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**Bryndís Marteinsdóttir, Landgræðsla ríkisins**

HARMONIOUS workshop

15. february 2018

# VEGETATION MONITORING IN ICELAND USING UAV'S



SVARMI



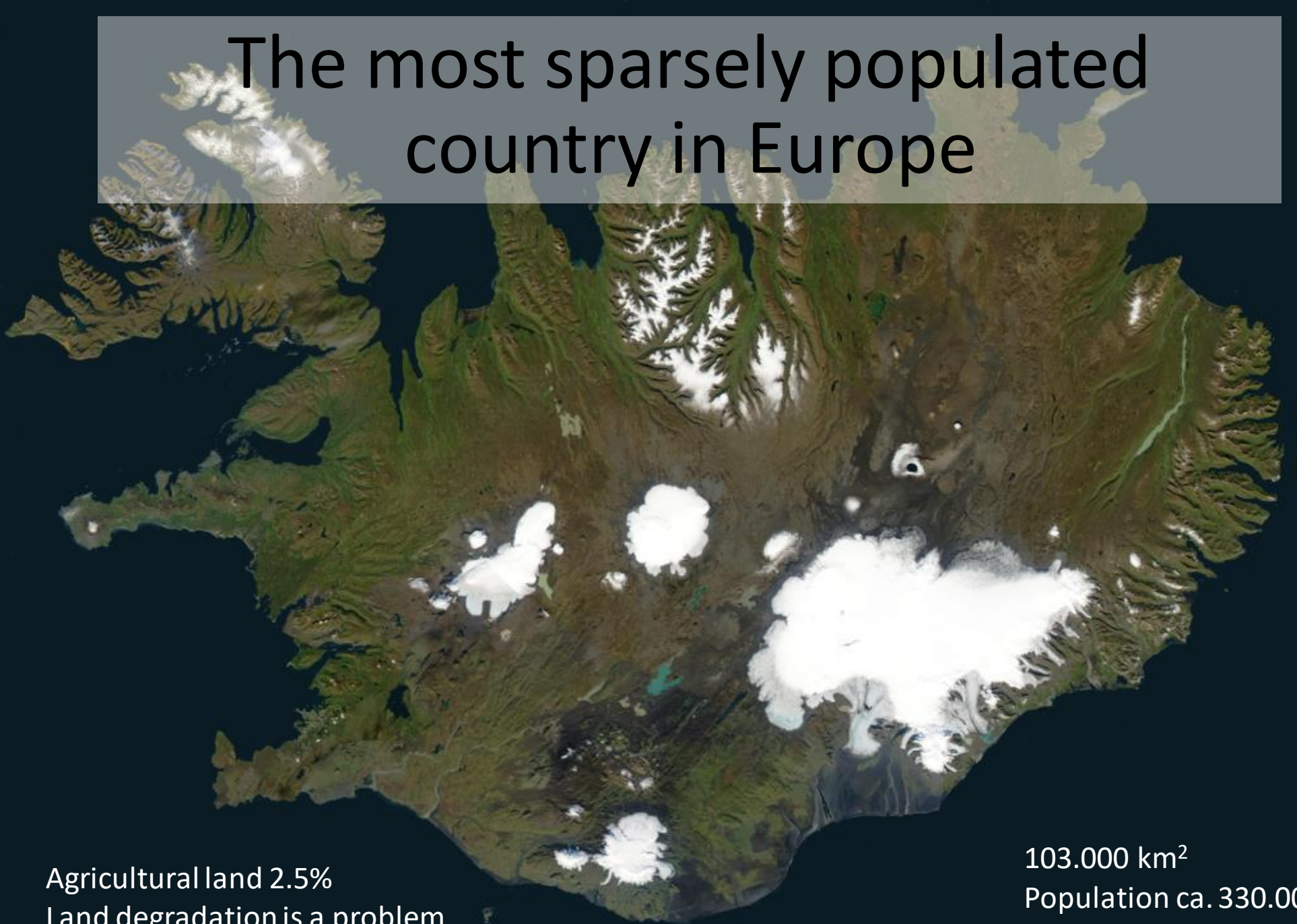
# Iceland



Agricultural land 2.5%  
Land degradation is a problem

103.000 km<sup>2</sup>  
Population ca. 330.000  
Sheep > 1 million

The most sparsely populated  
country in Europe



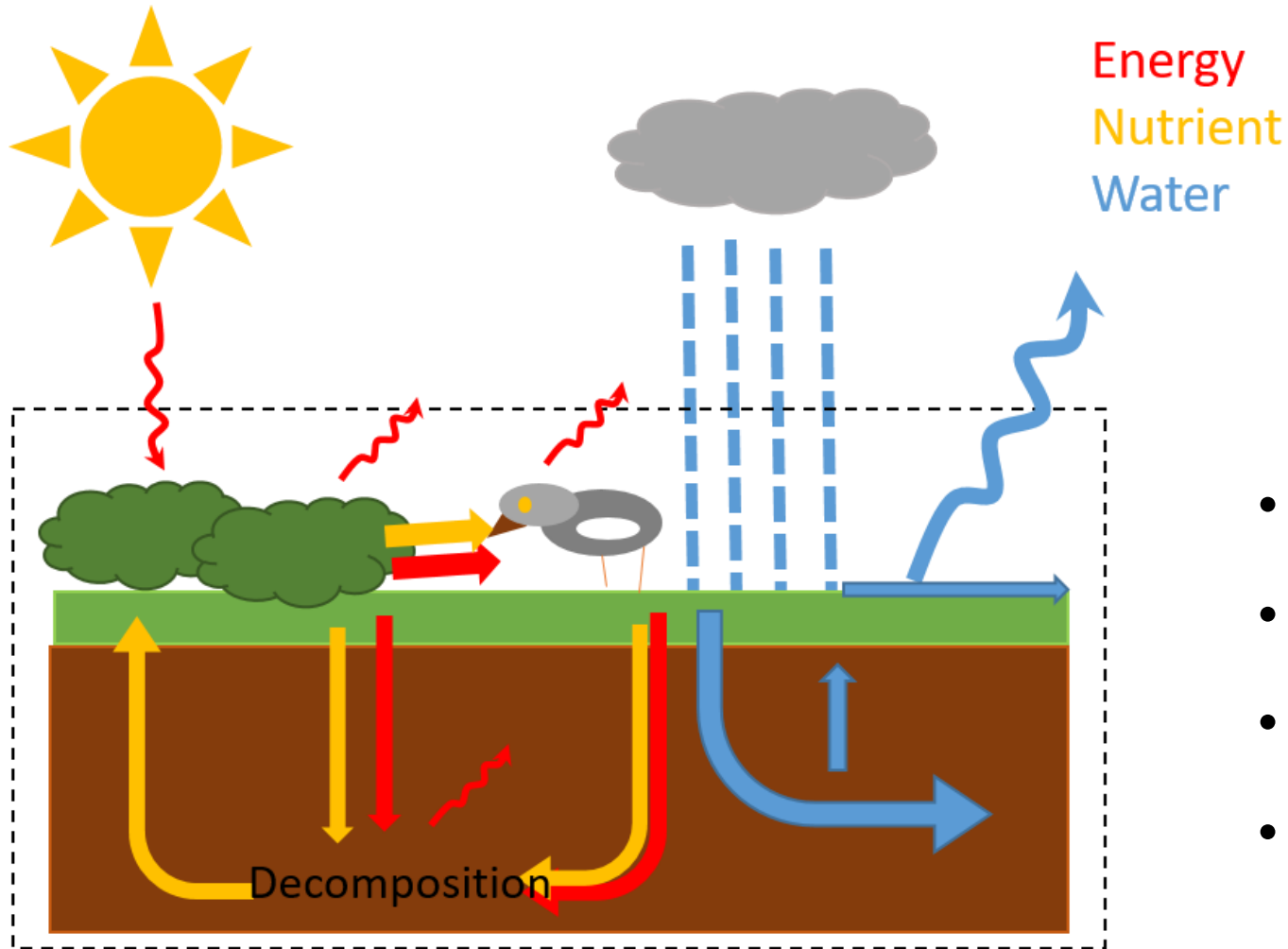
# GróLind

## The first large scale vegetation monitoring in Iceland

- Funded through the agricultural subsidy system
  - Focus on rangelands (most of rural Iceland)
- Monitoring natural (semi-natural) ecosystems
- Long term project
- 2017-2019 development
- 2019 monitoring starts
- Harmonizing efforts of various institutions



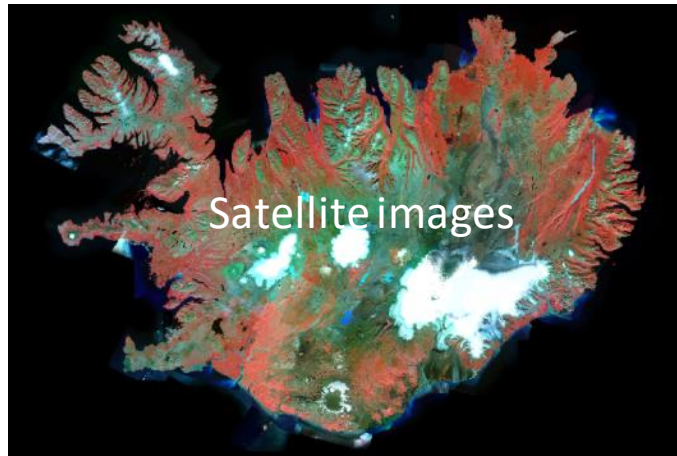
# Focus on ecosystem functioning and structure



- Vegetation cover and composition
- Ecosystem resistance and resilience
- Water and nutrient cycle
- Energy flow

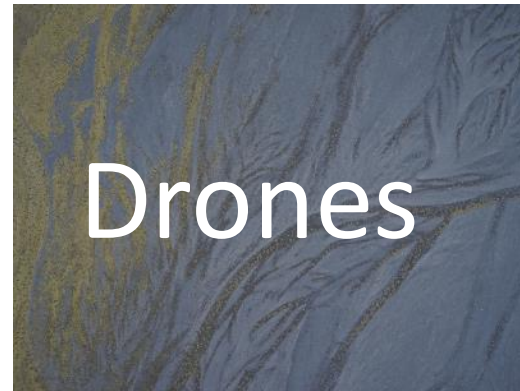


## The whole country

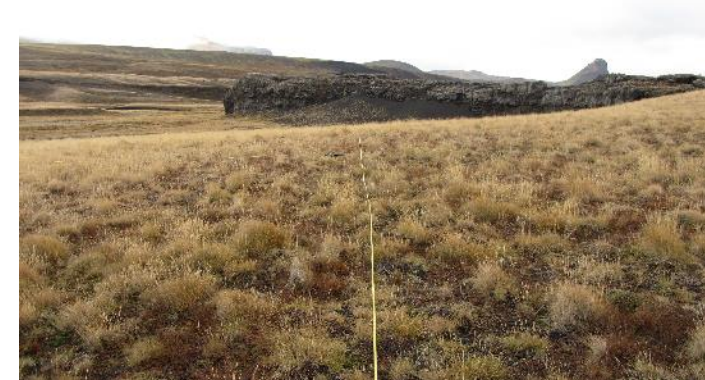


## Several spatial scales

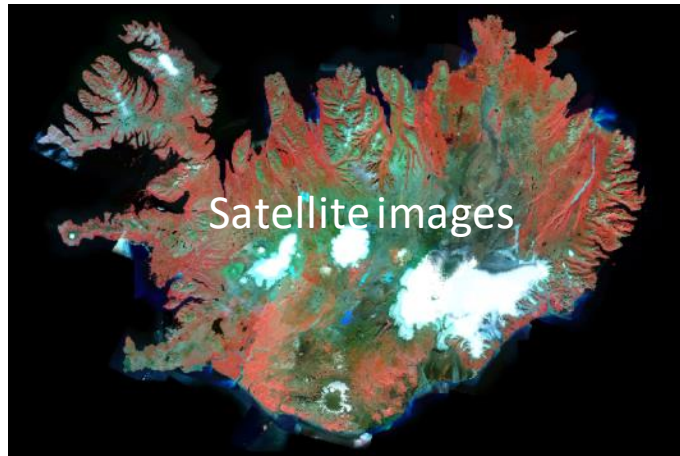
### Grid of target sites



### Stakeholder's monitoring

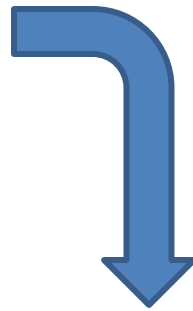


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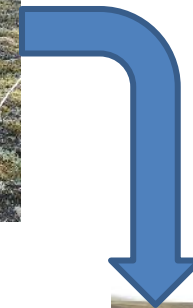
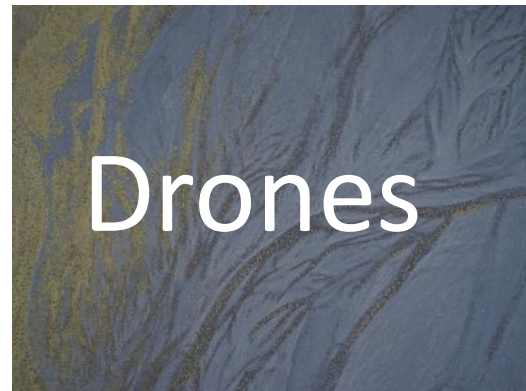


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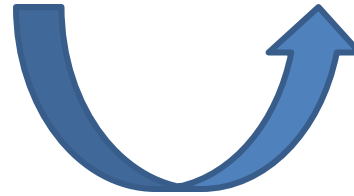
Linking different scales



Grid of target sites



Stakeholder's monitoring



# Drones in GróLind

- Vegetation classification
  - Identification and density of key species
  - NDVI
  - GPP
  - Carbon fluxes
  - improve data from satellites
- .....and more

Adaptive monitoring

# Icelandic examples of spatial scale linkages



S V A R M I



Breiðarfjörður

# Icelandic examples of spatial scale linkages



SVARMI



Breiðarfjörður



Skeiðarársandur

# Breiðafjörður: seaweed stock estimation

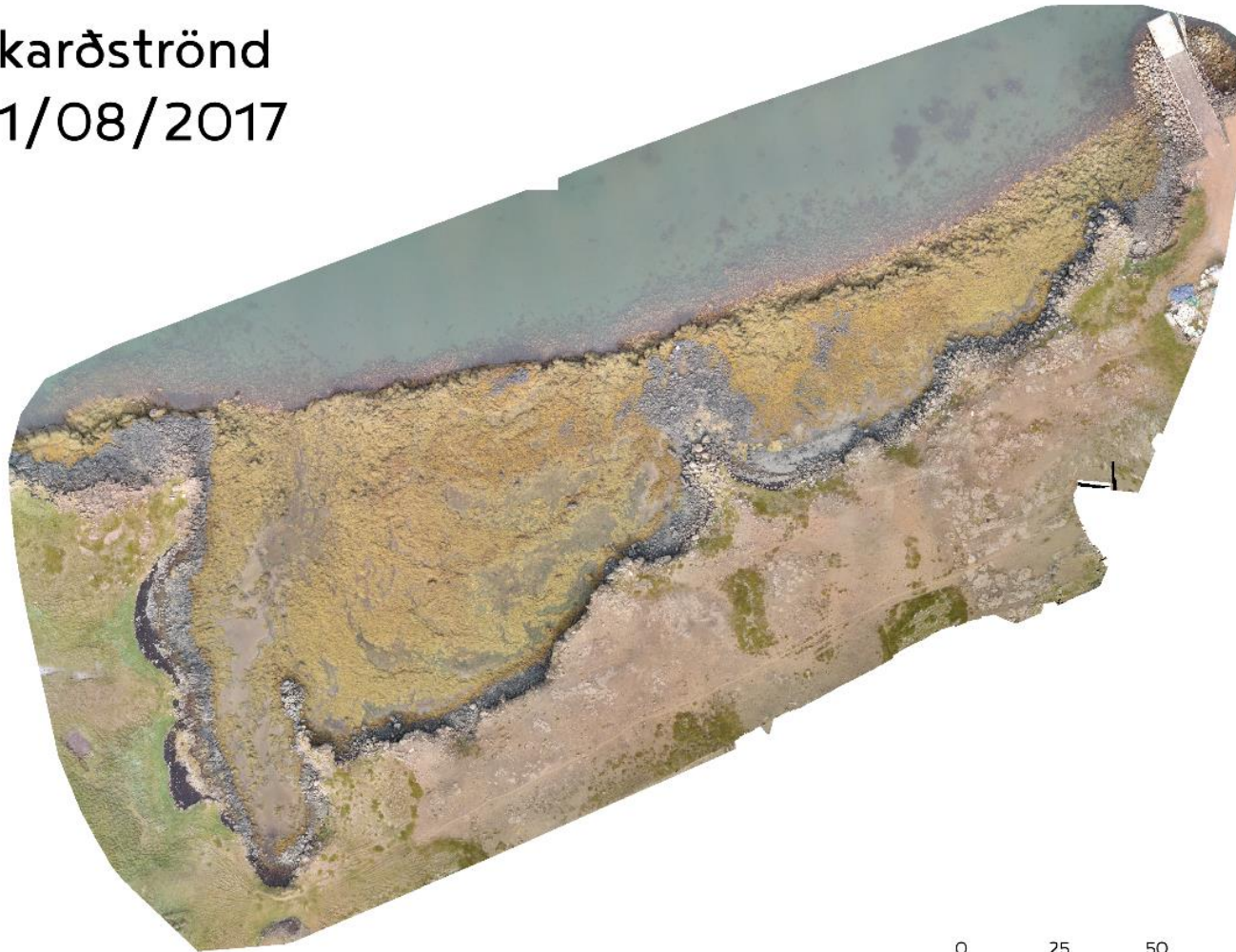


- Purpose: estimate threshold for sustainable harvest
- Previous workflow: manual digitalization of aerial imagery
- Developed workflow: a MULTISCALE approach
  - **SCALE 1** → Ancillary/ground truth data: field samples of algae
  - **SCALE 2** → Classification of satellite imagery (Sentinel/Landsat)
  - **SCALE 3** → Classification of sparsed UAV multispectral data

# Breiðafjörður: seaweed stock estimation



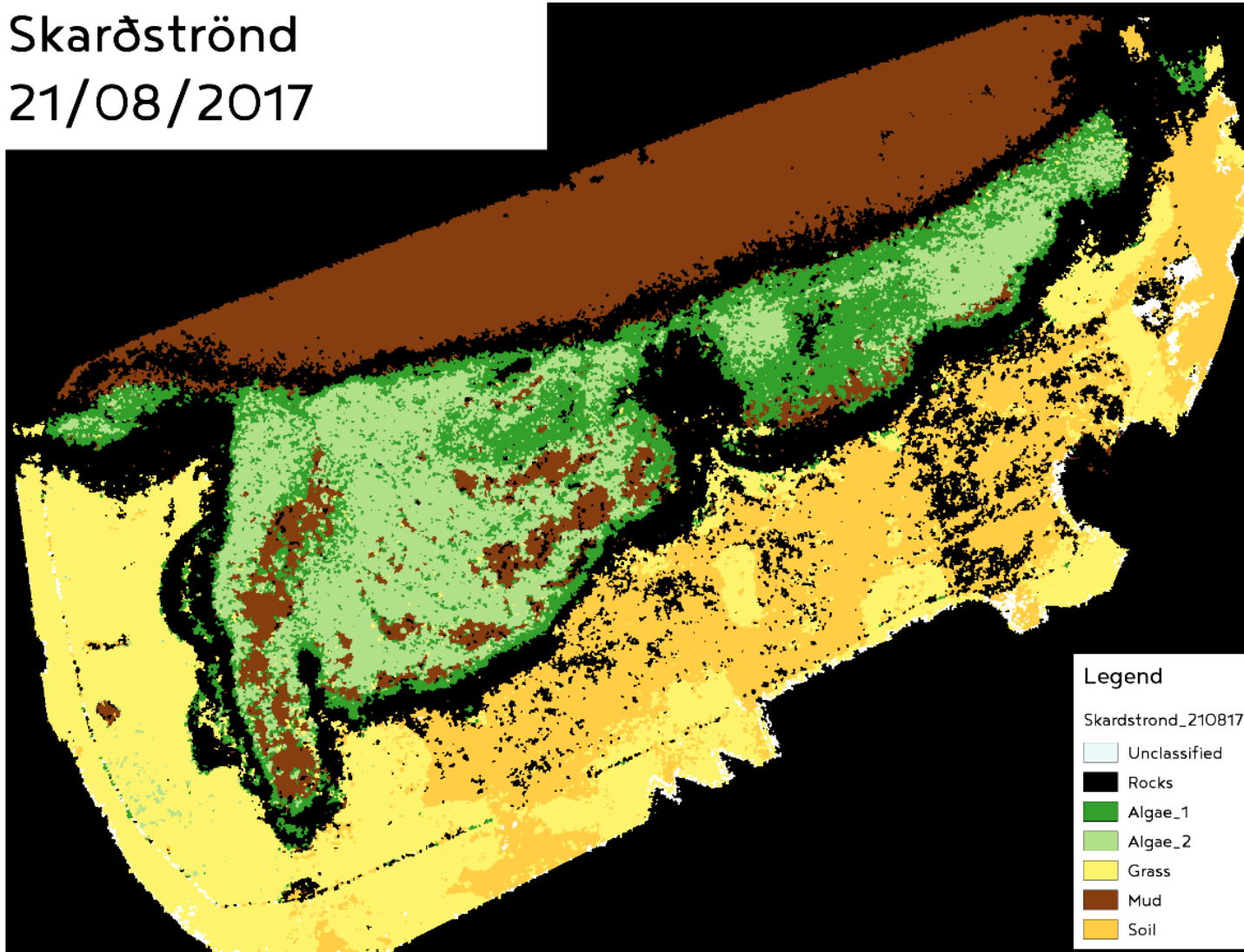
Skarðströnd  
21/08/2017



# Breiðafjörður: seaweed stock estimation



Skarðströnd  
21/08/2017



# Breiðafjörður: seaweed stock estimation



S V A R M I



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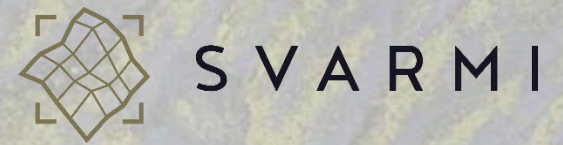
S V A R M I





Mesoscale: fixed wing RGB flights

# Skeiðarársandur: birch colonization study (2016 -2019)



Mesoscale

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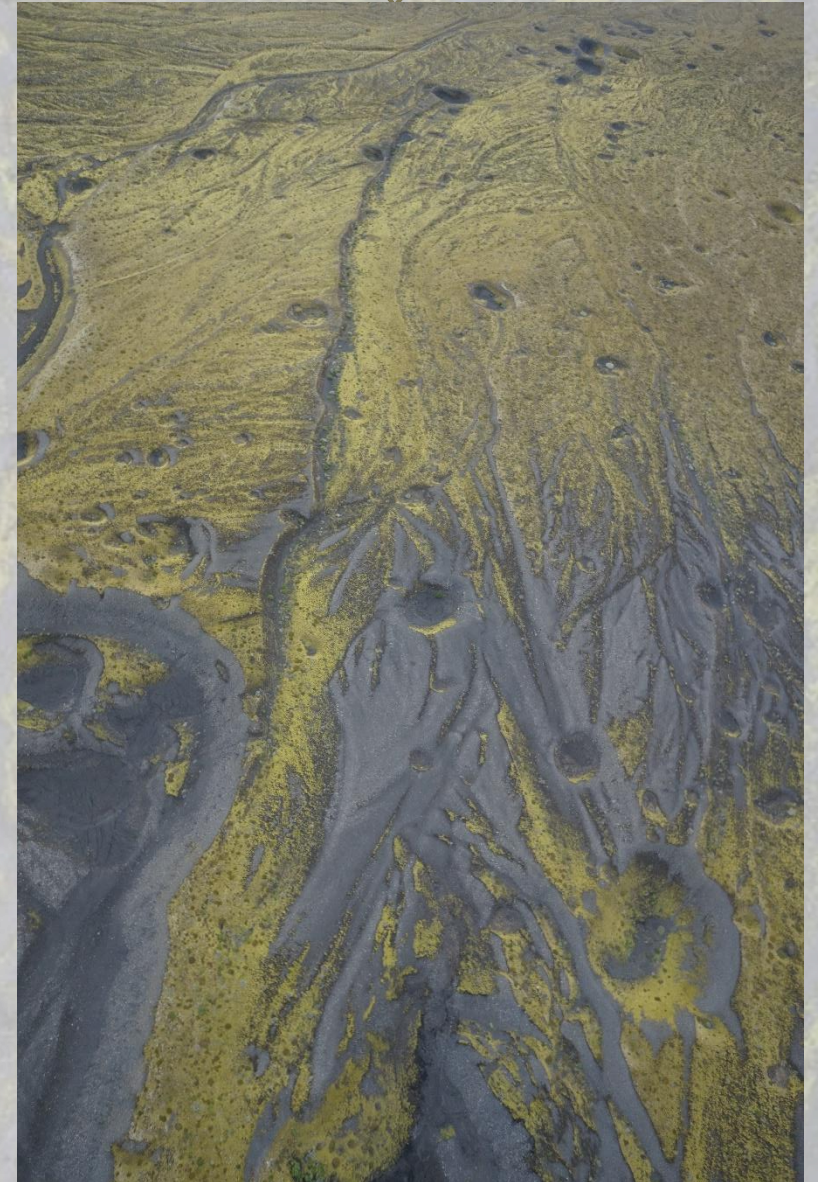


Mesoscale

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Mesoscale



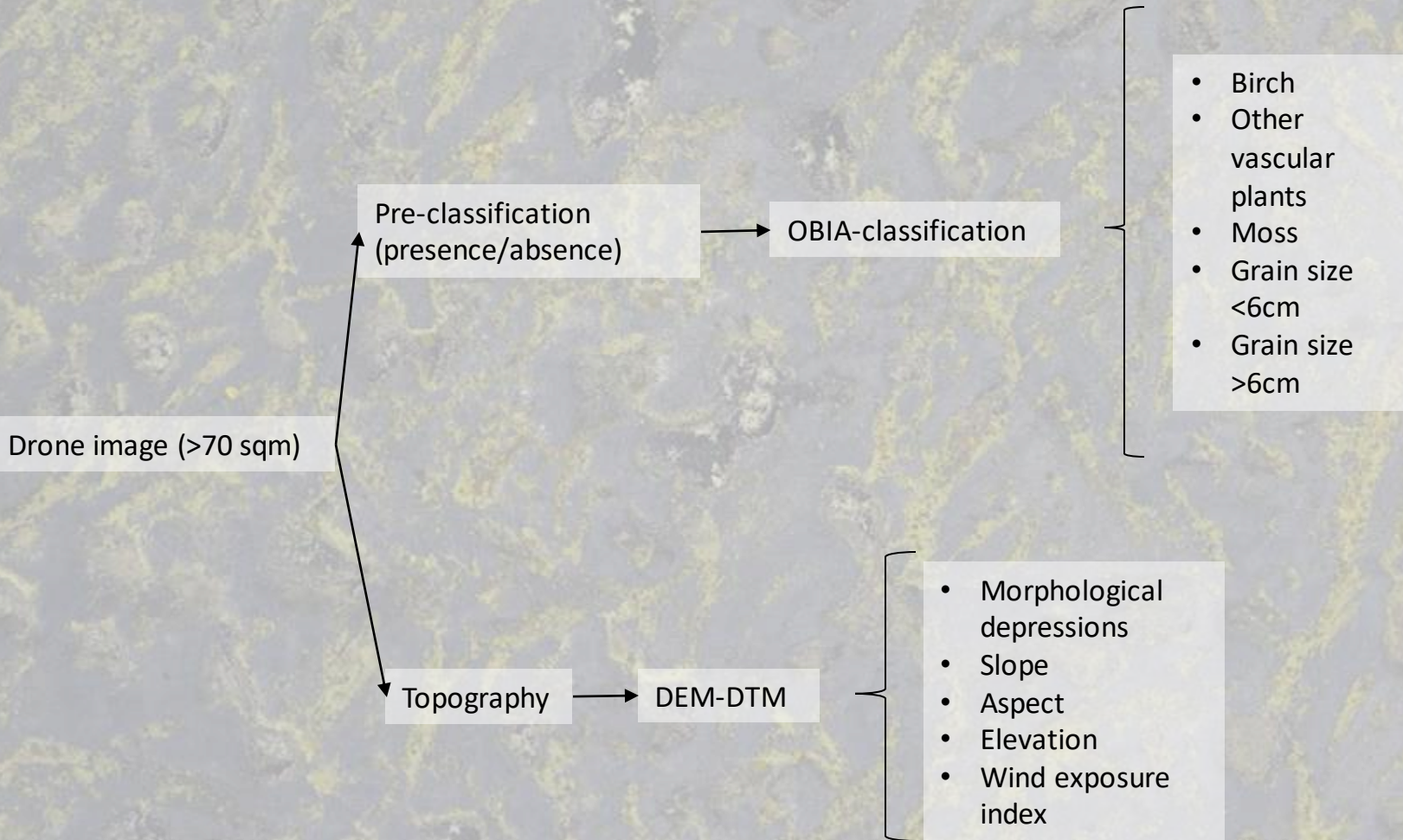
# Skeiðarársandur: birch colonization study (2016 -2019)



- **Purpose:** Study the birch distribution and its environmental correlates and its ecological impact
- **SCALE 1** → Ancillary/ground truth data: campaign of field sampling
- **SCALE 2** → Fixed wing data: most extensive acquisition of drone imagery in Iceland (70 km<sup>2</sup>)

**Mesoscale**

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Mesoscale

# Skeiðarársandur: birch colonization study (2016 -2019)



- Birch
- Other vascular plants
- Moss
- Grain size <6cm
- Grain size >6cm

- Morphological depressions
- Slope
- Aspect
- Elevation
- Wind exposure index

Geographic regression analysis

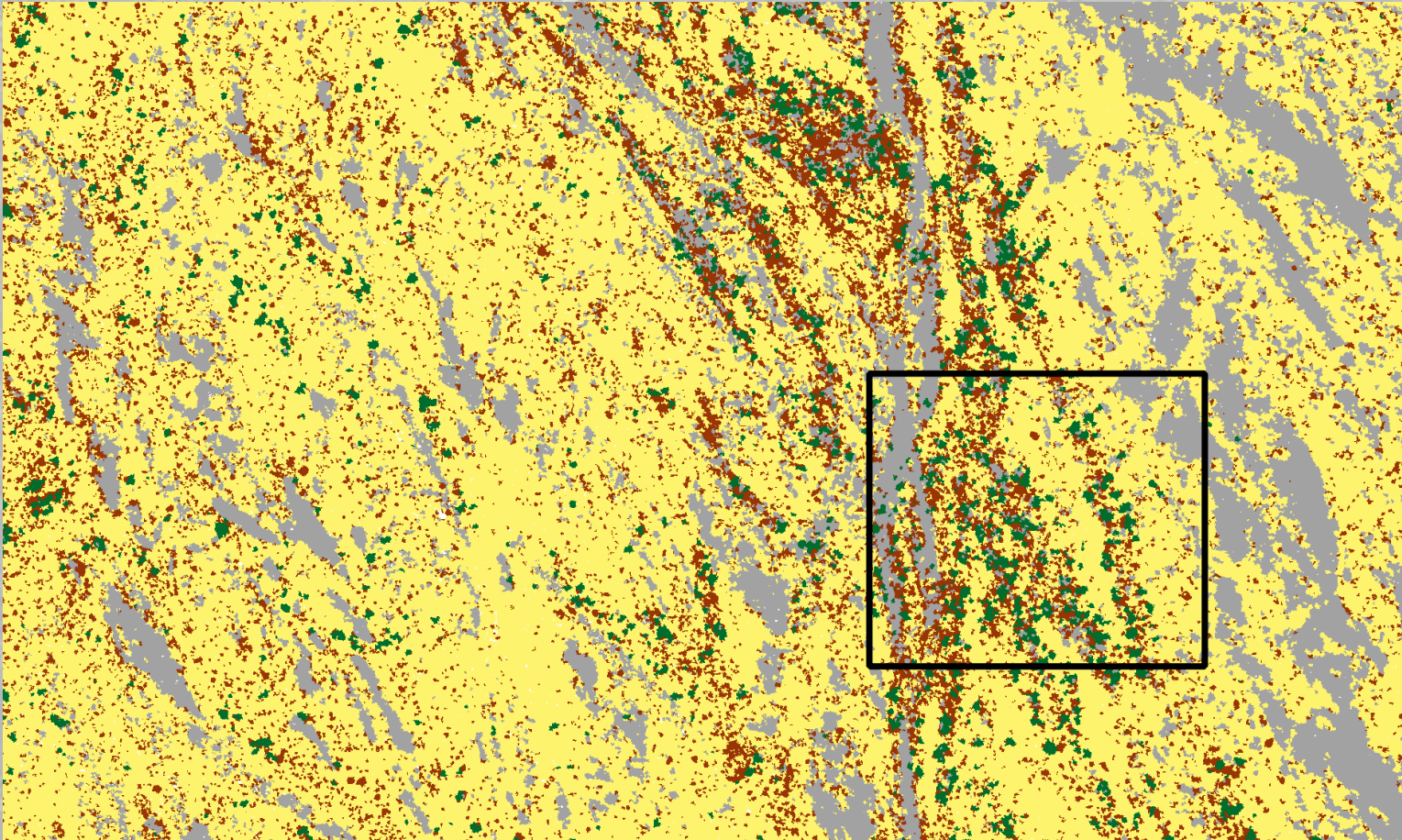
Independent variable: birch

Spatial model of distribution for prediction and understanding

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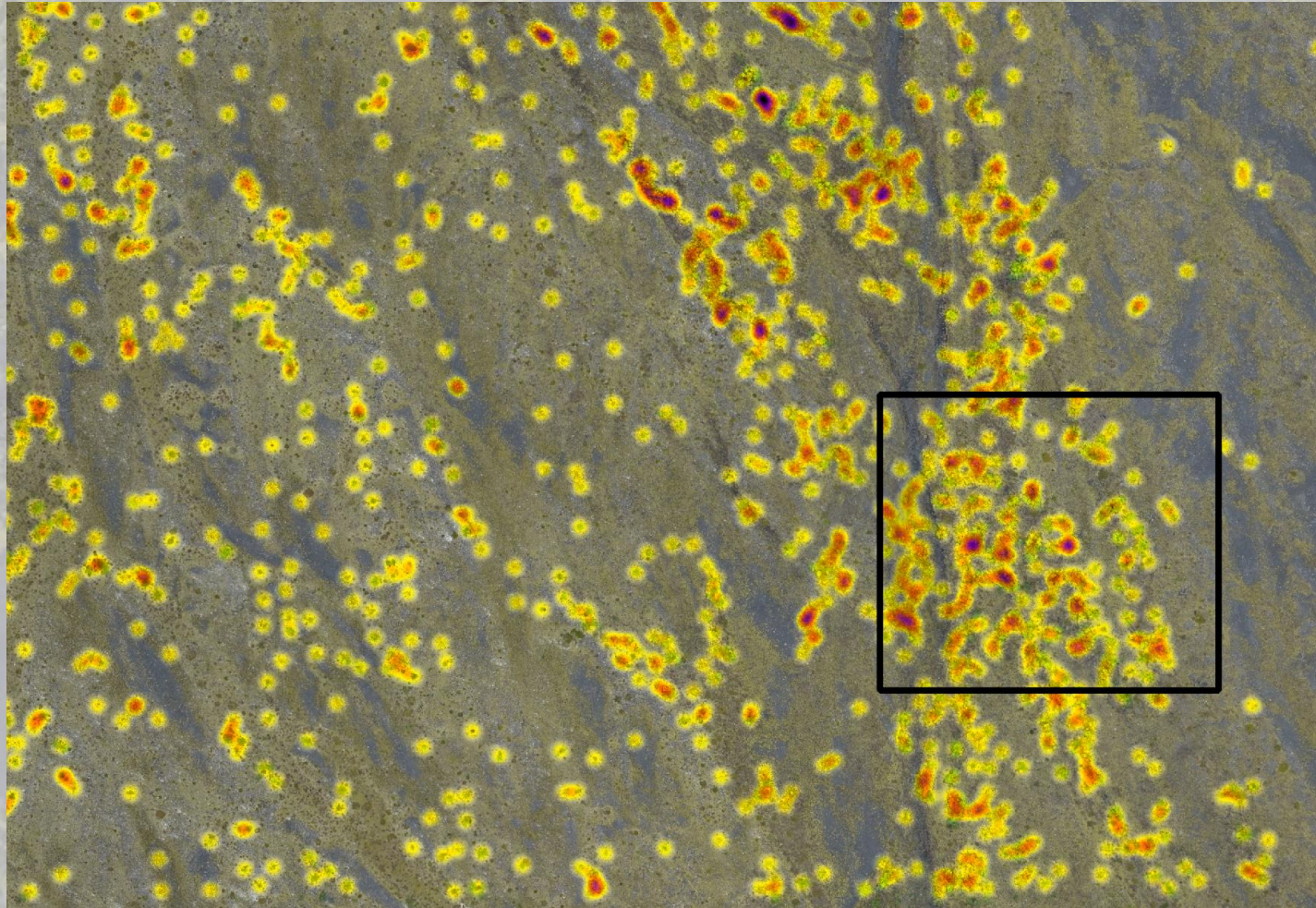
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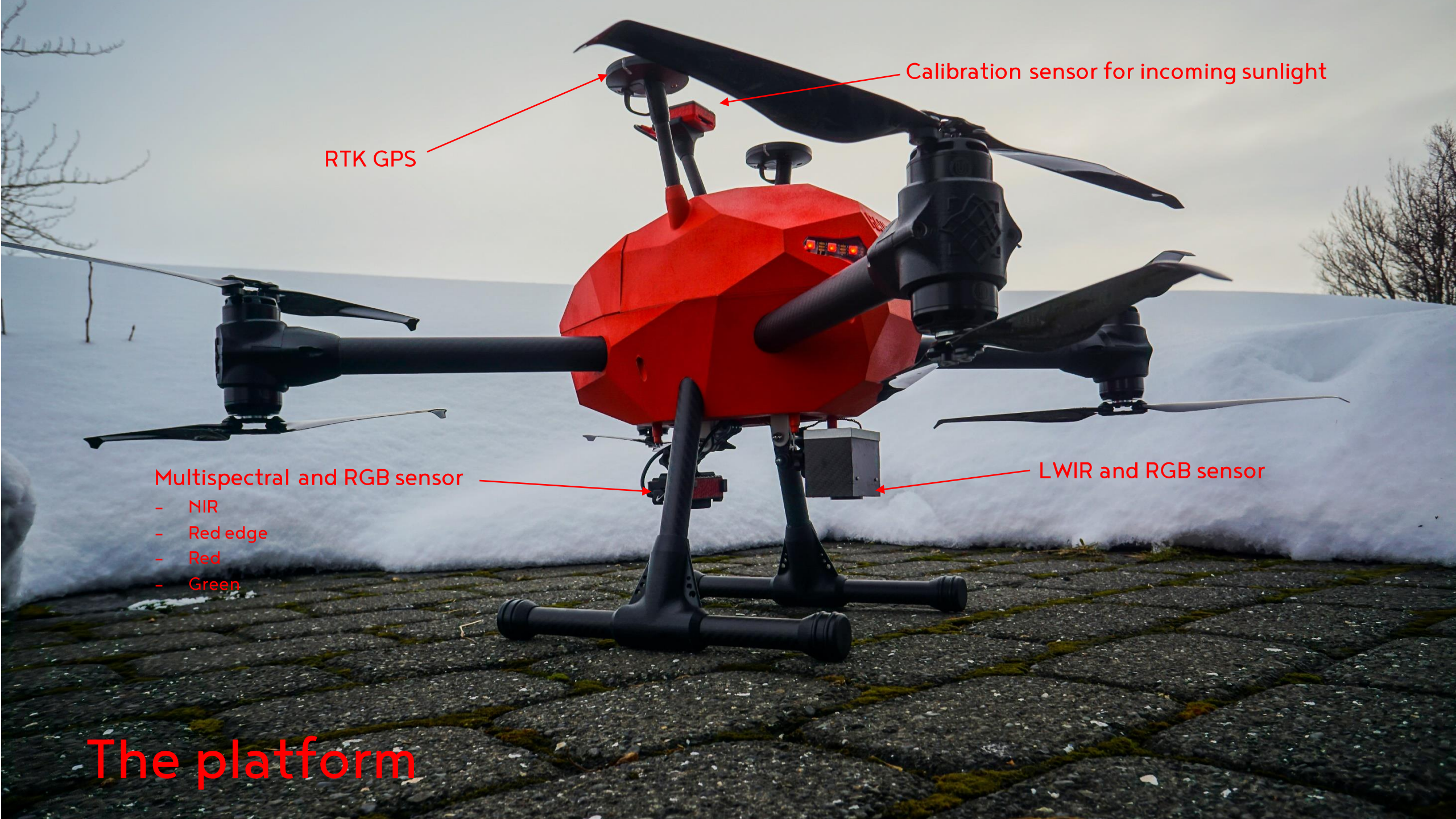


**Mesoscale**

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Microscale: low multirotor flights with camera rig



RTK GPS

Calibration sensor for incoming sunlight

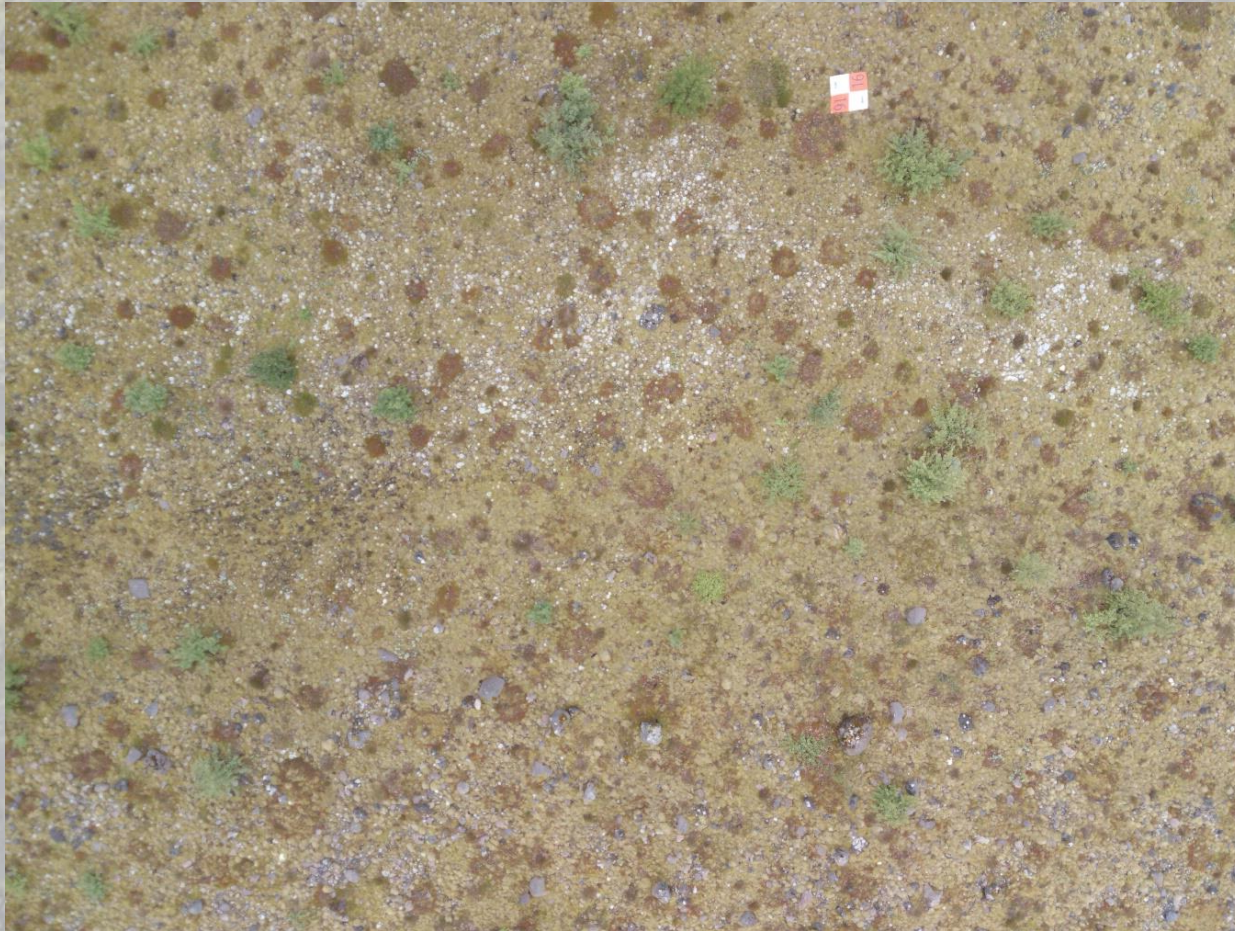
Multispectral and RGB sensor

- NIR
- Red edge
- Red
- Green

LWIR and RGB sensor

The platform

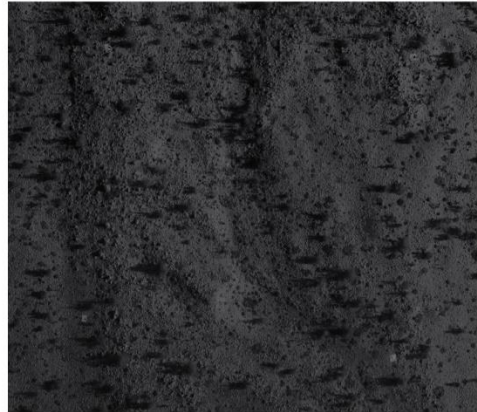
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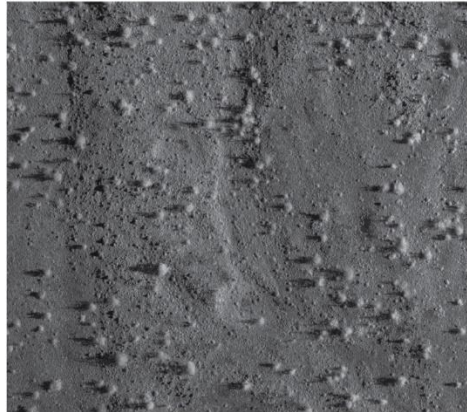
**Microscale**

- **Purpose:** examine the potential ecological engineering influence of birch on vegetation and soil parameters using ground and remotely sensed data
- **SCALE 1** → Ancillary/ground truth data: campaign of field sampling
- **SCALE 2** → Low flight UAS: mounting a camera rig of a Thermal and multispectral sensor

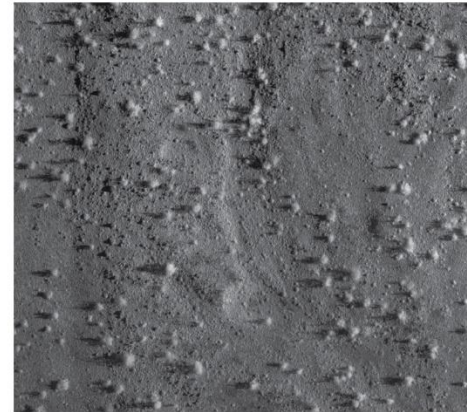
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Red 640-680nm



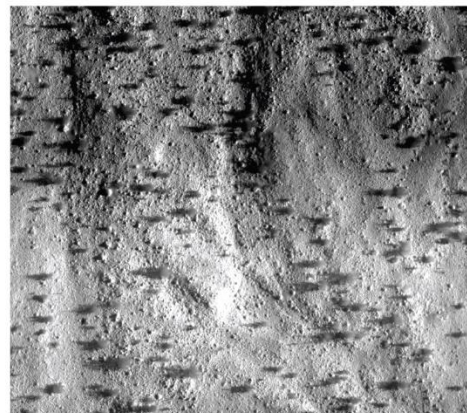
Red edge 730-740nm



NIR 770-810nm



Green 530-570nm



LWIR 7500-13.500nm



RGB 400-700nm

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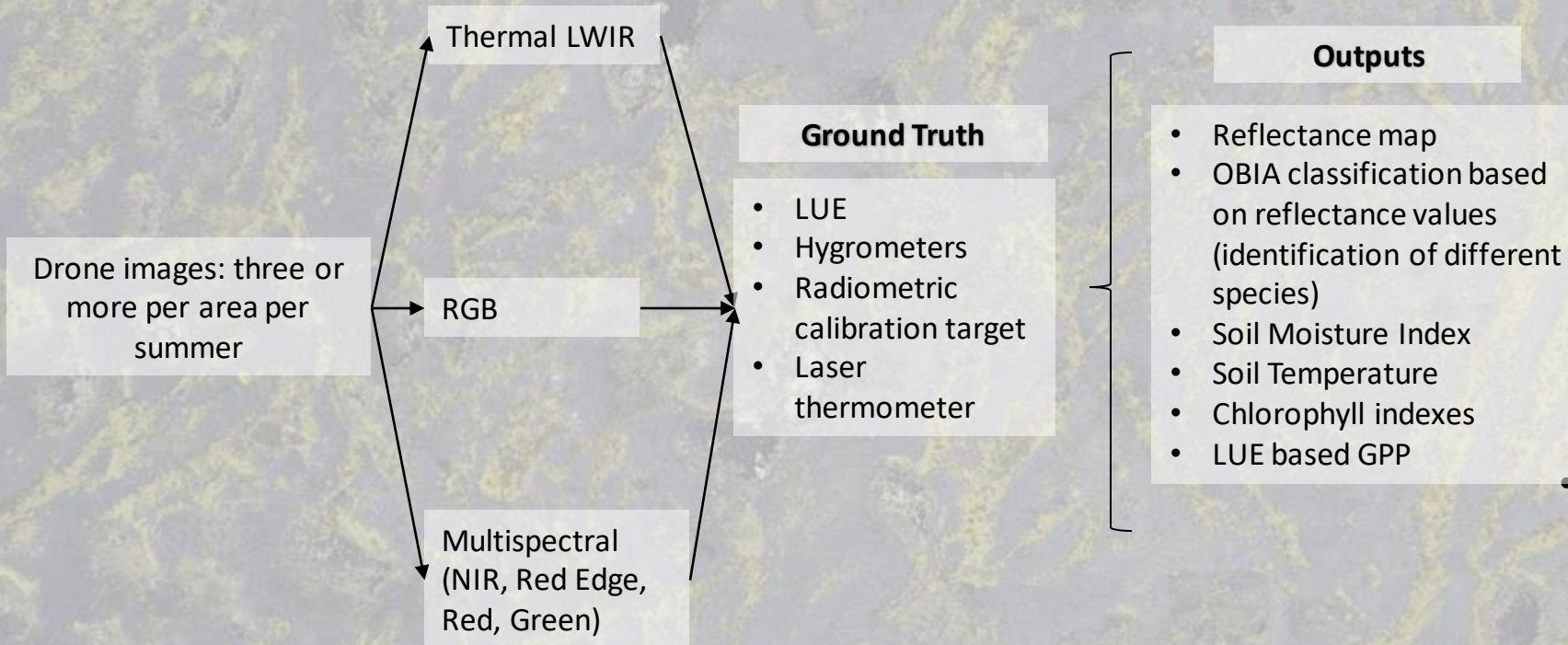
Microscale

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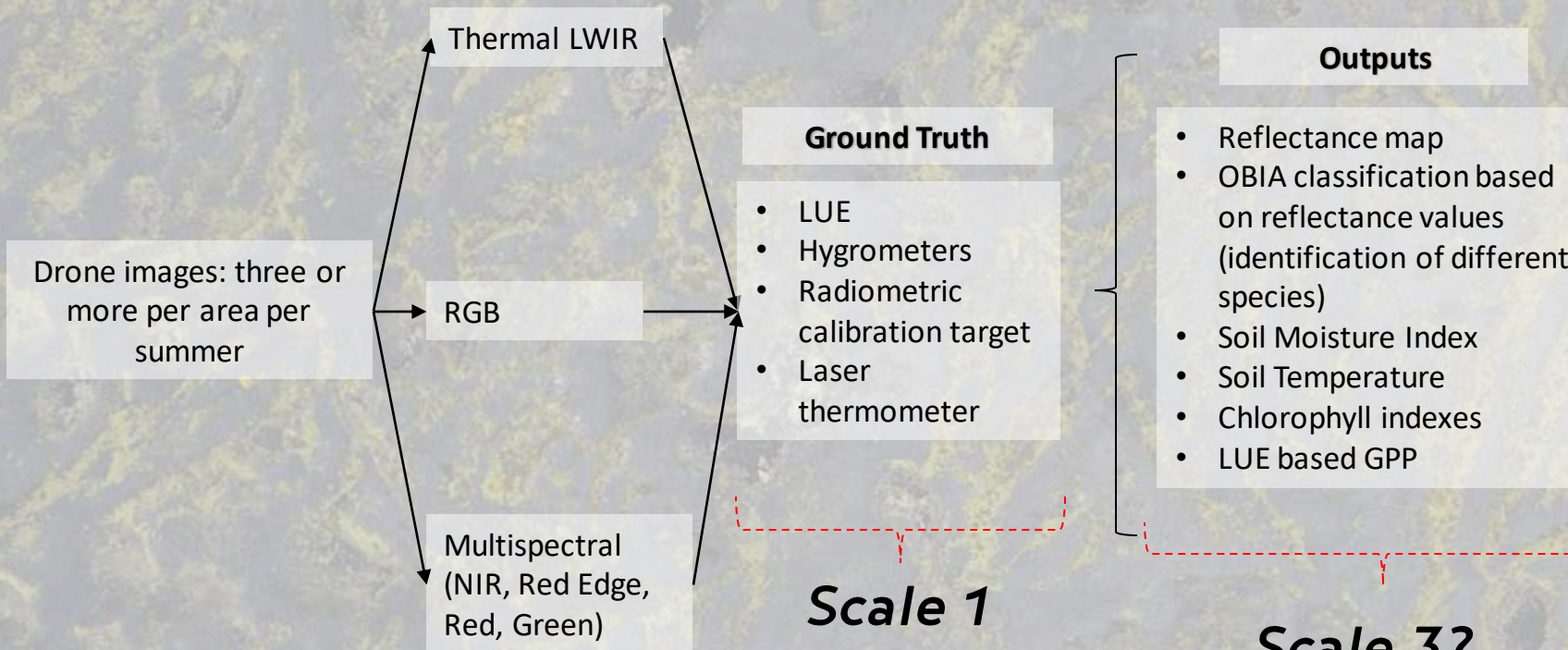
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**Microscale**

# Skeiðarársandur: birch colonization study (2016 -2019)



**Scale 2**

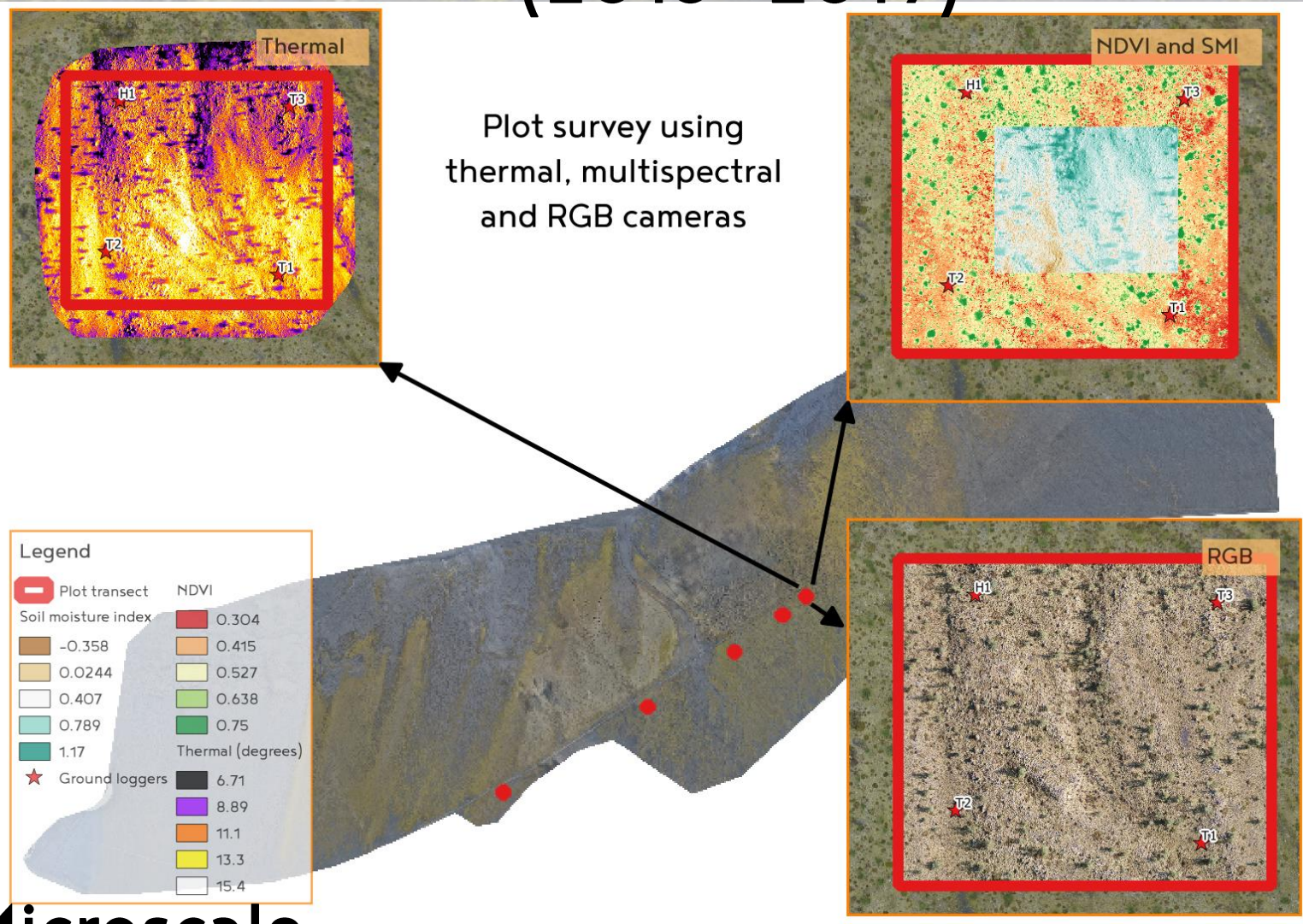
**Scale 1**

**Scale 3?**

**Microscale**

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# Skeiðarársandur: birch colonization study (2016 -2019)



Microscale

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An aerial photograph of a dry, cracked landscape. The ground is a mix of light brown and tan soil, with numerous deep, dark blue and purple cracks running across it. There are also some small, scattered green plants and patches of yellowish-brown vegetation. The overall appearance is that of a severely arid or drought-stricken area.

Thank you!!

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[victor@svarmi.com](mailto:victor@svarmi.com)