Detection, Monitoring and Control of Alien Plant Species: a Hybrid Approach

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Studied species

Heracleum mantegazzianum

Fallopia sp.

Robinia pseudoacacia

Ailanthus altissima
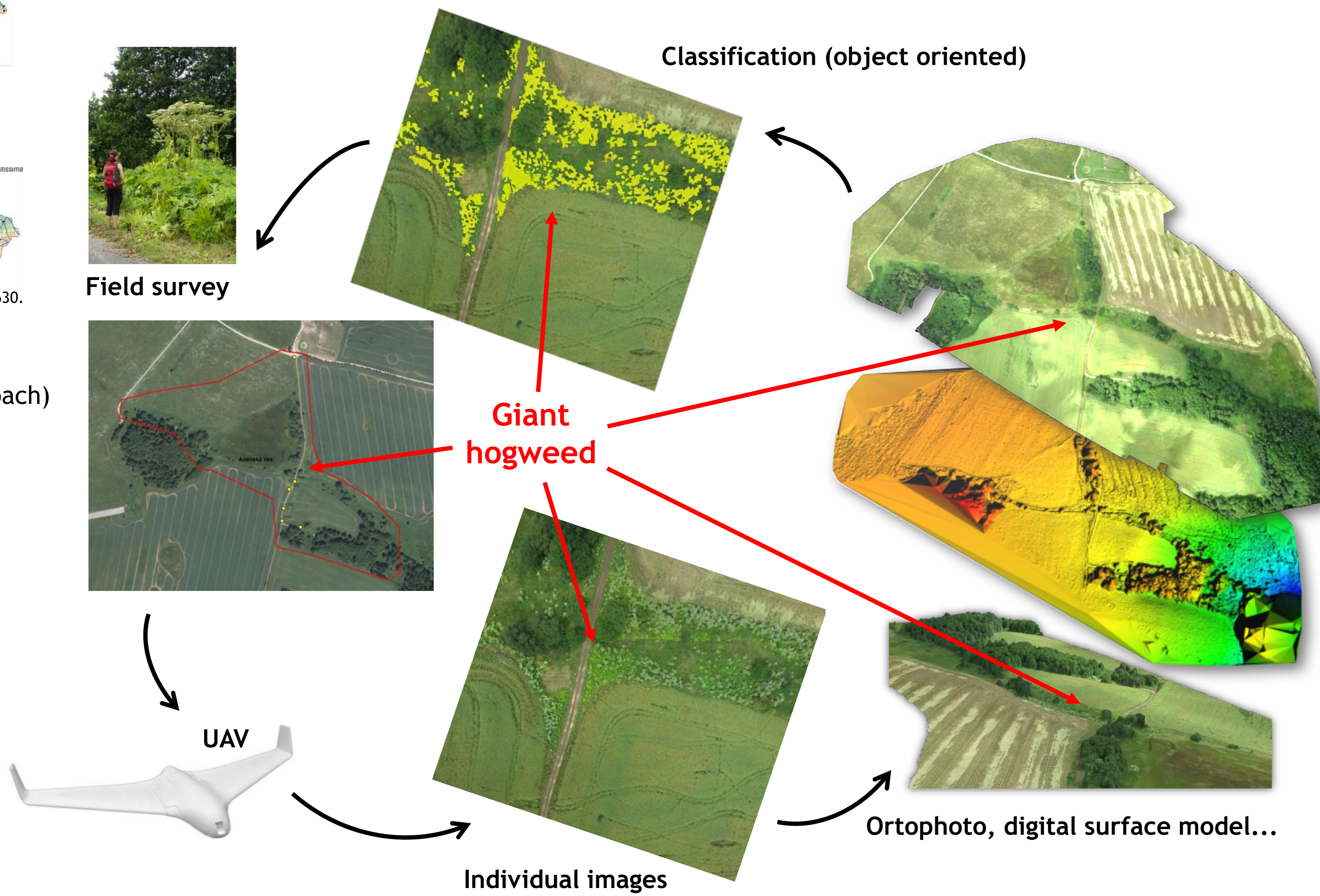
Pyšek et al. (2012), Preslia 84: 576-630.

Remote sensing data:

- UAV (5 cm)
- panchromatic historical aerial photography (0.5 m)
- color aerial orthophotos (0.5 m)
- World View-2 (0.5/1.84 m PAN/MSS)
- World View-3 (0.3/1.24 m PAN/MSS)
- Pleiades (0.5/2.8 m PAN/MSS resolution)
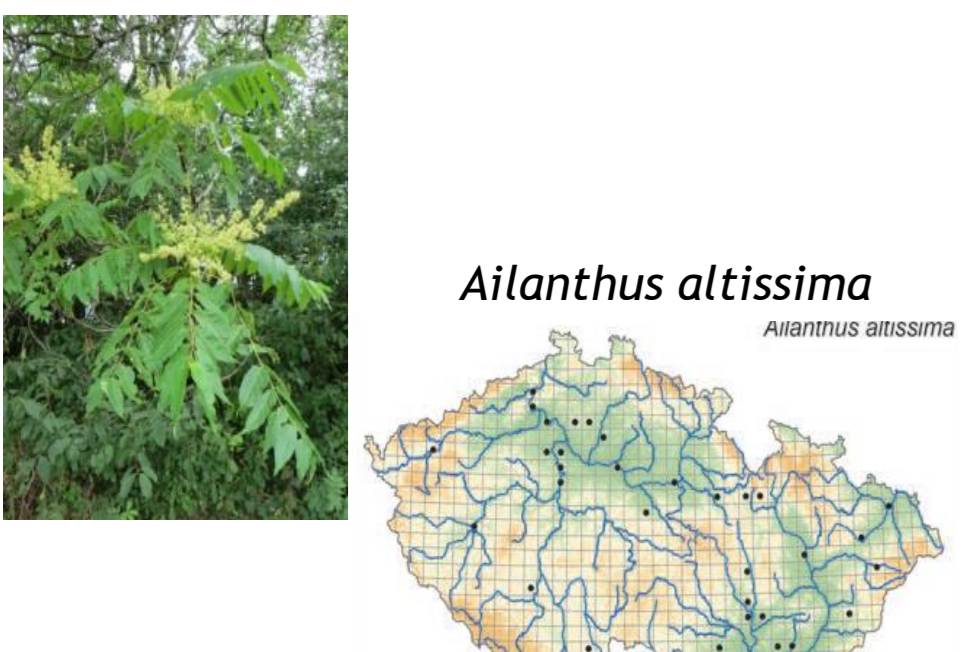- RapidEye (6.5 m)
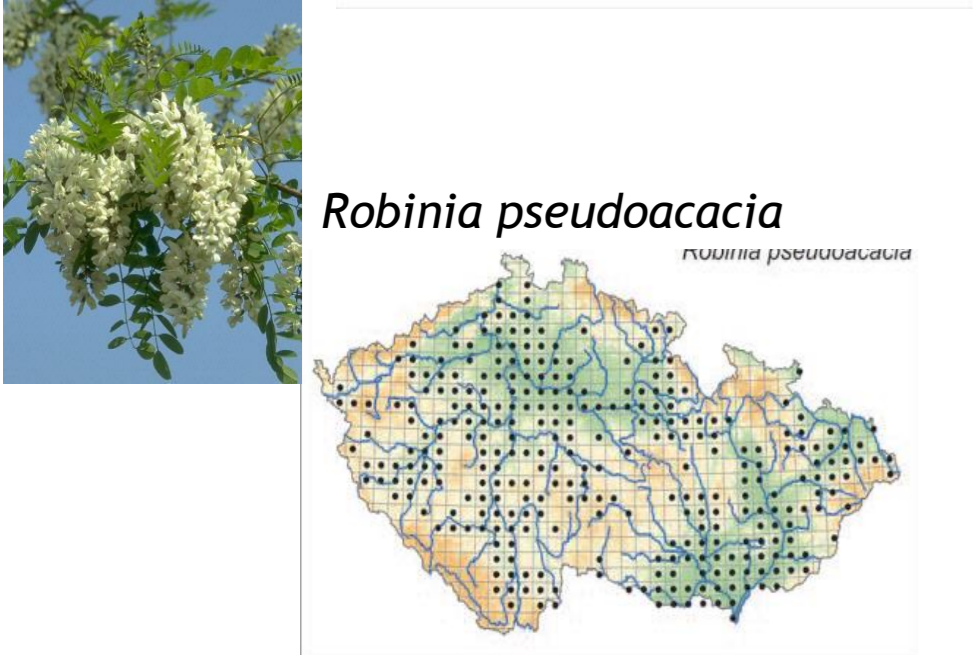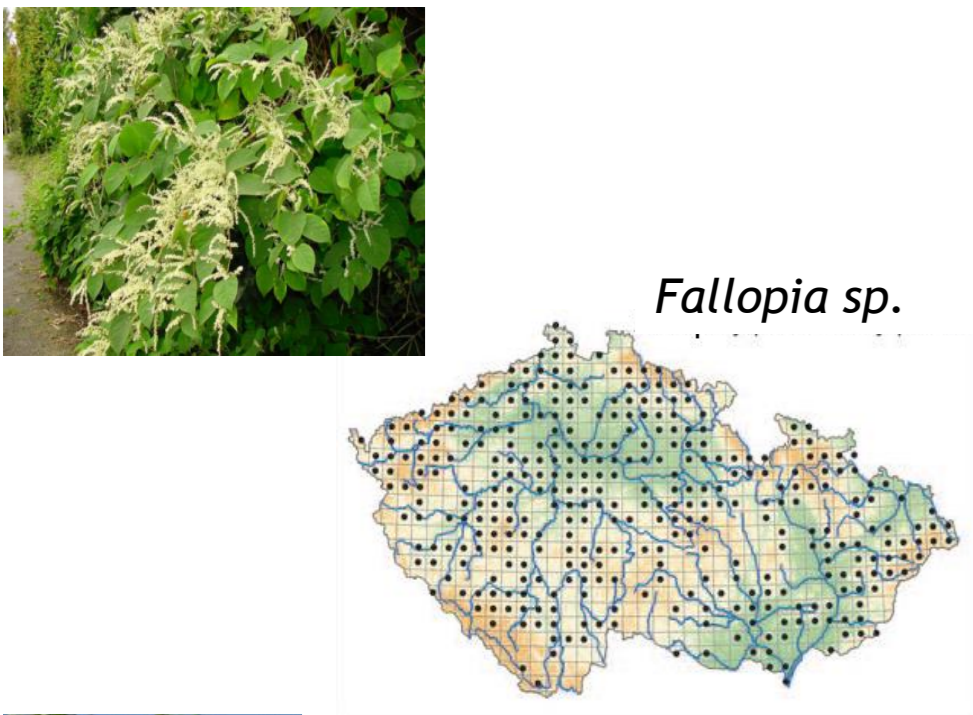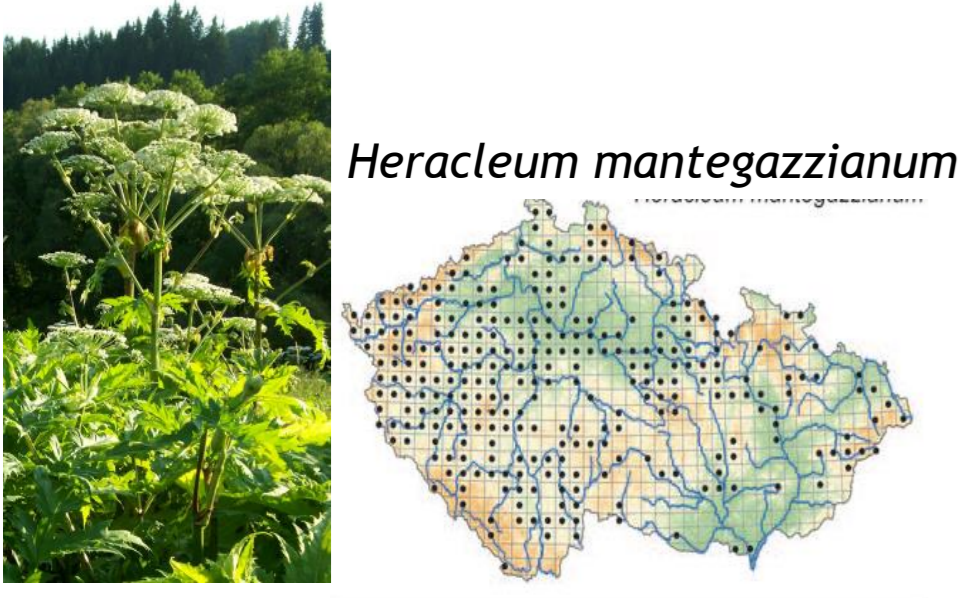- Sentinel-2 (10 m)

Classification approaches:

- pixel-based - unsupervised (ISODATA, K-means and Fuzzy K-means) and supervised (maximum likelihood and minimum distance)
- object-based - multiresolution segmentation, ruled-based classification
- hybrid approach (inter-object variability)
- aspect of phenology and change detection, use of additional thematic layers (e.g. DEM)

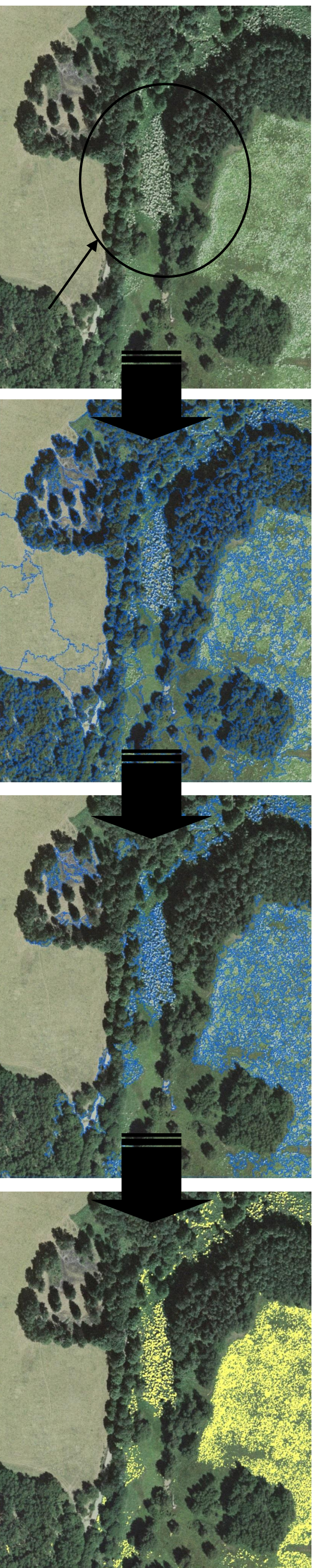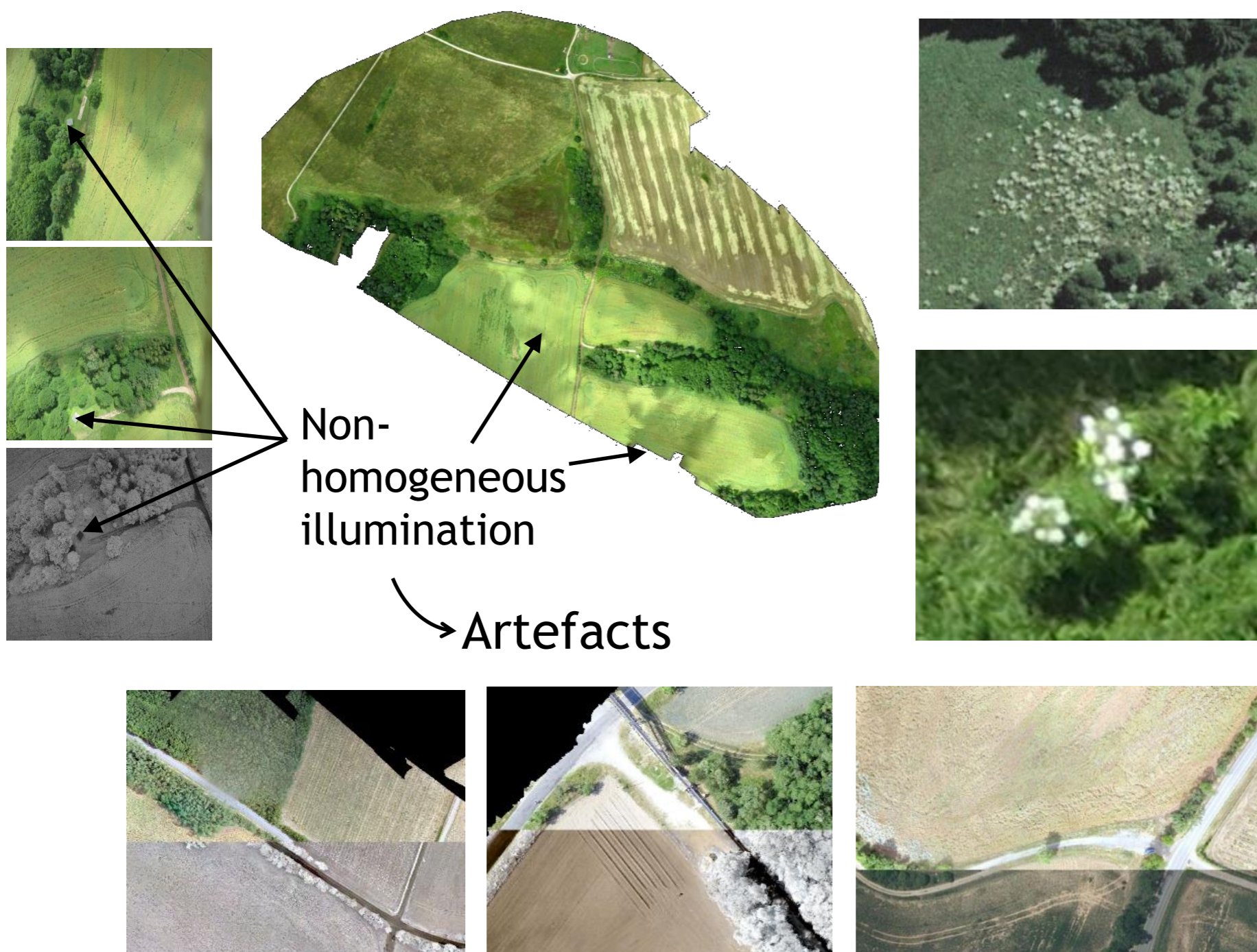## Example of workflow – giant hogweed detection from UAV MSS data

Classification (object oriented)

Field survey

Giant hogweed

UAV

Individual images

Ortophoto, digital surface model...

Giant hogweed – different resolution

Panchrom.(1962, Dobruška) Color (2006, GEODIS, 0.5 m res.)

UAV (2015, 5 cm res.) RapidEye (2010, 6.5 m res.) Pleiades (2013, 2.8 m res.)
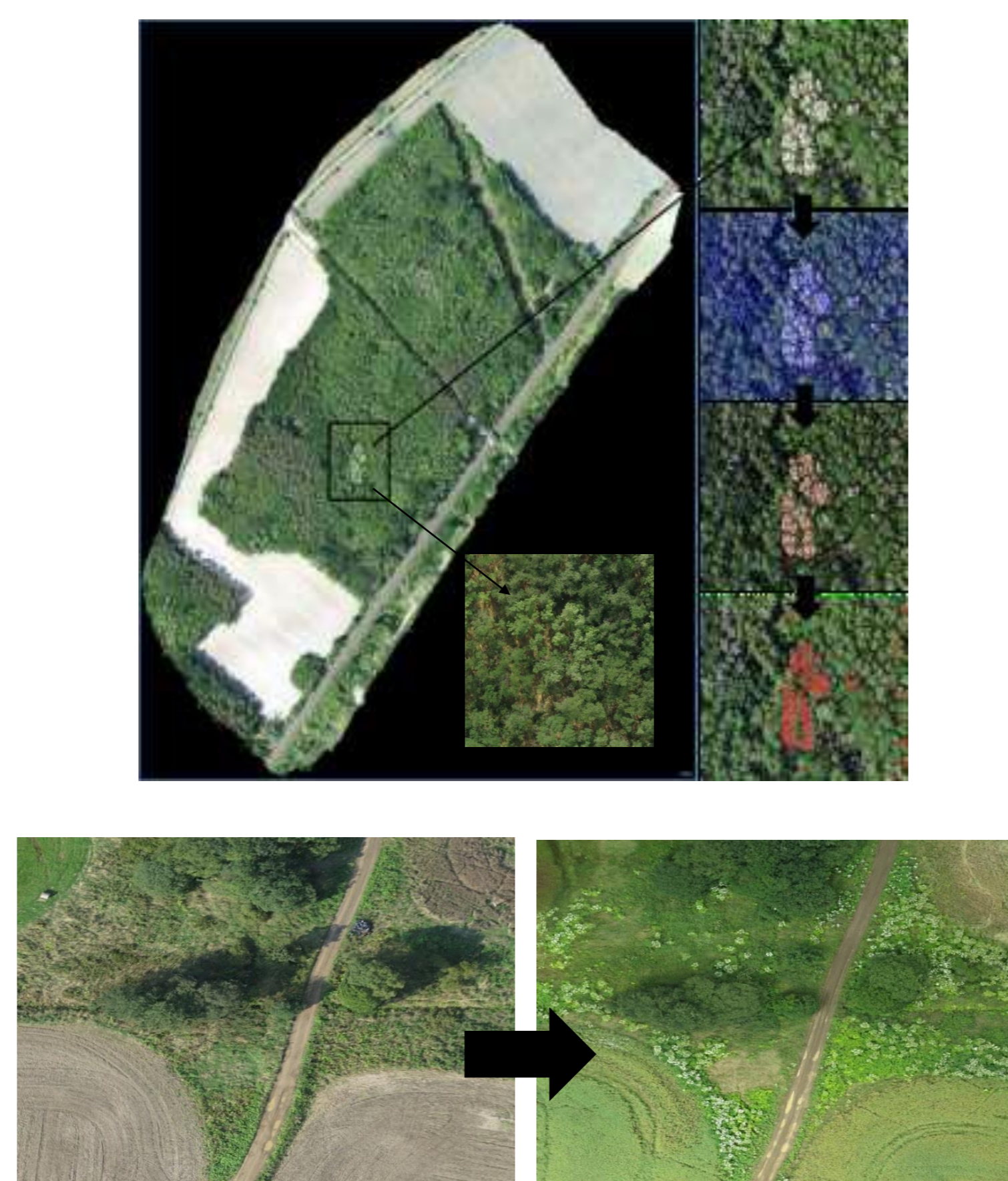
Image classification (object-oriented approach)

PROBLEMS of UAV

- Amount of data
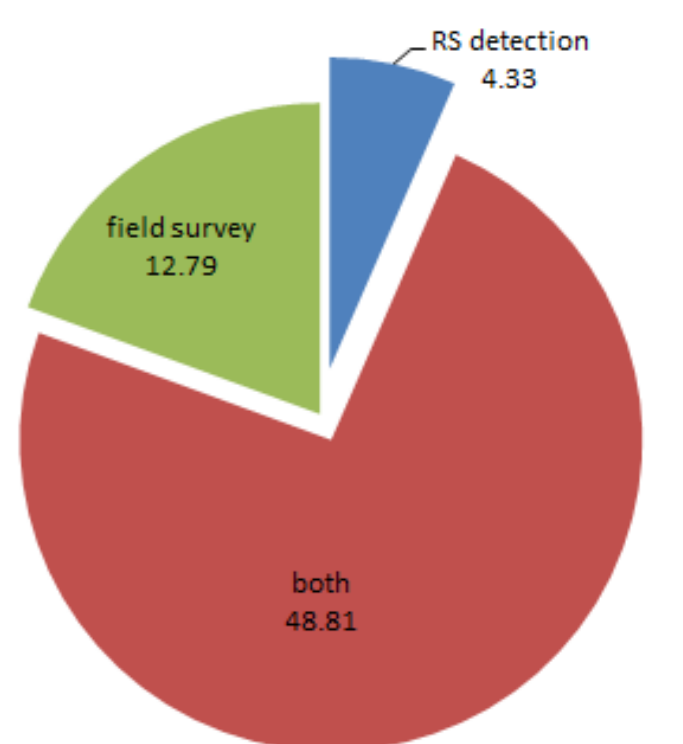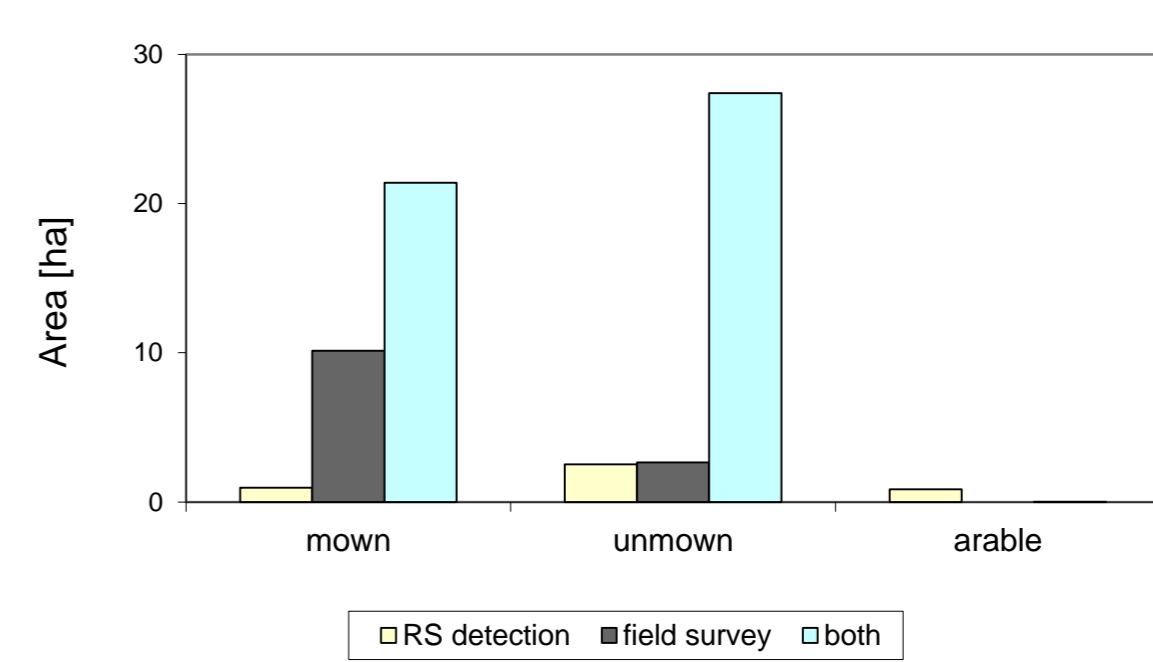- Differences in images (radiometric and geometric distortions) – demanding pre-processing

Non-homogeneous illumination

Artefacts

Role of PHENOLOGY

Giant hogweed invasion progress

H. mantegazzianum invasion in Slavkovský Forest, Czech Republic mapped from aerial imagery (VGHMÚř and Geodis)
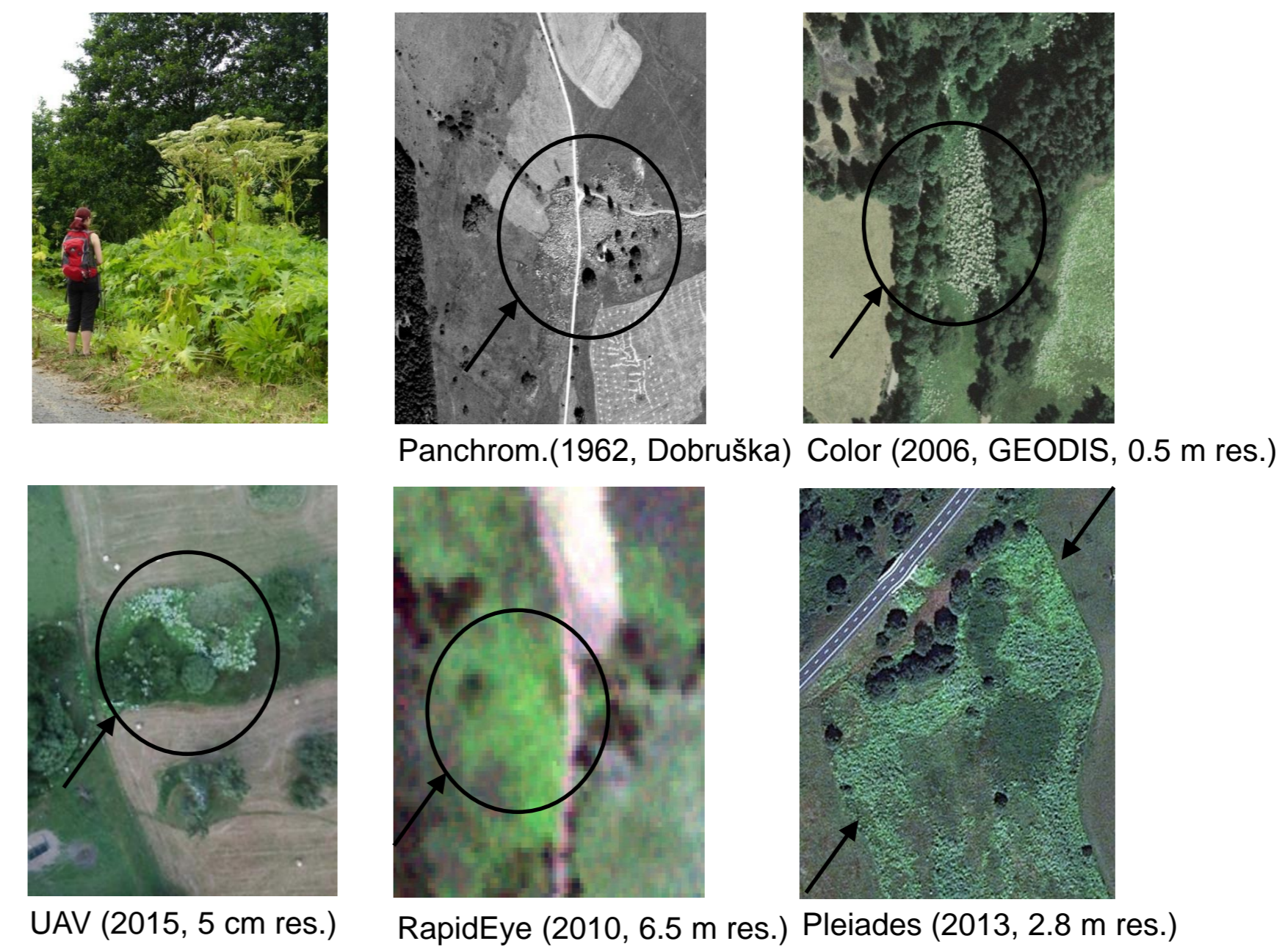

1962

1973

1991

2006

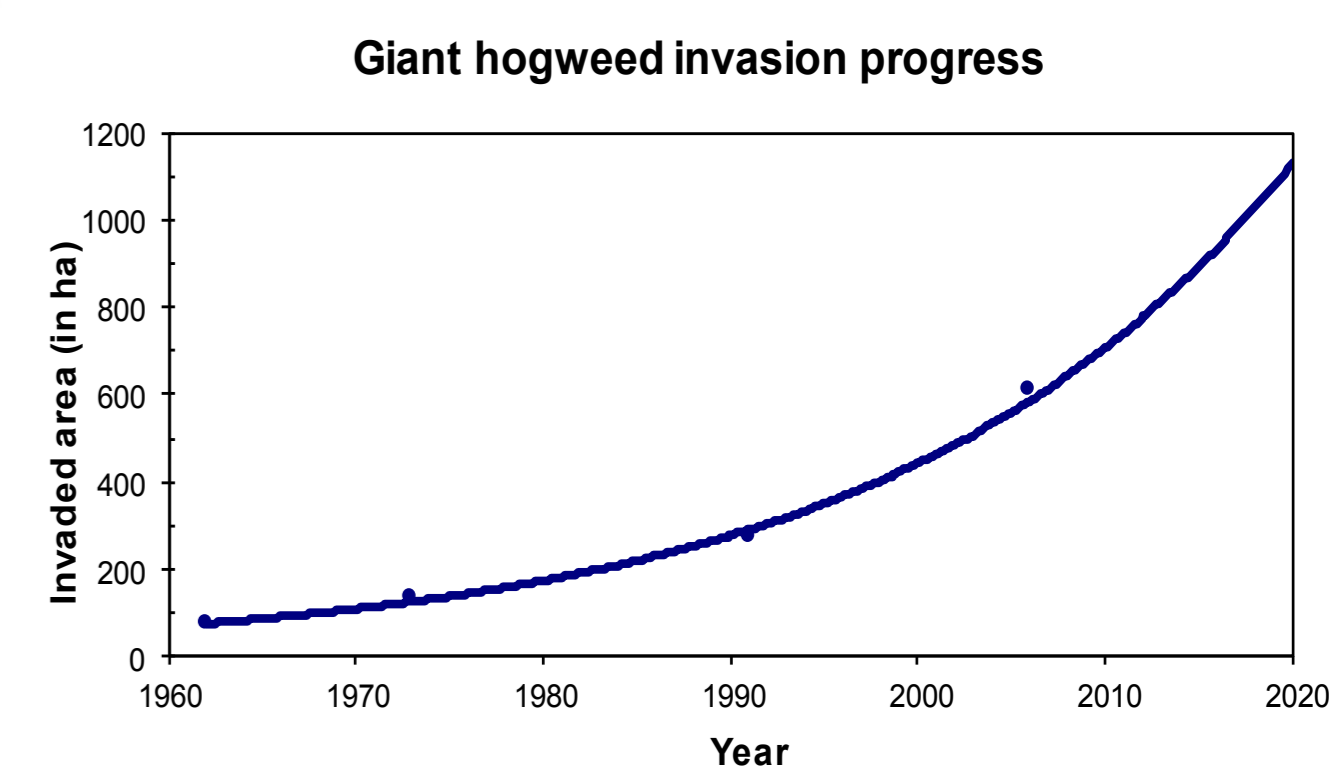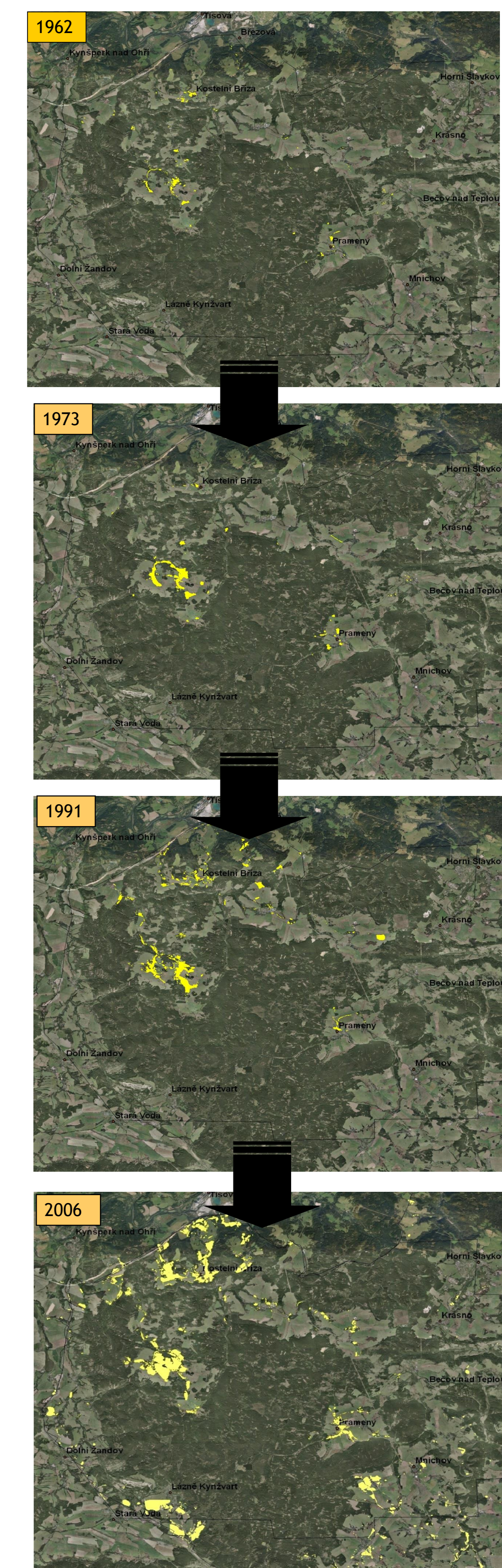## TRADE-OFFS between accuracy/scale, field/RS survey

1. Choice of data, method and acceptable accuracy level depends on species and purpose
2. Spectral vs spatial resolution – compensated
3. LIMITS- under the canopy, if mown (grazed), species less distinct...
4. ADVANTAGES – faster, more objective, repeatable, lower costs, UAV – flexible, targeted, but pre-processing more complex

References:

Dvořák, P., Müllerová, J., Bartaloš, T., and Brůna, J.: Unmanned aerial vehicles for alien plant species detection and monitoring. Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-1/W4, 83-90.

Müllerová J., Pergl J. & Pyšek P. (2013): Remote sensing as a tool for monitoring plant invasions: testing the effects of data resolution and image classification approach on the detection of a model plant species Heracleum mantegazzianum (giant hogweed). - International Journal of Applied Earth Observation and Geoinformation 25: 55-65.