Earth Observation application for energy crop analysis

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Copernicus conference

we bring science into practice

Astri Polska

Established in 2010 as a joint venture

AIRBUS DEFENCE & SPACE

CBK PAN

On-Board Electronics
Elektronika pokładowa

Optoelectronics
Optoelektronika

Satellite Imagery& Interpretation
Zobrazowania satelitarne

Secure Satellite Communications
Bezpieczna Łączność Satelitarna

2D & 3D Data Management
Zarządzanie danymi 2D i 3D

Advanced Navigation Solutions
Zaawansowane Rozwiązania Nawigacyjne

Technology Transfer
Transfer Technologii

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Activities | Działalność

- Astri Polska has been cooperating with European Space Agency's (ESA) within PECS (3) and ESA projects (6) *Astri Polska współpracuje z Europejskią Agencją Kosmiczną (ESA) w ramach projektów PECS (3) i projektow ESA (6)*
- Astri Polska had been or is involved in **8 FP7 and 2 H2020 projects** in Space & Security and several European consortia for new projects applications *Astri Polska była i jest zaangażowana w 8 projektów 7PR oraz 2 projekty h2020 z obszaru Przestrzeń Kosmiczna i Bezpieczeństwo oraz w kilka konsorcjów Europejskich opracowujących nowe wnioski*
- Astri Polska is actively involved in **running demonstrations of new technologies in real environments**, with a special interest in the security & crisis management sector *Astri Polska aktywnie uczestniczy w prowadzeniu demonstracji nowych technologii w rzeczywistych środowiskach, szczególnie w zastosowaniu do bezpieczeństwa i zarządzania kryzysowego*

Copernicus related products & services

- Satellite image delivery:
  - Pleiades 1a&1b
  - Spot 5, 6, 7
  - TerraSAR-X; TanDEM-X
  - Radarsat-2
- Full industrial EO/GIS data processing chain
- EO based agriculture/environment services

Copernicus related products & services

- New technologies demonstrations in real environment, focused on Crisis Management and Security
- 2D GIS systems for security

- Web3D products family, including 3DCity system

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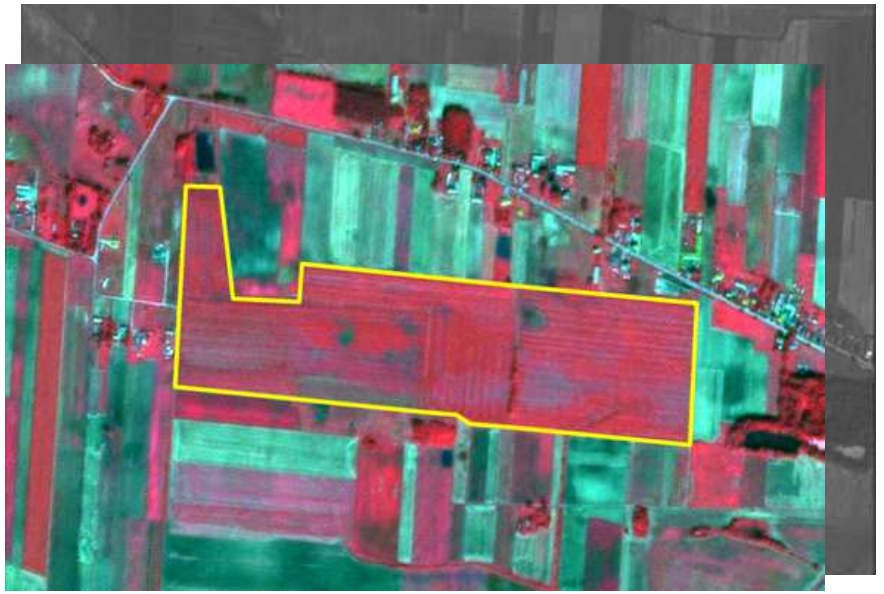
Agriculture support service

- Pilotage ongoing on:
  - Crops destruction detection
  - Yield estimation
  - Input recommendation creation



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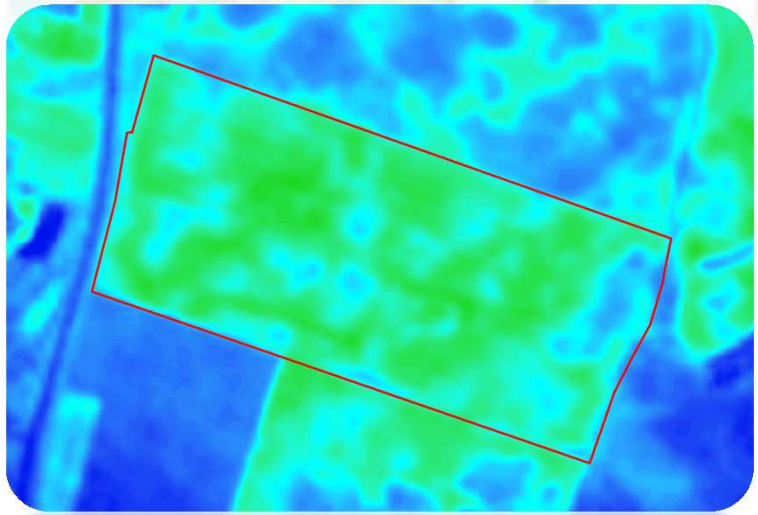

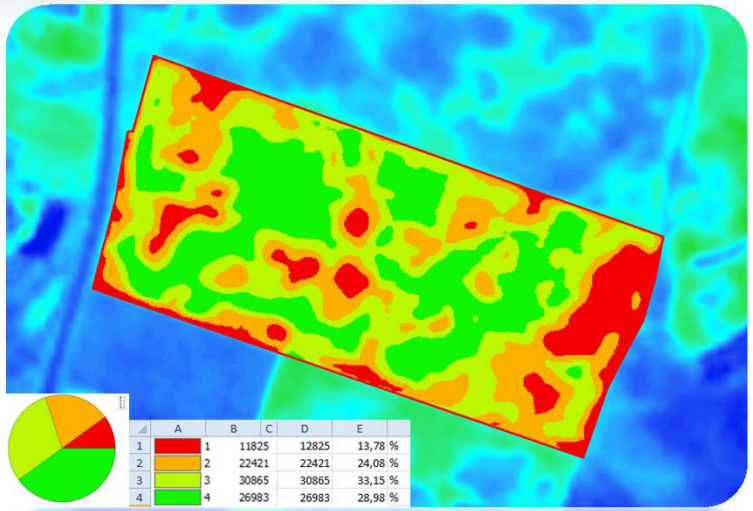

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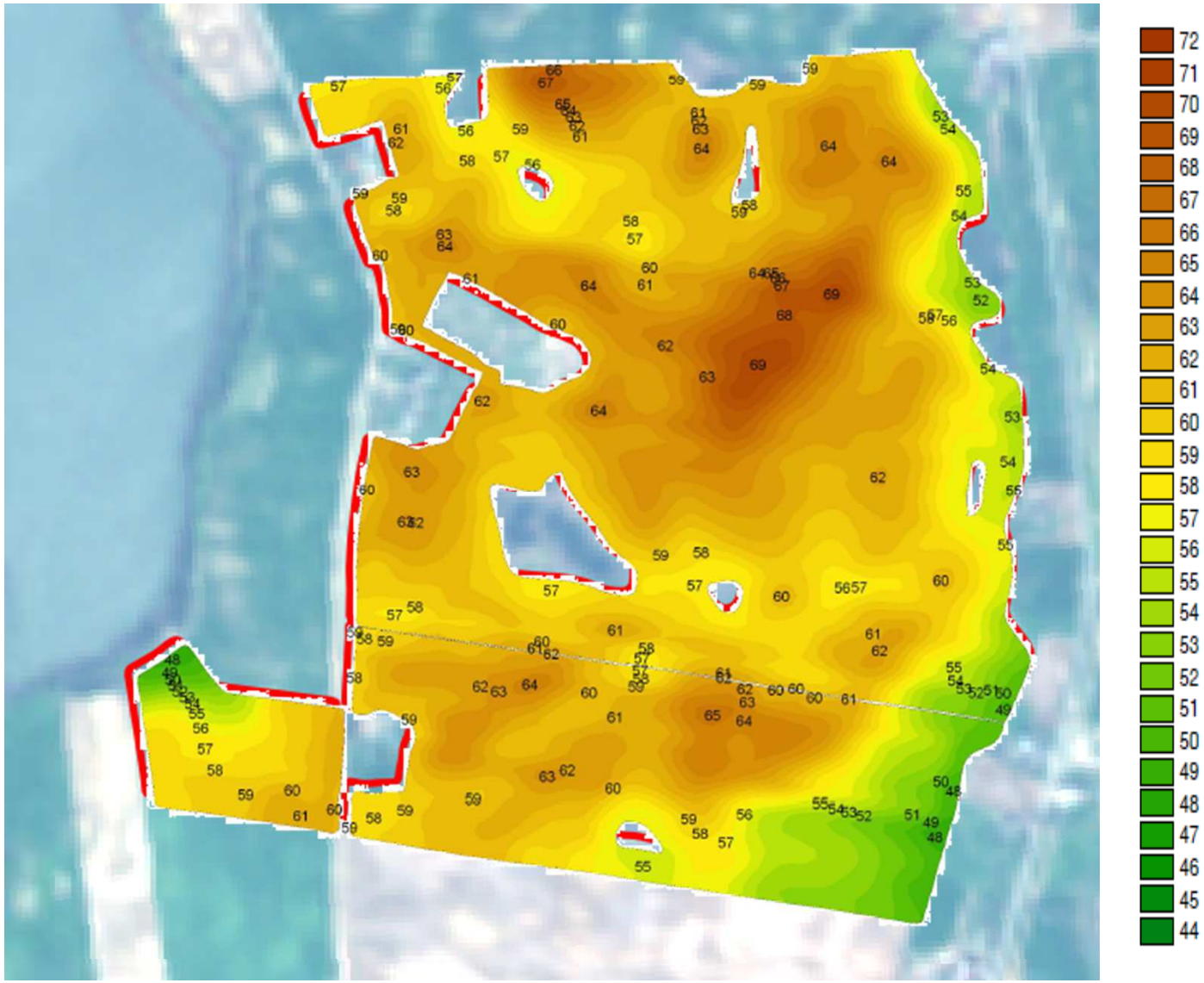
Agriculture support service

- Originally based on SPOT6 1.5m or 6m data
- Addopted to medium size fields and agriculture machinery accuracy
- In cooperation with local precise agriculture companies and thier specialists
- **Crucial role of *in-situ* data**
- **Can be easily adopted to *Sentinel-2***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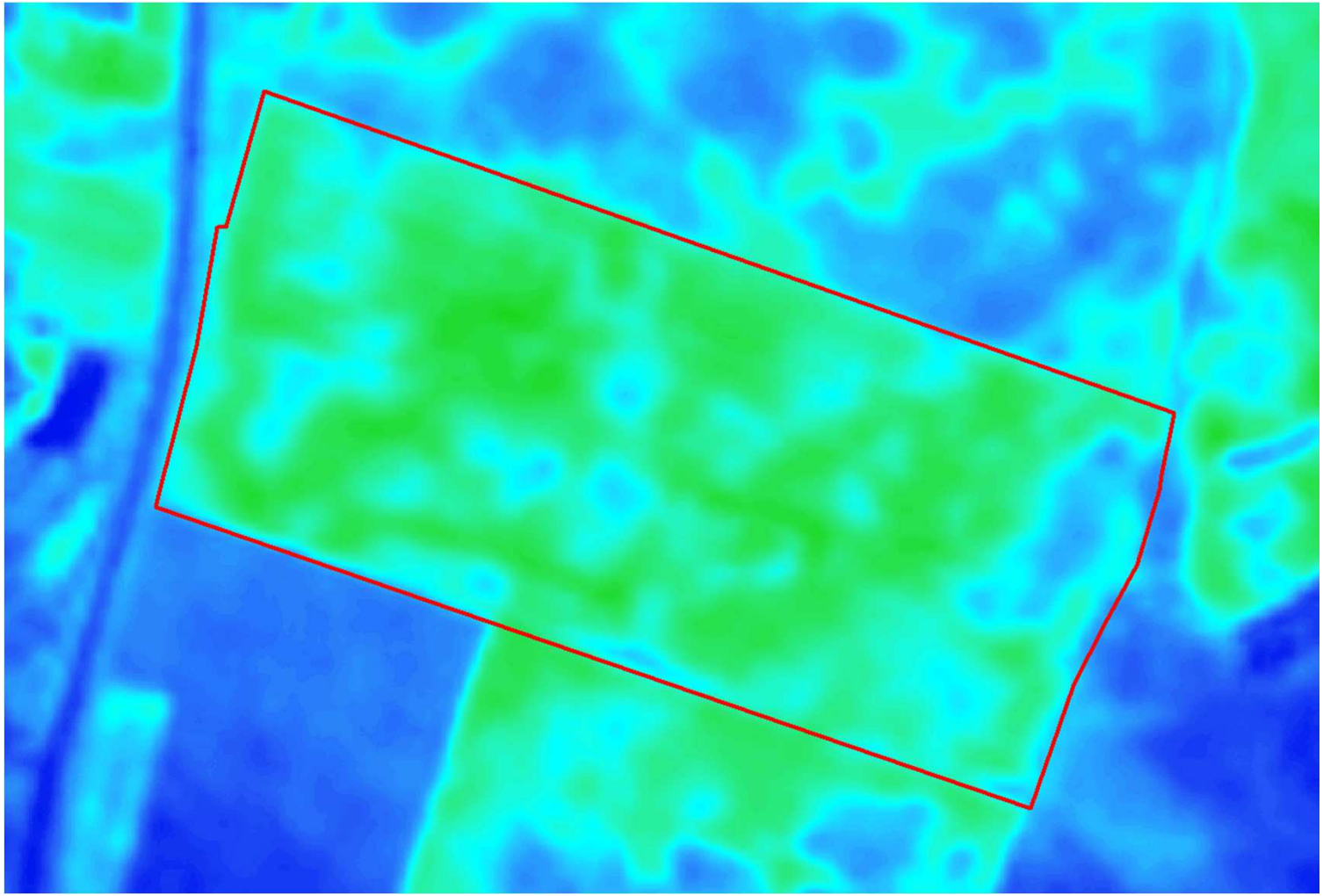
Mała zawartość piasku
Duża zawartość piasku

Agriculture support service



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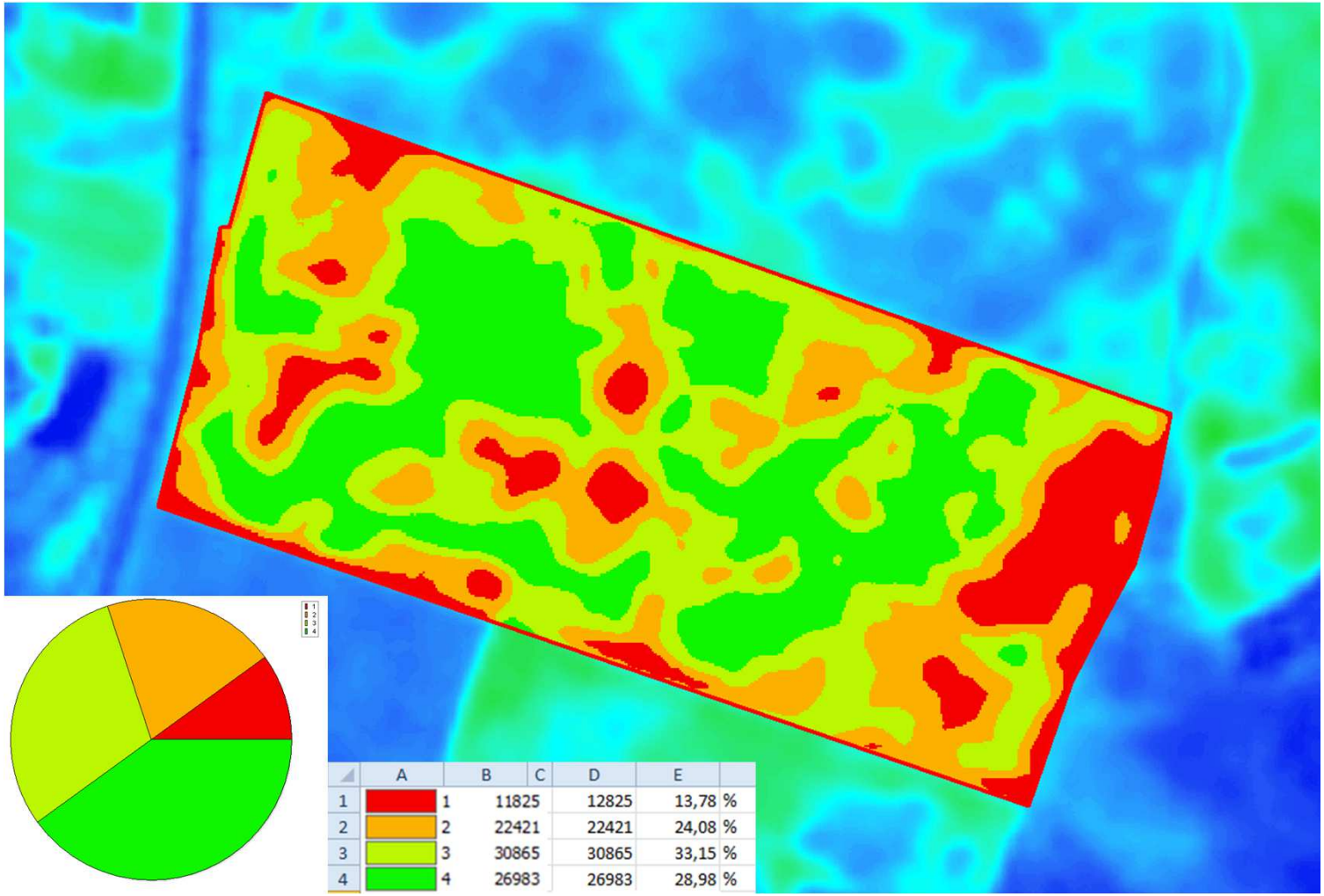

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1		1	11825	12825	13,78	%
2		2	22421	22421	24,08	%
3		3	30865	30865	33,15	%
4		4	26983	26983	28,98	%

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ENERGY CROPS ANALYSIS

B-FIRST

B-FIRST: Implementation of remote sensing data and models in optimizing the localisation of renewable energy sources on the example of biofuel crops with respect to ecological constraints

ESA PECS project no 4000105537/12/NL/KML

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BFIRST "Key questions"

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Is it profitable for Farmer to change to energy crops?

Should region (*gmina*) invest in biogas power station?

What are perspectives for regional and national renewable energy plans?

What are best locations for energy crops

What is the optimal localisation of energy crops?

What are best energy crops for each field?

What is income/loss for change to energy crop?

Can new energy crops plantation cover regional needs?

Can renewable energy development harm the envionment?

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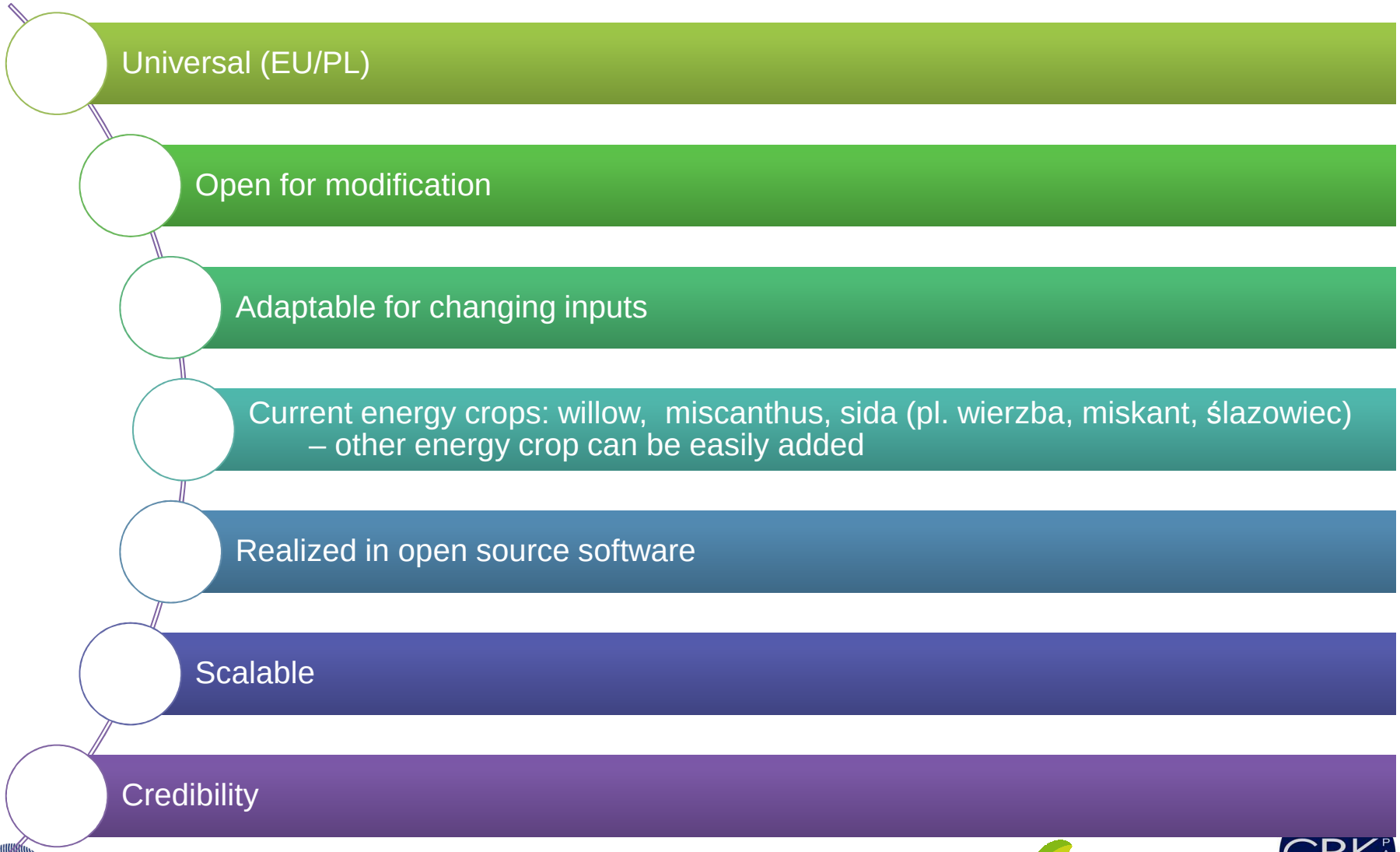
BFIRST Modeling assumptions



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BFIRST Modeling aspects

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Biogas power plant:

- Location of existing/potential power plants

Type of crops (agronomical and ecological):

- Biomass production depending on soil
- Typical annual incomes, soil dependant (including creation amortization), including direct subsidiaries

Localization:

- Exlcuded land cover and protected area
- Water protection zones

Influence on environment:

- Acidification
- Eutrophisation
- CO_2 reduction

Transport

- Road based transport to power plant
- Categorized road network and rail road delivery points

Local consumption/needs of energy from energy crops

INPUT

- Land cover
- Road network
- Soil maps
- Biogas power plants localization
- Protected ares
- …

∑ = 17

adaptation and weighting

- Predefined economic factors (can be modified)
- Transport indicators
- Local power consumption

Criteria:

- Economy
- Environment
- Energy

OUTPUT

- Intermadiate results and statistics
- Optimal recommendation maps

∑ = 20

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BFIRST Satellite image processing

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- Image processing based on Space Research Centre PAS (*CBK PAN)* methodology

AIM

- Detailed Land Cover
- Integration with external GIS databases
- Additionally: granularity of fields; specific crops detection

SOURCES

- Based on optical images:
  - SPOT5 – resolution10m
- Improved with SAR:
  - RADARSAT – resolution 8m, quad polarization
  - TerraSAR-X – resolution 3 m, dual polarization

PROPERTIES

- Scalable
- Credible thrugh detailed *in-situ* verification
- High resolution of analysis
- Ready to utilize ESA Sentinel

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Power	Economy	Environment
Recommendation map for crops that generates most energy	Recommendation maps for most profitable crops	Recommendation maps for environment friendly crops

Additional set of scenario maps; grading maps for each energy crop; statistic for each analyzed energy crop and statistic for recommended crop.

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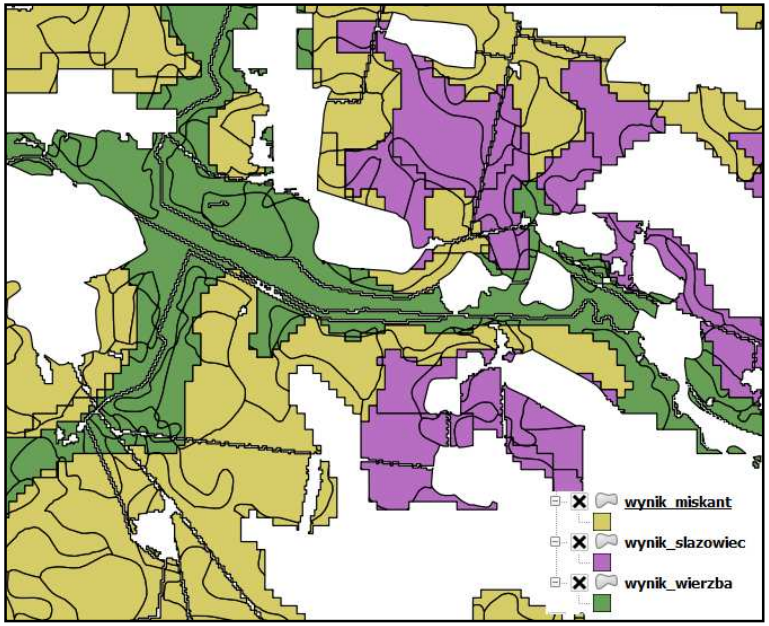
Multi-criteria analysis
ΔkWh [PLN] Δ$ [kWh] Δeco [points]

Power | **Economy** | **Environment**

Recommendation maps for optimal crop plus output energy production and incomes for farmers



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BFIRST Model advantages

Scalable

- Regions applicable
- Single field application

BFIRST Model advantages

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Regions applicable
Single field application

Open for input data modification

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Single field application

Open for input data modification

Maps:

CORINE, national survey offices, COPERNICUS HR Layers

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EO:

Different resolution of optical images HR, MR; also could be realized only with SAR data
Open for Sentinel data

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Crops statistics:

User can add easily new crop (also energy one)
User can modify economic and energy factors for each crop, including easy implementation of direct subsidiaries

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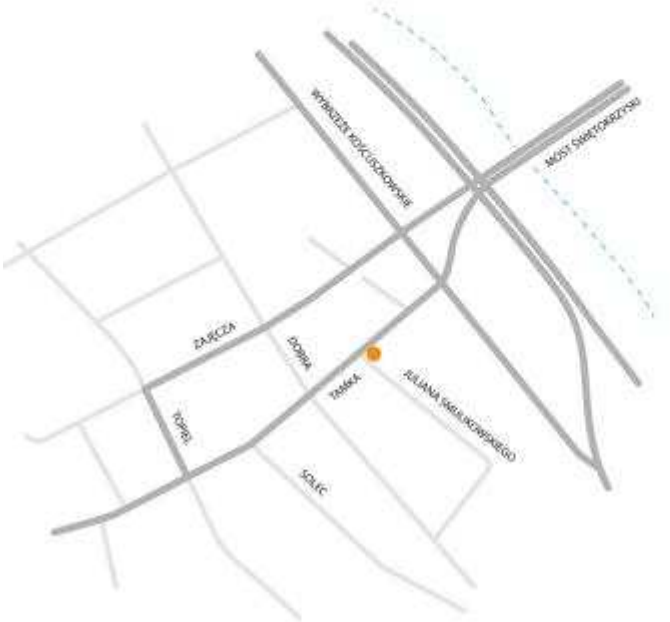
Open for new elements

Railroad transortation
Forest sourced biomass
Biogas power plants could be substituted with other users

Thank you !



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