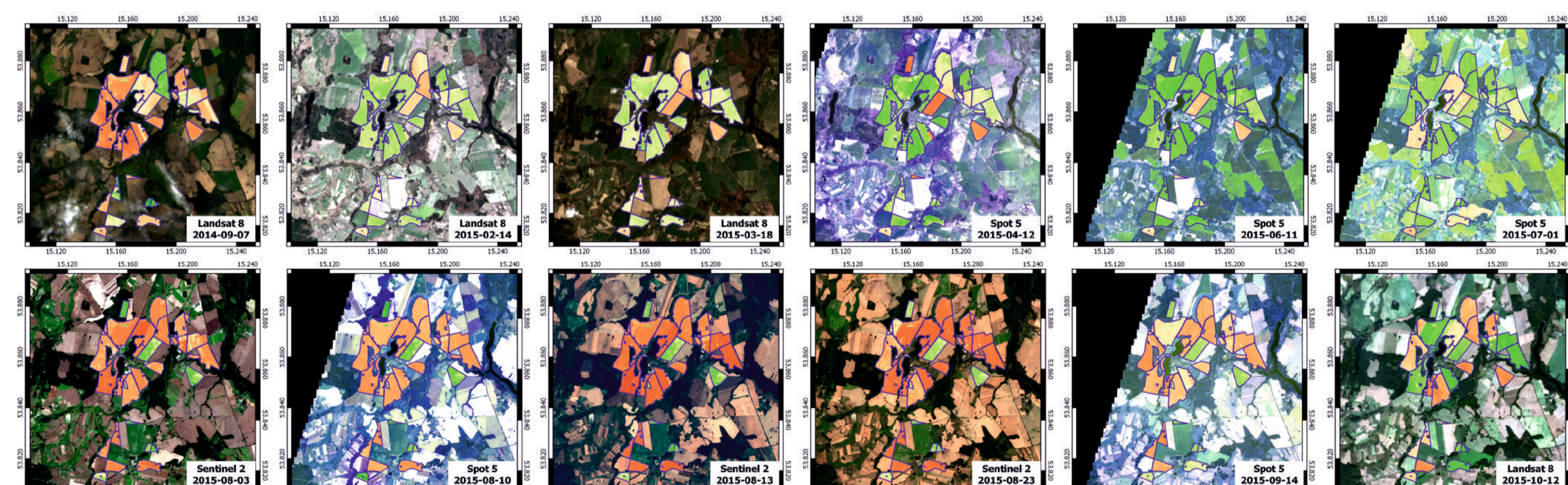
SPOT 5 satellite data were used for all above presented studies and were proved to have a significant potential for such applications. SPOT 5 satellite data met all the requirements of Energy Market in Poland towards the input data, such as: high frequency of satellite data acquisition and high spatial resolution. Low number of spectral bands (in comparison to Sentinel 2 for example) was found not to be disadvantageous since only optical images and NDVI index were found to have significant application in Energy Market (location of the plantations and biomass assessment).

APPLICATION OF SPOT 5 SATELLITE DATA FOR AGRICULTURAL SECTOR IN POLAND

Within the ASAP Project, Remote Sensing Centre IGiK delivers the following maps based on satellite data to its ASAP Service Users:

- maps of crops conditions: NDVI and NDII vegetation indices,
- crops recognition
- problematic zones in the field

SPOT 5 satellite data were applied for continuous monitoring of agricultural fields in North-West Poland during the growing season, in 2015. SPOT 5 satellite data supplemented the Landsat 8 satellite data, often not available because of the high cloud cover in Poland. NDVI and NDII vegetation indices were calculated on the basis of SPOT 5



The frequency of SPOT 5 satellite data acquisition as well its high spatial resolution is considered to be very beneficial for the above presented applications. Sentinel 2 satellite data are expected to deliver more information for the management of the agricultural fields because of higher spectral resolution. But, in case of agricultural fields, the frequency of data acquisition is equally important as the spectral resolution. The SPOT 5 satellite data spatial resolution was found as very beneficial for fields of various size and shape.

On the basis of SPOT 5 satellite data, the classification of crops was performed. The results of the classification are presented in the Map. SPOT 5 satellite data from several months were used for classification purposes, because of changing vegetation. The cadaster data from Central Geodesy and Cartography Documentation Centre. On the basis of SPOT 5 satellite data from April, winter crops were classified, on the basis of NDVI index (winter crops are sown in the Autumn and in April their NDVI is approx. 0,4). The bare soil classified on the SPOT 5 from April was categorized as spring crops. The "spring crops classification" was subsequently overlaid on SPOT 5 image from August, and corn and beet roots were extracted from this classification. Beet roots in August as well as Rye in July were classified with the objective classification, on the basis of training samples.

