



Využití ENVI Crop Science modulu v precizním zemědělství

Jan Lukáš¹, Radek Pražan², Kateřina Křížová¹

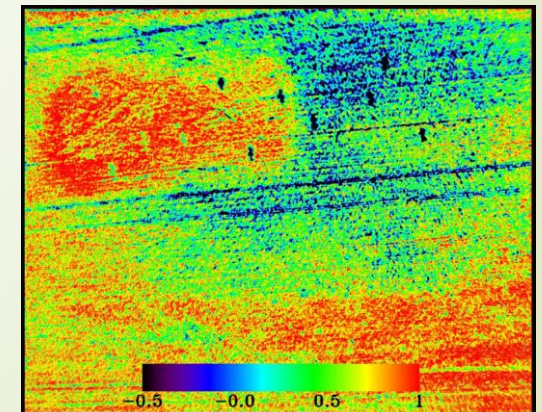
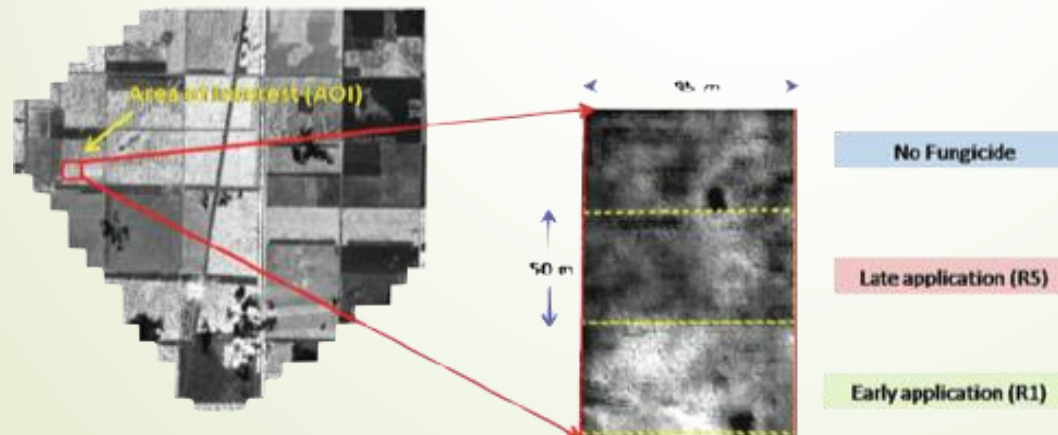
¹Výzkumný ústav rostlinné výroby, v.v.i.

²Výzkumný zemědělské techniky, v.v.i.



Heterogenita prostředí

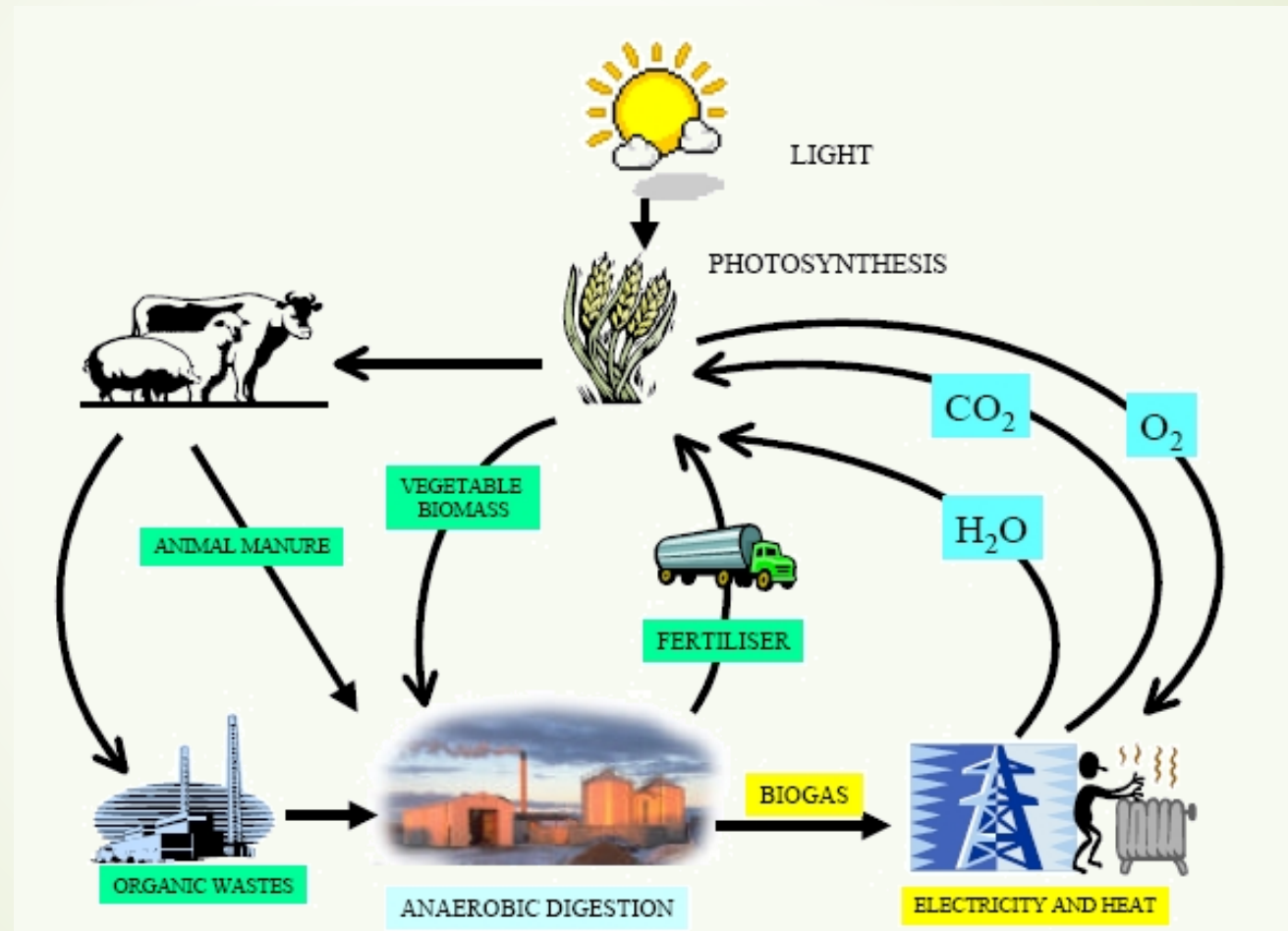
- Precizní zemědělství – heterogenita (prostorová, časová, faktorová)
- Rozlišení heterogenity ve velkém měřítku umožňují nové technologie
- Mapy heterogenity jsou podkladem pro cílený management
- Aplikační mapy - výstupní nástroj pro konkrétní opatření



Příklad hnojení trvalého travního porostu



Příklad hnojení trvalého travního porostu



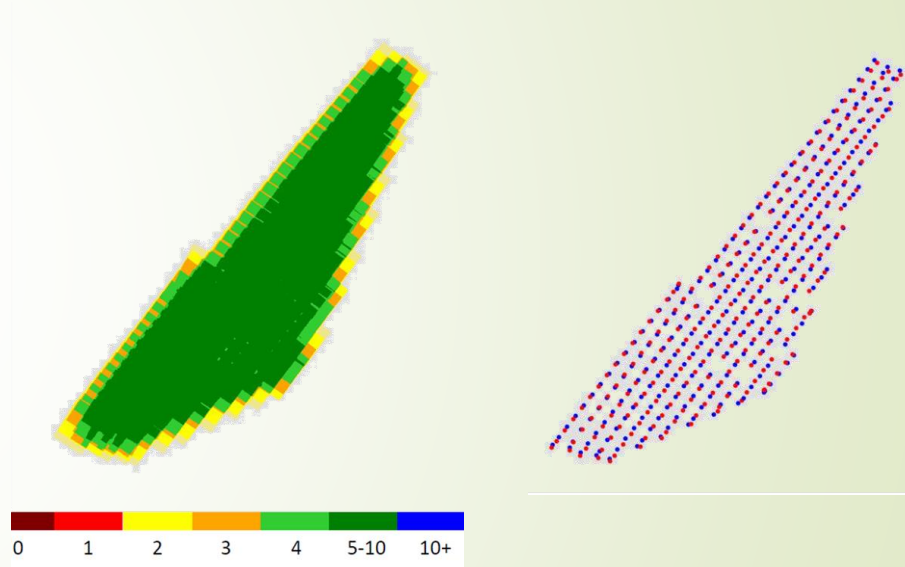
Aplikace digestátu hadicovým aplikátorem na TTP



Vstupní data

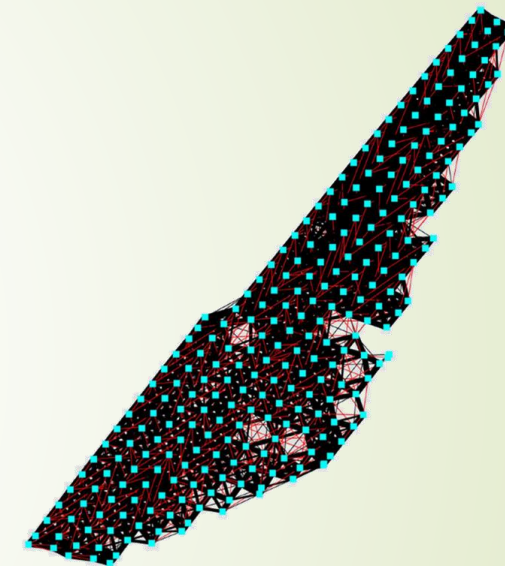
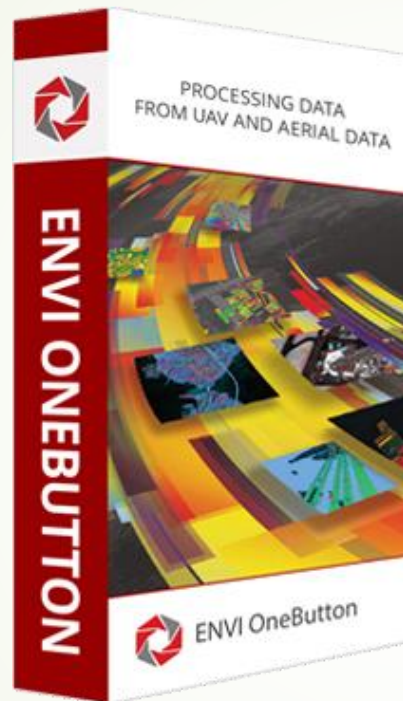


Výška: 32m AGL
Rychlost: 5.1 m/s
Interval závěrky 2.0 sec
Interval snímání čelní: 10.3m., boční 10.1m
Čelní překryv 80%
Boční překryv 70%
Úhel gimbálu -90°
Celková snímaná plocha 2.65ha
Délka letové dráhy 2856m
Fotografie 4864x3648, F3.2, 1/400,
ISO 400 JPEG komprese
Počasí: Mrholení, 100% oblačnost



Ground sampling distance (GSD)	0.8 cm - 0.3 inch (approximate input gsd) / 1.0 cm - 0.4 inch (output)
Sensor type	Standard
Camera make	DJI
Camera model	FC6310
Input spatial reference	WGS 84 (EPSG:4326)
Output spatial reference	WGS 84 / UTM zone 33N (EPSG:32633)
Project output	GeoTiff Image Map

Zpracování dat a ortorektifikace



Number of connections: 1-3 4-8 9-15 16-22 23-30 30+

Total processing time	01h:32m:57s
Processing result	Process completed succesfully
Image size (pixels)	4864 x 3648
Number of images processed	264 out of 264 images
Number of control points	0
Total number of matched points	19067
Mean reprojection error (pixels)	0.9805

Výstup

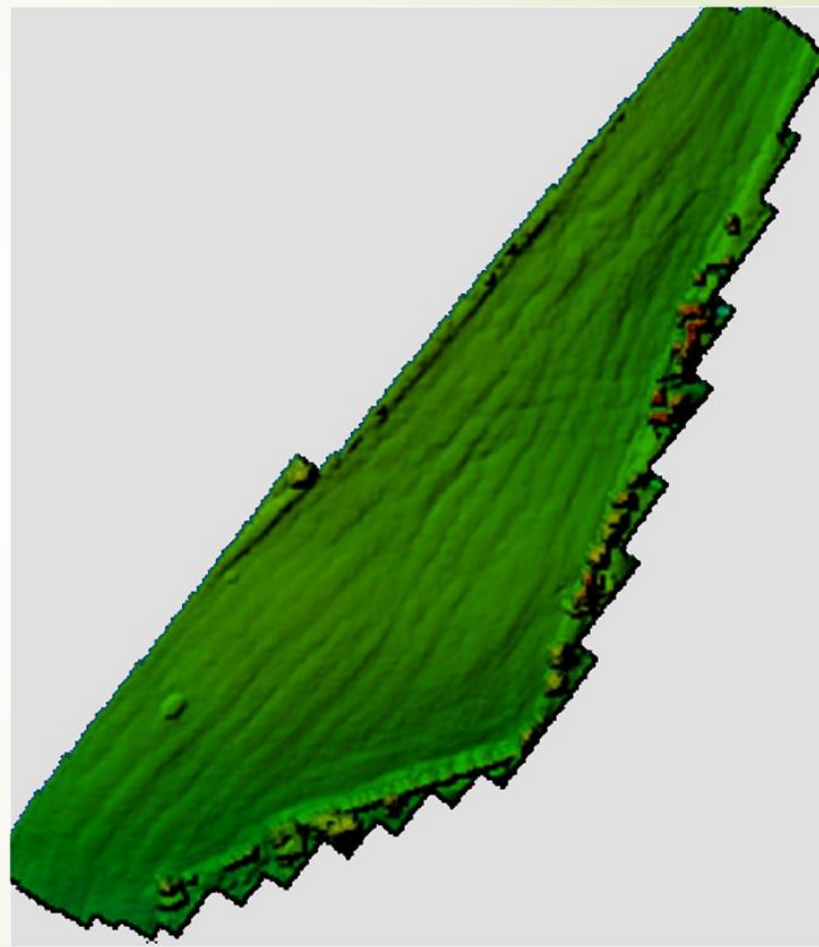


Figure-1 Final Orthomosaic and Terrain Model

Poškození pojezdem

Lokálně zvýšený výskyt plevelu (*Rumex obtusifolius*) v místech přehnojení



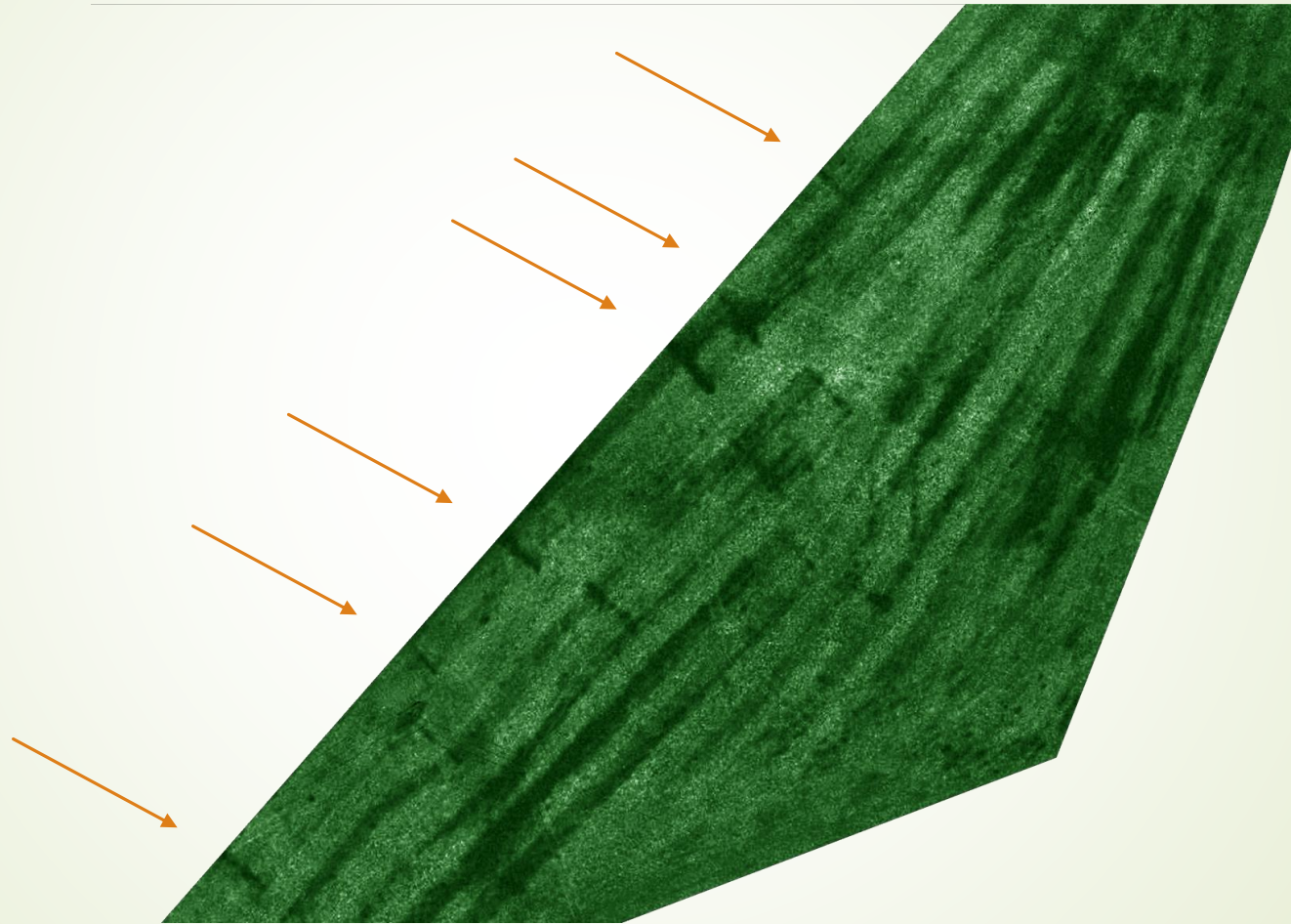
Lokálně zvýšený výskyt plevelu (*Rumex obtusifolius*) v místech přehnojení



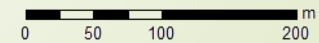
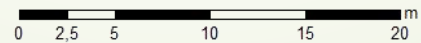
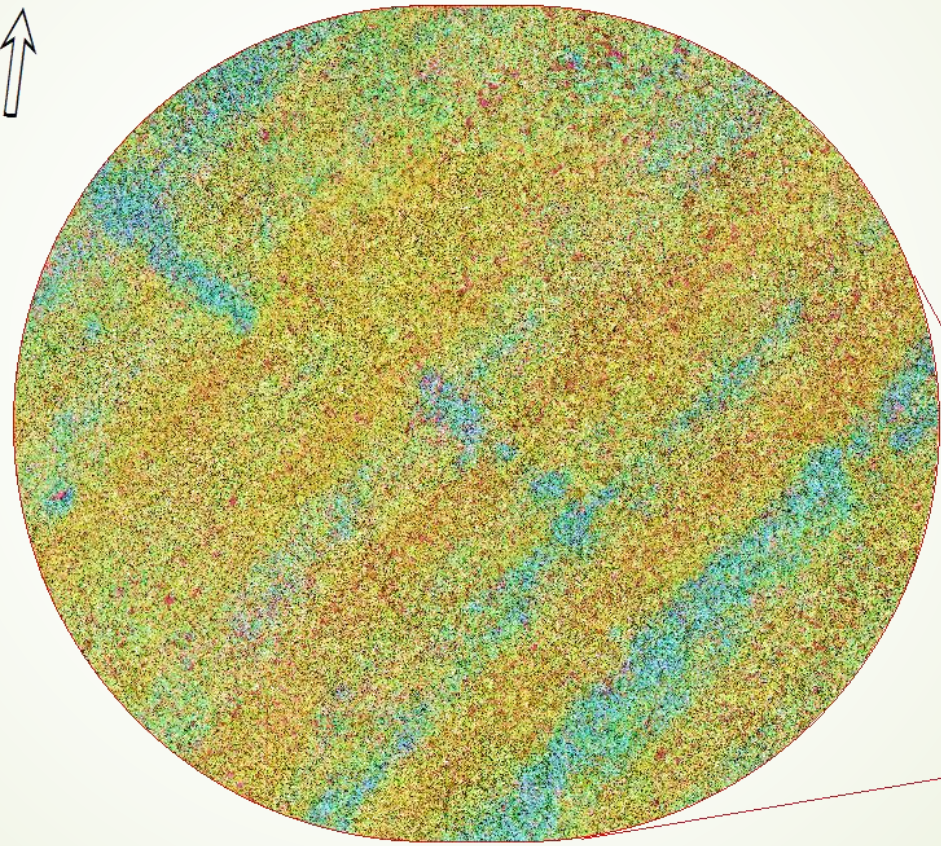
Chybná aplikace s překryvy
a zastávkami



Opakující se chybové vzorce



Opakující se chybové vzorce



Kolísající objem biomasy

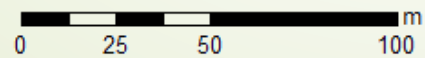
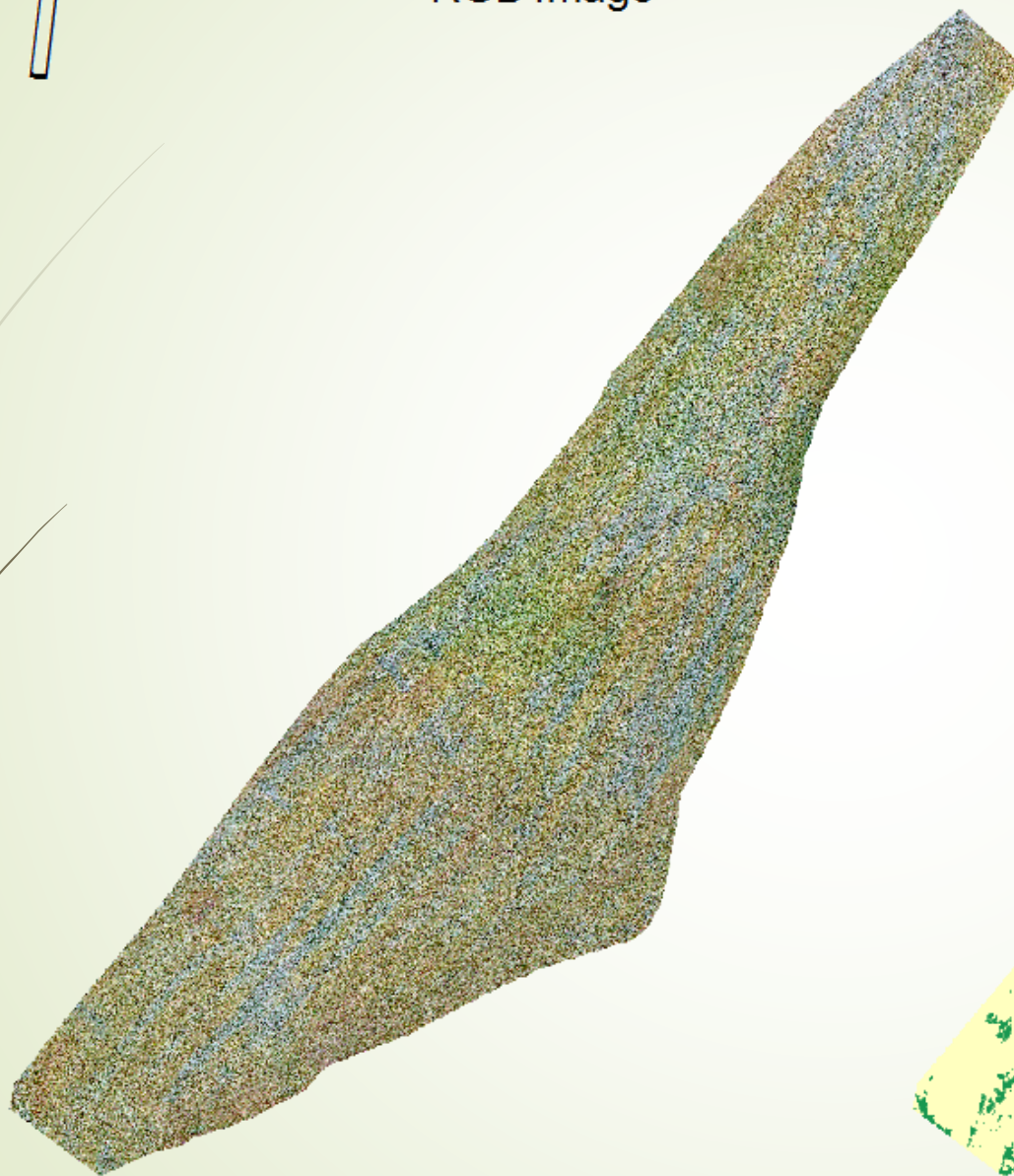


Zpracování dat

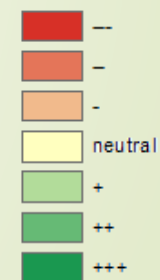
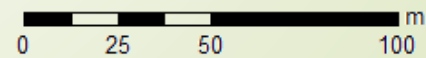
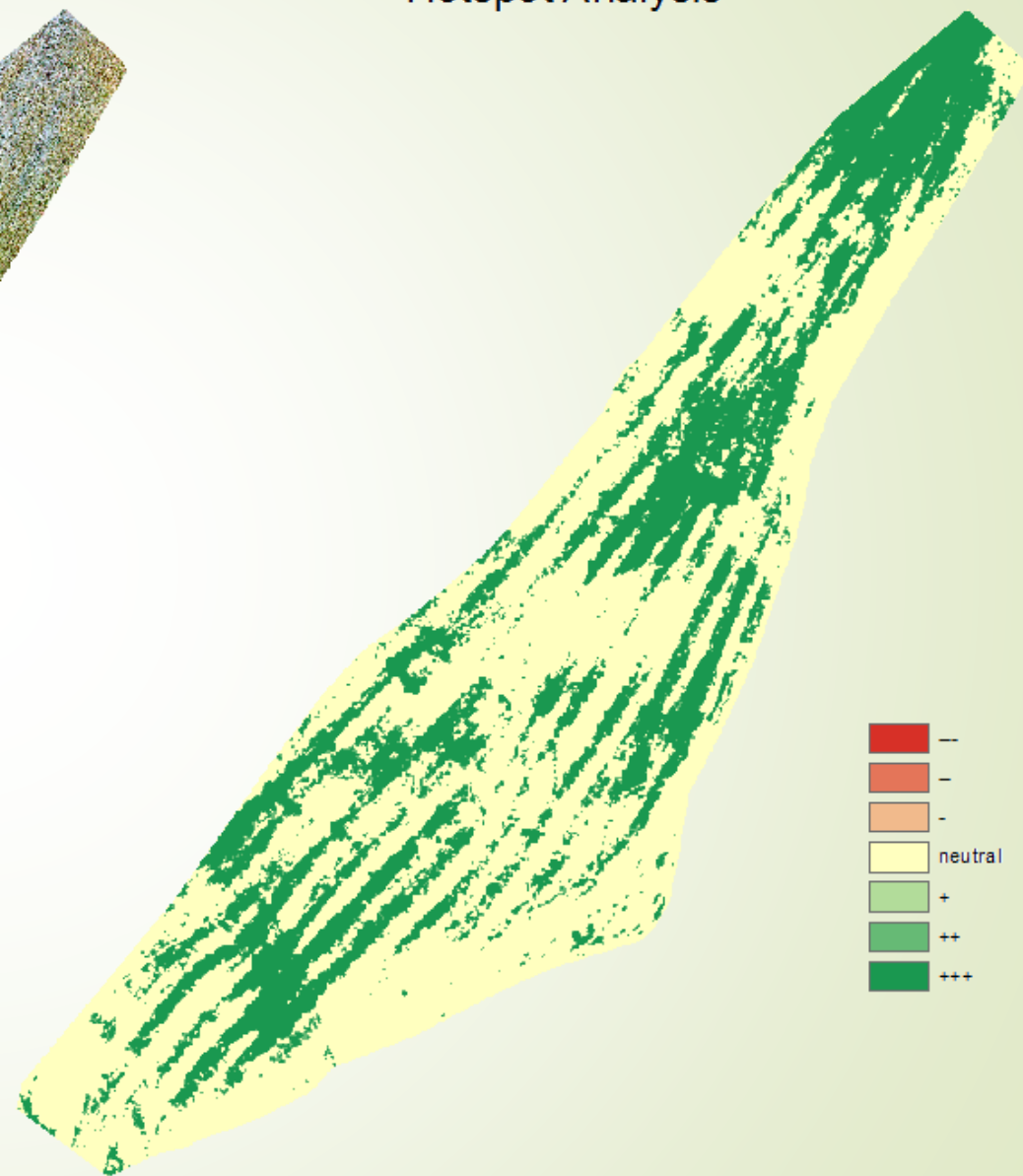




RGB Image



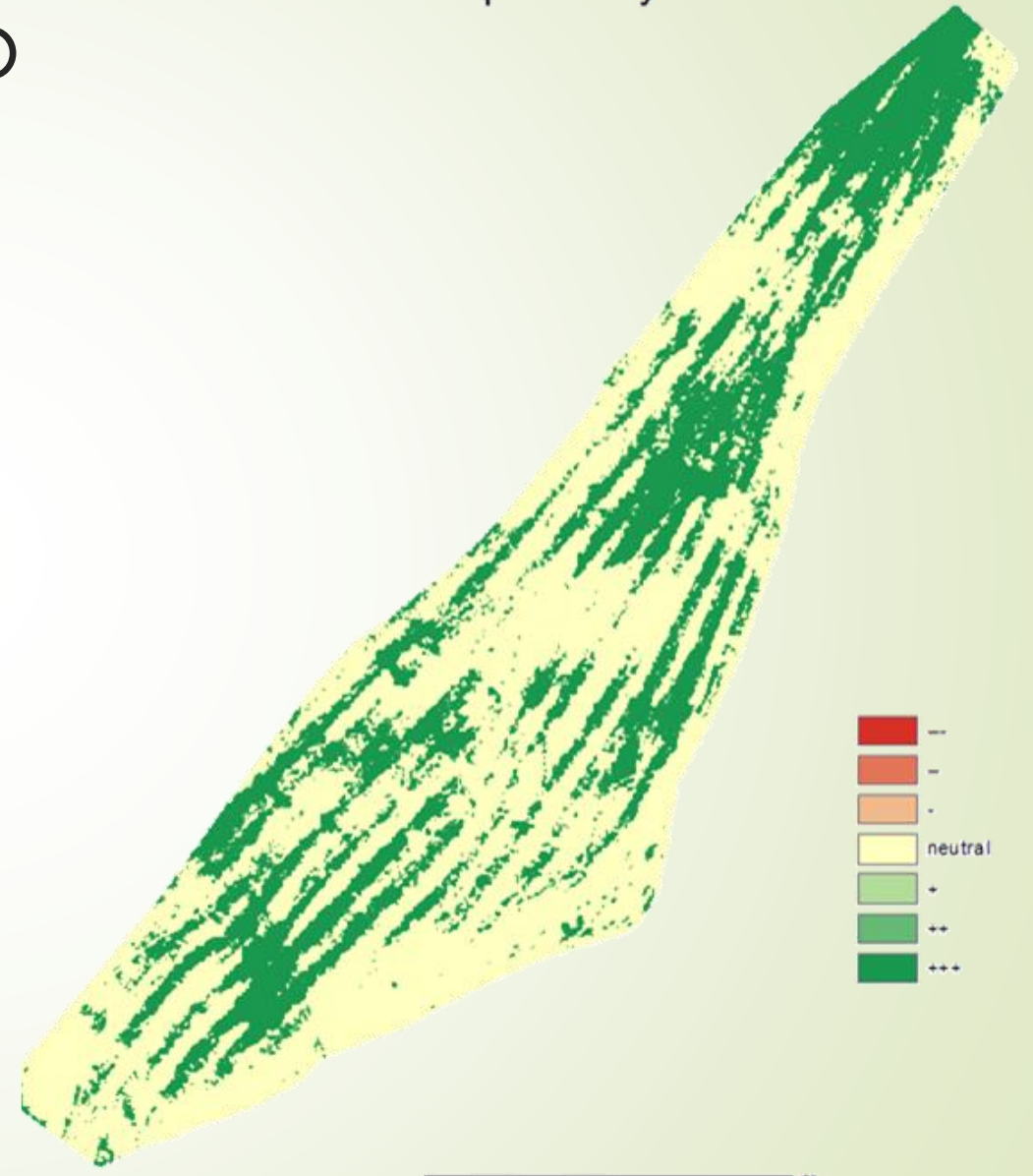
Hotspot Analysis



Chybně ošetřeno

36%

plochy



0 25 50 100 m

Závěr



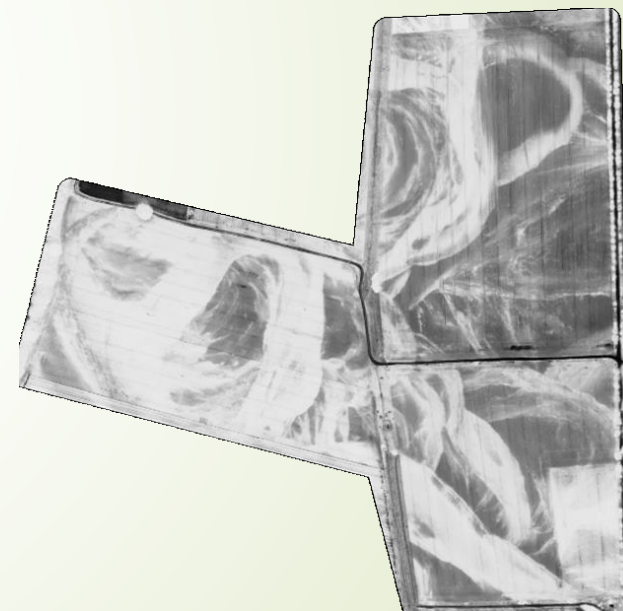
- Hot spot analýza je vhodný nástroj pro kontrolu zemědělských opatření
- Zpřesnění analýz kombinací NIR, SWIR, LWIR a lidary
- Systém řízení a kontroly kvality PZ



Závěr



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Projekt Ministerstva průmyslu a obchodu TRIO FV10213

USING ENVI CROP SCIENCE TO DETECT IRREGULAR FERTILIZER APPLICATION

ANALYZING IN-FIELD HETEROGENEITY WITH ENVI CROP SCIENCE

BENEFITS

The ENVI interface helps easily ingest RGB images captured from a UAV platform.

The Hotspot Analysis tool calculates local statistics and groups pixels with similar values.

Results are presented in a simple way on a map with a color scale from red to green.

BACKGROUND

Detection of heterogeneity (crop, soil, etc...) has gained a lot of importance in the field of site-specific farming in recent years. Areas significantly different from the surrounding are crucial to be identified to apply the right management response. It is possible nowadays to measure in-field heterogeneity using various sensors, but the data analysis and results explanation are the main challenge.

BUSINESS PROBLEM

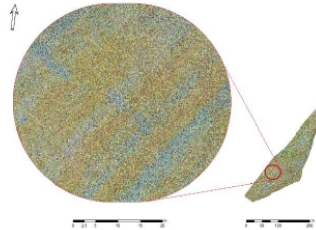
A fertilizer spreader has developed a defect while applying fertilizer to a field and therefore the application has become irregular. This has caused very different growth conditions within one single plot and the vegetation has responded by different growth rates. An understanding of these variations in growth rates was required to apply prescriptive farming techniques and better estimate the impact on the yield.

The Crop Research Institute (CRI) in the Czech Republic was asked to carry out the research in the detection of heterogeneity in the field in question.

DATA CAPTURE AND INGESTION

The result of the irregular spreading became noticeable even on simple RGB images, captured using a UAV platform, however the significance of this growth difference could not be quantified without deeper analysis.

The blue band was chosen when creating the single band raster as an input in ENVI 5.4. Spatial resolution of this input raster was 0.1 m. The Search Distance was set up for 0.5 m, so the tool was searching similar pixel values in the distance of 50 cm.



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ENVI CROP SCIENCE HIGHLIGHTS

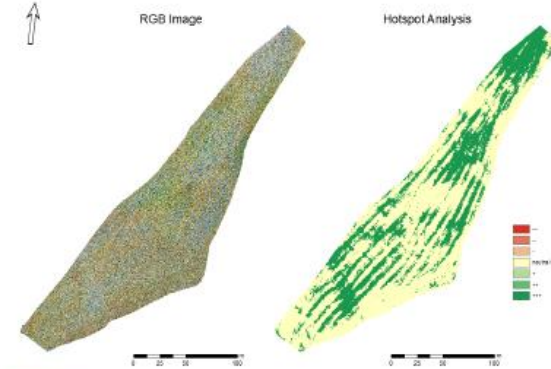
Enabled for desktop or cloud environments, ENVI Crop Science allows analysis to be automated – putting actionable information into the hands of decision makers in the field.

Create maps and reports from high-level views of fields, all the way down to individual plant health information.

Real-time preview function offers the ability to adjust parameters prior to running the analysis.

HOTSPOT ANALYSIS

The Hotspot Analysis tool of ENVI Crop Science can determine regions of a field that require attention: it can calculate local statistics and to group pixels with similar values. The results are then presented in a very simple way – on a map, where values significantly negatively different are marked by red while significantly positively different areas are represented by green colour.



CONCLUSIONS

The resulting map presents the field heterogeneity in colours. When comparing the output with the input RGB image, the same areas had been marked. Green coloured lines thus very likely indicate the lines, where the fertilizer spreader has applied different amount of fertilizer, respectively greater amount.

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