

## Leveraging Remote Sensing, GIS, and Open-Access Data to Investigate Nocturnal Cold Air Formation in Dutch Dune Slacks



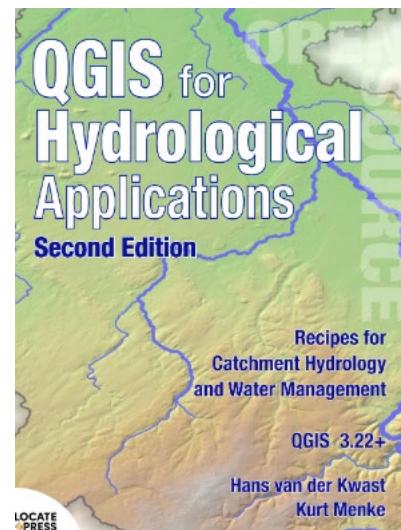
FOSS4GNL 2023 Middelburg

14 September 2023

# Bio.

- BSc. Agricultural Engineering
- MSc. Water and Sustainable Development  
(Digital innovation and Hydro informatics)  
IHE Delft institute for water education
- 7 years experience in engineering hydrology, soil and water conservation and GIS.

[#QGISHydro Book fund](#)



# Dune slacks

low-lying areas within the coastal dunes

(Grootjans et al. 2002)



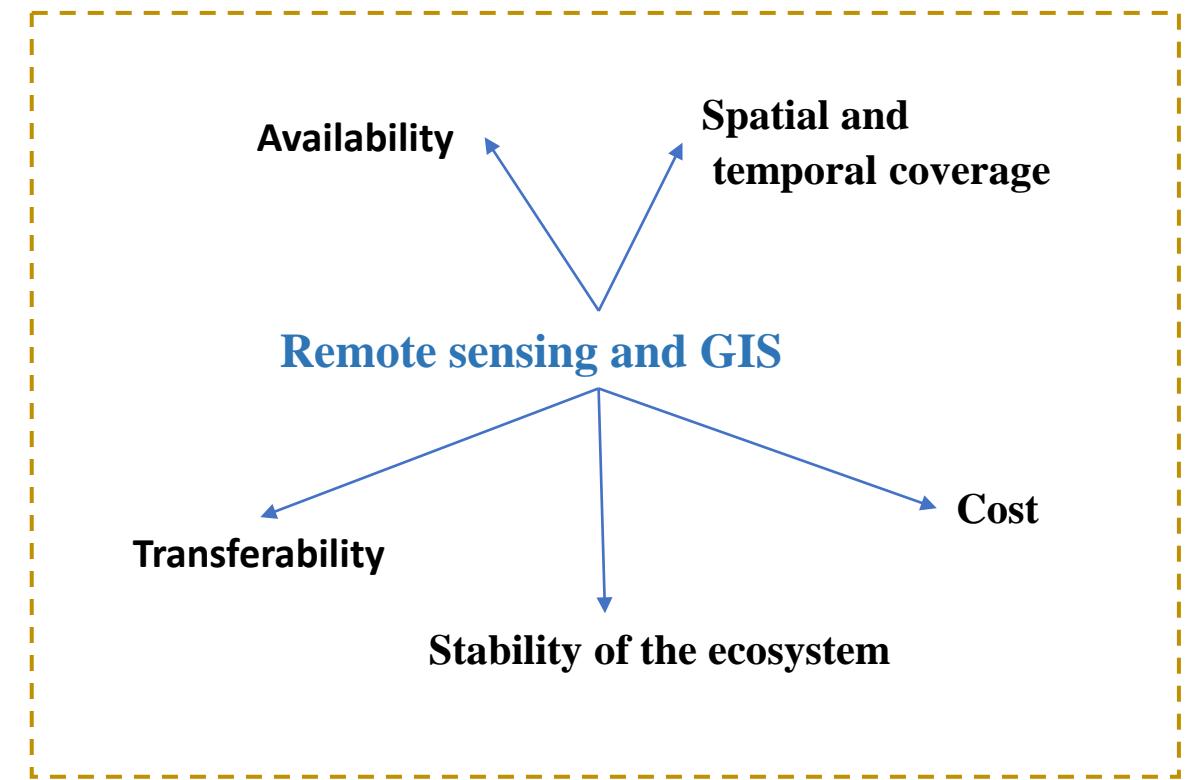
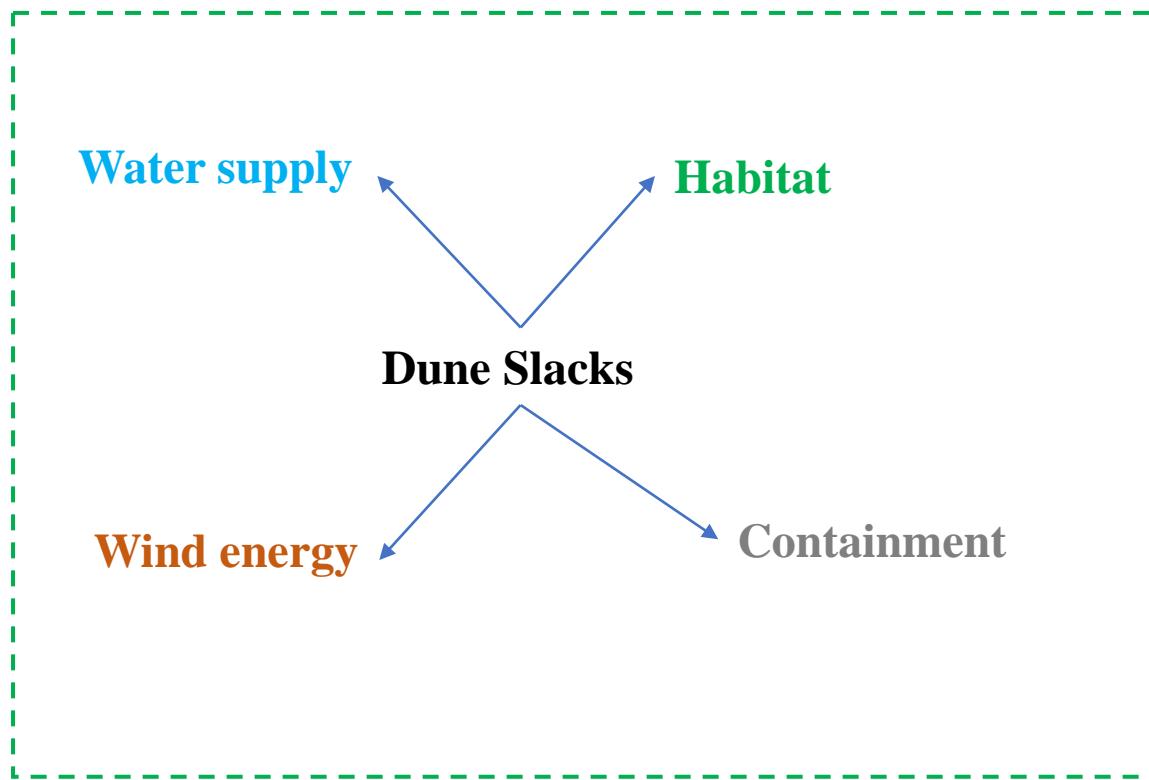
Photo by: Pieter Blieck

# Objective

To identify the main **drivers** of the nocturnal **cold air pooling**

## Relevance

Due to the **changing climate**, cold air pool formation areas are the **future refuges** of various species (Lundquist et al. 2008)



# Ground measurements

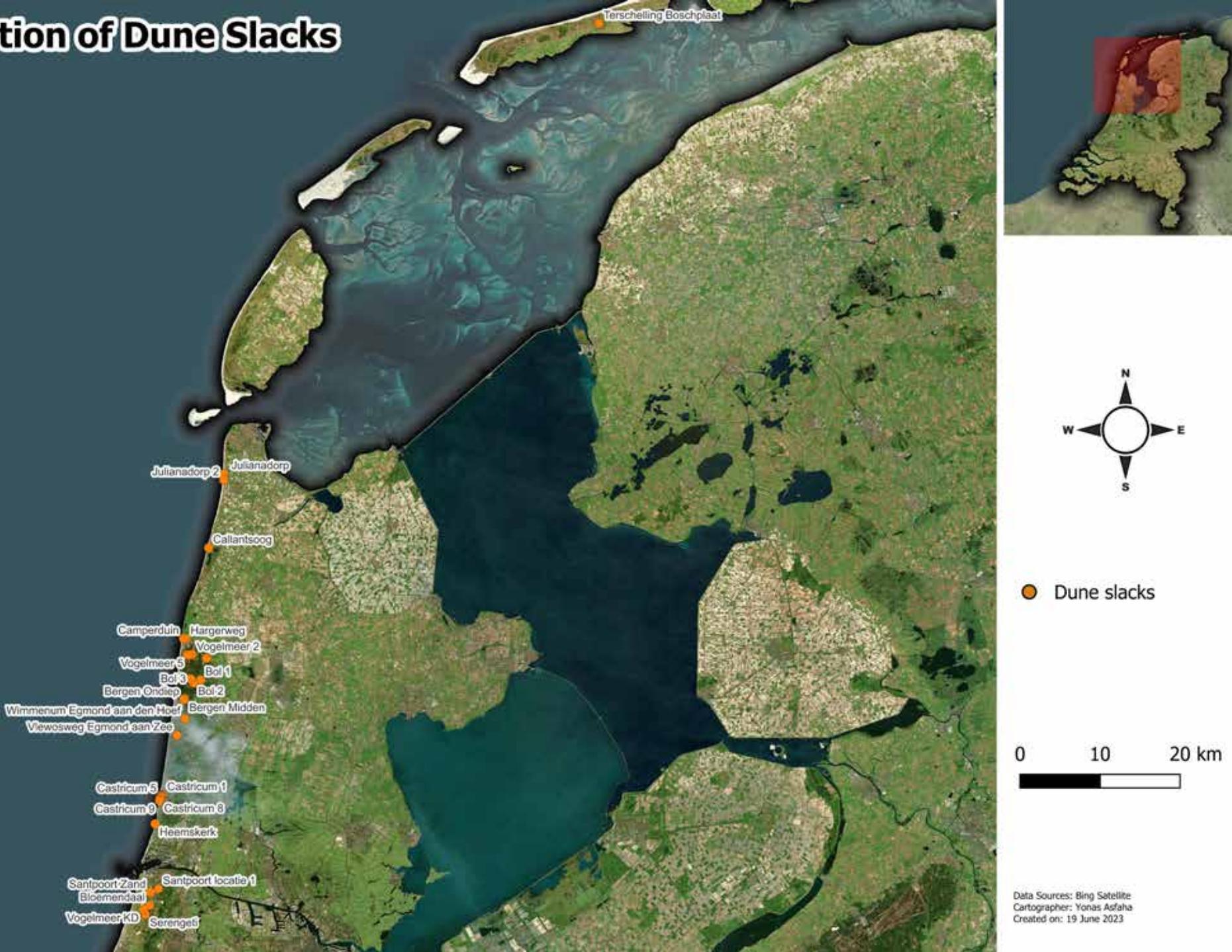
**Temperature measurement at 10 cm and 1.5 m**



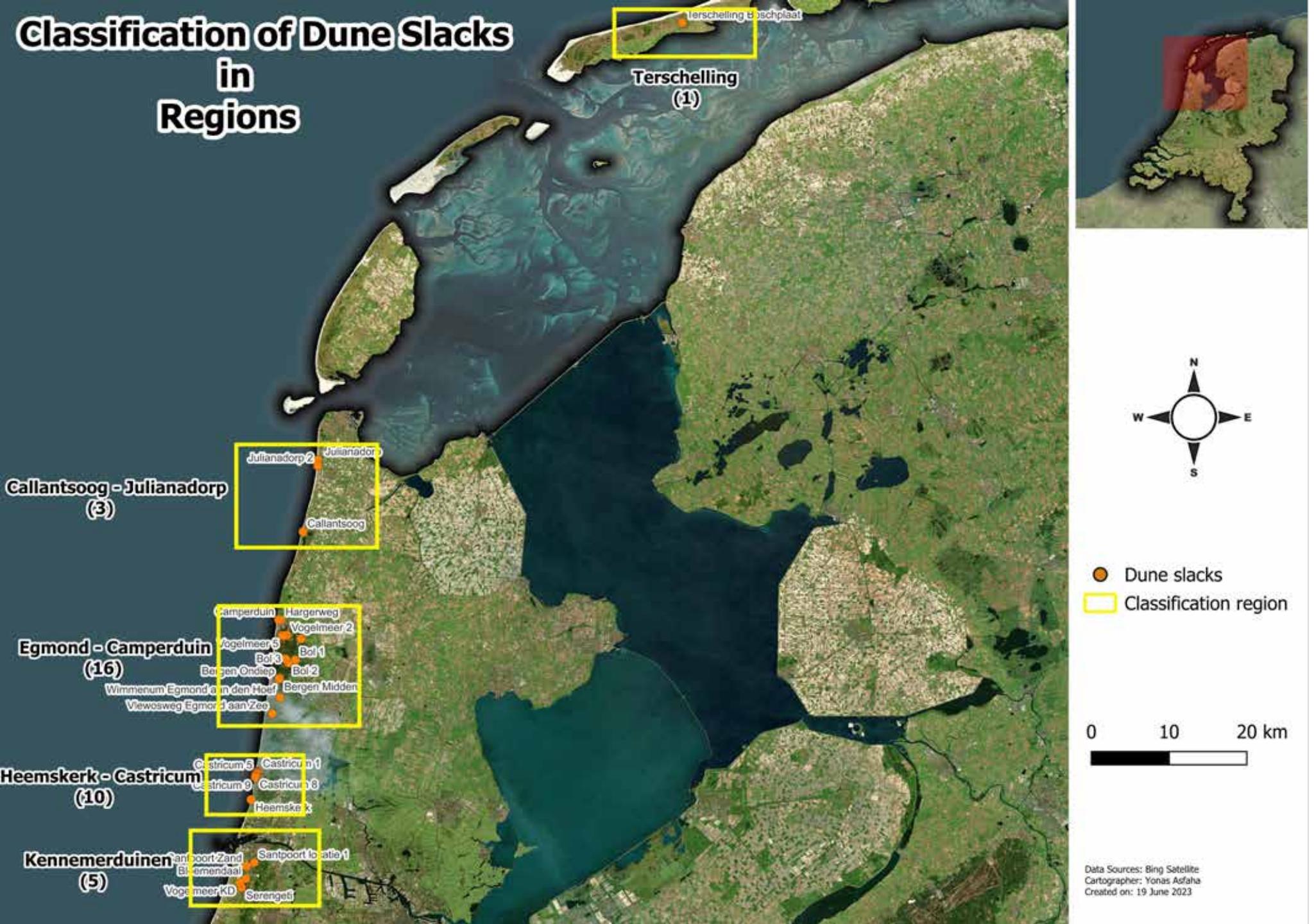
Photo by Pieter Blek



# Location of Dune Slacks



# Classification of Dune Slacks in Regions

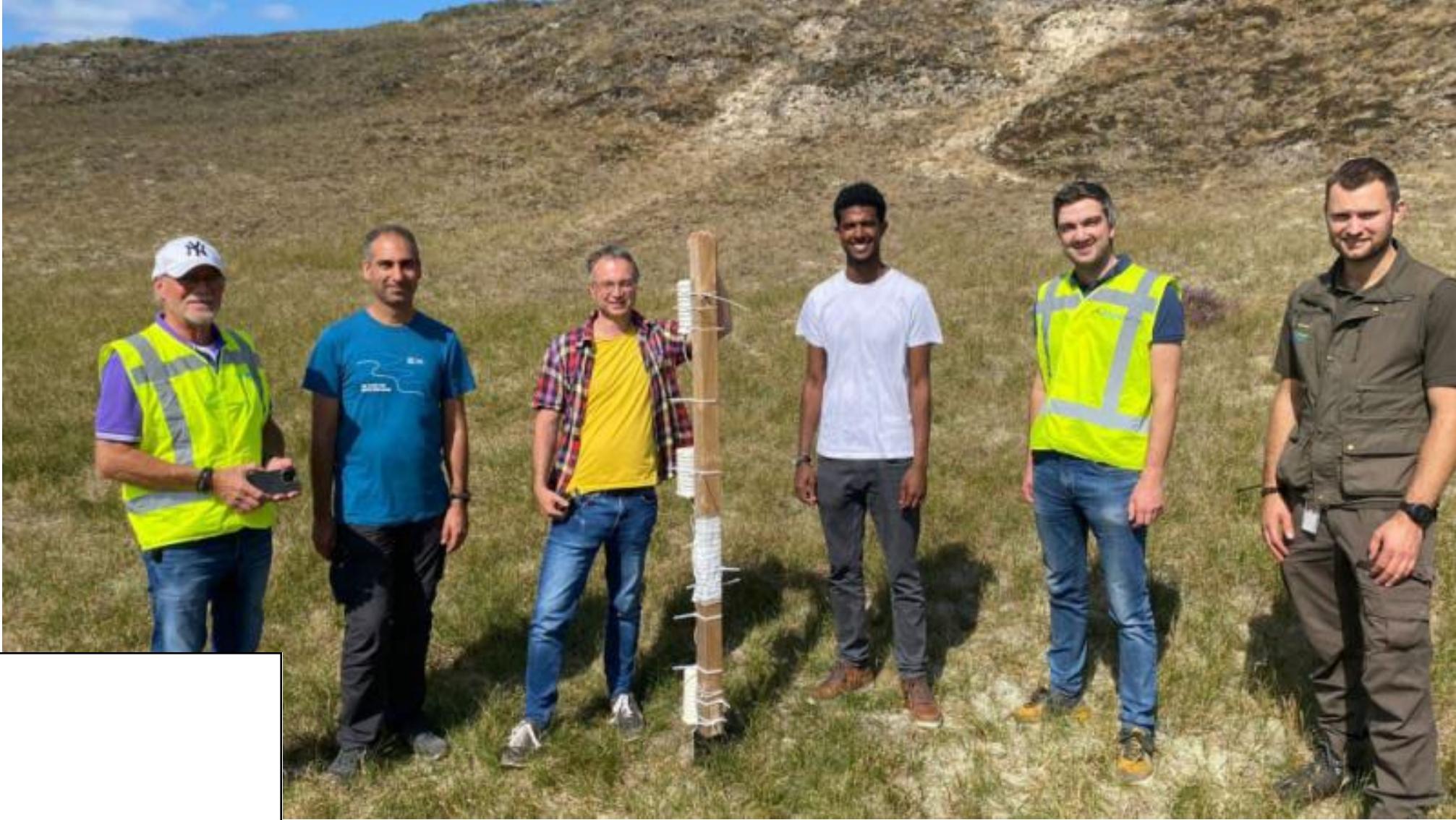


Data Sources: Bing Satellite  
Cartographer: Yonas Asfaha  
Created on: 19 June 2023

Noordzee

# GeoTiles.nl

Source of Point cloud data





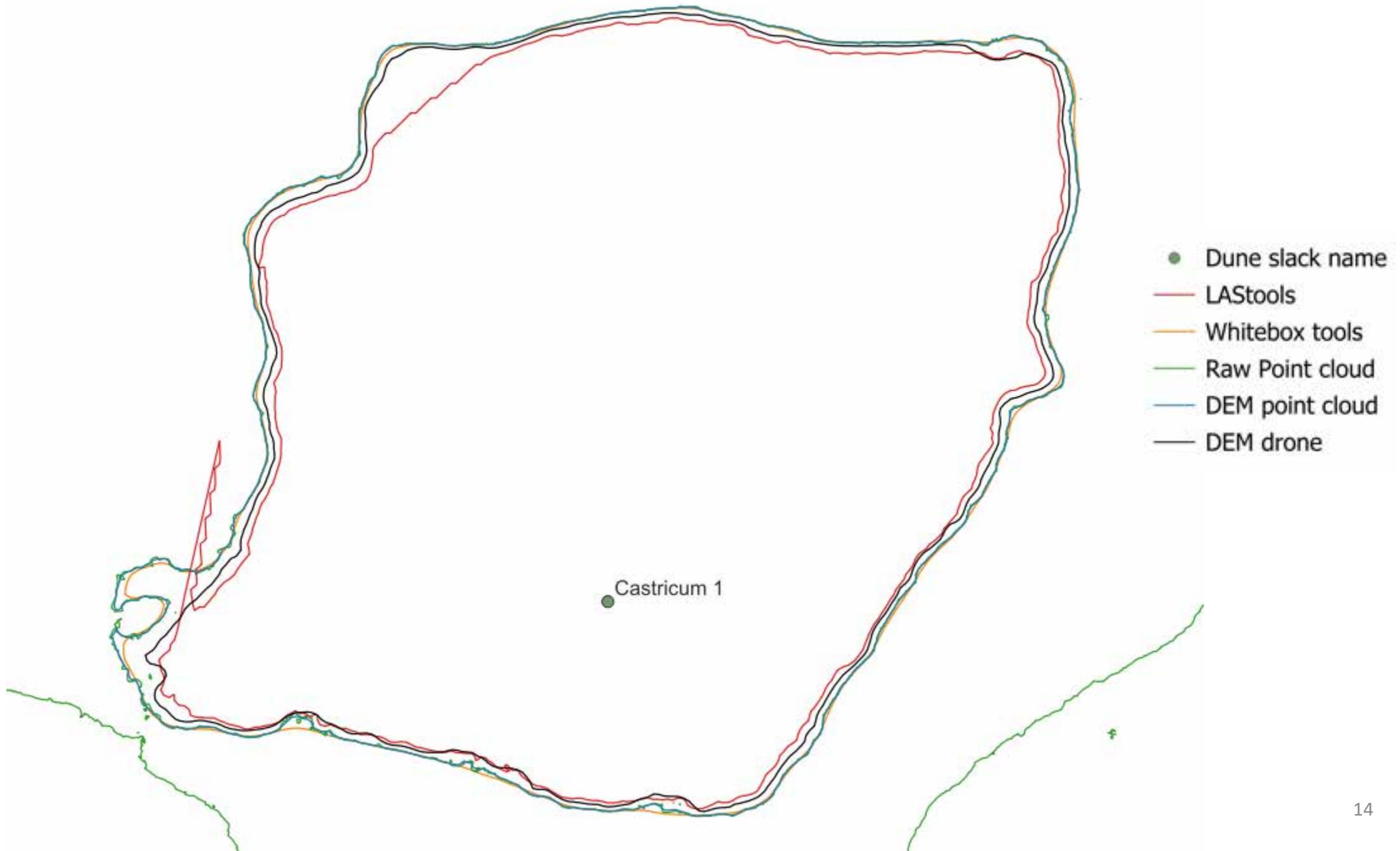
Search...

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- ▶ Vector creation
- ▶ Vector general
- ▶ Vector geometry
- ▶ Vector overlay
- ▶ Vector selection
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- ▶ Vector tiles
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- ▶ LAStools



Native PC tools

## Contour line comparison



Luchtfoto Actueel Ortho 8cm RGB

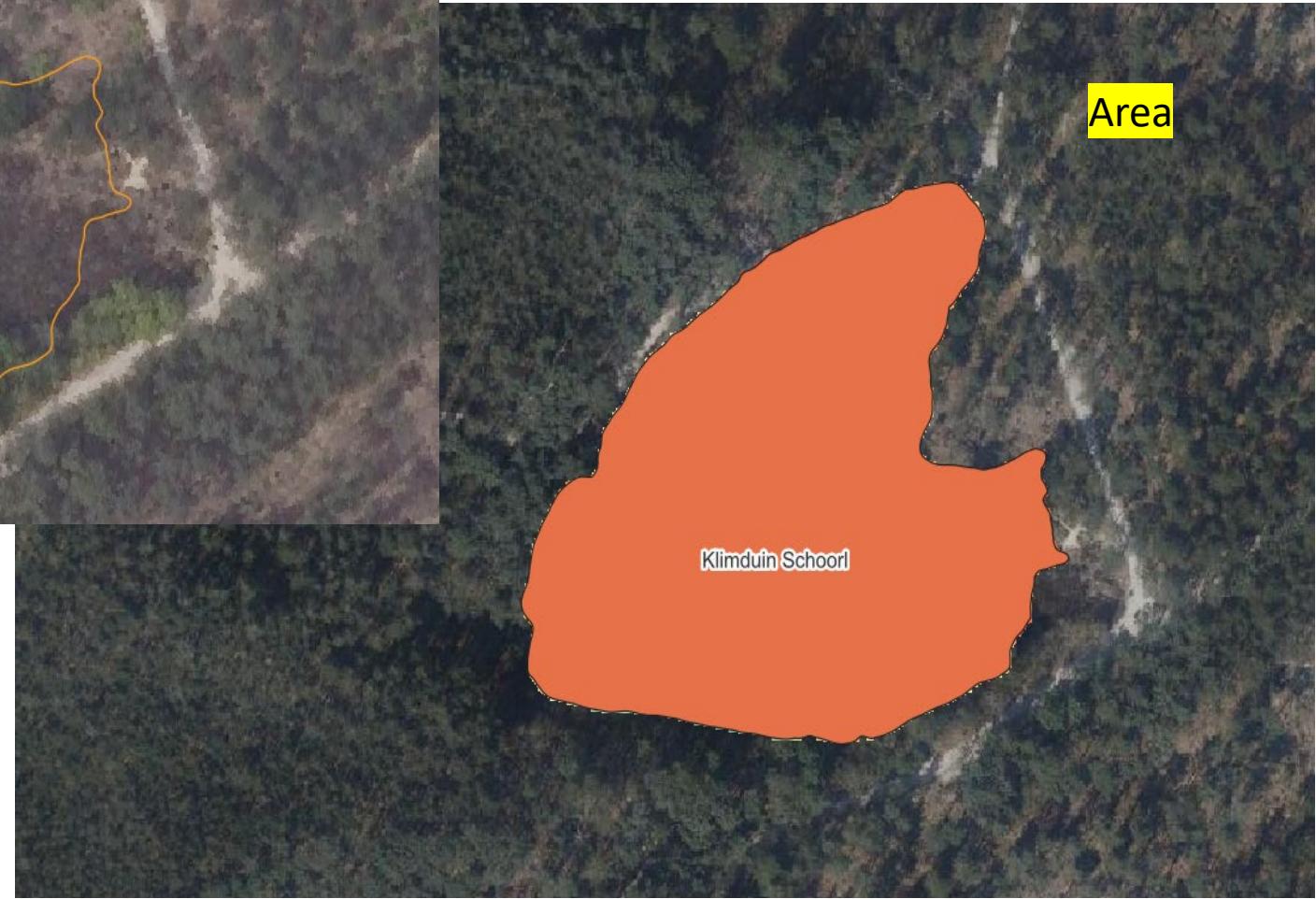
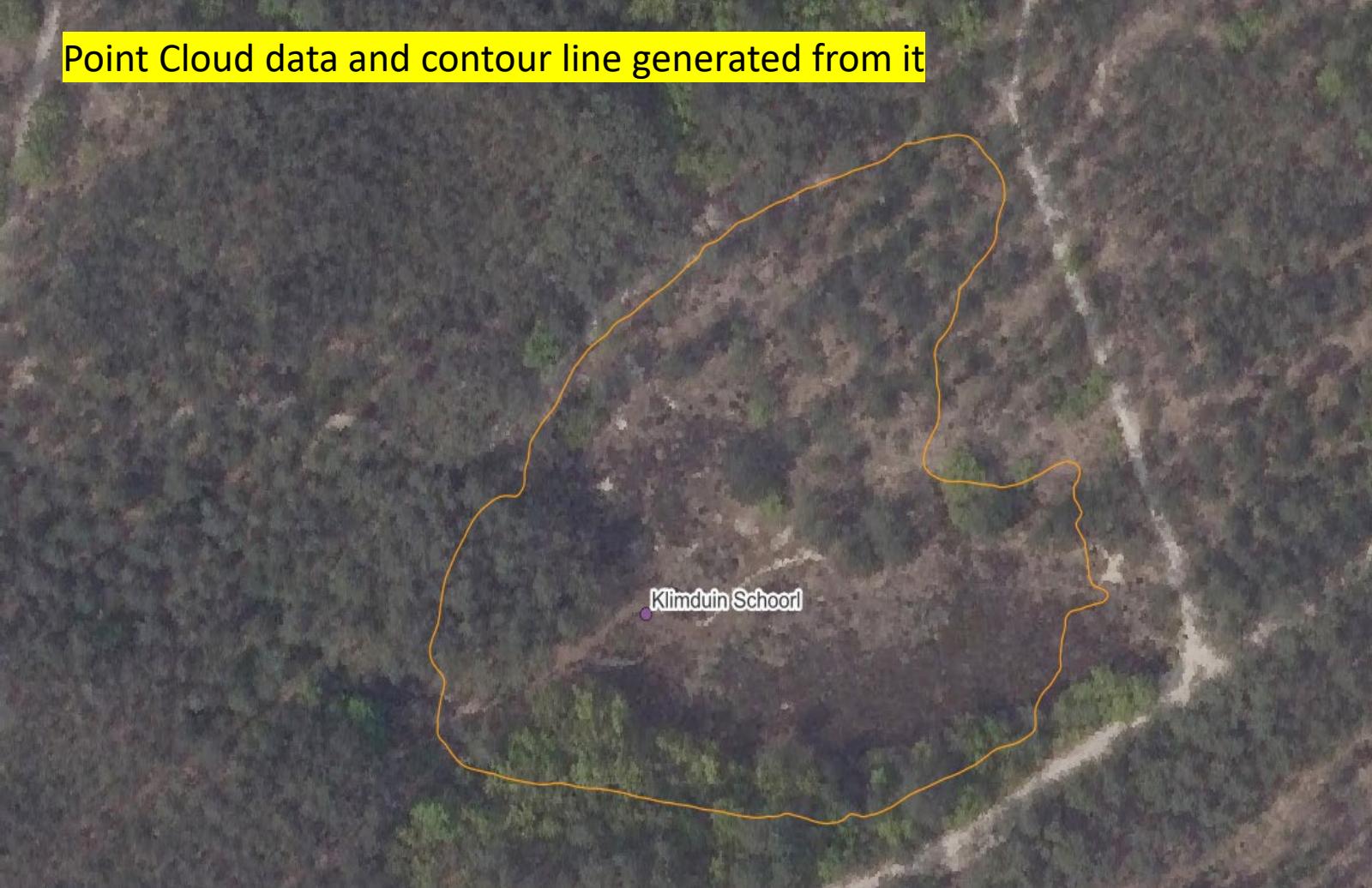
Used to validate geomorphologies and as a backdrop



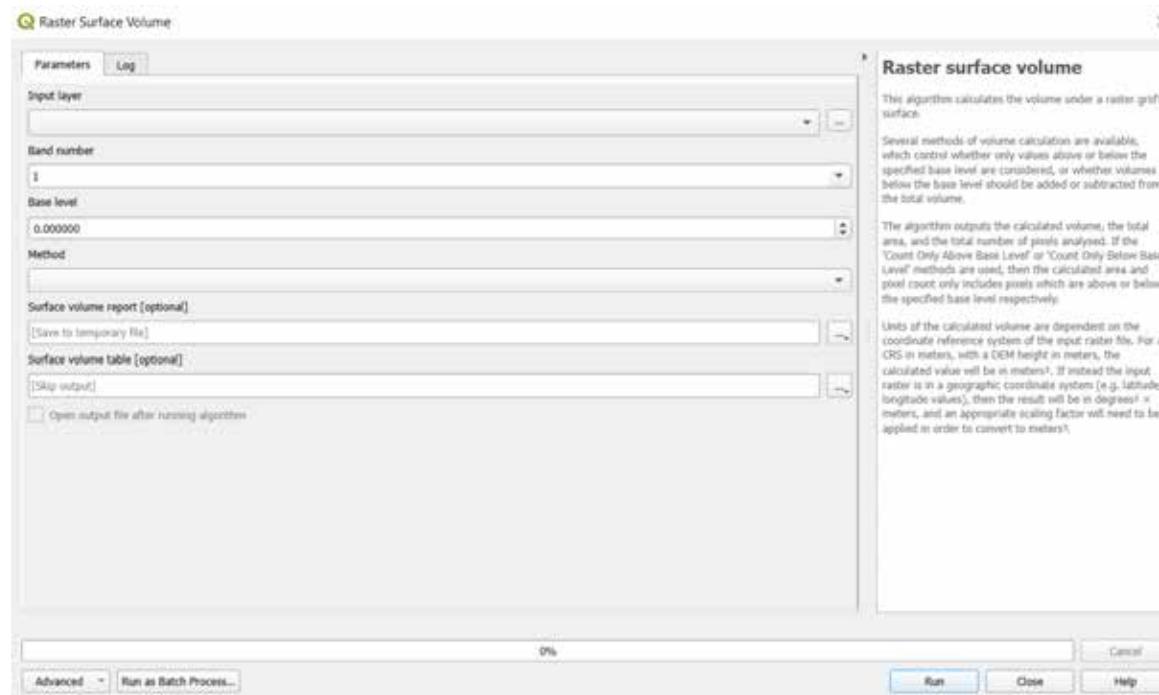
Used to validate vegetation cover



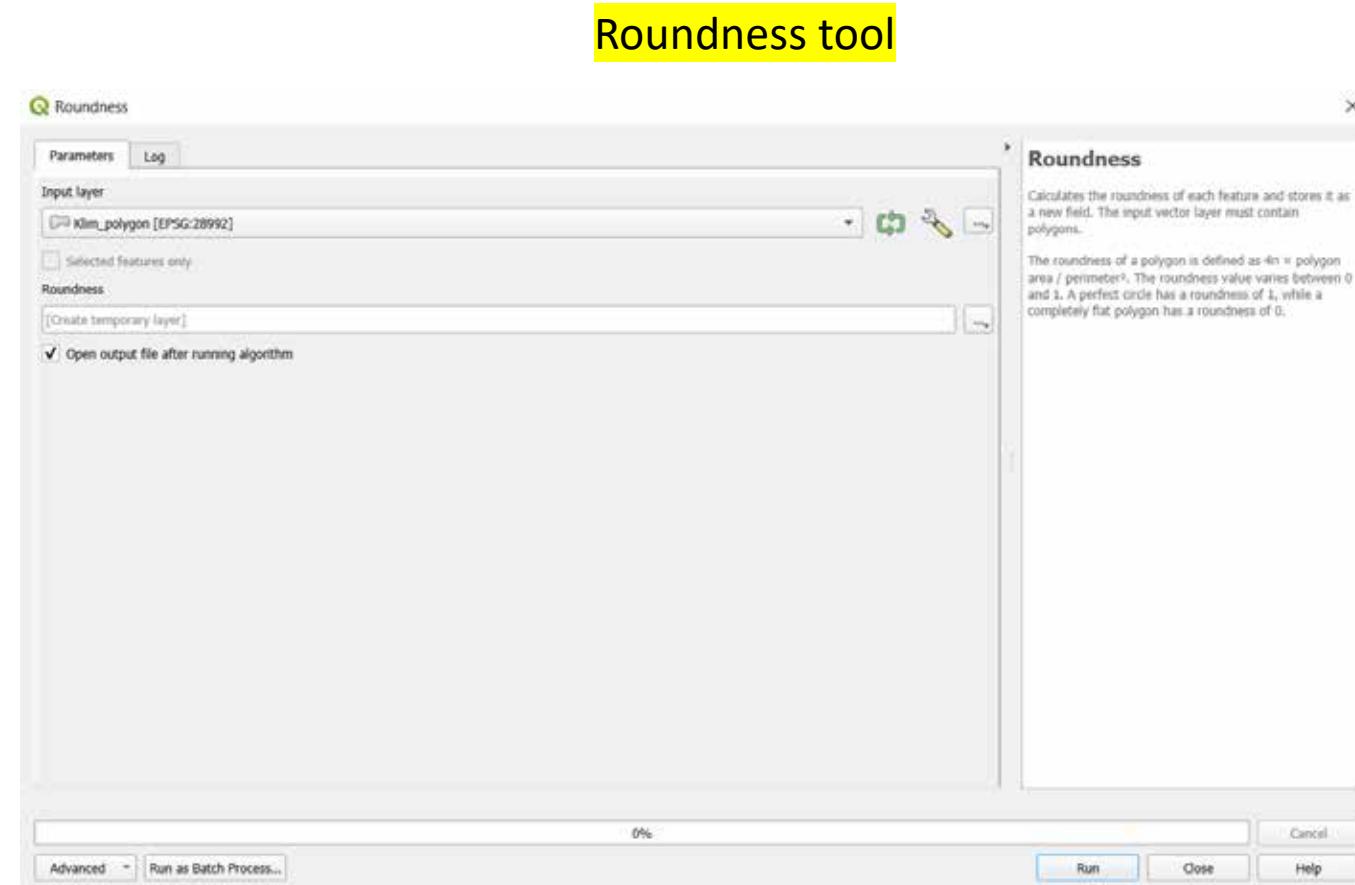
Point Cloud data and contour line generated from it



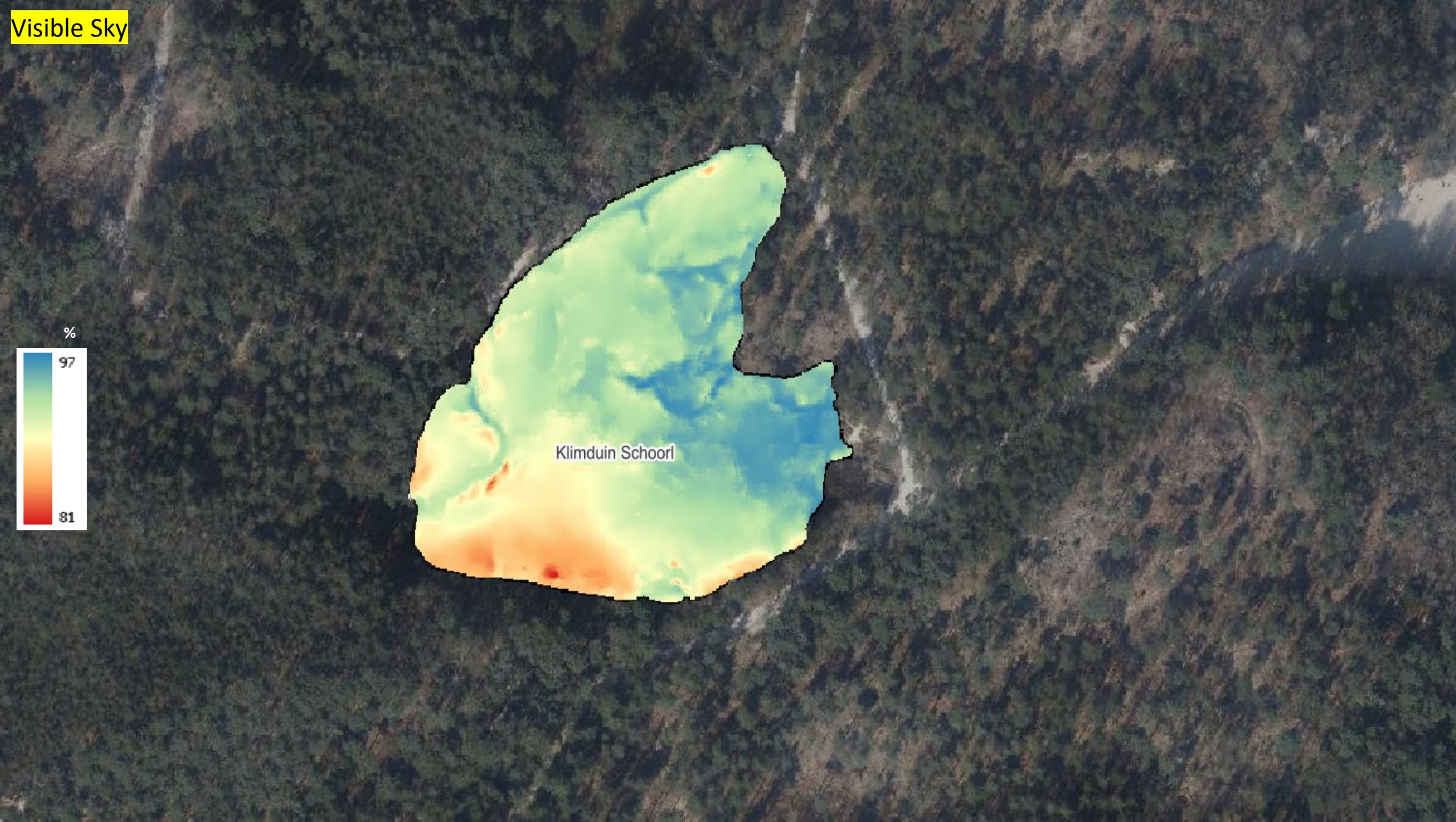
# Volume calculated from DEM generated from Point clouds



## Roundness tool





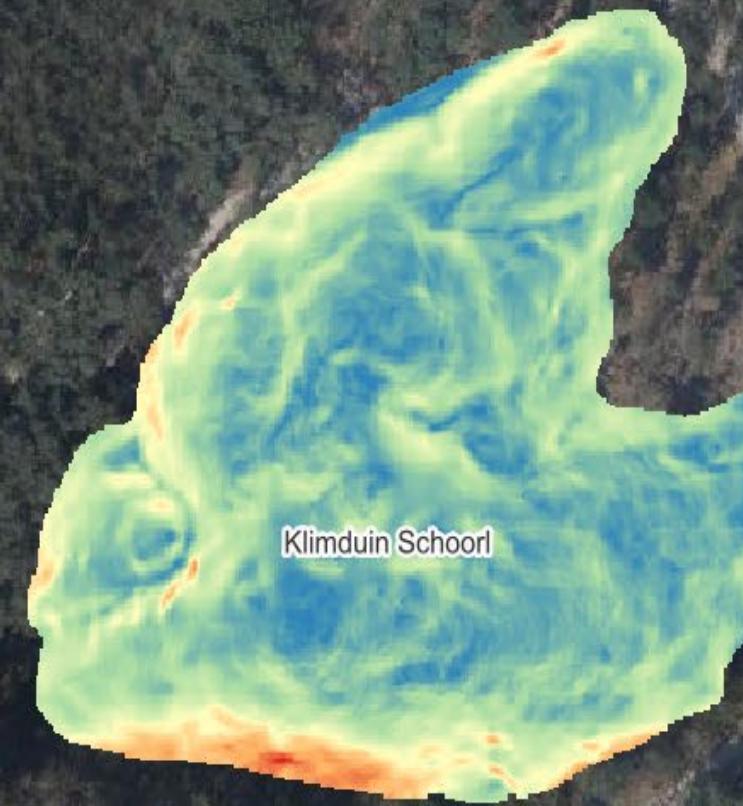


Slope

Degrees

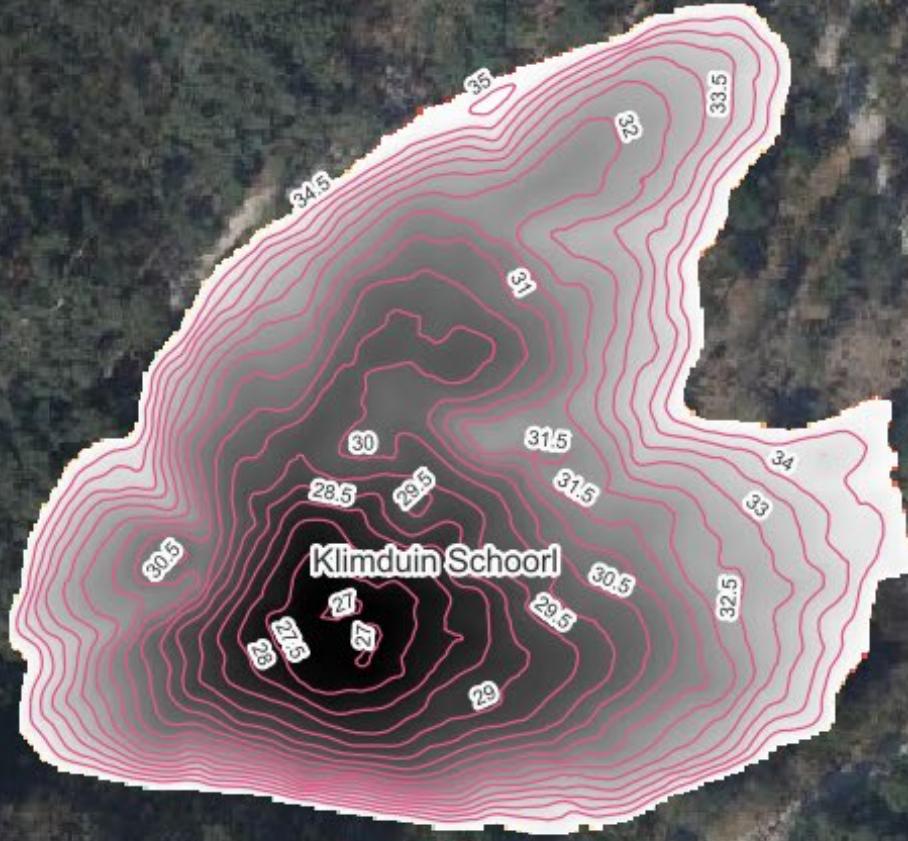
43.67

0.04





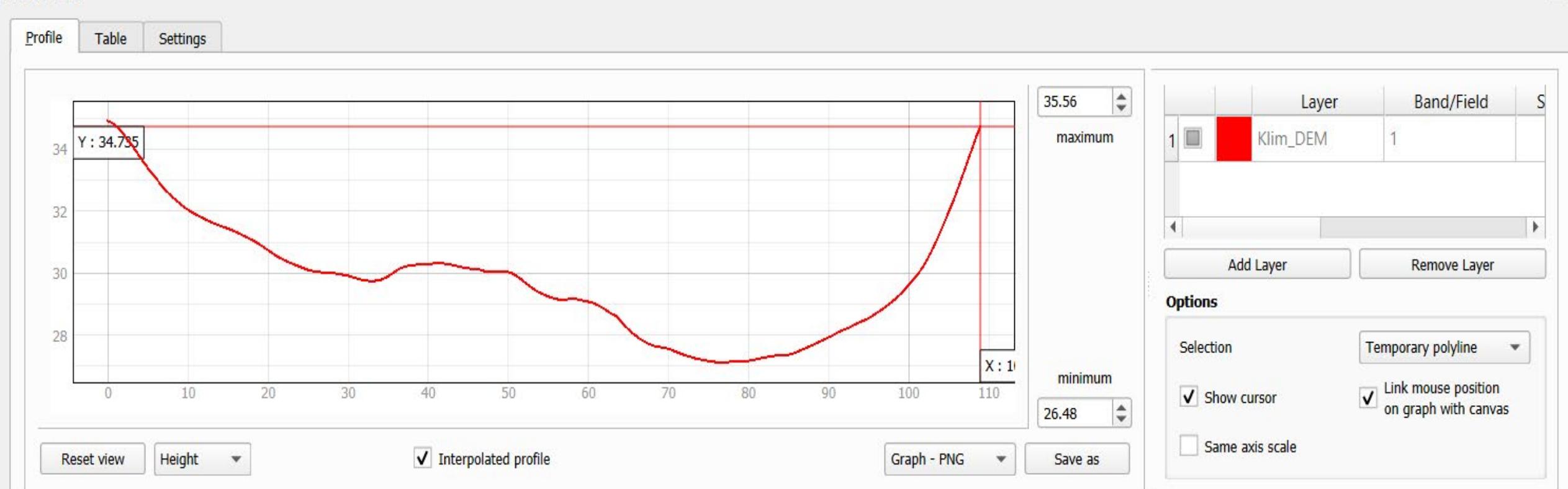
Contours generated at 0.5m interval



# Profile



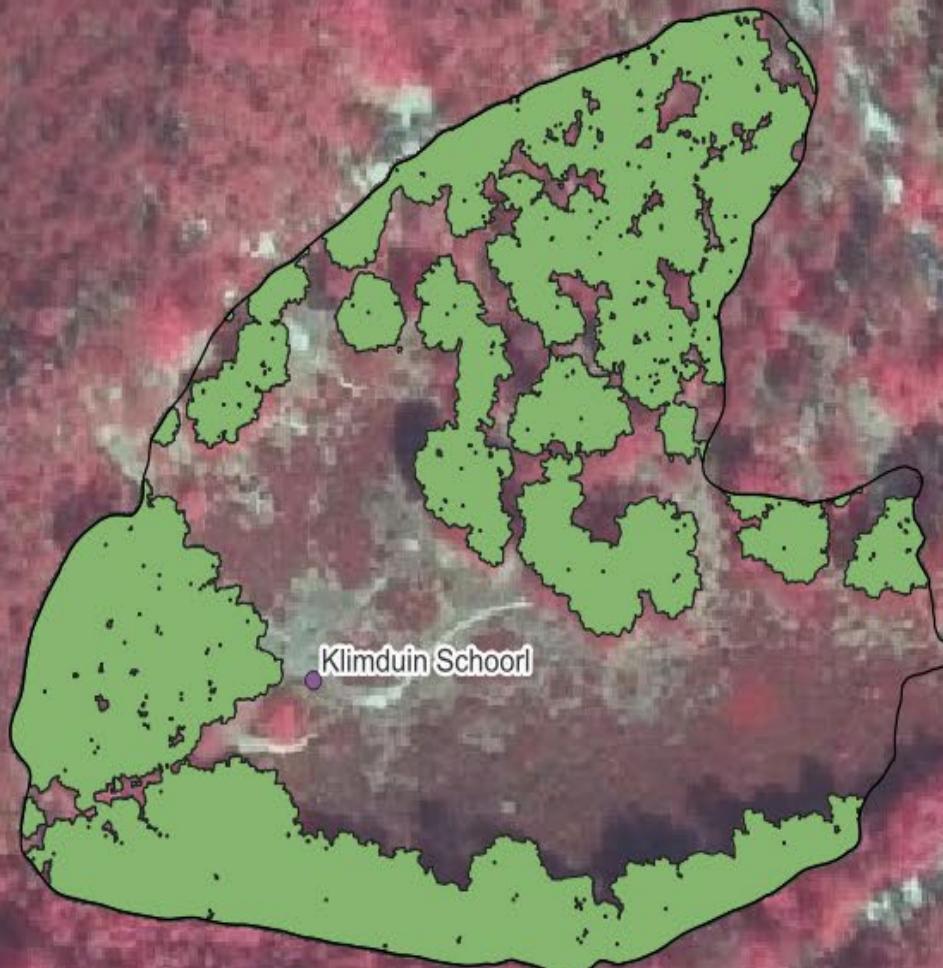
Profile Tool



Vegetation filtered from Point Cloud



Vegetation in Vector format



```
1 // Load the shapefile as a feature collection
2 var shapefile = ee.FeatureCollection('projects/ee-yonas/assets/Klimduin');
3
4 // Get the geometry from the first feature in the collection
5 var geometry = shapefile.geometry();
6
7 // Filter Image Collection by VH polarization and IW mode
8 var imgVH = ee.ImageCollection('COPERNICUS/S1_GRD')
9   .filter(ee.Filter.listContains('transmitterReceiverPolarisation', 'VH'))
10  .filter(ee.Filter.eq('instrumentMode', 'IW'))
11  .select('VH')
12 <
```

Use print(...) to write to this console.

Mean:

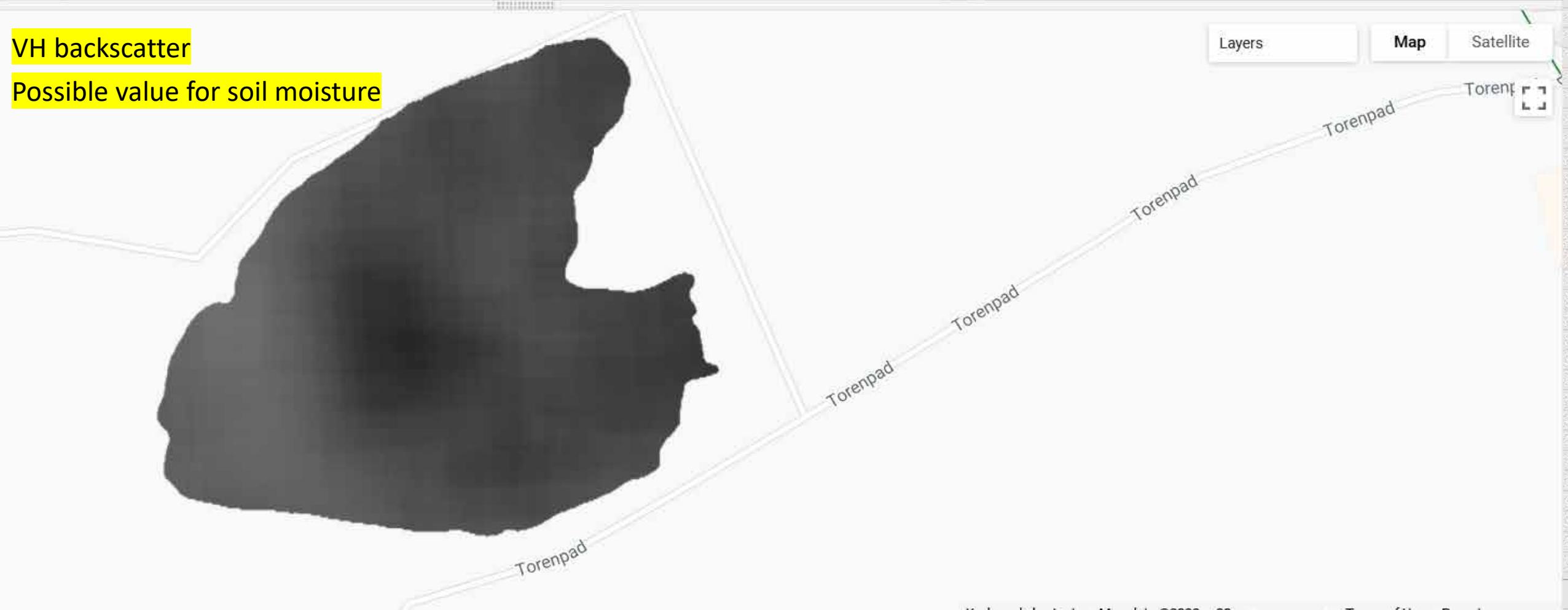
-16.16901153225649

Standard Deviation:

1.779946890389169

VH backscatter

Possible value for soil moisture



# Conclusion

Correlation and regression analysis between temperature and geomorphologies shows:

- Vegetation
- Roundness Significant in cold air pooling
- CaCO<sub>3</sub>
- Visible Sky/Sky View Factor

A wide-angle landscape photograph of a coastal dune system. The foreground shows light-colored sand with dark, wavy patterns from vegetation. Sparse green grass and small bushes are scattered across the slopes. In the background, a dense line of trees marks the horizon under a bright blue sky with wispy white clouds.

Thank you