





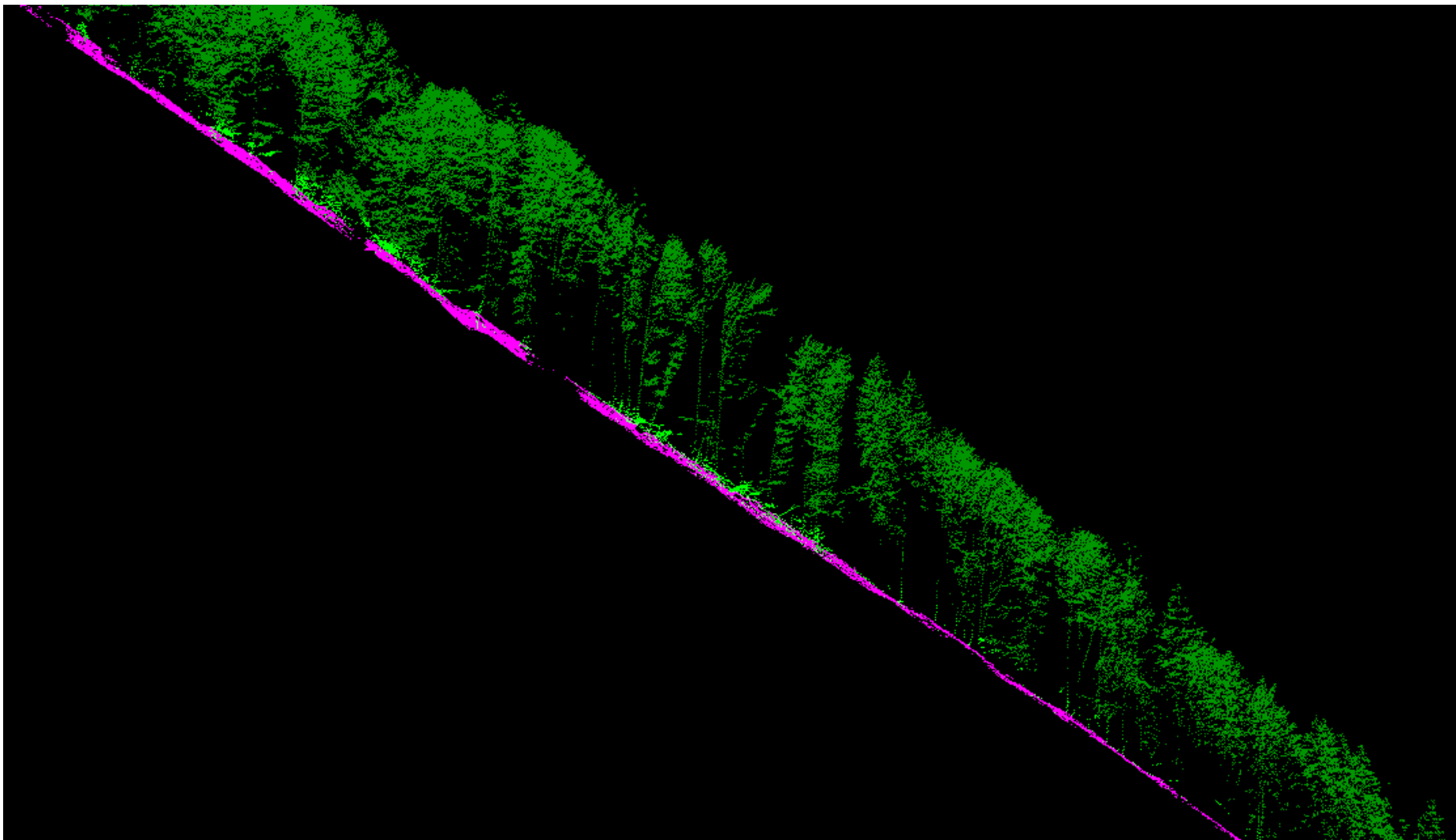
Evaluation vollautomatischer Einzelbaum- Erkennung aus luftgestützten Laserscanning-Daten

**Luuk Dorren¹, Julia Menk¹, Christian Ginzler²
Markus Huber², Johannes Heinzel², Mauro Marty²**

¹ HAFL - Berner Fachhochschule

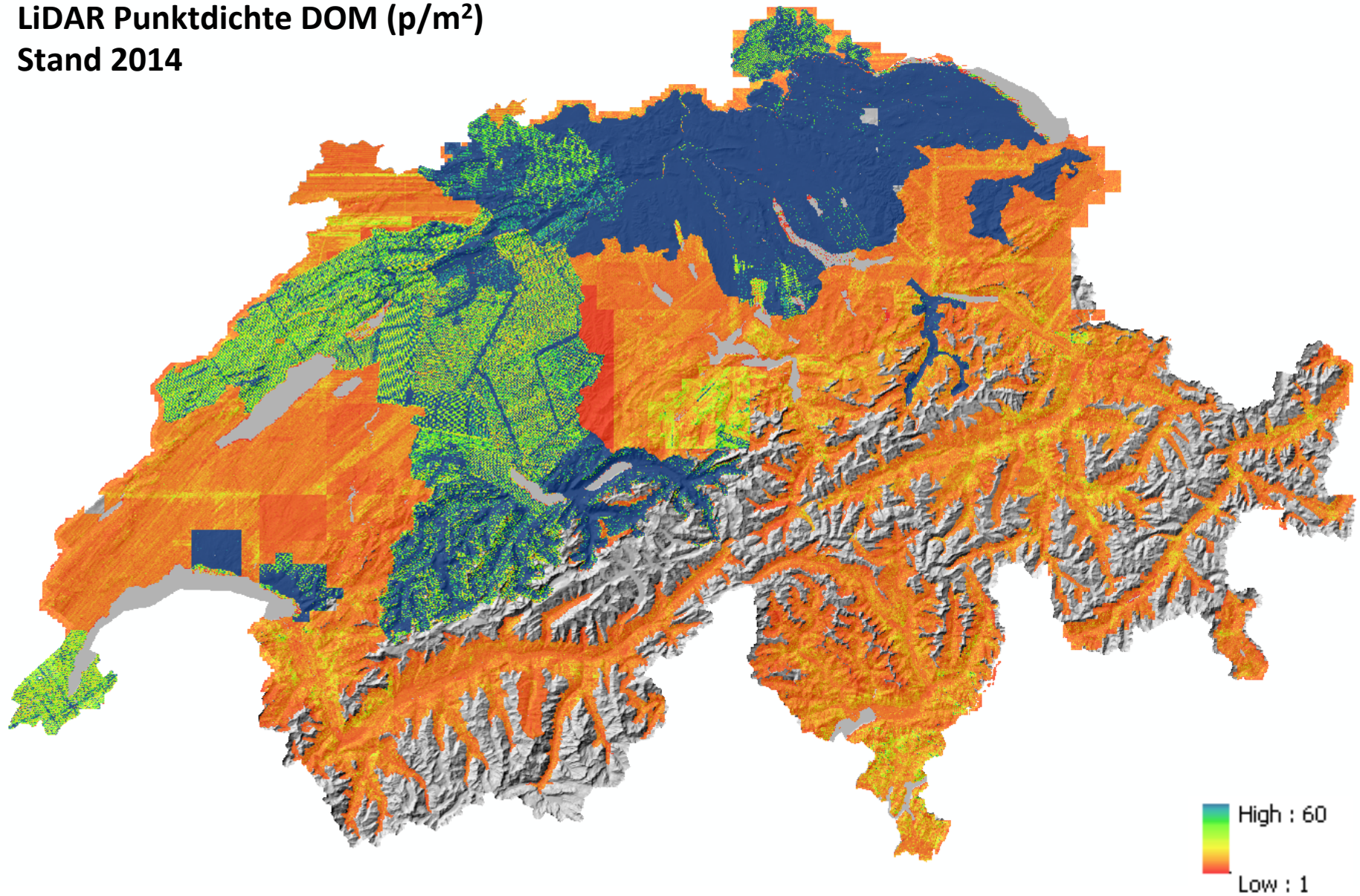
**² Eidg. Forschungsanstalt für
Wald, Schnee und Landschaft WSL**

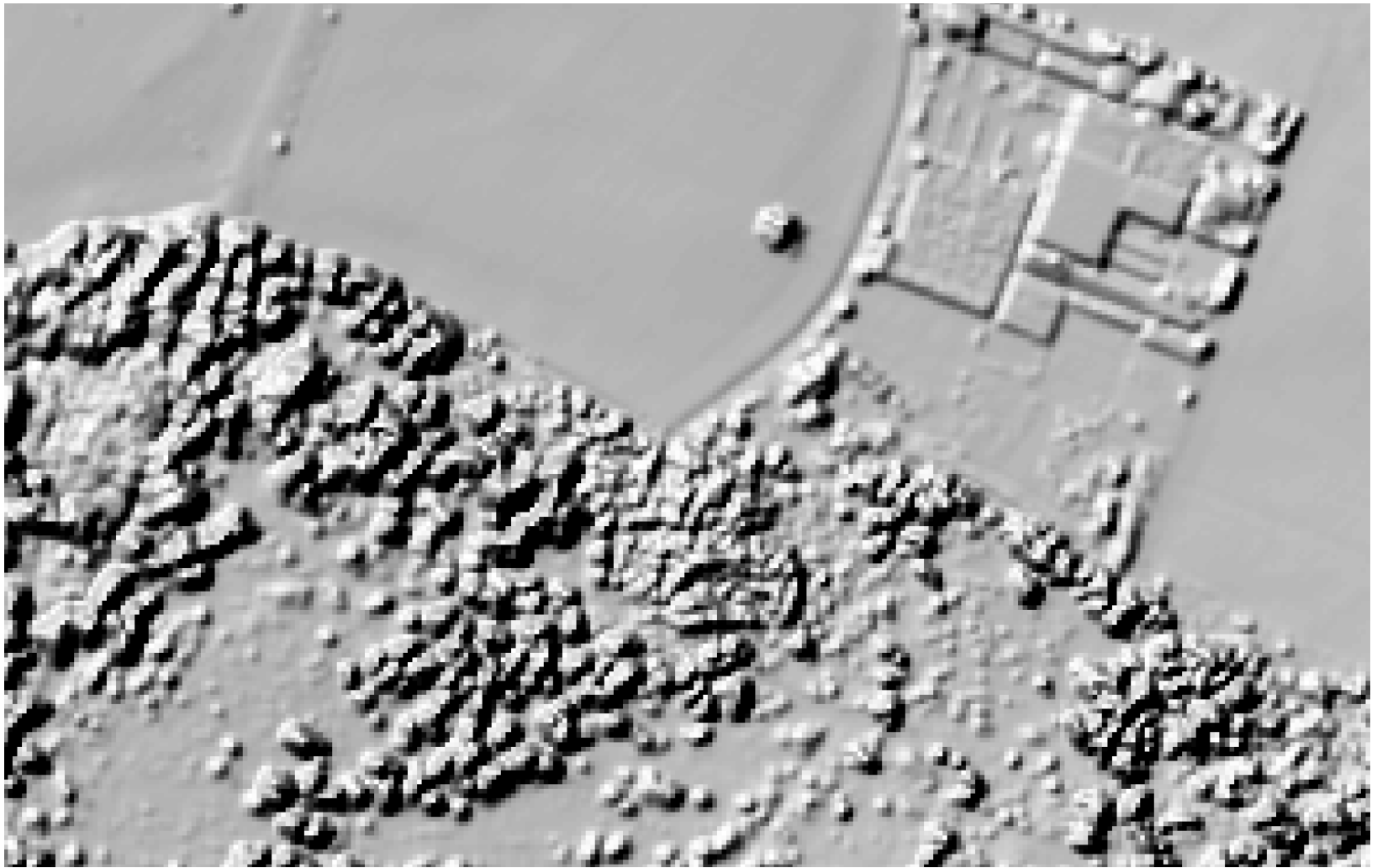




LiDAR Punktdichte DOM (p/m²)

Stand 2014





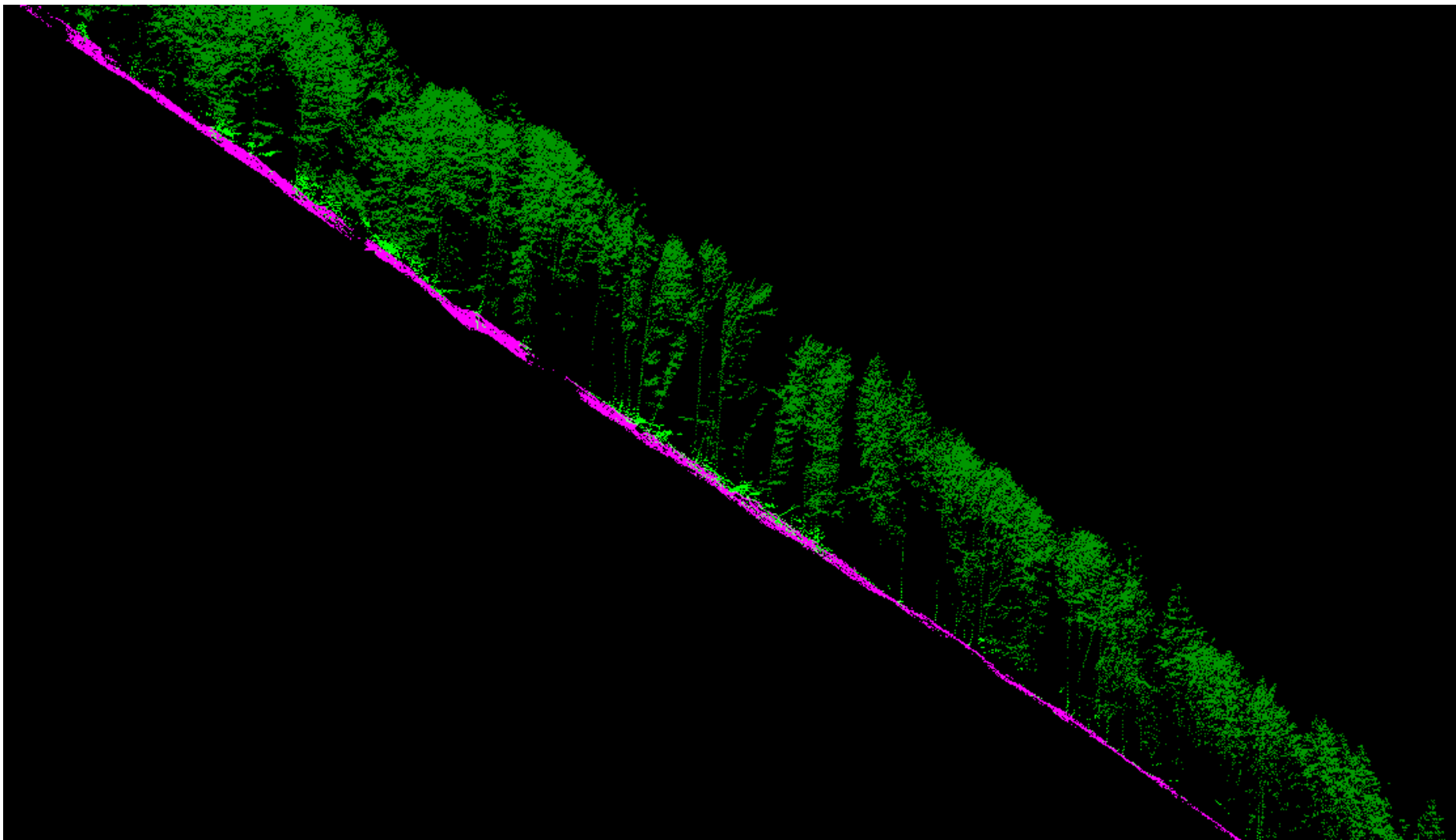
DOM 2m

Datengrundlage: LiDAR 2002 / LWN swisstopo



DOM 0.5m

Datengrundlage: LiDAR 2014 / Kt. Zürich



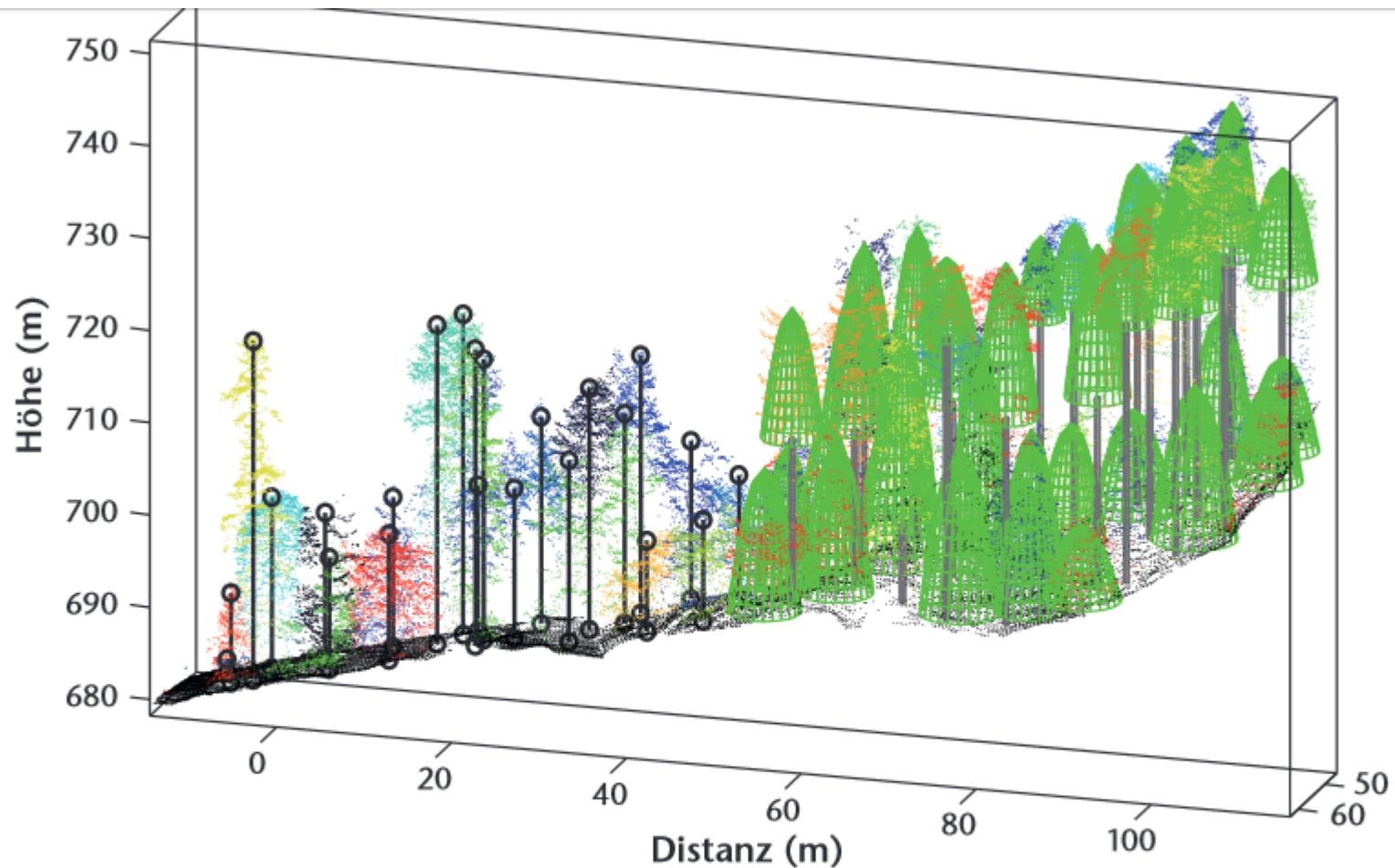


Abb 3 Schematische Darstellung der Prozesskette zur Einzelbaumextraktion von den erfassten und segmentierten Daten (Punktwolke, links) bis hin zum fertigen Produkt, einer geometrischen Rekonstruktion des Waldes mit geometrischen Primitiven (rechts).

Morsdorf F. (2011) Schweiz. Z. Forstwes. 162(6): 164–170

2500 m

Realität
Réalité
Reality

900 m

2500 m

Digitales Geländemodell (DGM)
Modèle Numérique du Terrain (MNT)
Digital Terrain Model (DTM)

Digitales Oberflächenmodell (DOM)
Modèle Numérique de la Surface (MNS)
Digital Surface Model (DSM)

900 m

2500 m

Digitales Geländemodell (DGM)
Modèle Numérique du Terrain (MNT)
Digital Terrain Model (DTM)

Digitales Oberflächenmodell (DOM)
Modèle Numérique de la Surface (MNS)
Digital Surface Model (DSM)

Normalisiertes Oberflächenmodell (NOM)
Modèle de la Surface Normalisé (MSN)
Normalised Surface Model (NSM)

900 m

2500 m

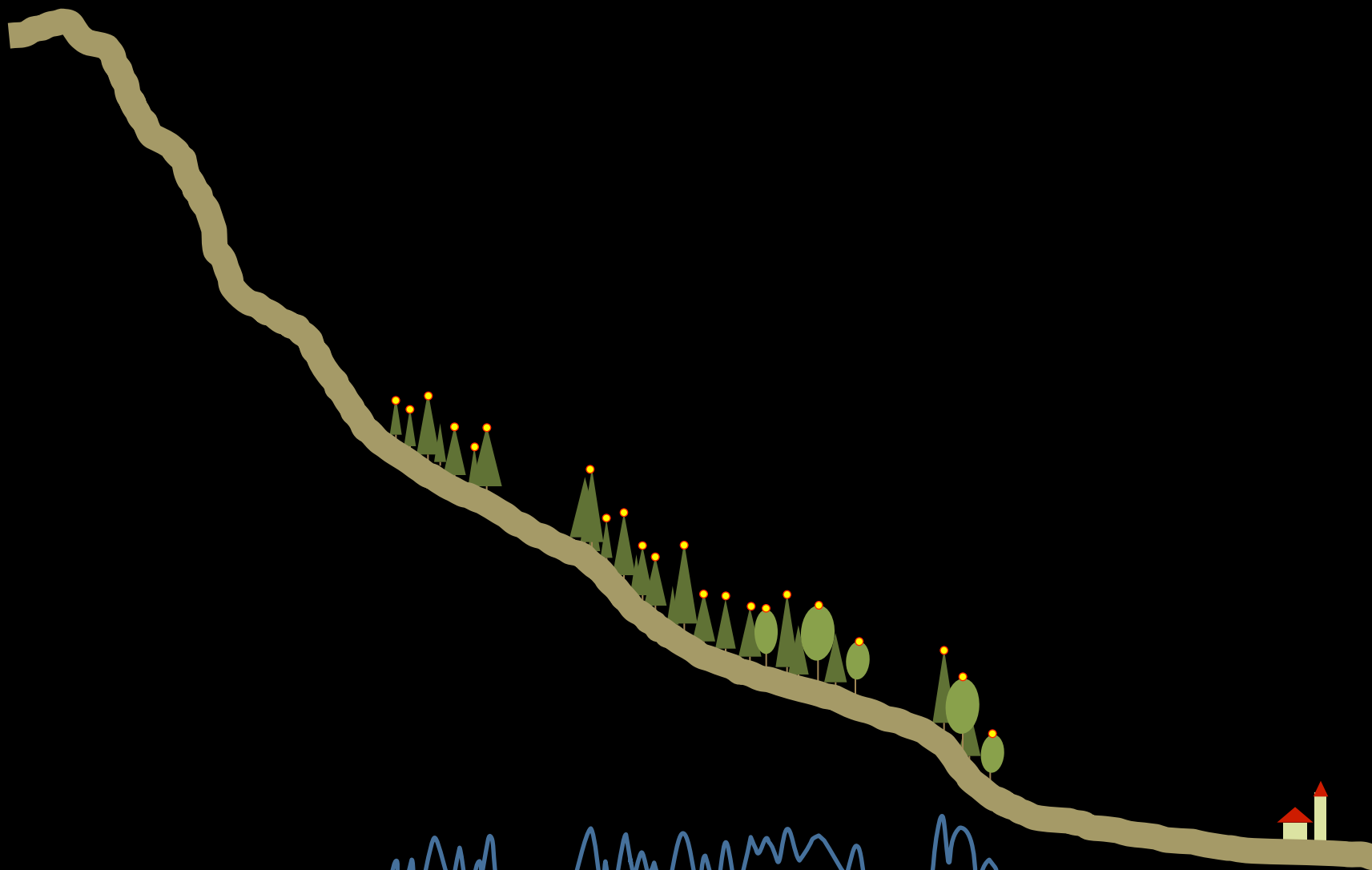
900 m



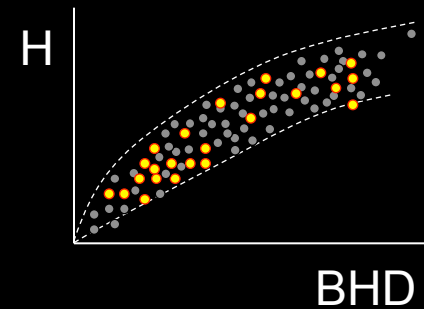
identifizierte Baumspitze
sommet d'arbre identifié
identified tree top

2500 m

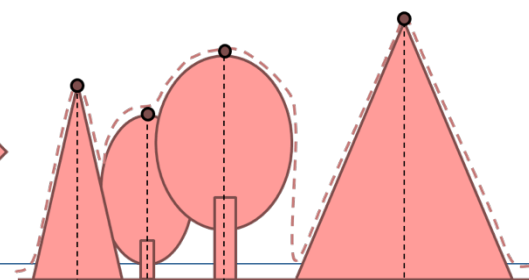
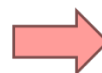
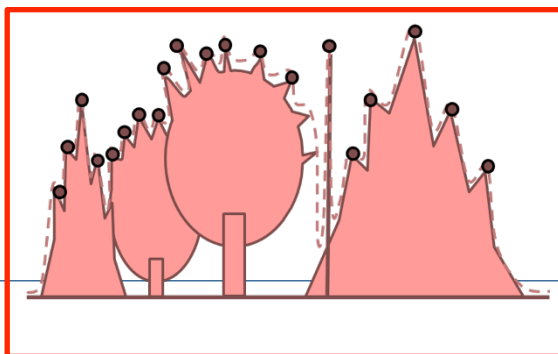
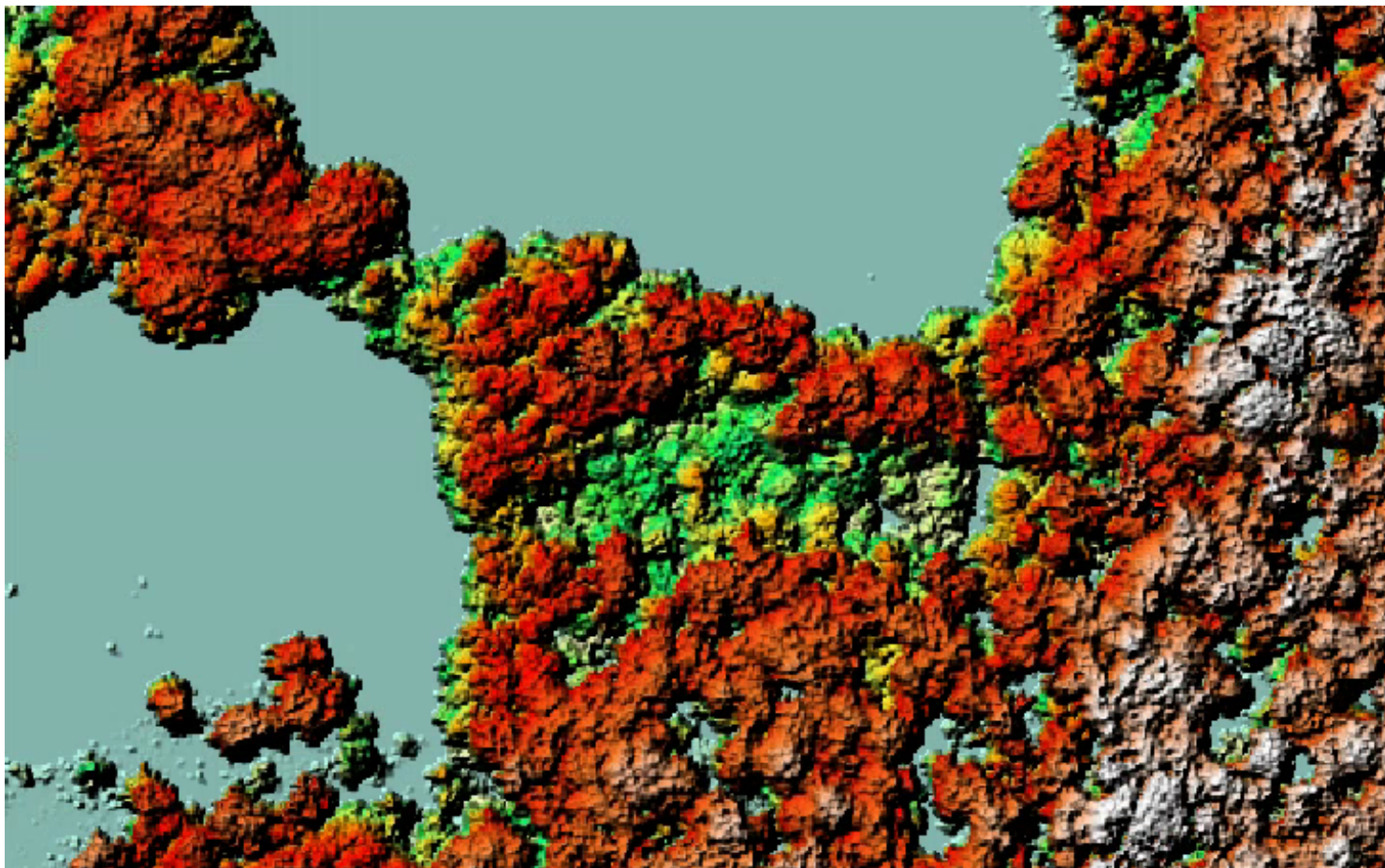
900 m

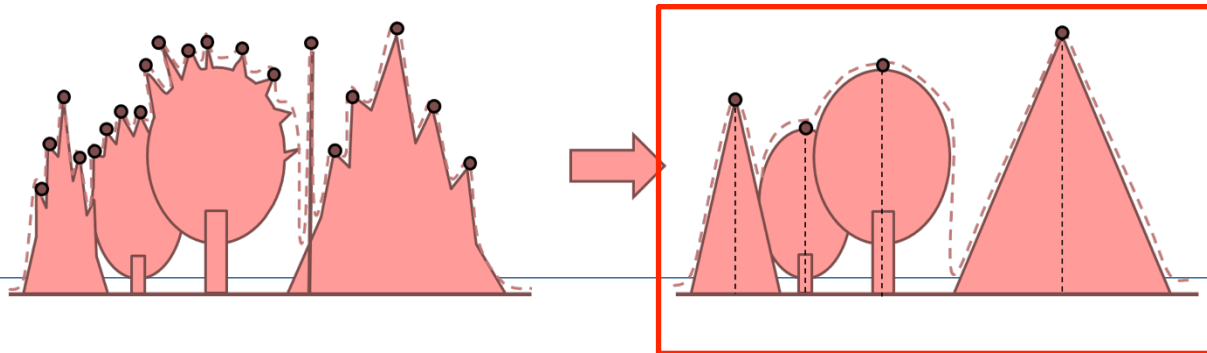
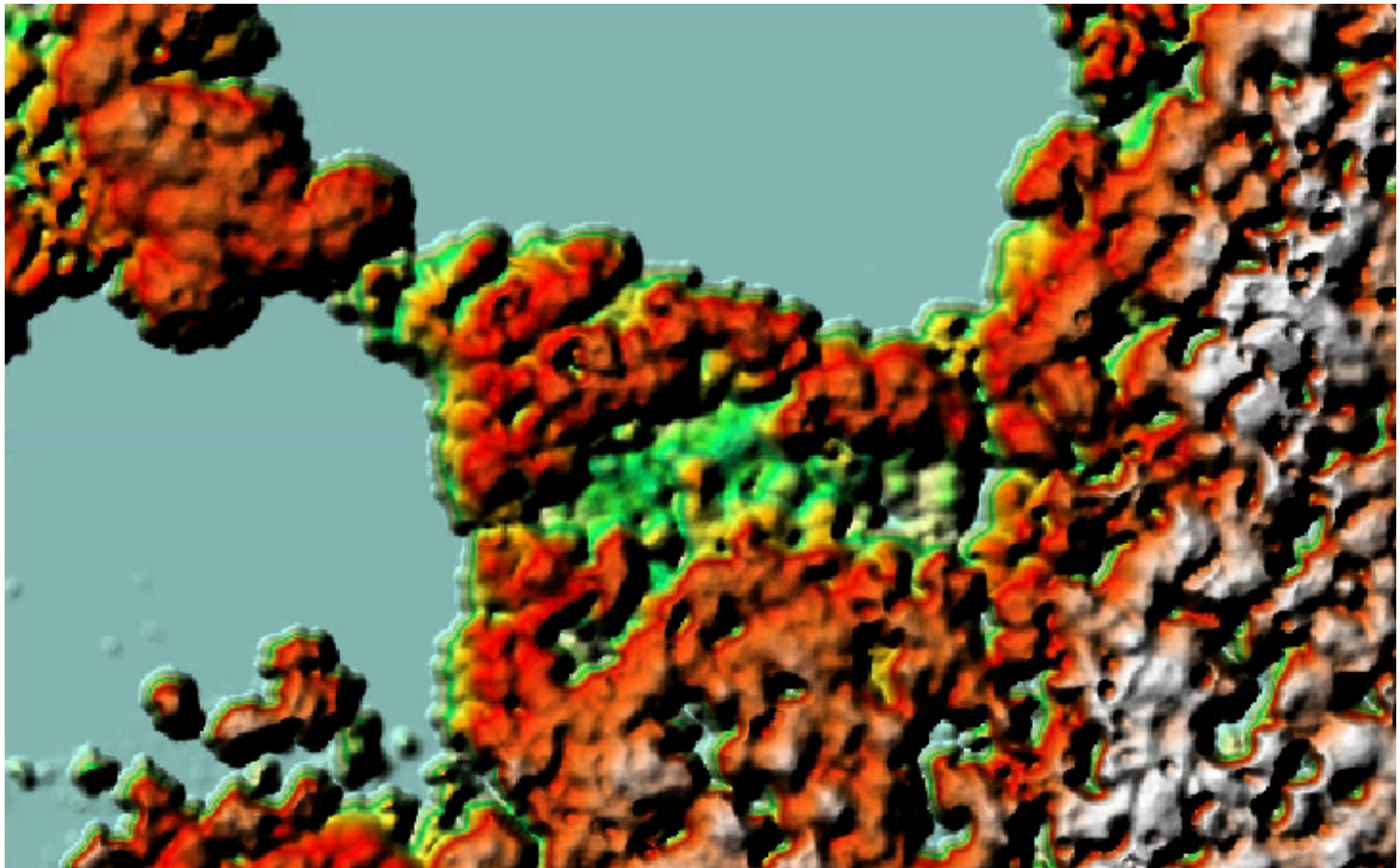


2500 m



900 m





Tools

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NATURAL HAZARD RISK MANAGEMENT

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TOOLS OF OTHER ORGANISATIONS

- BASEMENT* (Basic simulation environment for computation of environmental flow and natural hazard simulation)
- CRSP* (Colorado Rockfall Simulation Program - 3D; the non-free 2D version can be found [here](#))
- DAN-W (spatial and dynamic runout analysis of rapid landslides and rock avalanches)
- FLAC/PFC/UDEC (Numerical modeling codes for solving non-linear problems in rock mechanics and engineering)
- FLOW-R* (Flow path assessment of gravitational hazards at a regional scale)
- HEC-RAS* (One-dimensional steady flow, unsteady flow and sediment transport modeling)

Tools for members

- > Licence File
- > FINT - Tool for detecting trees in surface models
- > RockforNET - Rapid rockfall forest assessment tool
- > Rockyfor3D - 3D Rockfall modelling
- > SlideforNET - Landslide forest assessment tool

FINT - Find Individual Trees

ecorisQ

About FINT

Output directory: Browse

Input model(s):

Digital Elevation and Surface Models Normalized Surface Model

NSM file: Browse

If the altitude is required for calculating the DBH, a Digital Elevation Model (DEM) needs to be provided below

DEM file: Browse

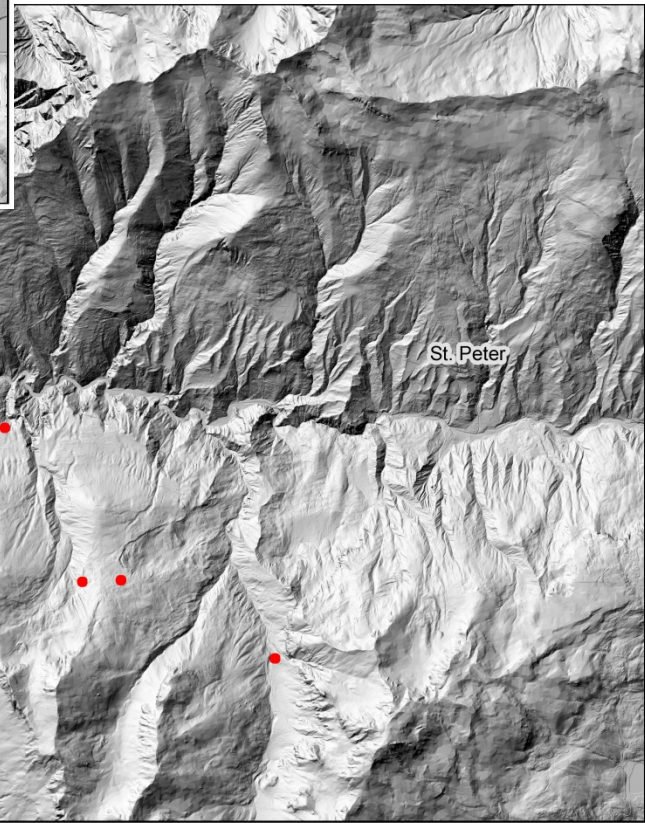
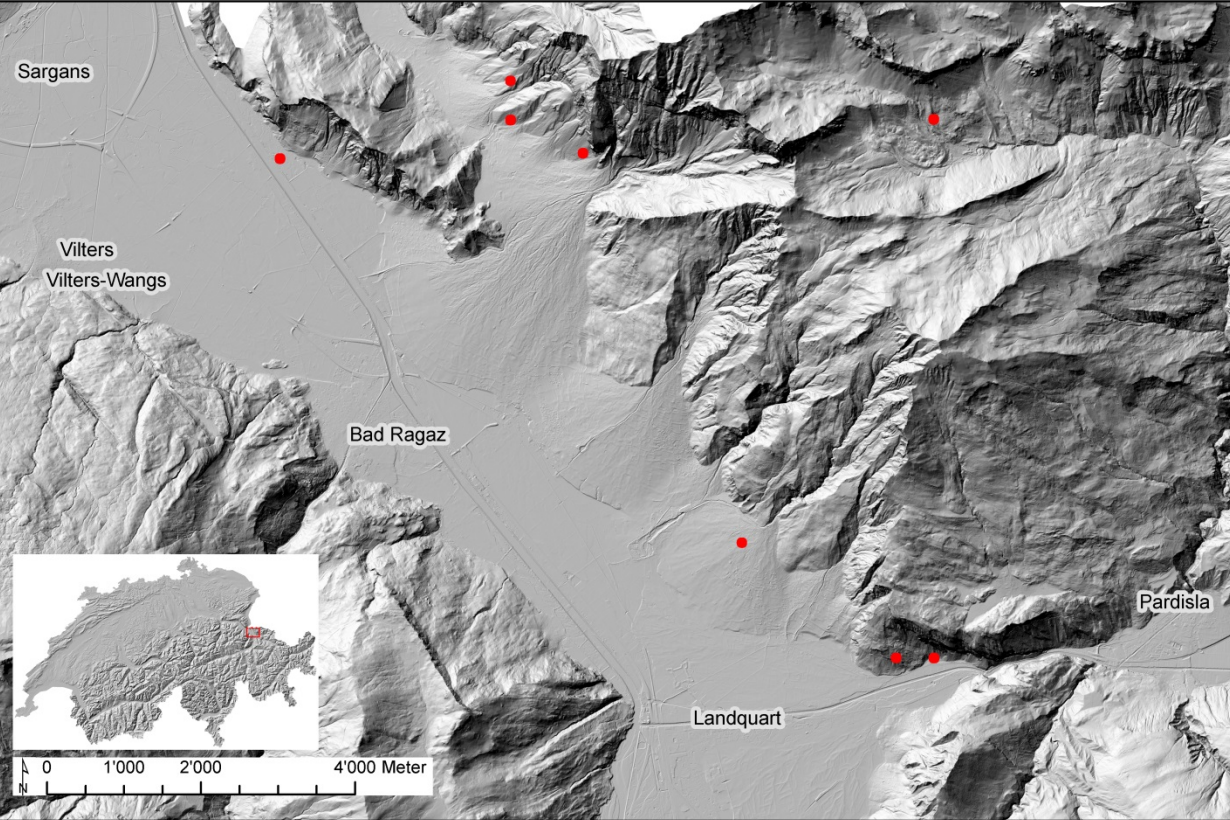
Minimum tree Height: m

Function for Diameter at Breast Height (cm):

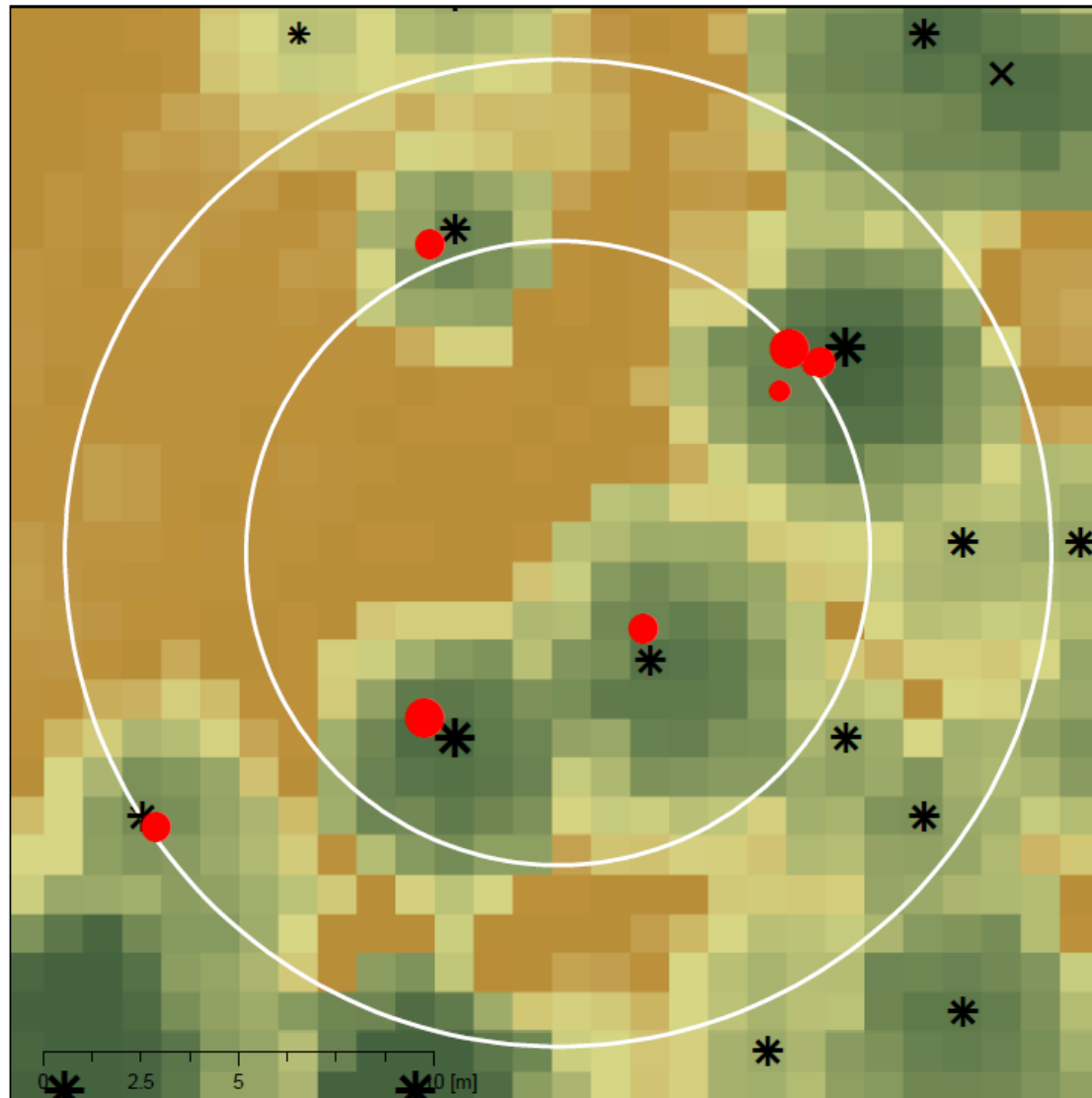
☒ DBH = $H^{1.25}$

☐ Custom DBH = ☐ Randomize calculated DBH values +/- %

Run

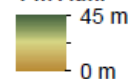


KHM-Auflösung	Variante	MBA-Modell	Gauss-Filter	RMSE [Stämme/ha]	MNAE [%]	MDR [%]
1.00 m	Beste Variante	ohne	ohne	117	35 %	81 %
	MBA-Gegenvariante	mit	ohne	130	29 %	73 %
0.50 m	Beste Variante	ohne	mit $\sigma = 1$	134	31 %	76 %
	MBA-Gegenvariante	mit	mit $\sigma = 1$	152	31 %	67 %
0.25 m	Beste Variante	ohne	mit $\sigma = 2$	118	31 %	71 %
	MBA-Gegenvariante	mit	mit $\sigma = 2$	149	32 %	59 %



KHM

1 m Aufl.



Detektierte Bäume

1 m-Aufl. - ohne MBA

x <= 10 m (0)

X <= 20 m (1)

X <= 30 m (12)

X > 30 m (4)

Detektierte Bäume

1 m-Aufl. - mit MBA

+ <= 10 m (0)

+ <= 20 m (1)

+ <= 30 m (12)

+ > 30 m (4)

Observed Bäume

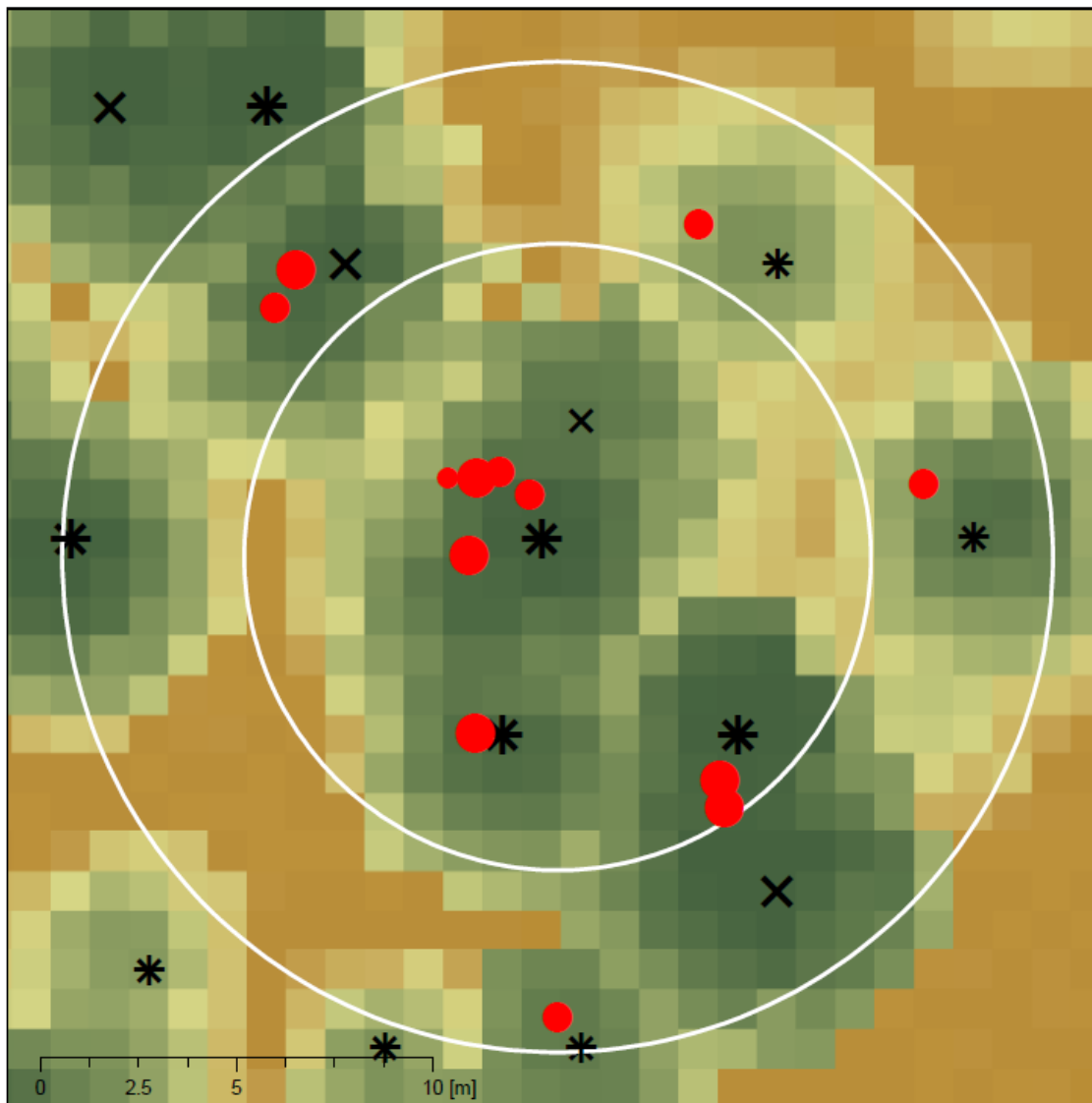
Baumhöhe

• <= 10 m (0)

• <= 20 m (2)

• <= 30 m (4)

• > 30 m (2)



KHM

1 m Aufl.



Detektierte Bäume

1 m-Aufl. - ohne MBA

- x <= 10 m (0)
- X <= 20 m (0)
- × <= 30 m (6)
- ⊠ > 30 m (8)

Detektierte Bäume

1 m-Aufl. - mit MBA

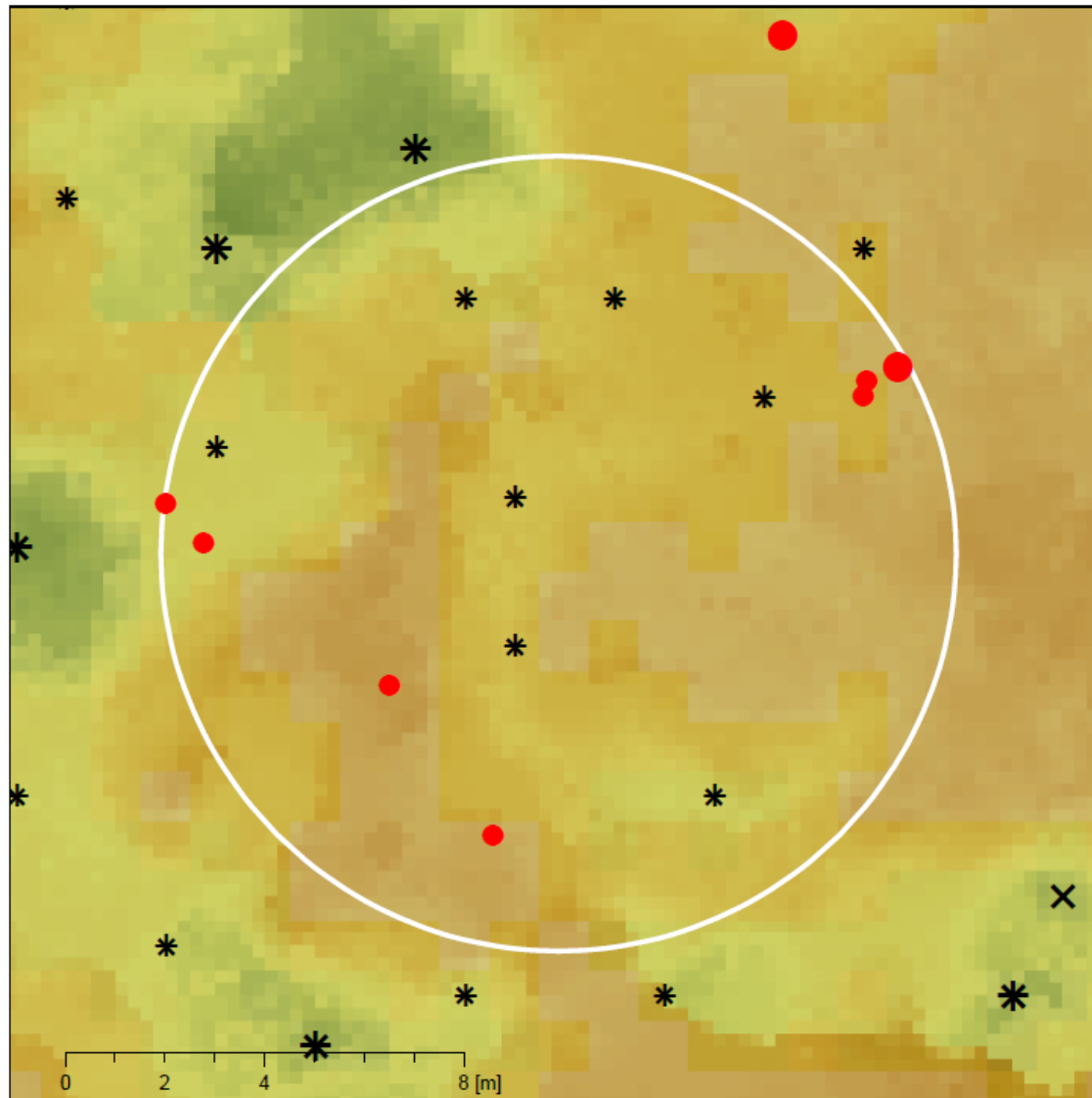
- + <= 10 m (0)
- ⊕ <= 20 m (0)
- ⊕ <= 30 m (5)
- ⊕ > 30 m (5)

Observierte Bäume

Baumhöhe

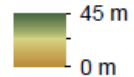
- <= 10 m (0)
- <= 20 m (1)
- <= 30 m (6)
- > 30 m (6)





KHM

25 cm Aufl.



Detektierte Bäume

1 m-Aufl. - ohne MBA

- x <= 10 m (0)
- X <= 20 m (14)
- ✕ <= 30 m (6)
- ✕ > 30 m (0)

Detektierte Bäume

1 m-Aufl. - mit MBA

- + <= 10 m (0)
- + <= 20 m (14)
- + <= 30 m (5)
- + > 30 m (0)

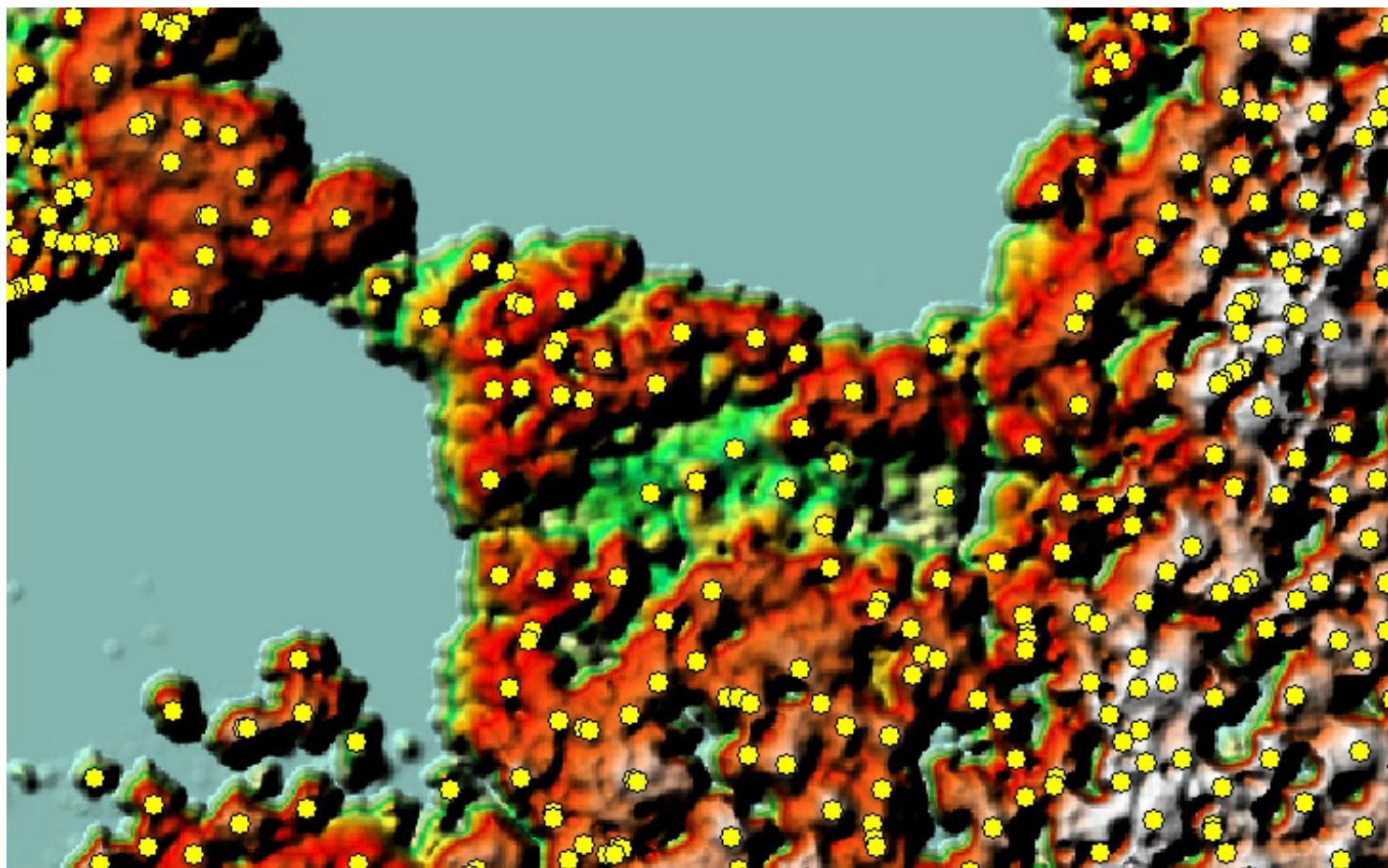
Observierte Bäume

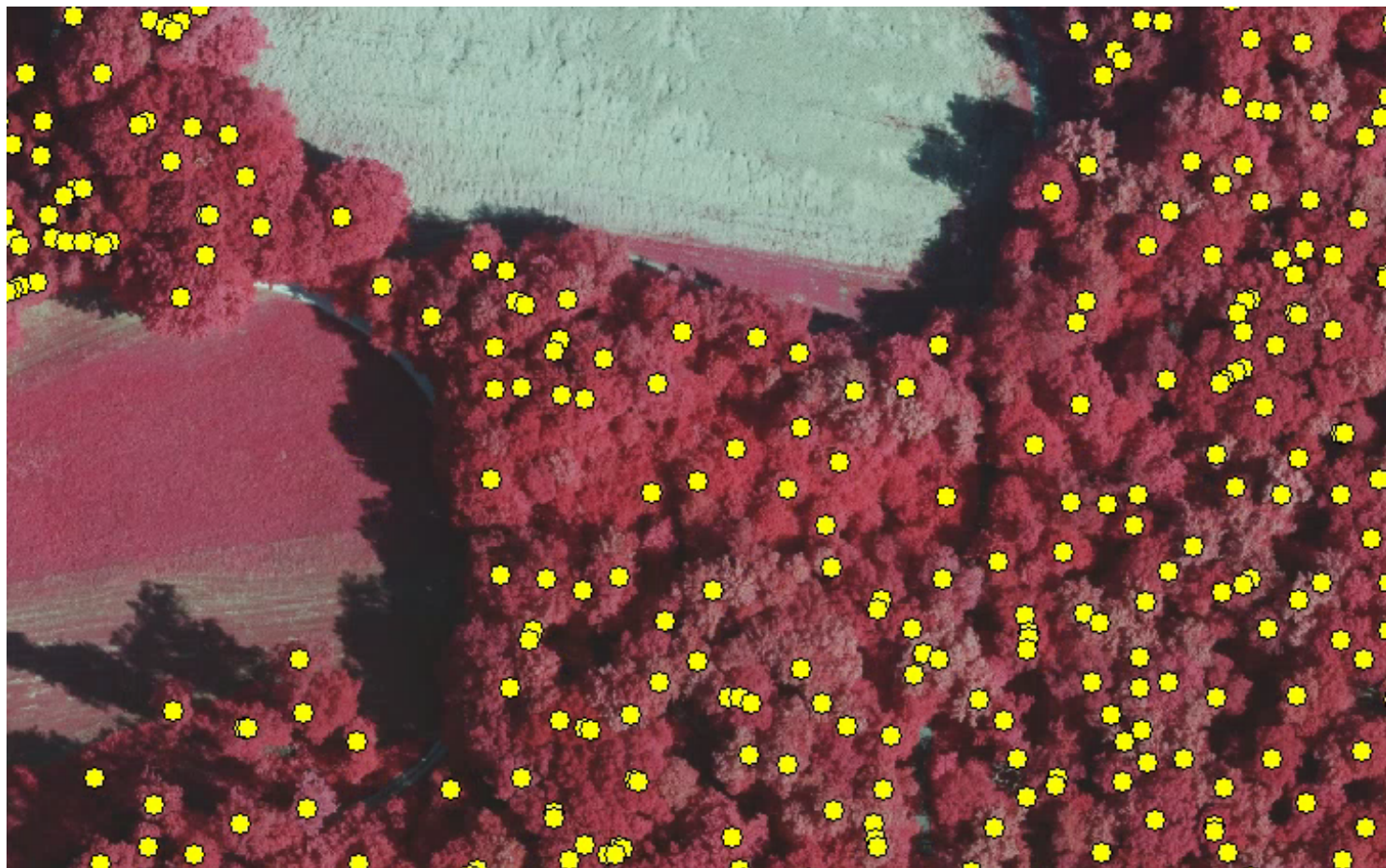
Baumhöhe

- <= 10m (0)
- <= 20m (6)
- <= 30m (2)
- > 30m (0)









Ganz Kanton Zürich (BHD > 30 cm):

6'910'000 Bäume (Geschätzt LFI)

6'300'000 Bäume (FINT – ALS)



Danke für eure Aufmerksamkeit

luuk.dorren@bfh.ch
christian.ginzler@wsl.ch