



# Bark beetle **detection** from UAV

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# Contents

01

## Monitoring protocol

- Interconnect Remote sensing with field data

02

## UAV based monitoring

- UAV's the missing link in remote sensing

03

## Study cases

- Examples of monitoring

04

## Conclusions

- Few ideas

# Monitoring protocol

open-source approach

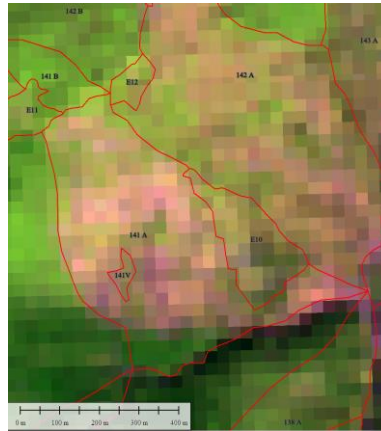


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## Satellite mapping

We use level 1 monitoring based on Sentinel 2 data, we generate change detection algorithms using Google Earth Engine



## Drone mapping

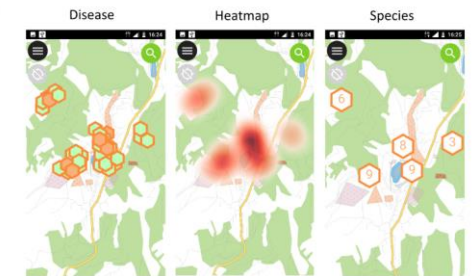
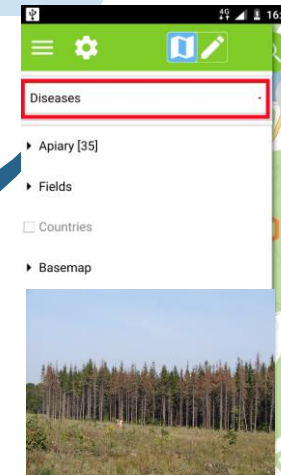
We use level 2 monitoring based on drones, especially on flagged areas detected at level 1

## Field GIS data

We transfer the data for field using open source

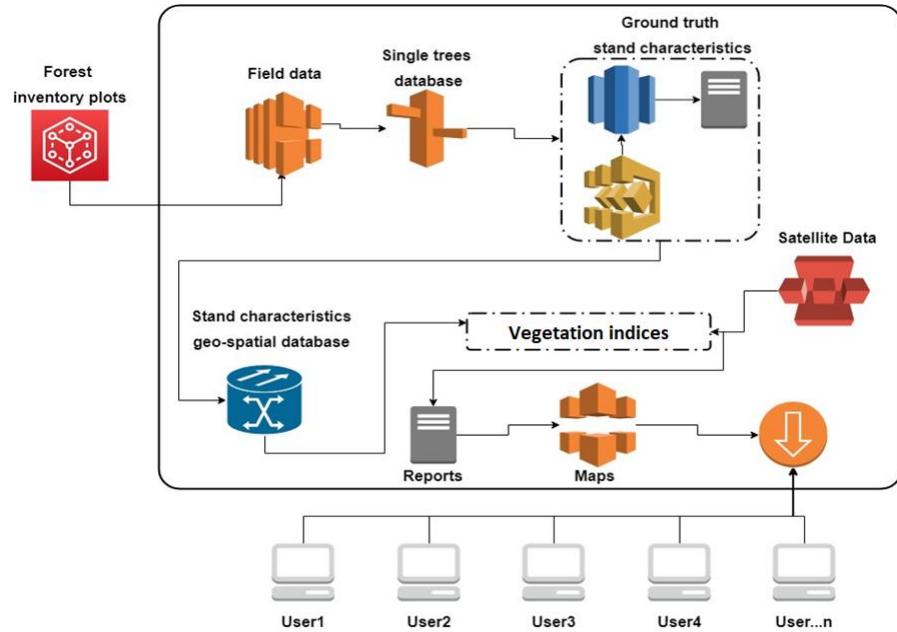
## Taking actions

We give the opportunity of decision makers to take actions through a portal





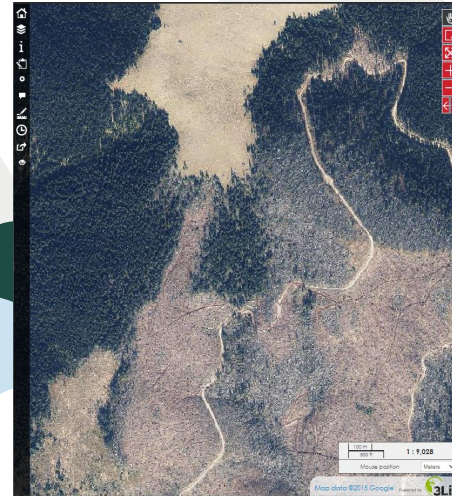
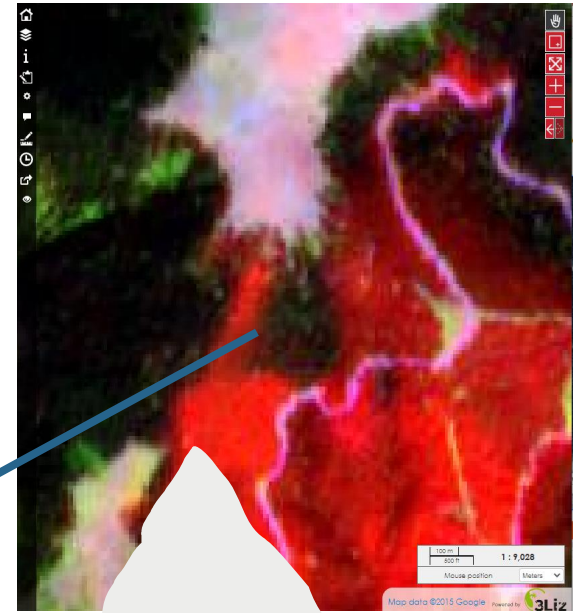
# Satellite mapping



✓ GEE algorithm

✓ Sampling

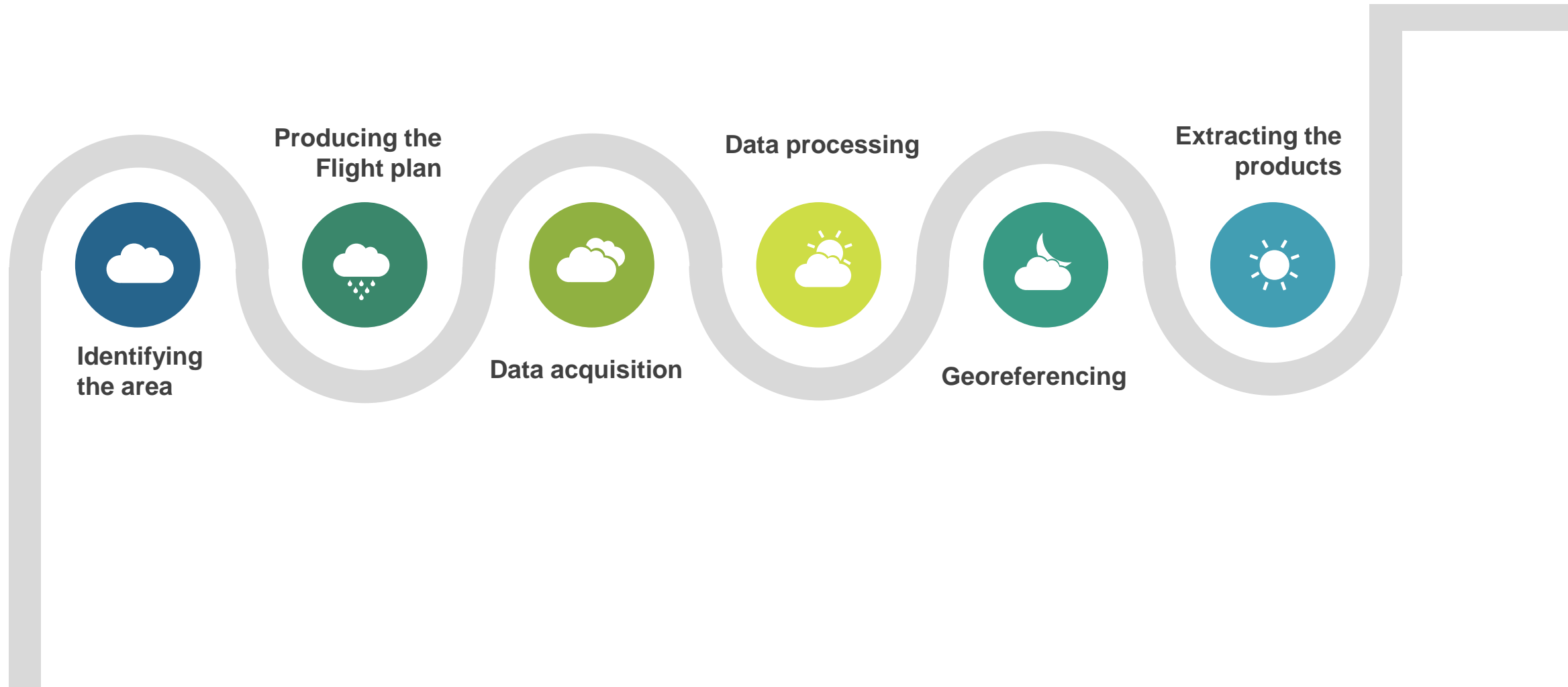
✓ Field data



# UAV based monitoring



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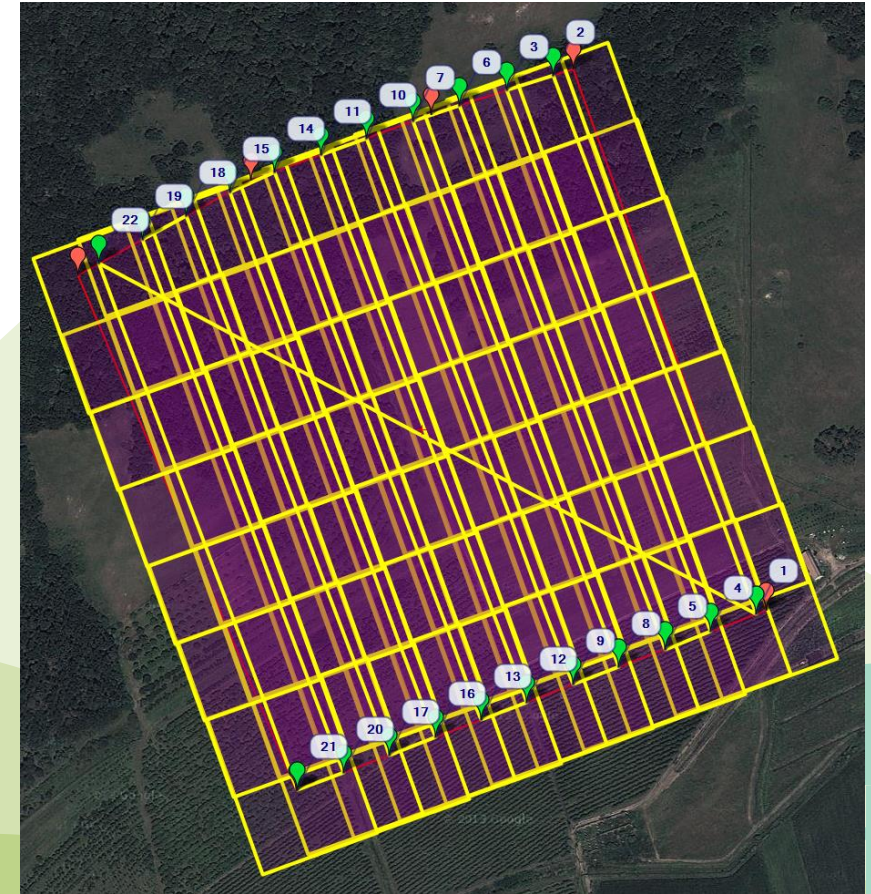
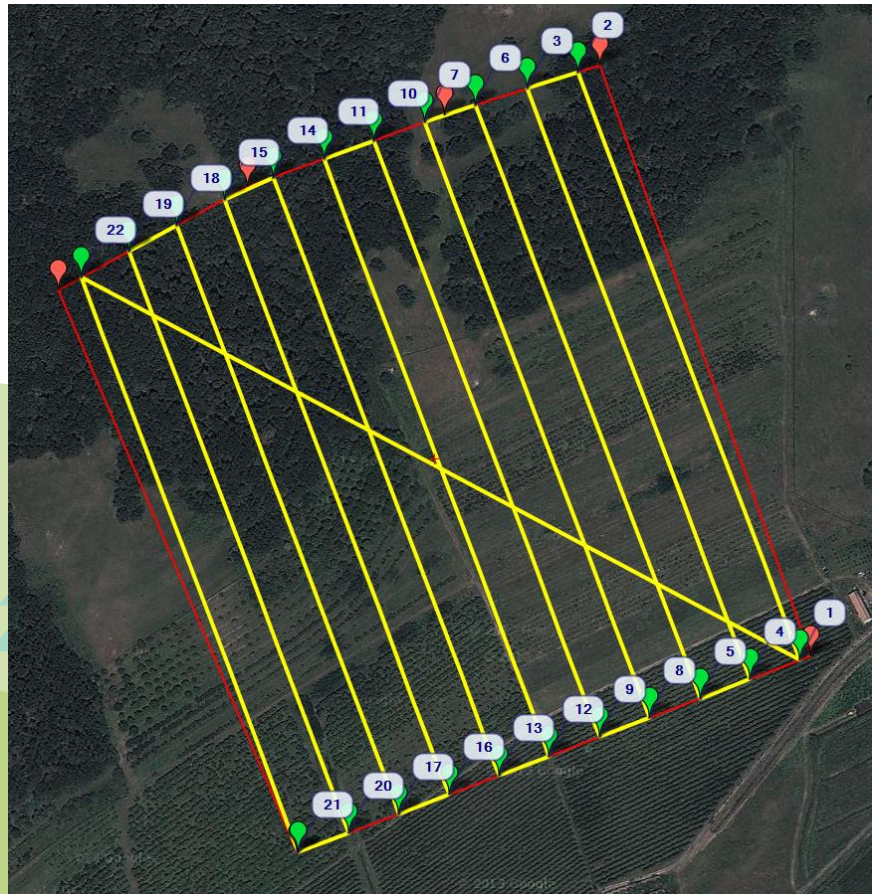






# S1. Flight Plan

We calculate the overlap and Ground Sampling Distance.  
For bark beetle damage assessment, a 20-30 cm is enough  
According to Romanian laws we cannot go under 15cm

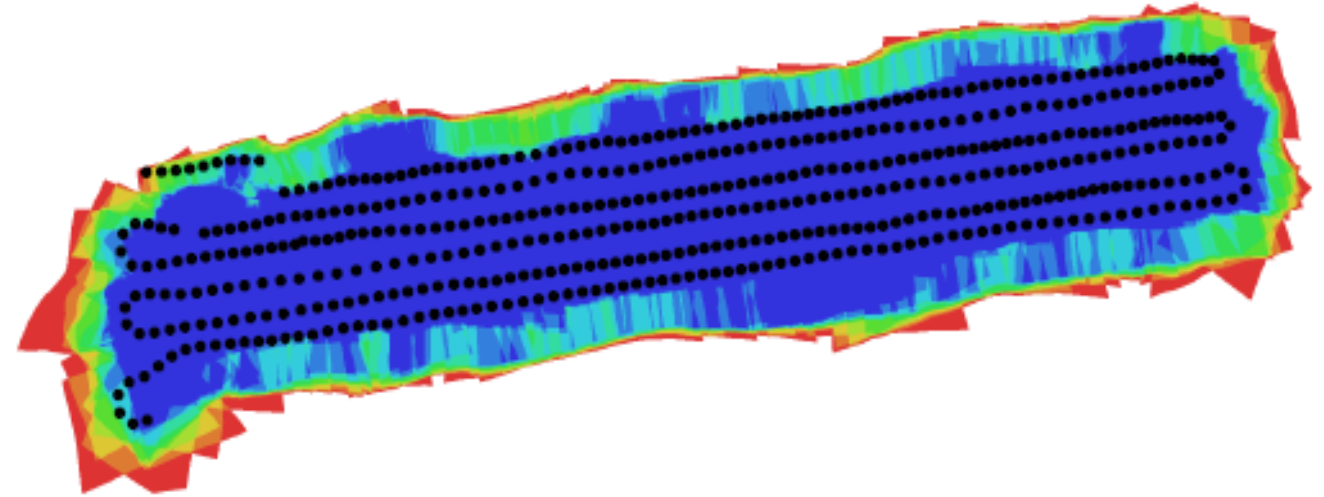






## S2. Data acquisition

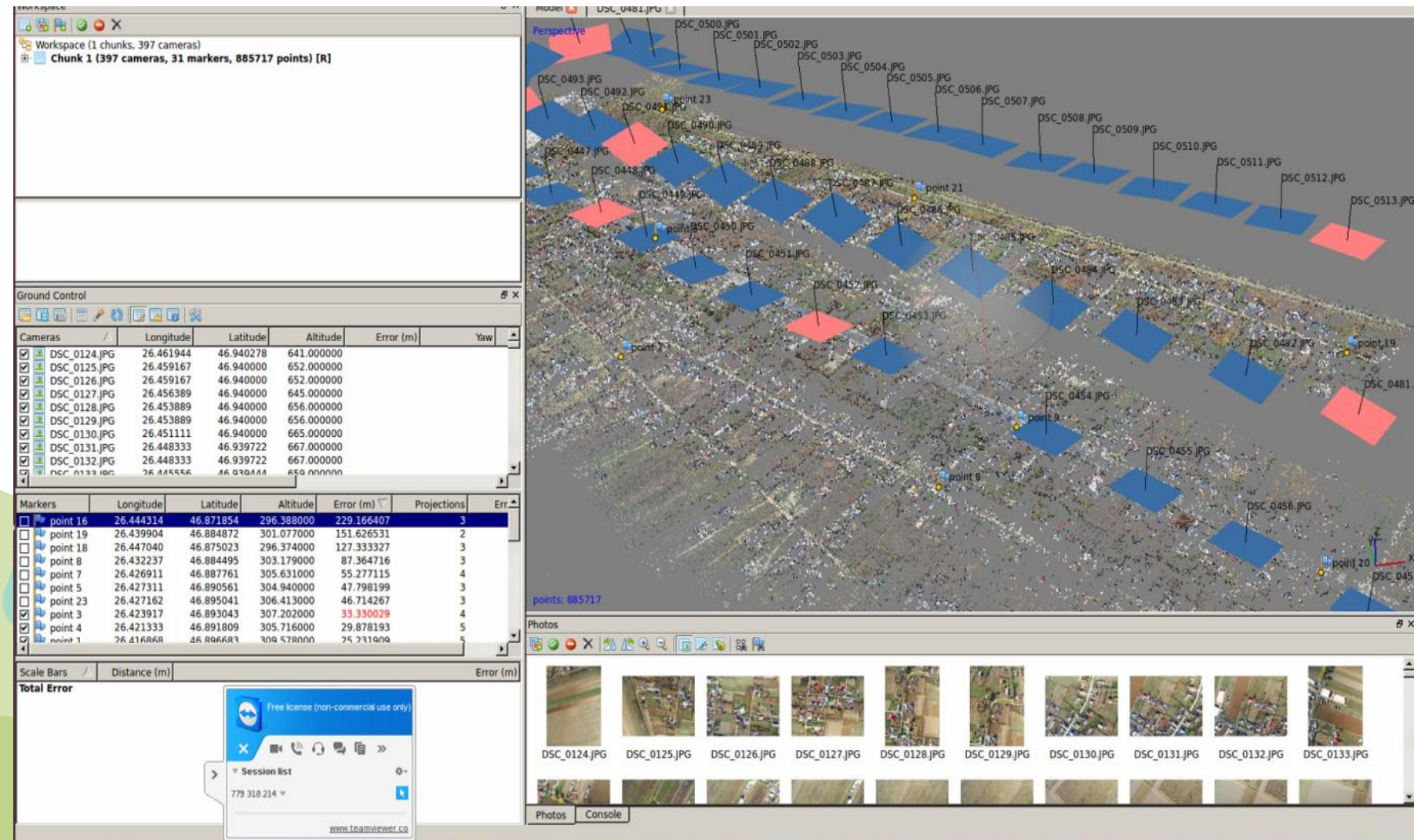
Takes into consideration weather conditions, sun position and shape of the area





# S3. Data processing

- We use Structure from Motion
- A lot of improvements have been done in processing time in the last years

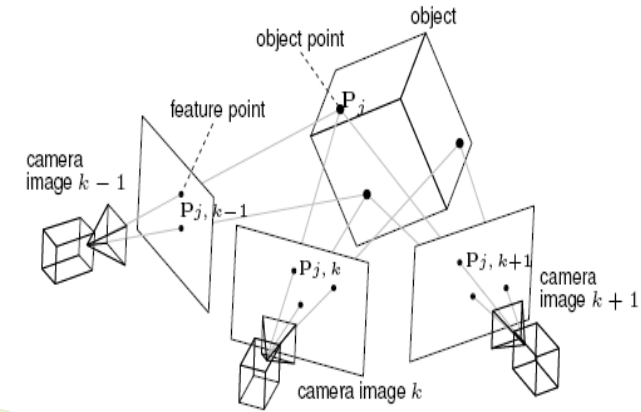




# S4. Georeferencing

For a better overlapping we are using 2 strategies:

- We take ground control points in the field
- We use real time kinematics approach



Label	X error (m)	Y error (m)	Z error (m)	Error (m)	Projections	Error (pix)
point 1	0.007806	-0.016210	0.025177	0.030945	11	1.106495
point 2	-0.012901	0.014468	-0.168445	0.169557	6	2.113992
point 3	-0.019241	-0.021600	-0.065353	0.071469	13	0.505121
point 4	0.033561	0.041795	0.192248	0.199581	7	0.548978

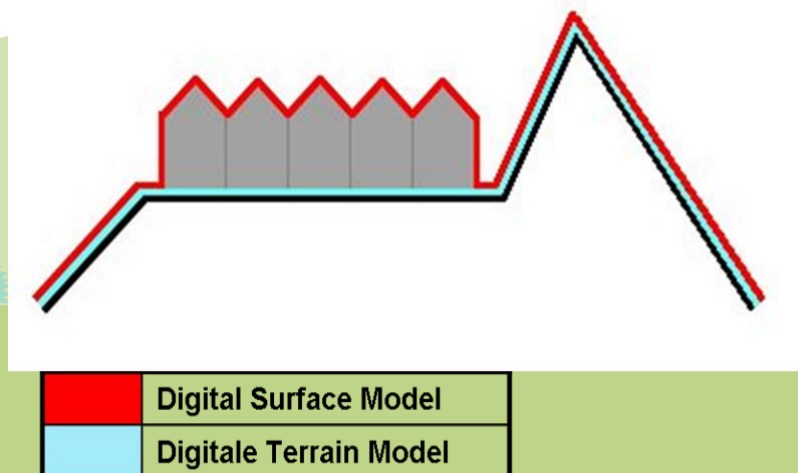




## S5. Orthomosaic

The final products:

- Orthomosaic
- Digital surface model: combined with LiDAR data we can derive Canopy Height Models





# UAV's in few words







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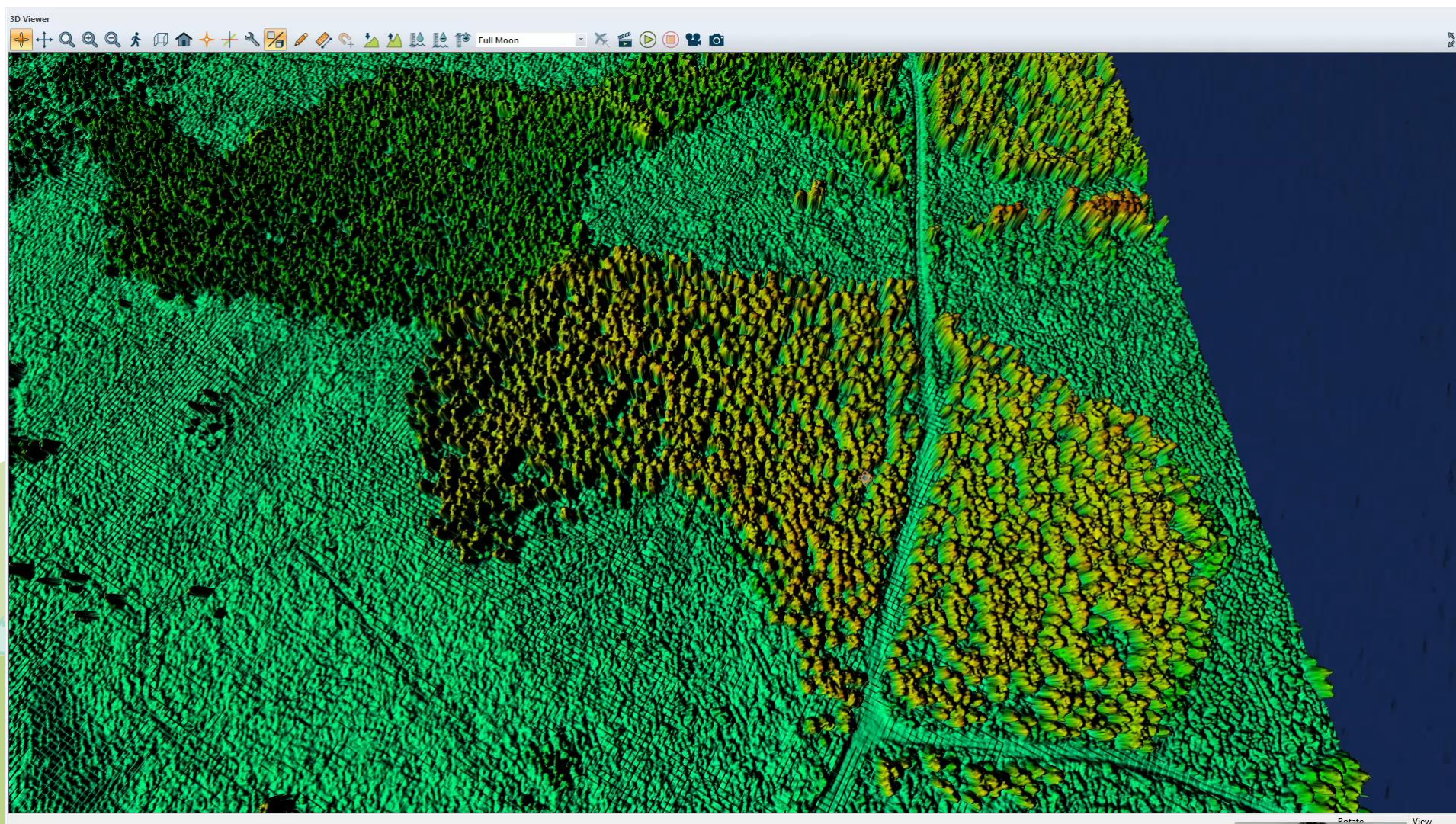
High-res satellite image



UAV high-res image



# UAV's in few words







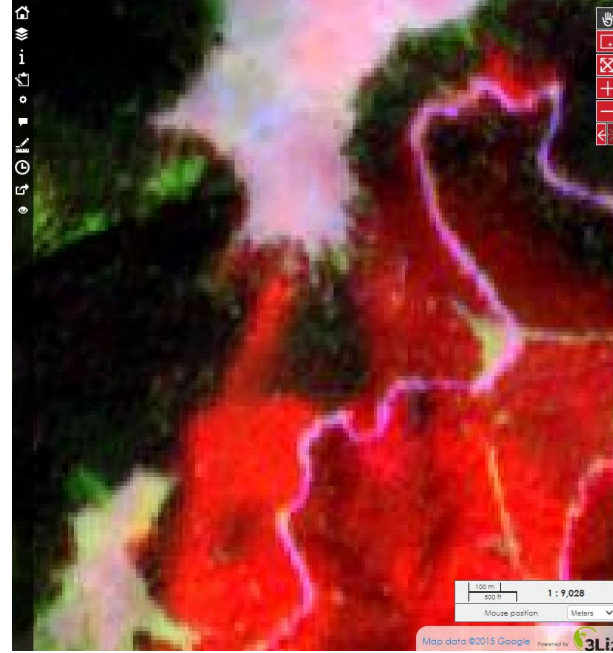
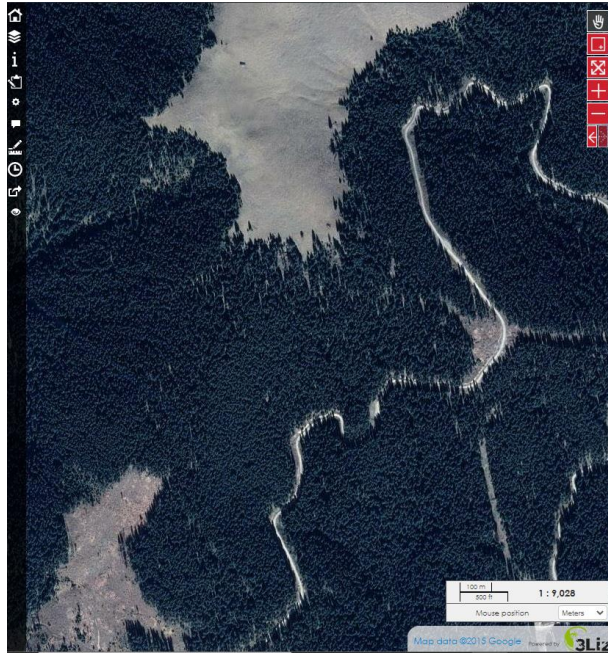
# Study cases

## Monitoring protocol based

U A V s   a n d   S a t e l l i t e s .



# Site 1 – monitoring disturbances



Historical high-res image



Sentinel2 monitoring



UAV confirmation and field data check





# Site 2 – monitoring disturbances





# Conclusions

## 1. Rapid response

UAV's provide a rapid response but they cannot cover very large areas – integrating with satellite technique provides a rapid response

## 2. Field validation

Disturbances often are mistakenly reported to other proxies without a proper field validation

## 3. Integrating experts

UAV's and remote sensing in general are becoming more accessible to different experts, still advance knowledge needs to be

