New technologies and options for future research at the Green Belt of Fennoscandia

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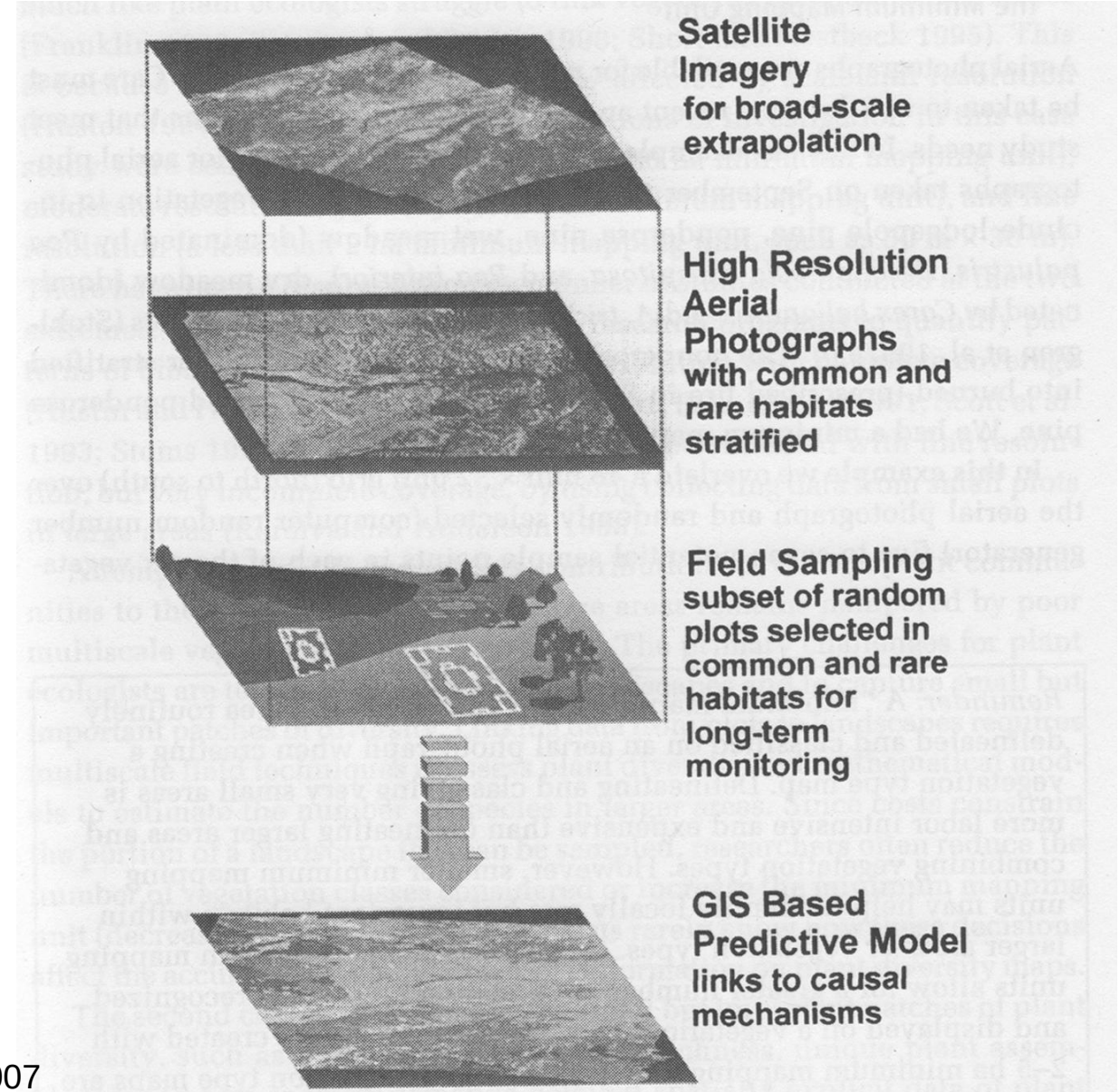
Multi-phase and multi-scale sampling



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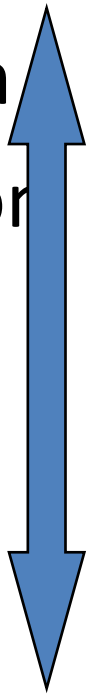
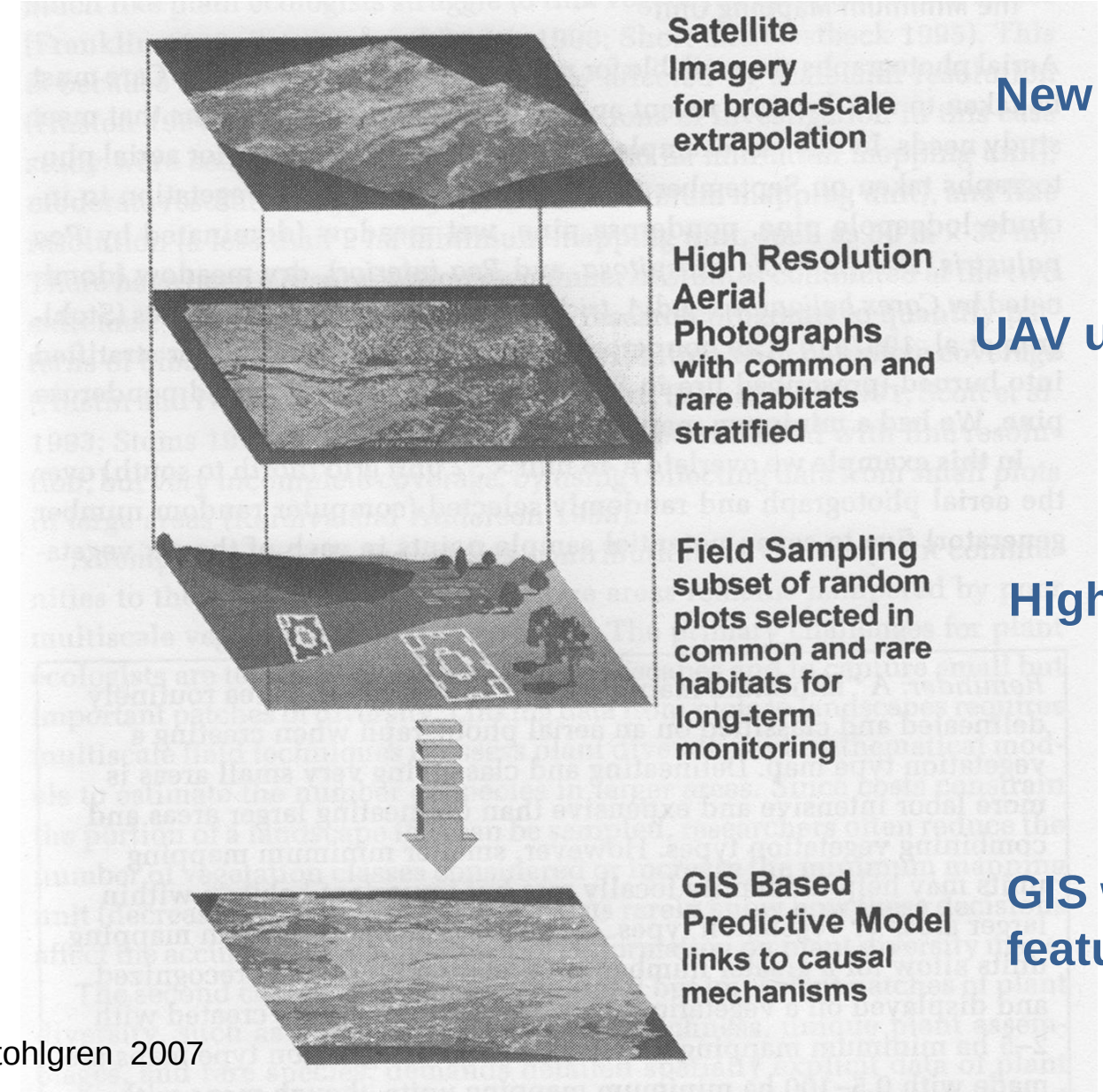
Multiscale biodiversity assessment

- 150 – 250 m (MERIS, MODIS) – whole region
- 6 – 15 m (Landsat, ASTER, IRS) – whole region
- 0,6 – 2 m (QuickBird, IKONOS) – subsets
- 10 – 25 cm (aerial images) – subsets



What we are loosing or gaining from the image resolution?

Multi-phase and multi-scale sampling



New satellites

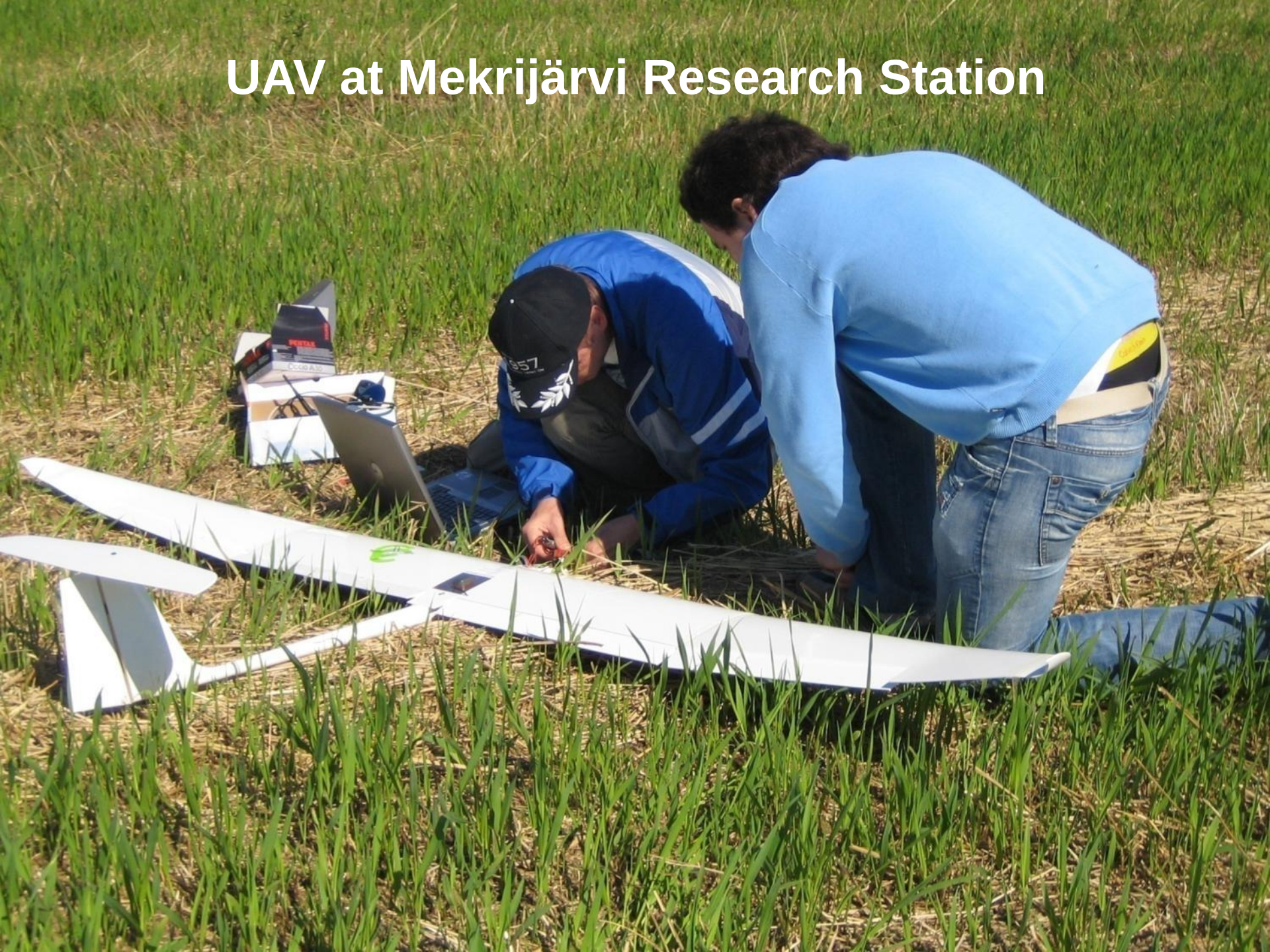
UAV unmanned aerial vehicle

High accuracy GPS

GIS with object-oriented features

Stohlgren 2007

UAV at Mekrijärvi Research Station



Electra Glider: Fiberglass
Length = 130 cm, Wing Span = 250 cm
Weight = 3 kg, Electric
Flight duration = up to 55 minutes
Max speed = 60 km/h

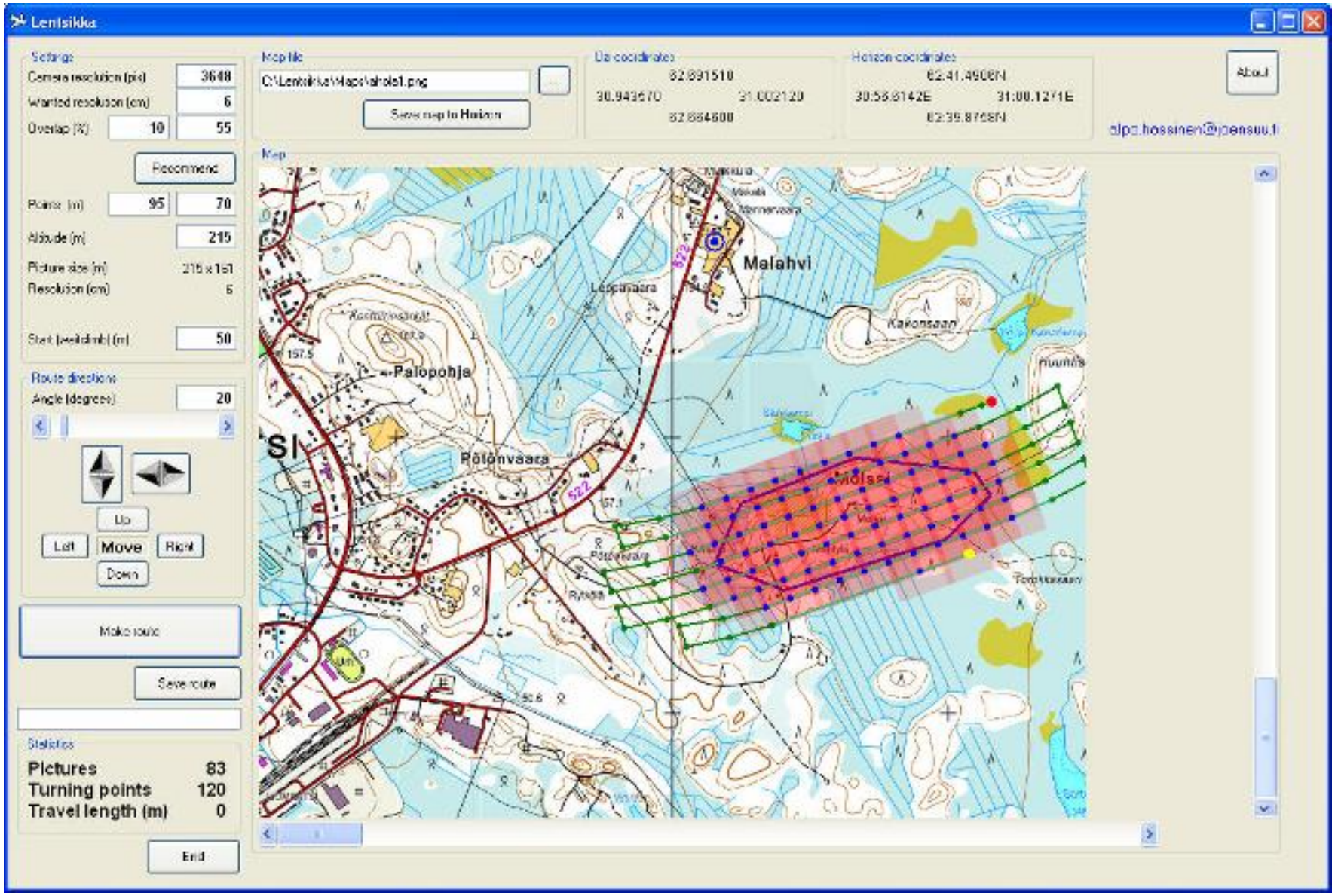
2 calibrated cameras = (digital camera, IR camera)

- MicroPilot Technology
- 28 gram miniature UAV autopilot, MP2028^{g}
- Powerful HORIZON^{mp} GCS

UAV Advantages

- High resolution images
- Geo-referenced
- On demand, not archived
- No cloud cover or satellite delay

1. To create flight program



2. To transfer flight file to the ground control software

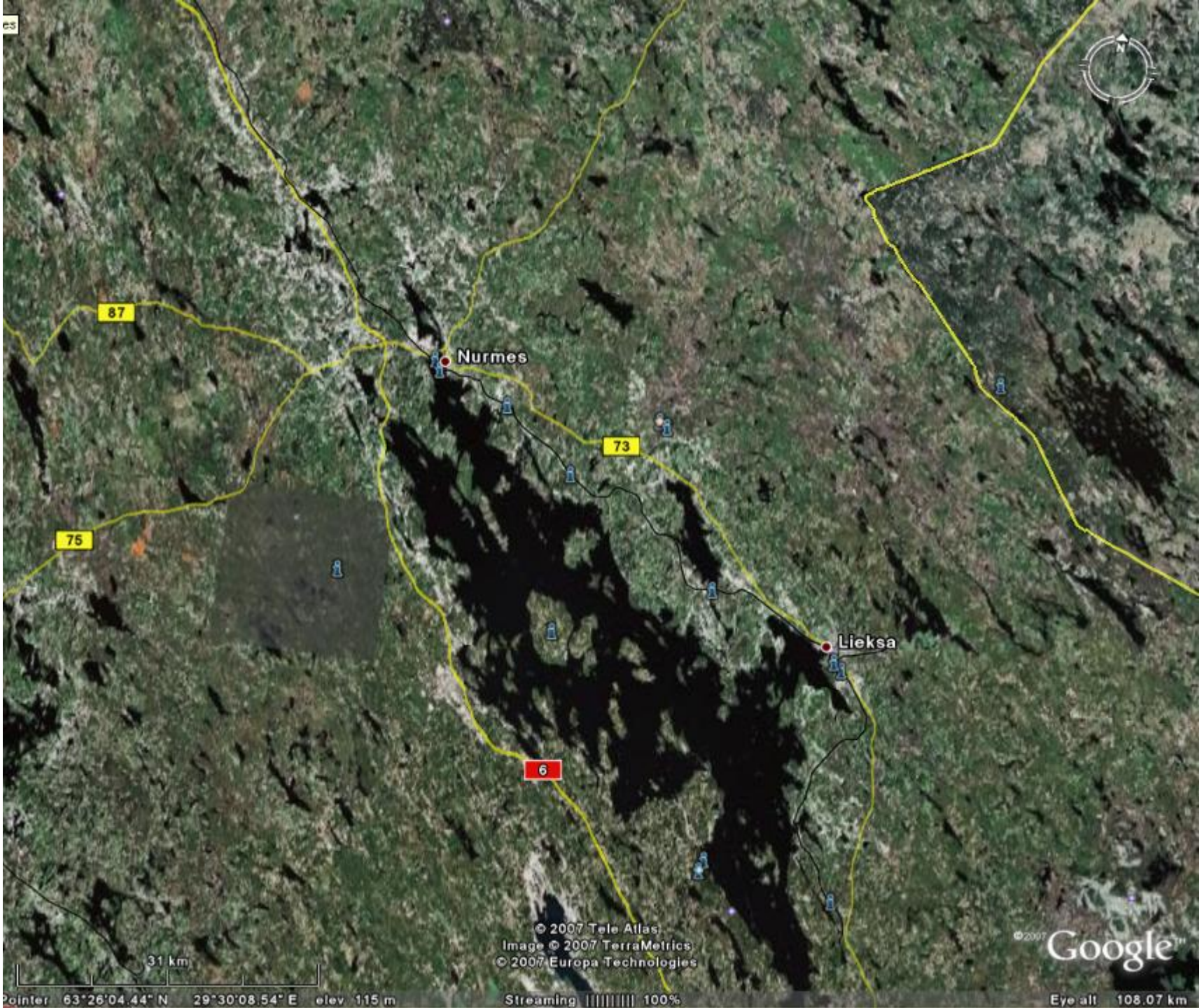
3. To send UAV to the air

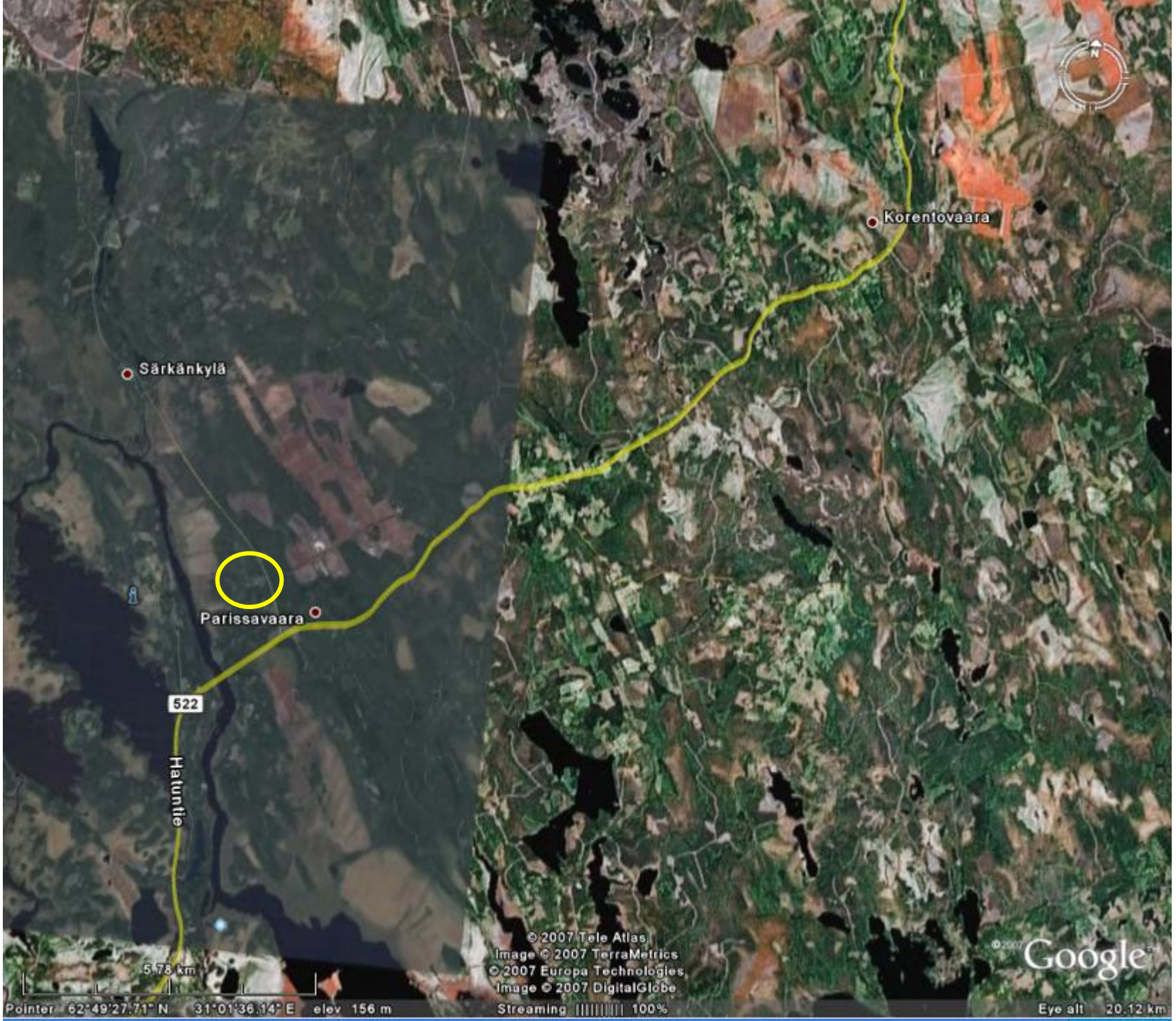
5. To process the log file and images

Current Pitch (rad x 1024)	328	cState	222
Current Roll (rad x 1024)	245	corrRoll	27
dP- Altitude	-16800	corrPitch	459
yDot Accelometer	10	GPS altitude (m)	445
dRoll	-174	GPS velocity (up / down)	31
GPS Heading (deg x 10)	2275	x- accelerometer	29
Location E (ft x 8)	-6031	Compass	0
Location N (ft x 8)	1715	Yaw	-2139
dPitch	354	desired heading	81
GPS Speed (ft/sec)	69	Heading control PID	20
AGL (Not in CropCam)	0	Climb state	5
GPS status	8192	Correction pitch dot	0
Temperature	19	Correction yaw dot	19
GPS pos E	31,02177	Body pitch dot	1136
GPS pos N	62,76311	Body roll dot	-15600
Air speed (ft/sec)	57	Body yaw dot	5472
Target speed (ft/sec)	47	Target heading (deg)	81
Current Altitude (ft x -8)	-8558	Event	-238

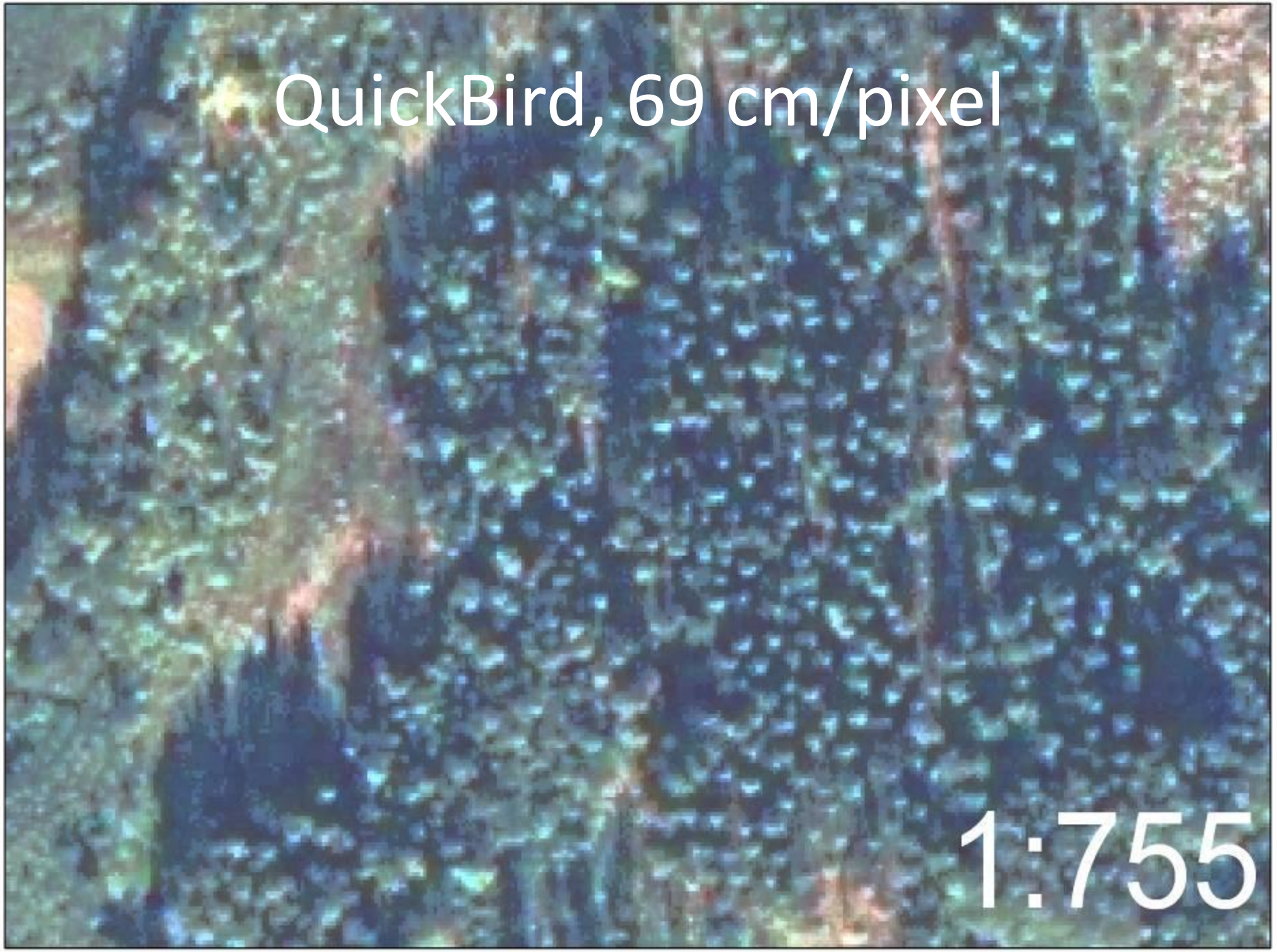
6. To mosaic the images and/or image run object-oriented image processing

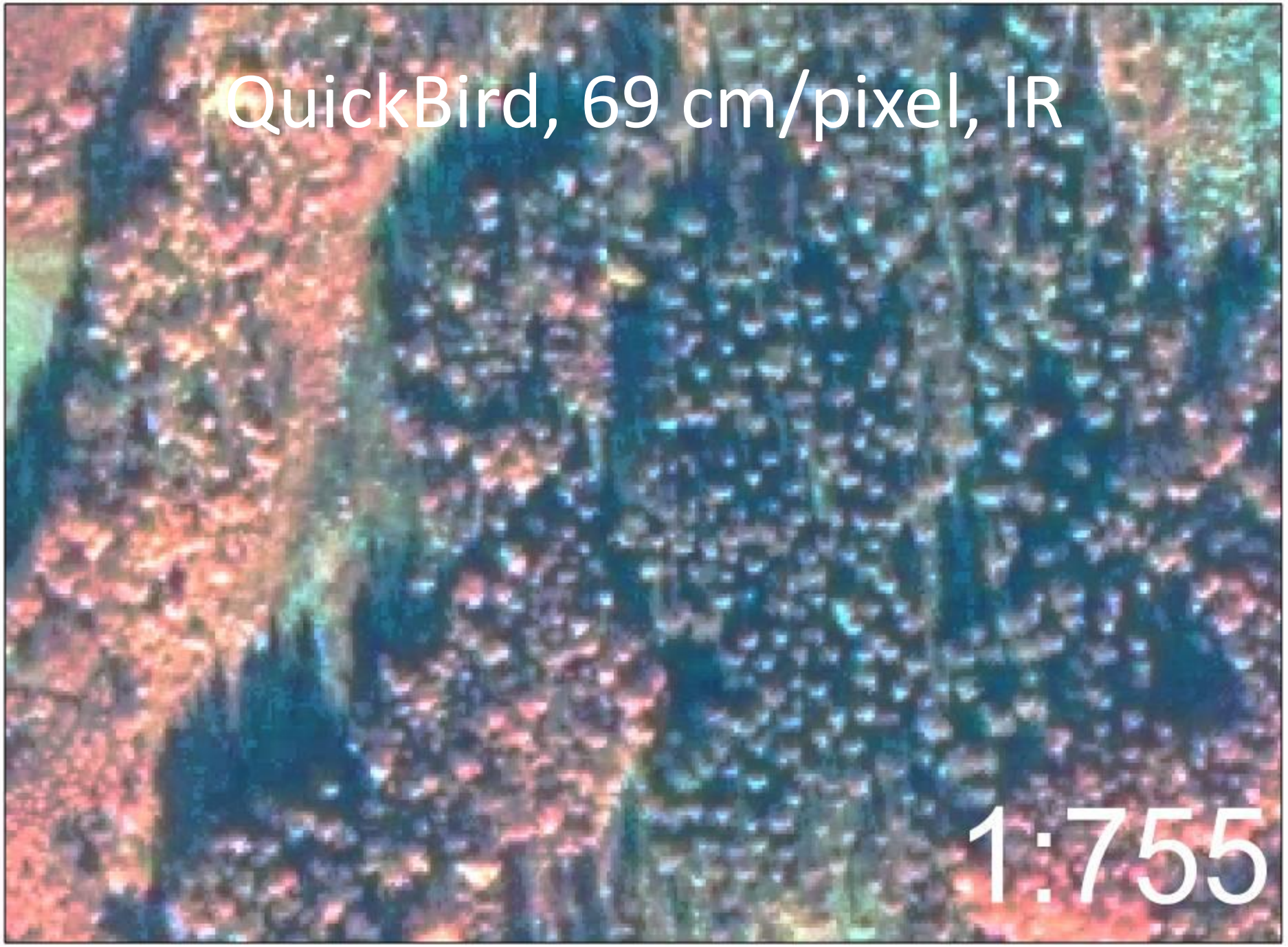
Resolution does matter!


87
Nurmes
73
75
Lieksa
6
© 2007 Tele Atlas
Image © 2007 TerraMetrics
© 2007 Europa Technologies
31 km
Google
Pointer 63°26'04.44" N 29°30'08.54" E elev 115 m
Streaming 100%
Eye alt 108.07 km


Korentovaara
Särkänkylä
Parissavaara
522
Hatuntie
5.78 km
© 2007 Tele Atlas
Image © 2007 TerraMetrics
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
Google
Pointer 62°49'27.71" N 31°01'36.14" E elev 156 m
Streaming 100%
Eye alt 20.12 km


N
© 2007 Tele Atlas
41 m
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
©2007 Google™
Pointer 62°46'18.82" N 30°59'10.37" E elev 140 m
Streaming 100%
Eye alt 285 m


QuickBird, 69 cm/pixel
1:755


QuickBird, 69 cm/pixel, IR
1:755


UAV


To mark the plots with visible from the air markers


To make the full biodiversity inventory (species lists with coverages: plants, mosses, liverworts, lichens, mushrooms)


To measure GPS coordinates of the plots (50 x 50 cm), postprocessing acuracy 50 cm

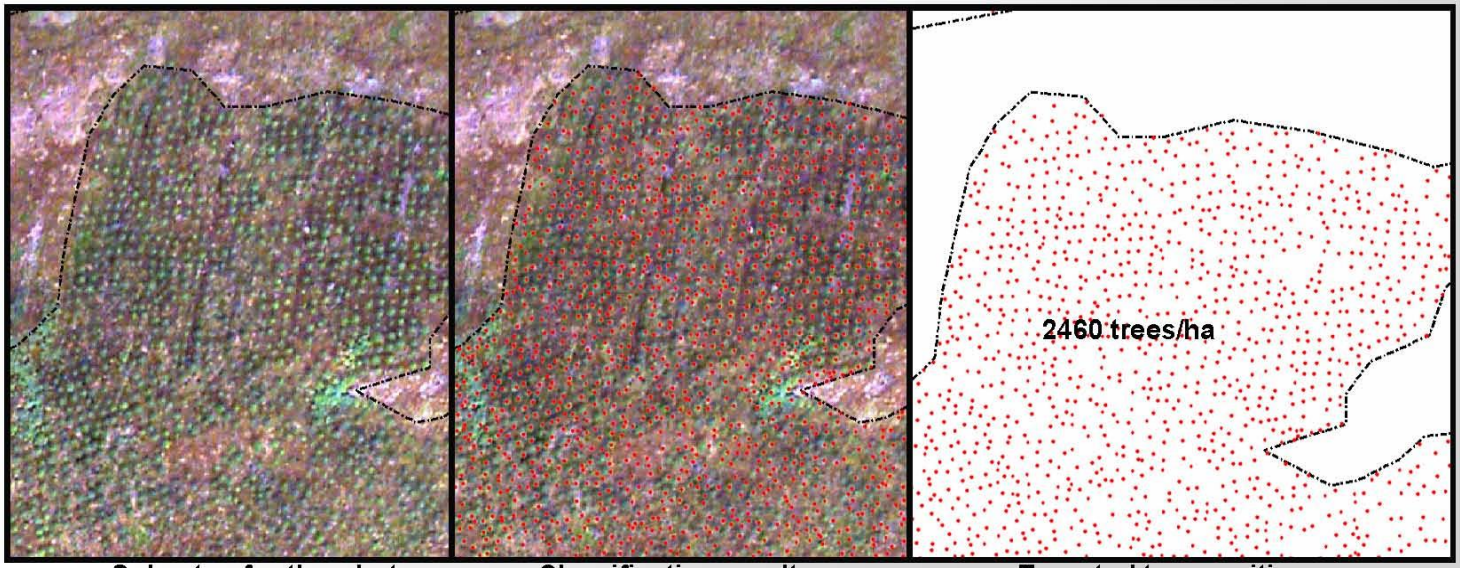
Additional information from UAV data

- Tree-wise inventory
- Age class of the individual trees (clear separation between old and medium-aged trees)
- Gaps structure
- Undergrowth
- Big species (ex. Vaccinium myrtillus)


measure diameter
measure the height

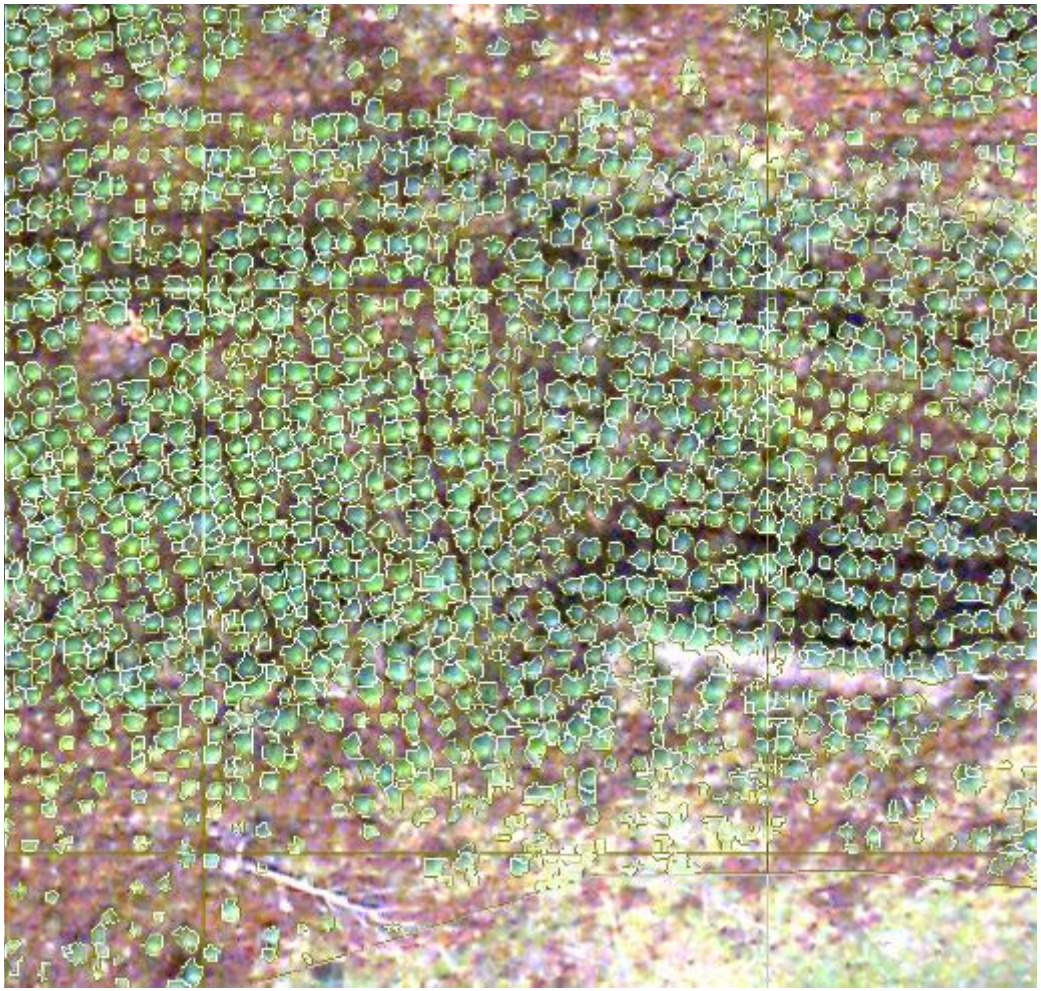
DEFINIENS
The Image Intelligence Company

Transferability



Transfer of rule base to ortho-photos of different areas with appropriate additional thematic layers.

Classification of single trees

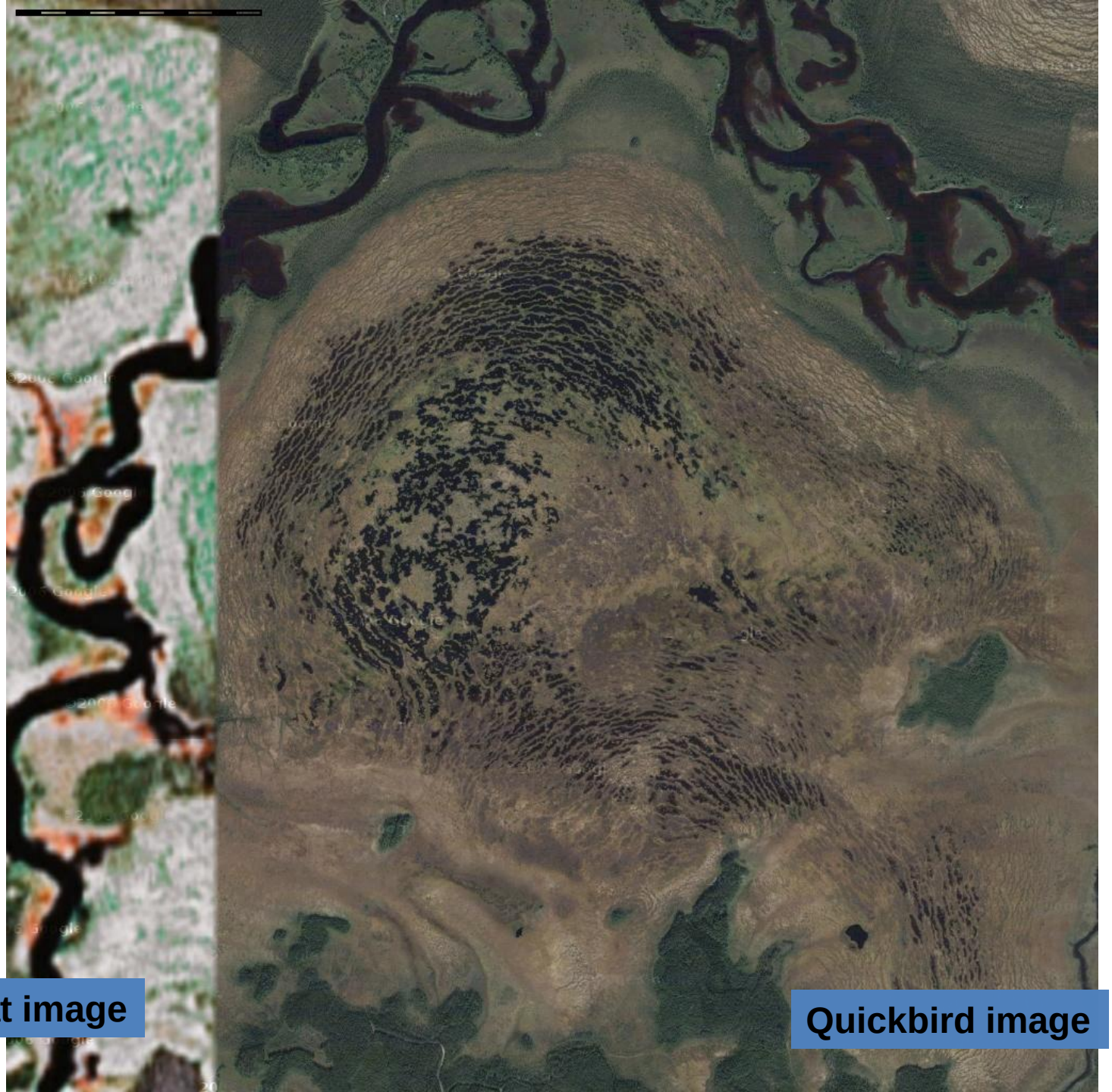



Tools
XY

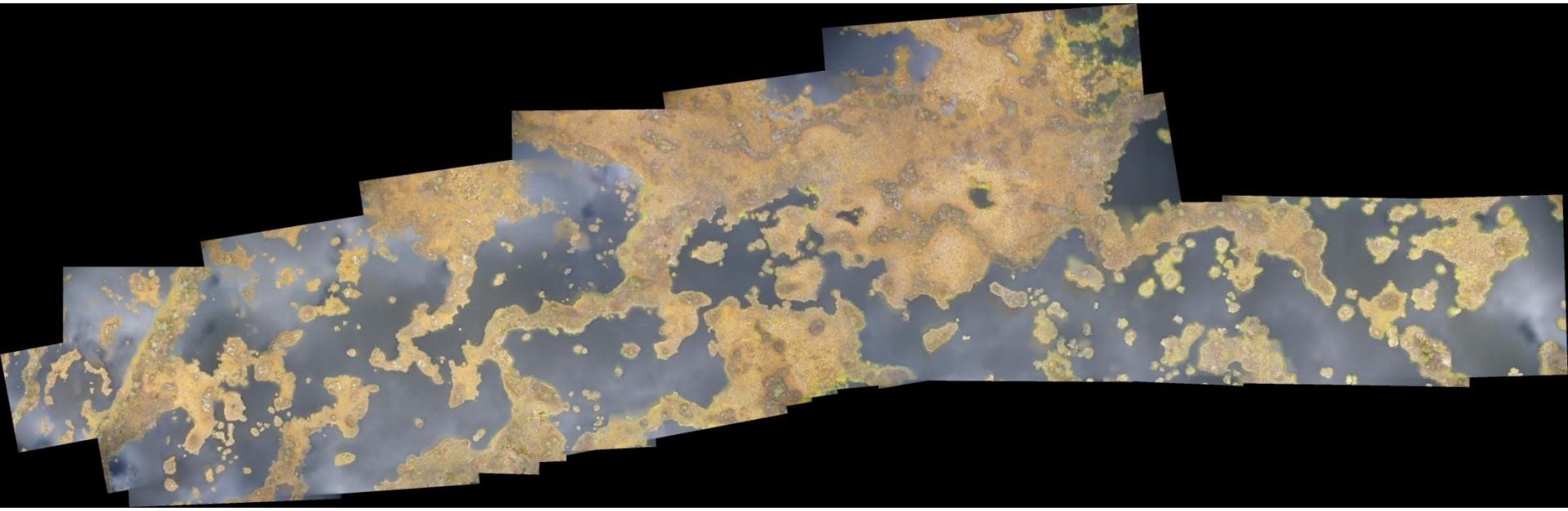
Gap structure in forest

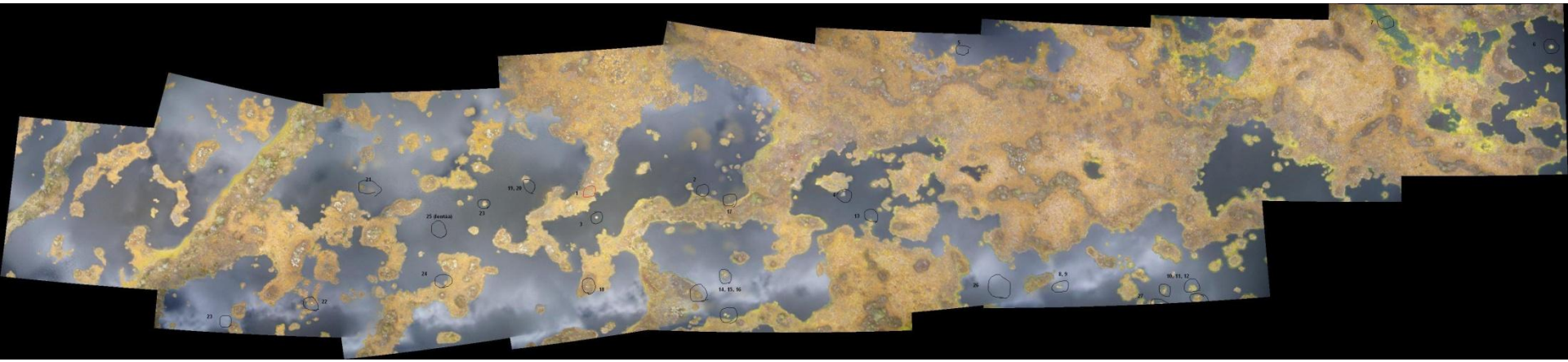
Example 2

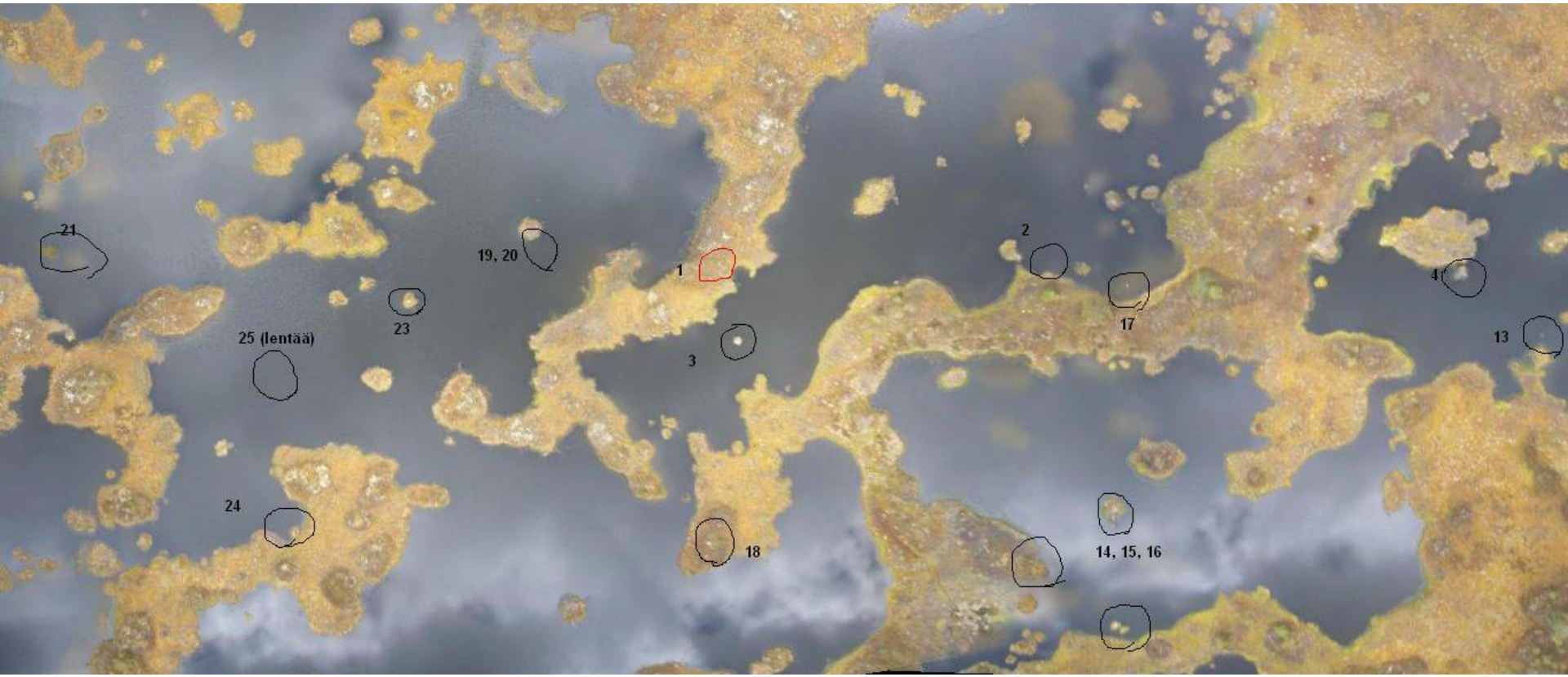
- Herring gull population living in Kesonsuo-mire (in Ilomantsi close to Mekrijärvi)
  - Small population
  - Eating in dumping ground of Joensuu (50 km)
  - Main questions:
    - Number of gulls
    - Number of nests
  - In co-operation with Risto Juvaste


Landsat image
Quickbird image

Kesonsuo-mire in Ilomantsi




21
19, 20
1
2
25 (lentas)
23
3
17
13
24
18
14, 15, 16
26
8, 9
10, 11, 12
22
23
27
7
6
4


21
19, 20
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25 (lentää)
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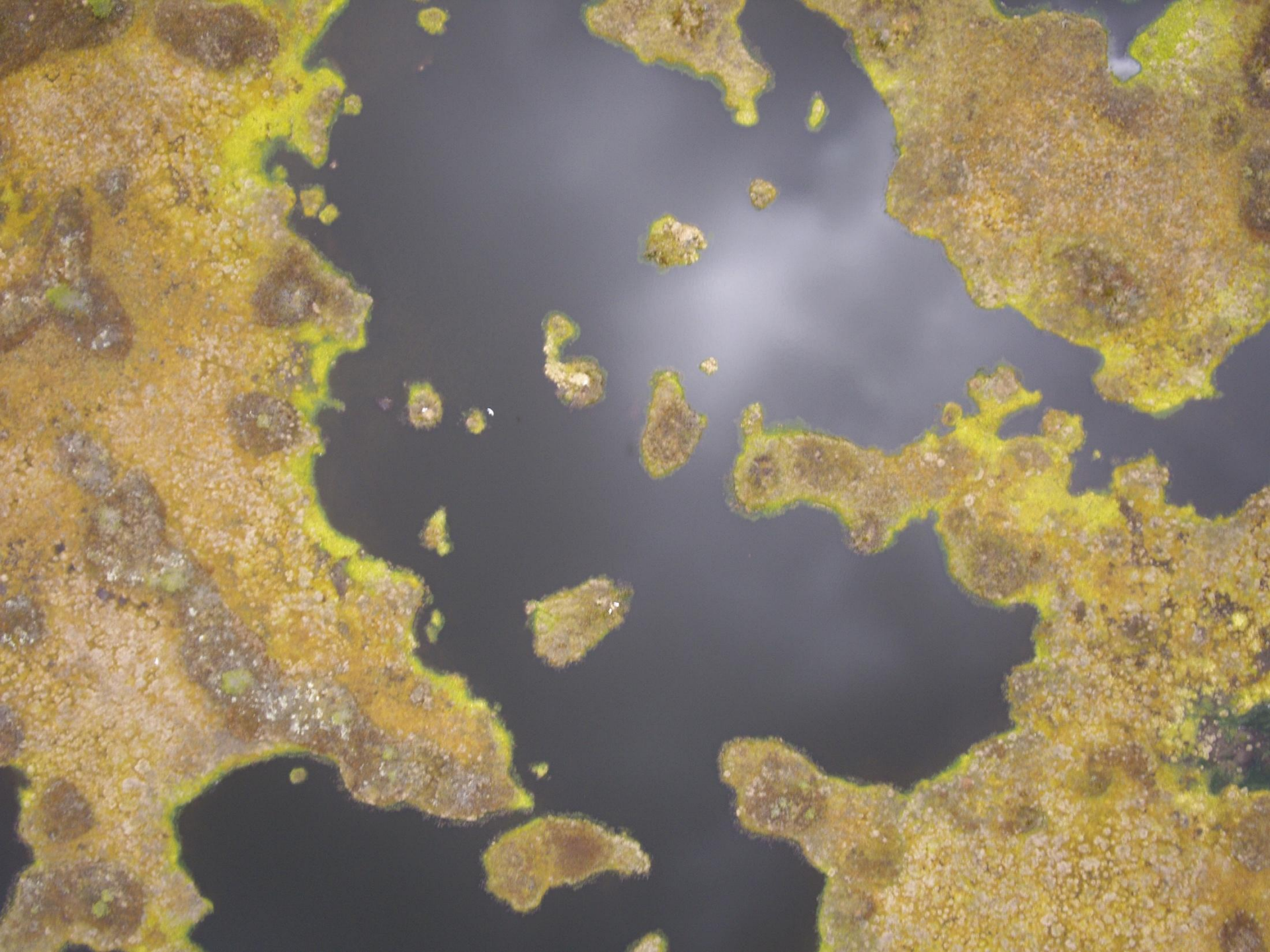
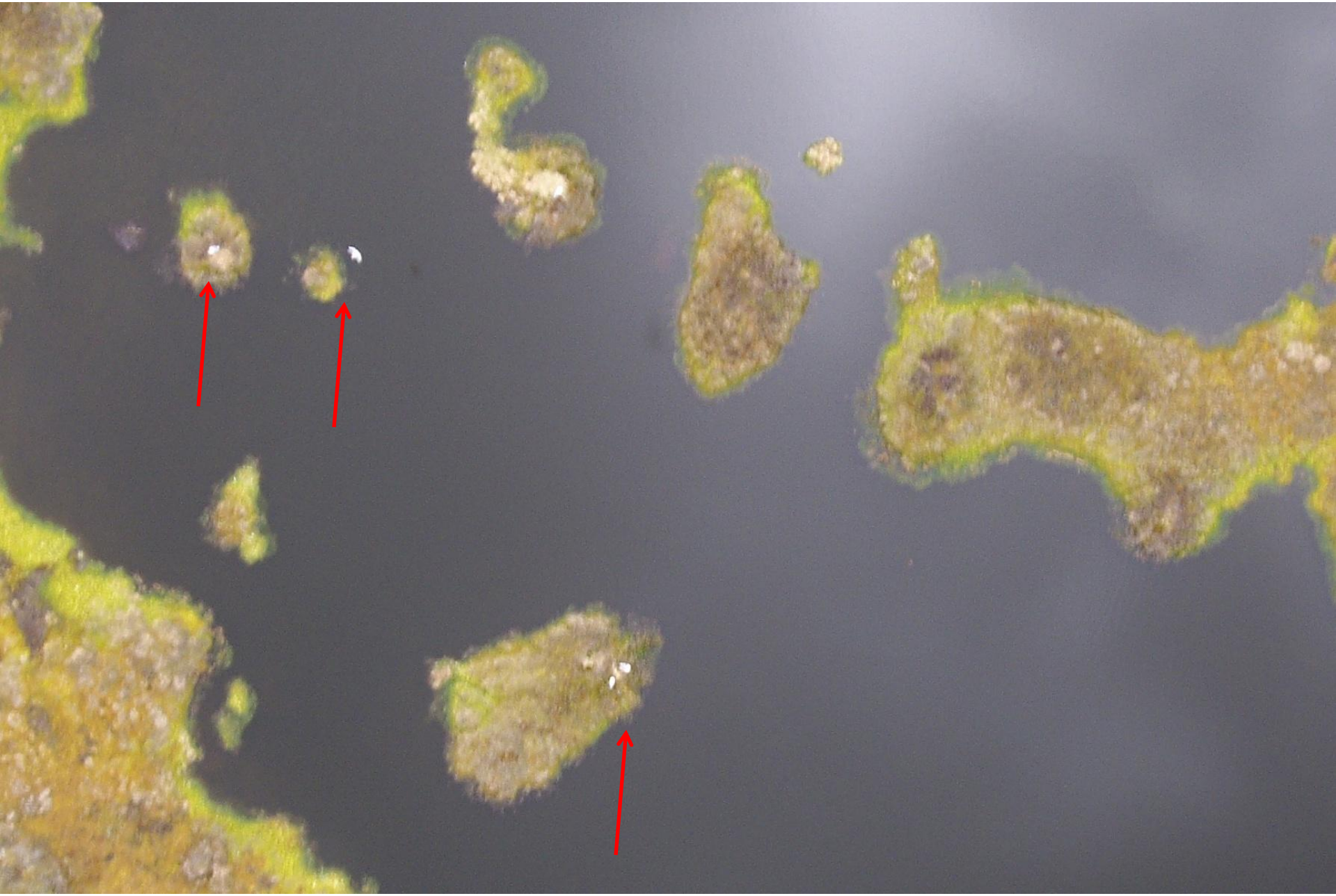
14, 15, 16





Other possibilities

- Lakes
- Winter images
- IR-images

Conclusions

- New techniques give a lot of new possibilities in remote sensing --- development is rapid.
- We do need the ground-truth data.
- Are we **open** and **capable** to utilise all the new possibilites available in near future?