Vegetation and drones?

WG 2 – Natural vegetation group

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HARMONIOUS
uas for environmental monitoring

Vegetation and drones? What did we learn

What can drones tell us about natural vegetation?

How to assess ecosystem heterogeneity & complexity?

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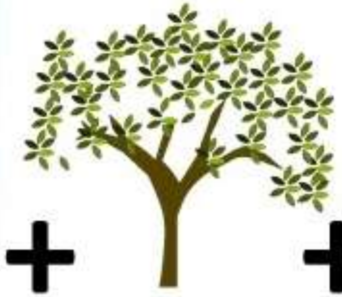

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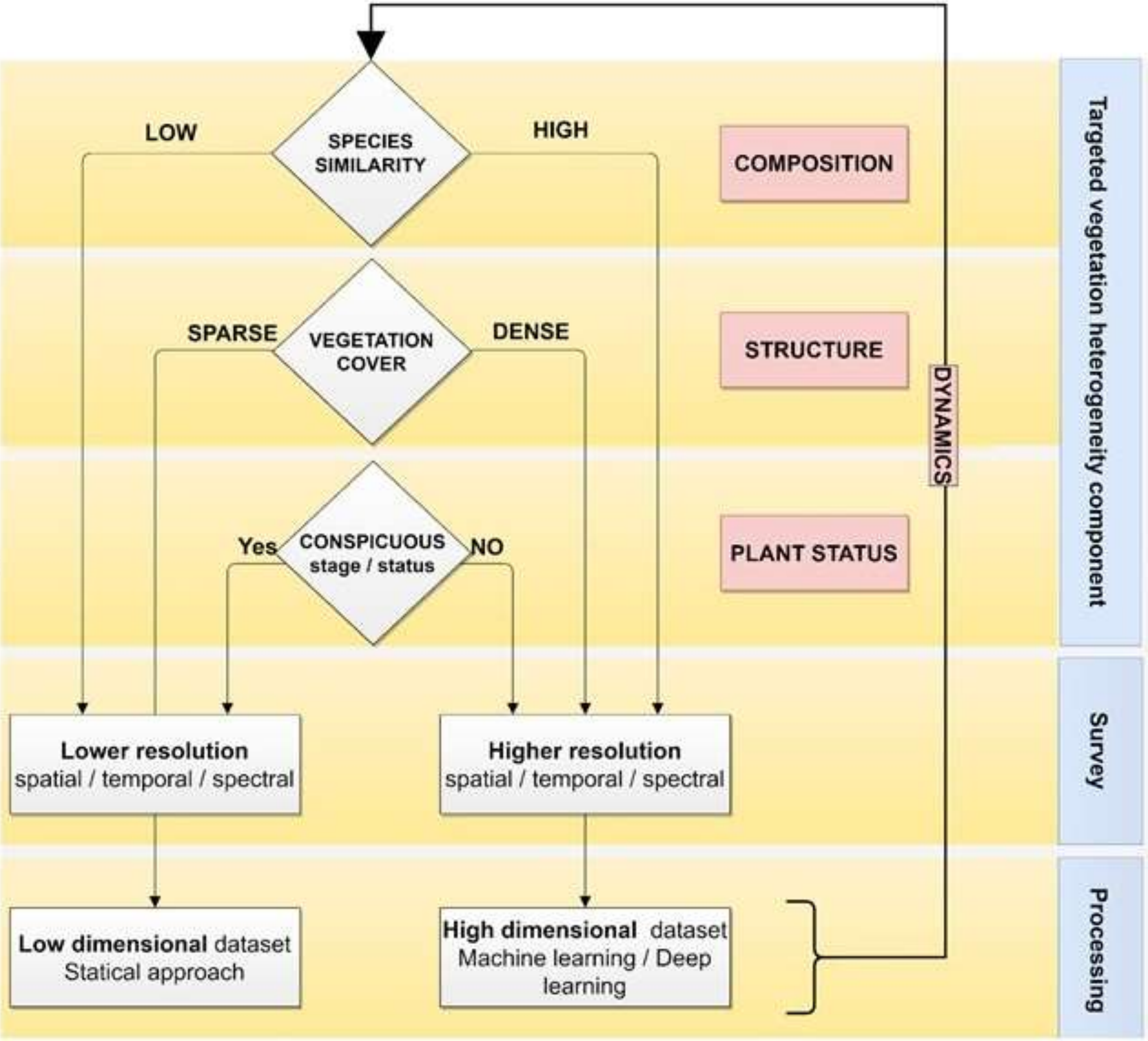

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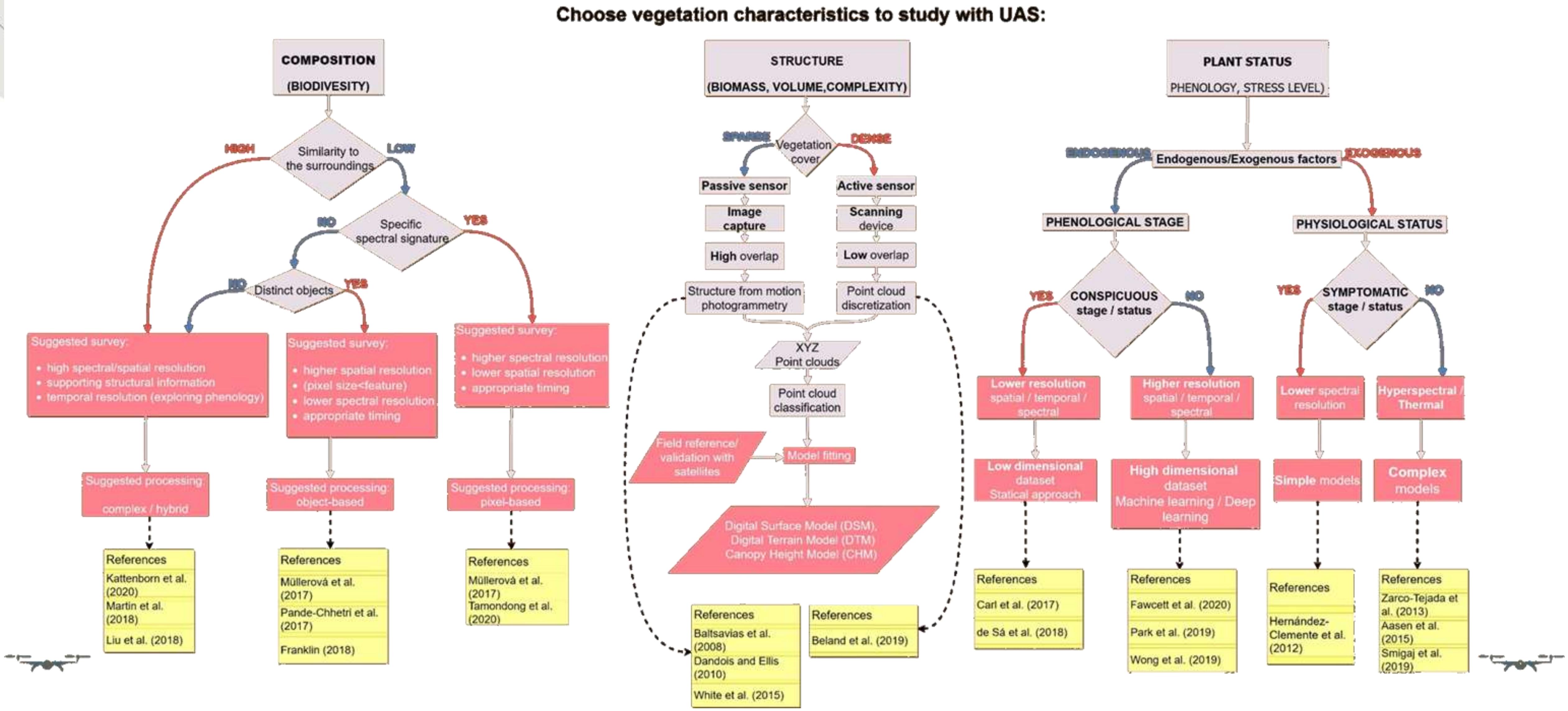
- BIODIVERSITY
- VOLUME BIOMASS COMPLEXITY
- PHENOLOGY
- STRESS LEVEL

Müllerová et al. (2021). Ecol. Indicators 131, 108156

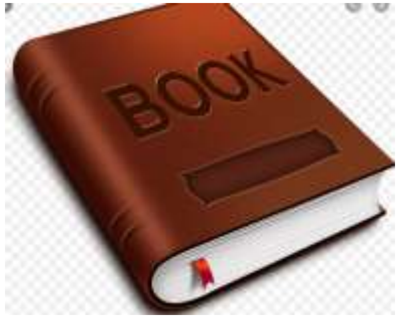


J. Müllerová, X. Gago, M. Bučas, J. Company, J. Estrany, J. Fortesa, S. Manfreda, A. Michez, M. Mokroš, G. Paulus, E. Tiškus, M. Tsiafouli & R. Kent (2021): **Characterising vegetation complexity with unmanned aerial systems (UAS) - a framework and synthesis,** Ecological Indicators

https://www.costharmonious.eu/characterizing-vegetation-complexity-with-uas

Eyal Ben Dor, Salvatore Manfreda (eds)

Remote Sensing of the Environment using Unmanned Aerial Systems (UAS)



Chapter 5. Vegetation assessment by UAS - current state and perspectives

Authors: Jana Müllerová, Martin Mokroš, Sander Mücher, Gernot Paulus, Tomáš Bartaloš, Martynas Bučas, Joan Estrany, Xurxo Gago, Rafi Kent, Salvatore Manfreda, Maria A. Tsiafouli, Adrien Michez

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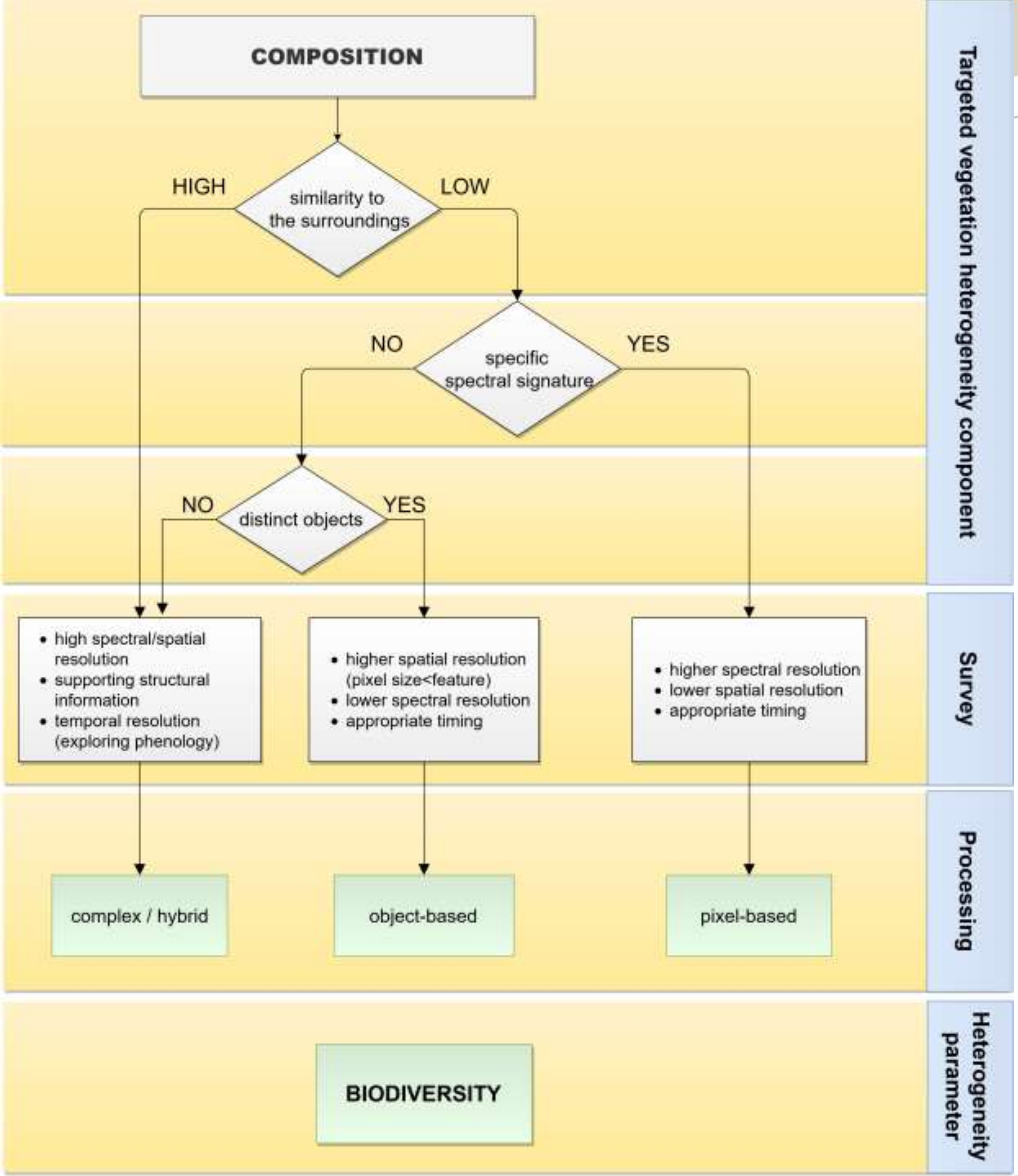
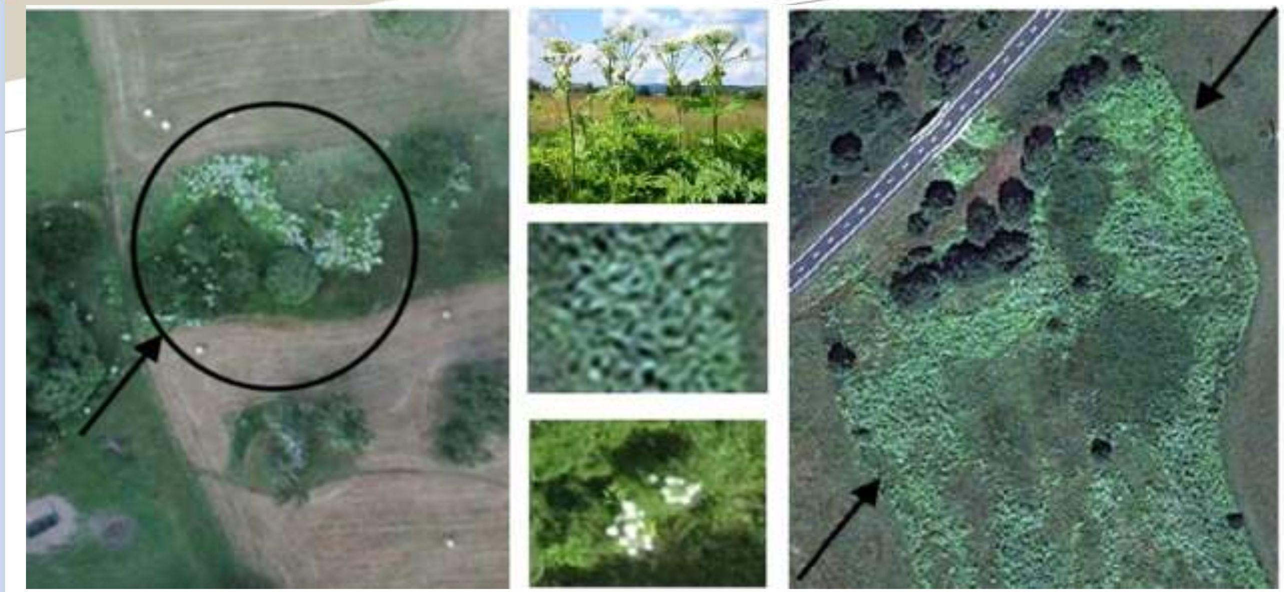
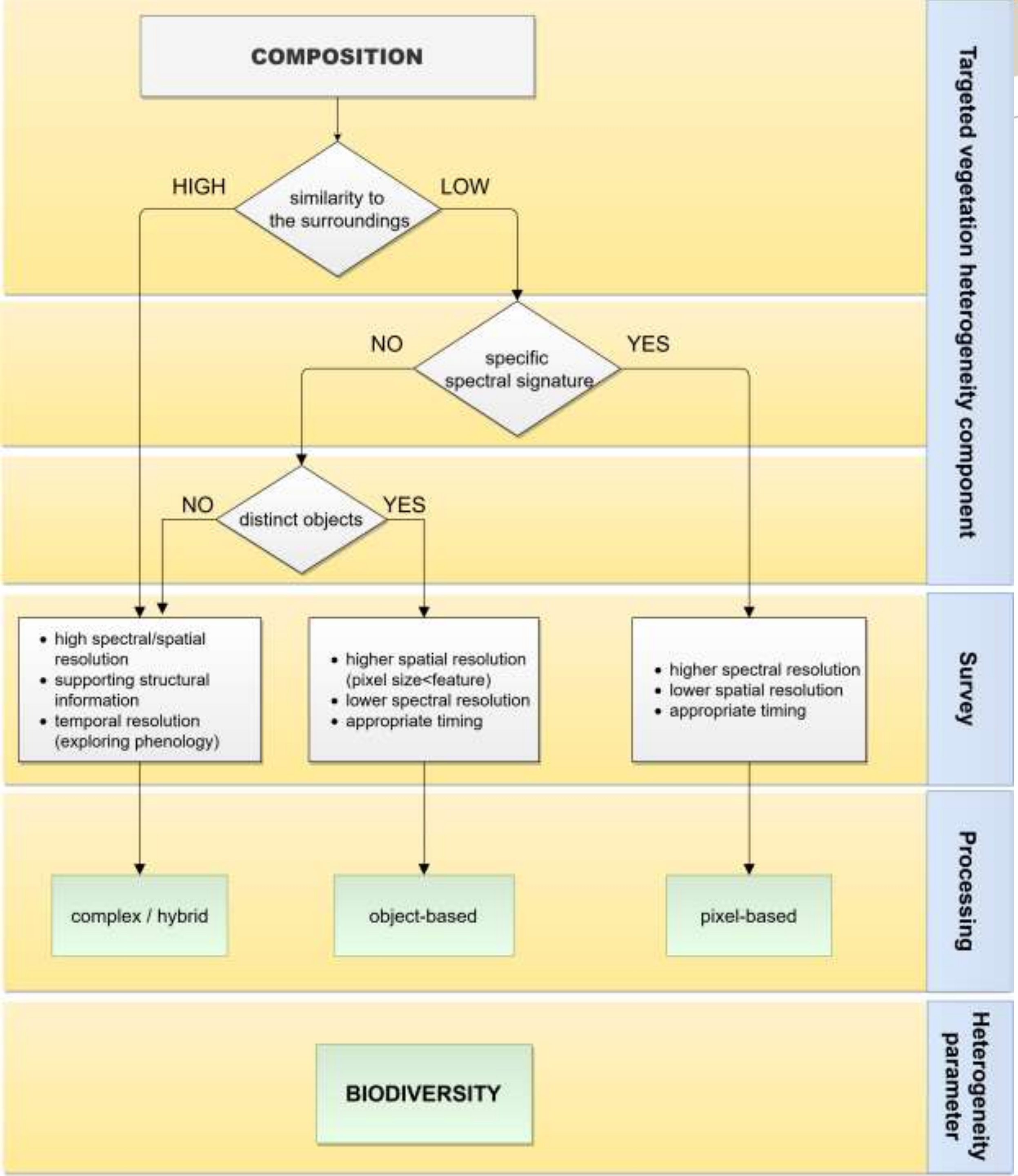
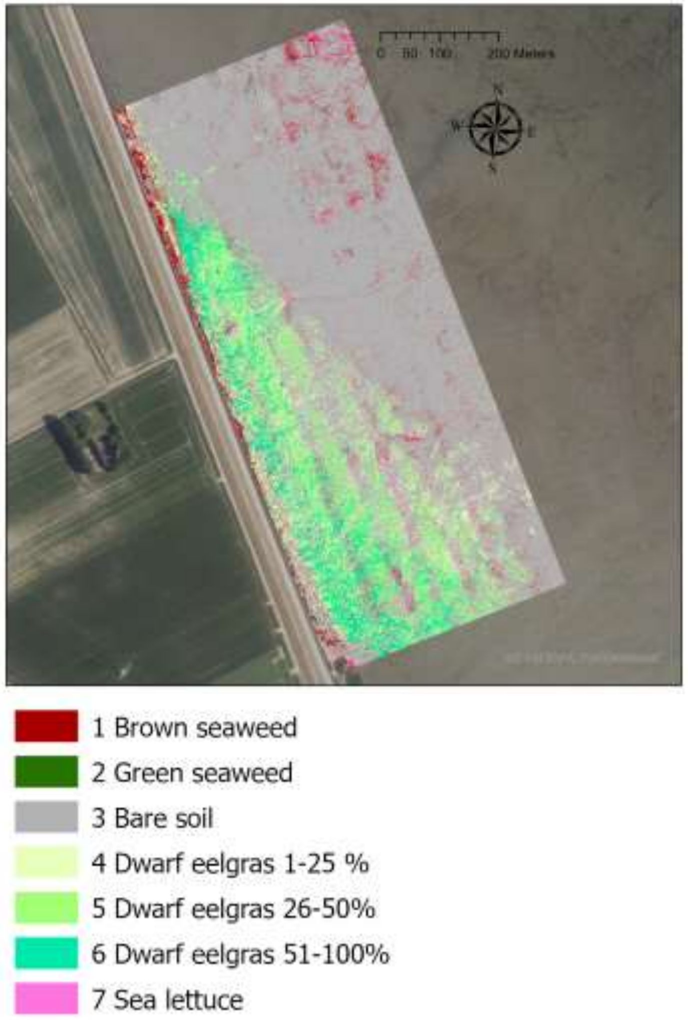




Comparison of different segmentations. From left: original image (RGB); yellow - multiresolution segmentation/RF classifier (eCognition); blue - OrfeoToolbox segmentation (mean_shift) and RF classifier; red - RF pixel-based classifier.

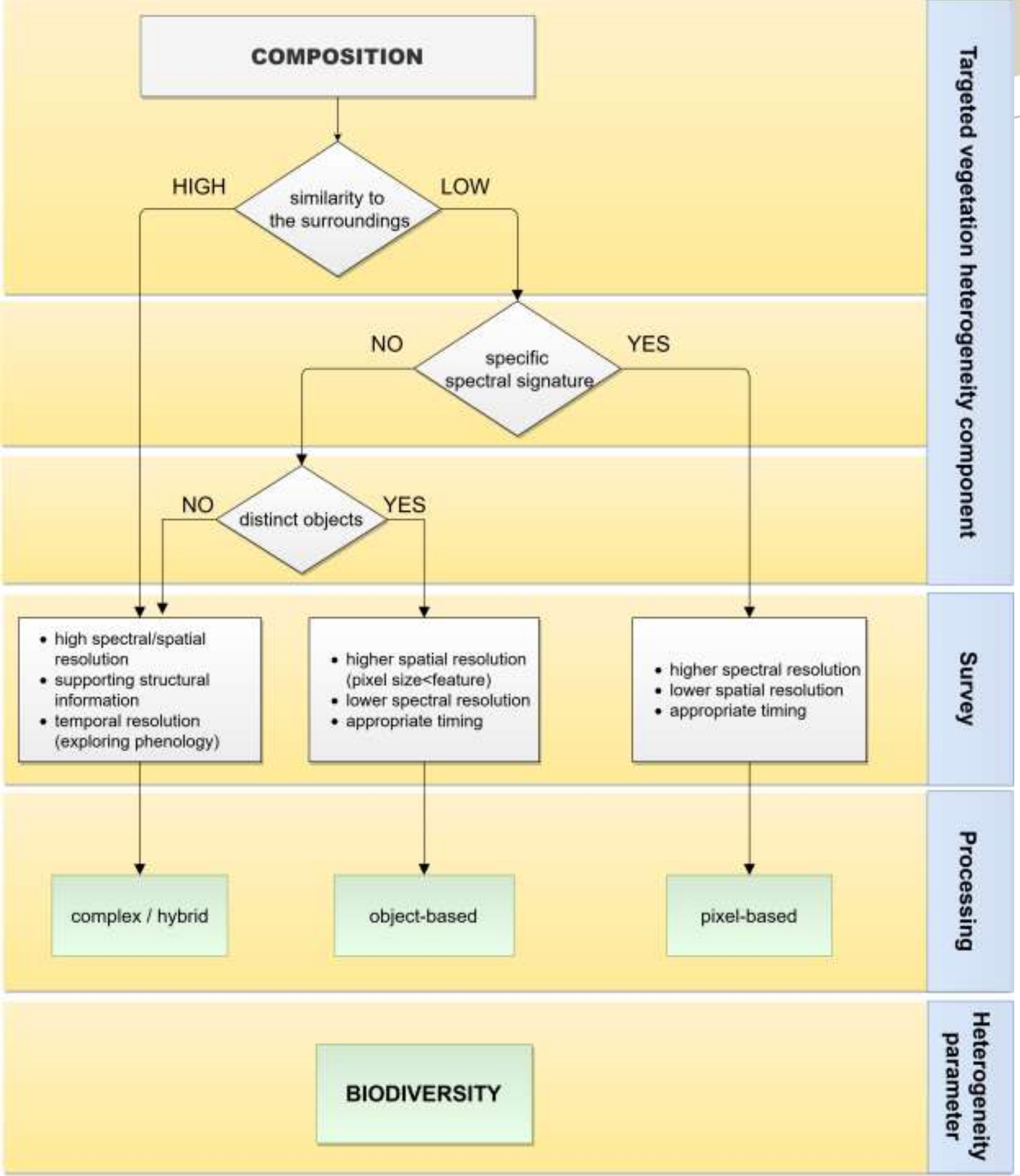
Müllerová et al. (2021). Ecol. Indicators 131, 108156
Müllerová et al. (2022). Remote Sensing of the Environment using Unmanned Aerial Systems (Elsevier, ed. Dor & Manfreda)

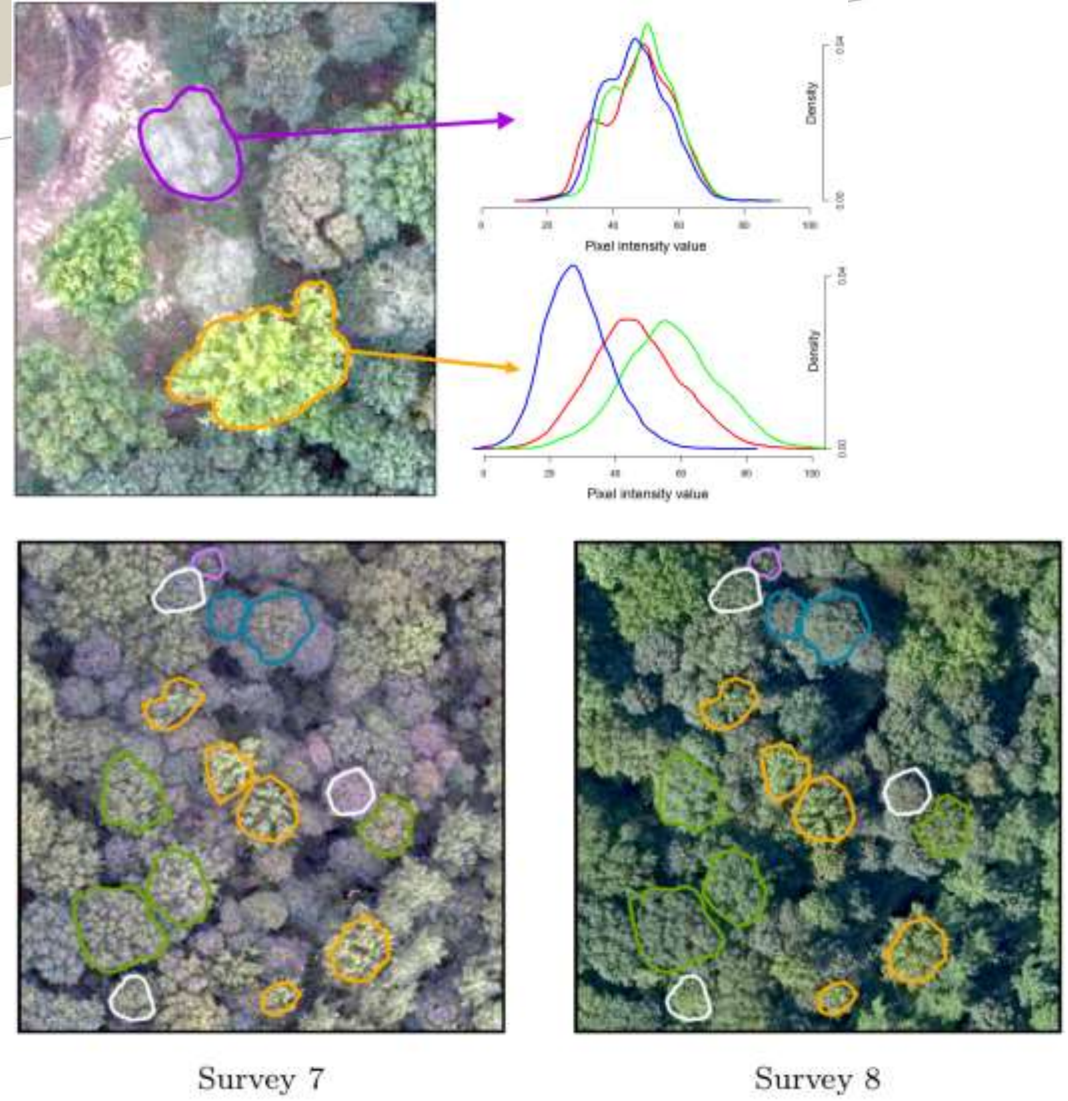




Deep learning classification of sea grass on Dutch sea coast (Mucher et al. 2020, Wageningen)

Müllerová et al. (2021). Ecol. Indicators 131, 108156
Müllerová et al. (2022). Remote Sensing of the Environment using Unmanned Aerial Systems (Elsevier, ed. Dor & Manfreda)





Differences in spectral response captured as a time series with a compact camera mounted on an UAS for two tree crowns (birch and poplar species). English oak: green; poplars: orange; sycamore maple: blue; common ash: white; birches: purple. Lisein et al. (2015) PLoS ONE 10 (11), e0141006

Müllerová et al. (2021). Ecol. Indicators 131, 108156
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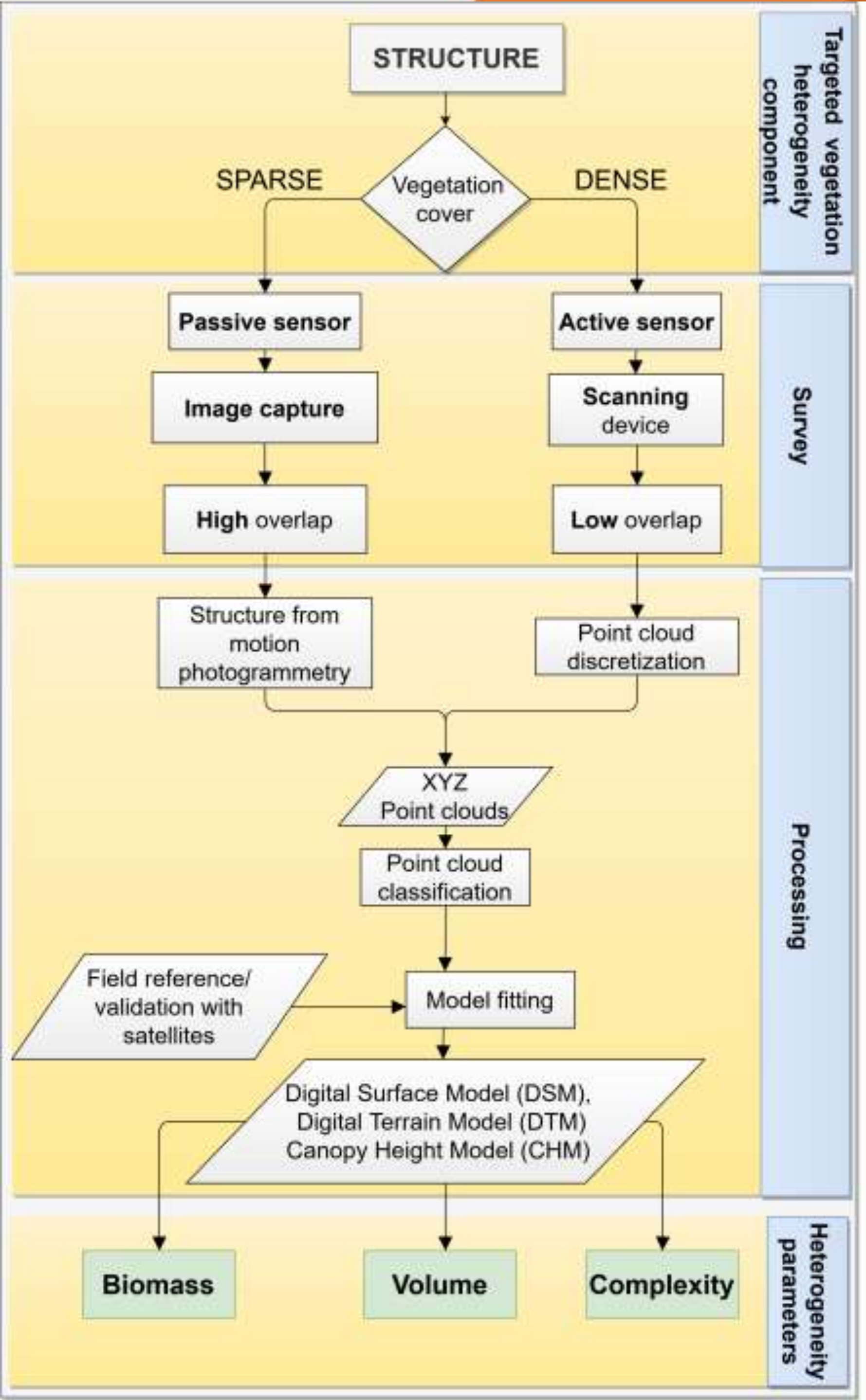

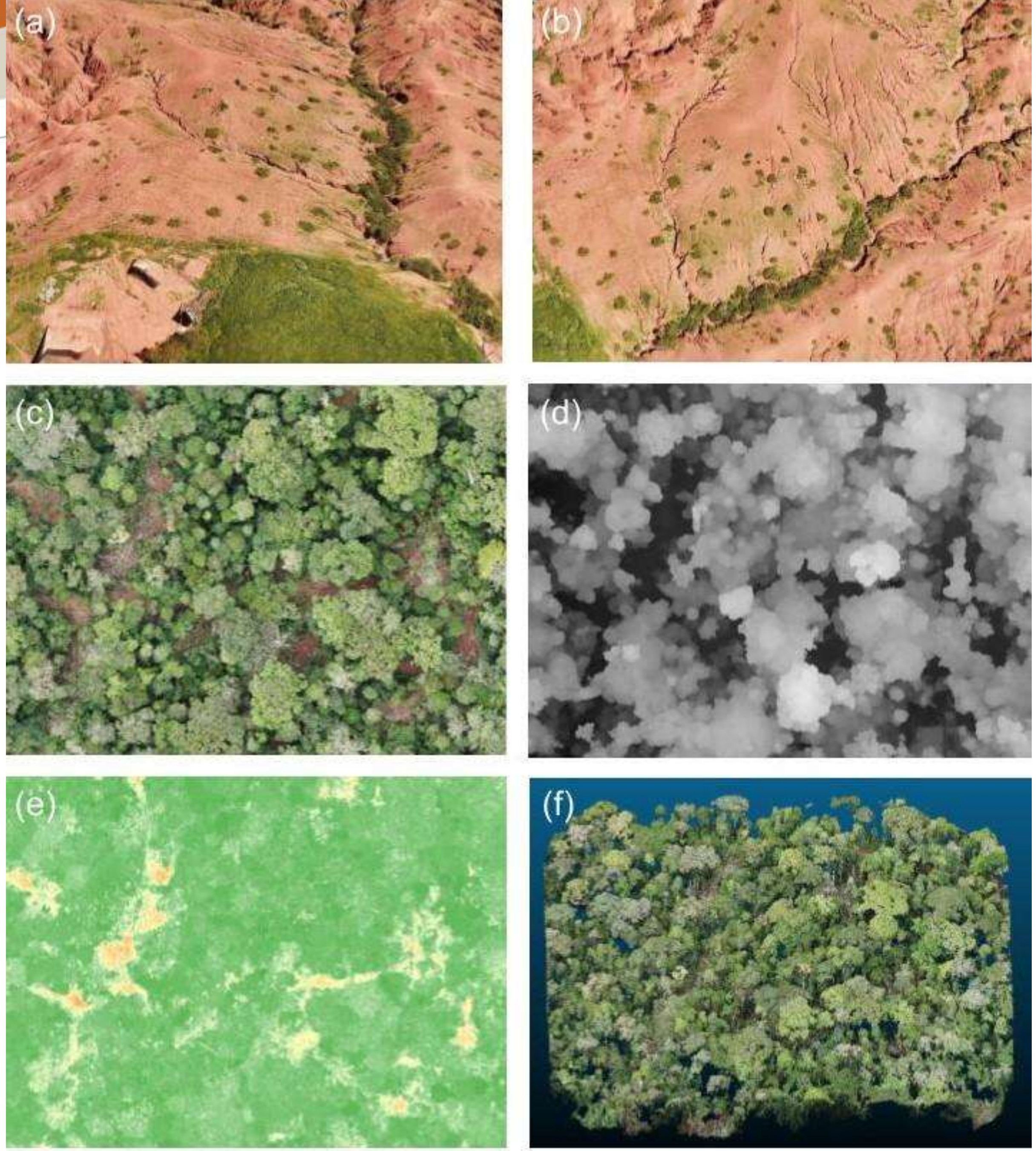

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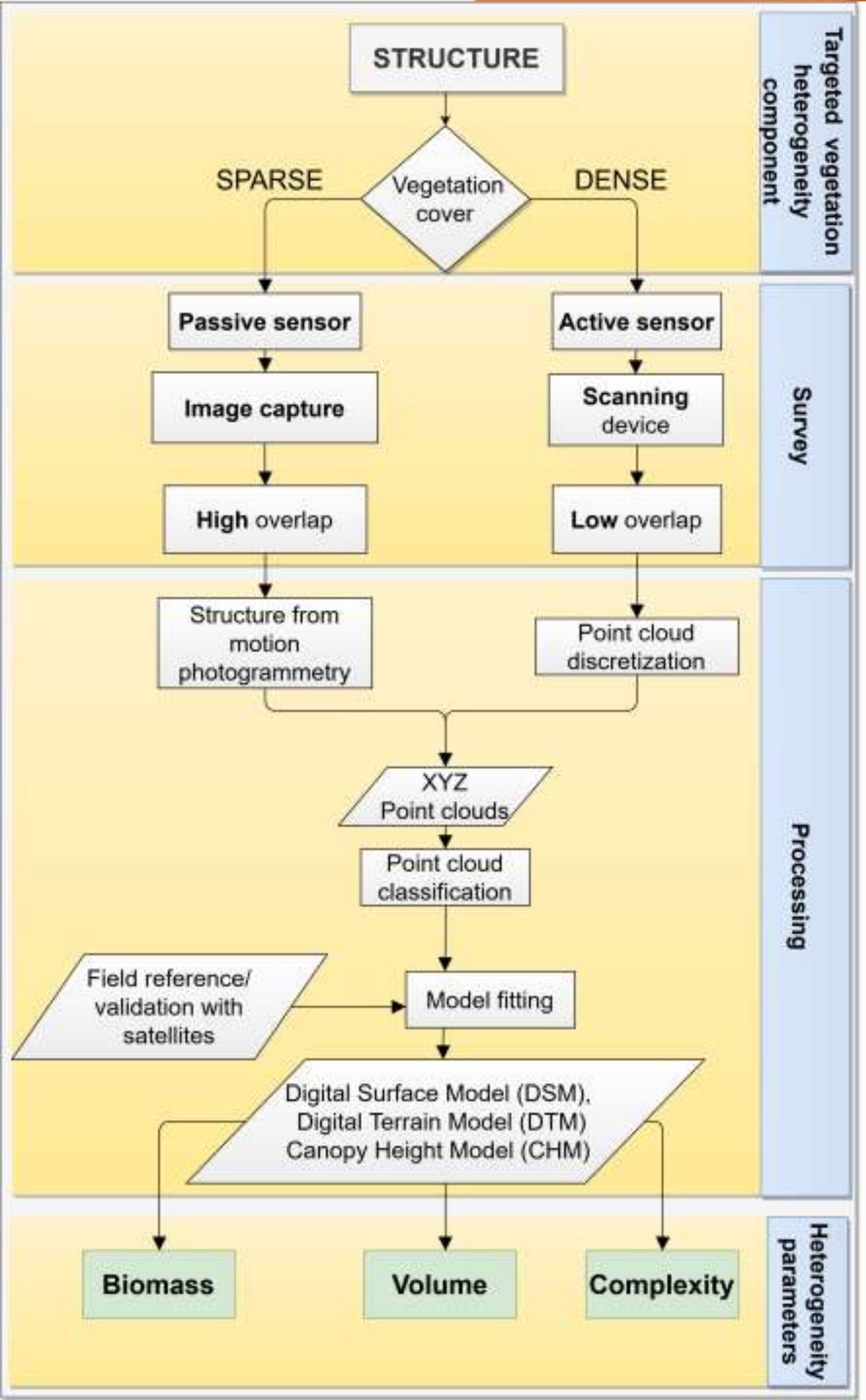

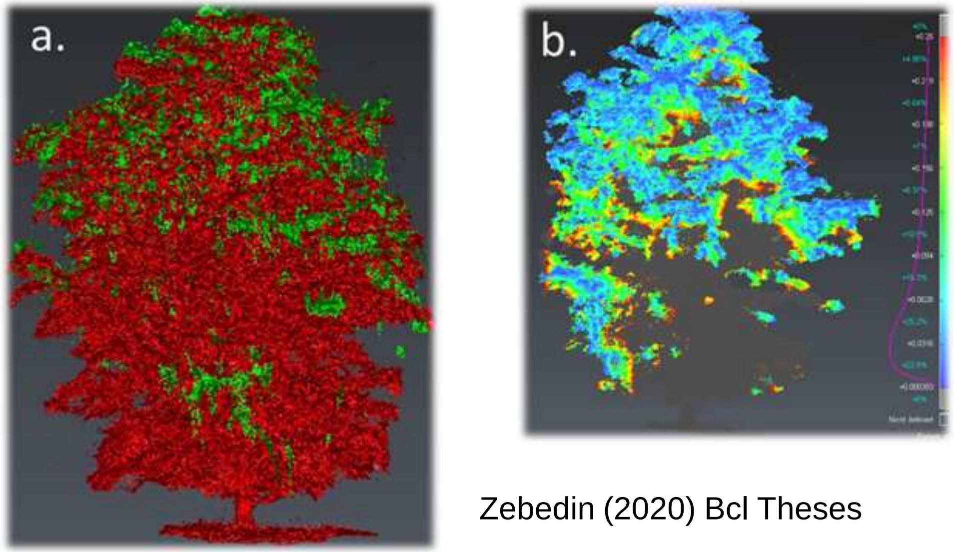

Zebedin (2020) Bcl Theses

Temporary Art Installation FOR FOREST by Klaus Littmann (8. 9 – 27. 10 2019, Klagenfurt, Austria)

Kainbacher(2020) Bcl Theses

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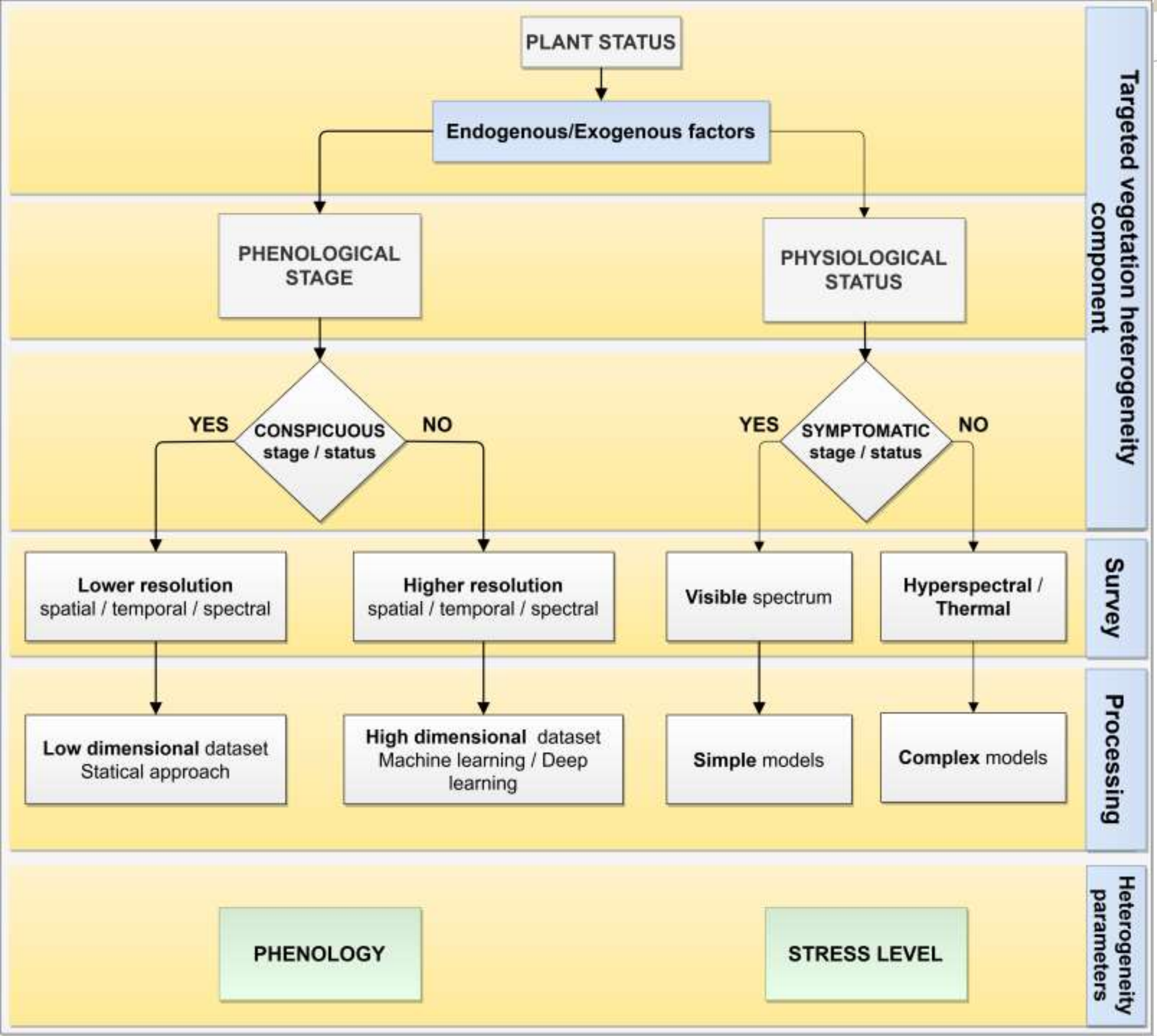

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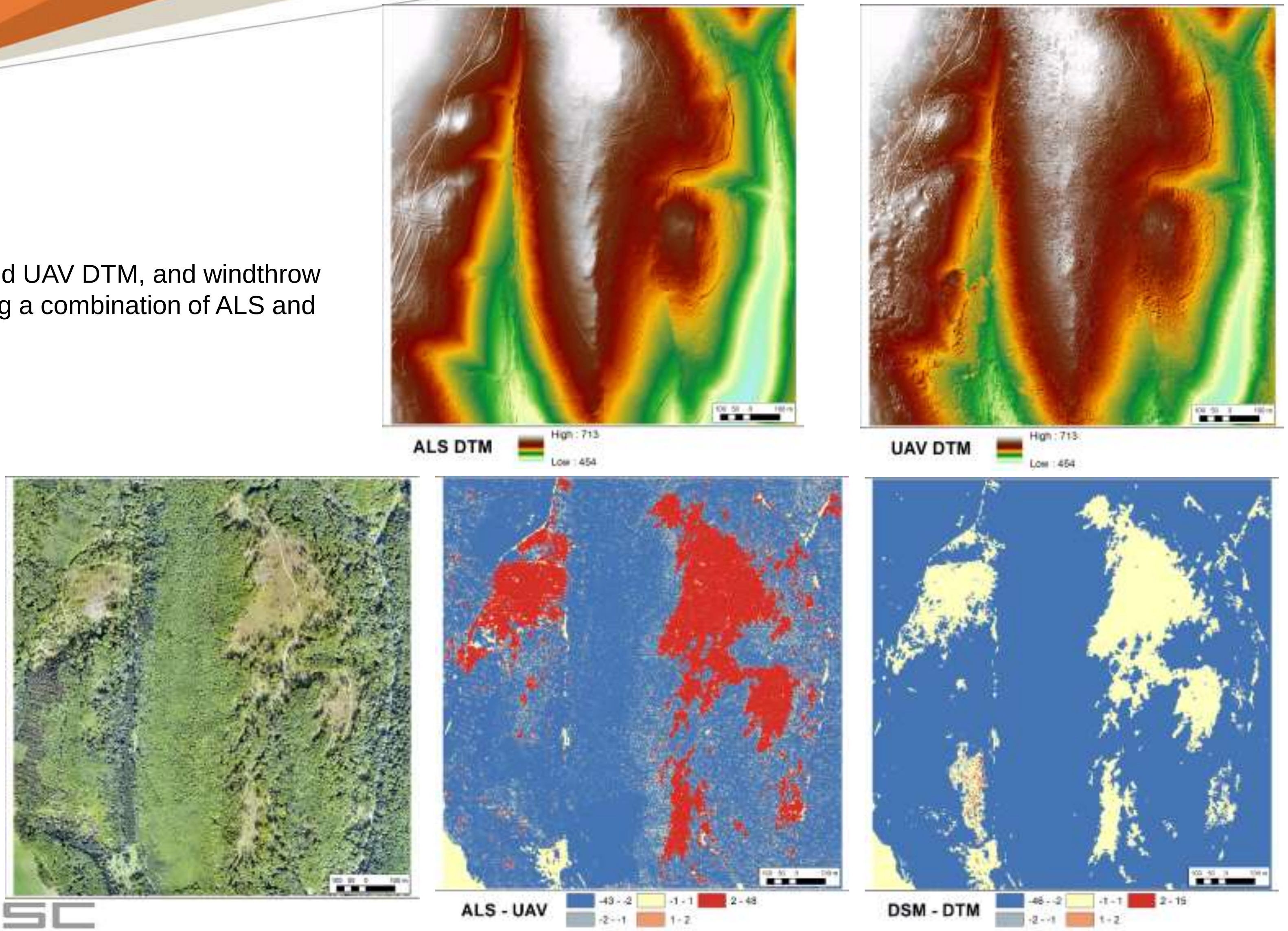
Dynamics - monitoring the development – windthrow damage

Comparison of ALS and UAV DTM, and windthrow damage detected using a combination of ALS and UAS data



Müllerová et al. (2022). Remote Sensing of the Environment using Unmanned Aerial Systems (Elsevier, ed. Dor & Manfreda)

What tools do we use to process UAS data?

…the open source perspective

From free tools preference…   …towards real use

T. Bartaloš, J. Brůna, P. Dvořák & J. Müllerová

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Challenges and perspectives

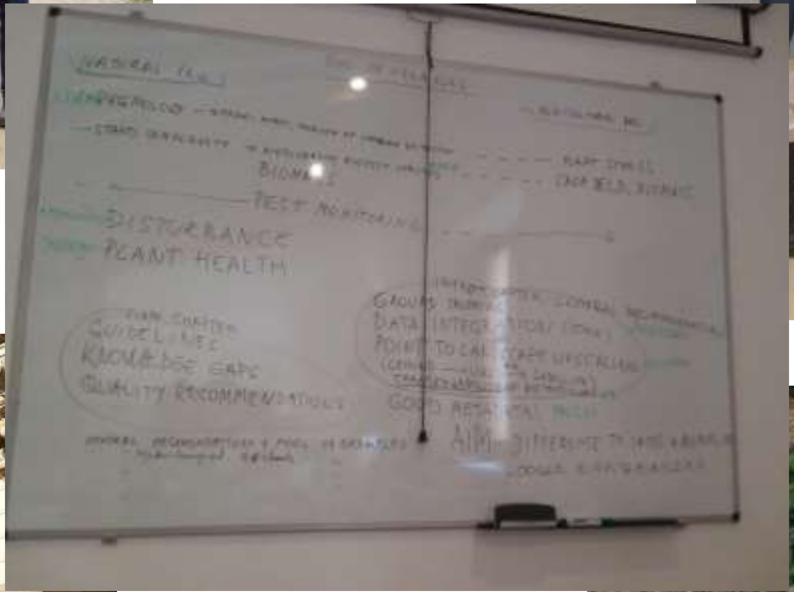
- **Technical** – e.g. geometric and radiometric distortions, calibration, improved sensors, standardization of techniques, power of processing algorithms, accuracy assessment.... **common to all drone applications** and are **expected** to be addressed with the technological **advancement**. Still, **imprecisions** of data could be **larger** than some part of **heterogeneity** and subtle **changes** we would like to detect

- **Conceptual** – **perspectives** of drones addressing ecosystem properties greatly **differ** from satellites & field → Mirroring is not enough

- Need for **original research strategies** that would **leverage** on drone data

- Urgent need for **standardized** workflows in drone-assisted ecosystem studies

- Drones are is capable to **expand portfolio** of addressed vegetation types, environmental problems and research questions → **advancements** in technology must go along with **modification of the concepts and paradigms** in vegetation science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Other ongoing HARMONIOUS-related projects

- Heterogeneity review paper
- What are the most important future challenges in drone-based environmental studies? (based on the questionnaire)
- Ecosystem heterogeneity across scales and ecosystems assessed by means of remotely sensed RGB and 3D data (call for data, still not processed...) – this could also be a baseline for a joint research proposal
- Creating maps of soil ecological functioning combining soil biological and UAV data (Maria Tsiafouli)
- Martin Mokroš is leading a **new COST action** „*Three-dimensional forest ecosystem monitoring and better understanding by terrestrial-based technologies*“. Action started 2021

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Working groups:

WG1 Laser- and image-based data collection
WG2 Data Fusion
WG3 Laser- and image-based point cloud processing
WG4 Precision Forestry
WG5 Forest Ecology
WG6 Dissemination, knowledge gaps identification and cooperation guidance

Thank you for your attention!

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