

Noel Gorelick (Google) @ ForestSAT 2018:

„Hi everyone,

would you like Google to map and monitor
every tree of the world?”

answers:

.... not possible

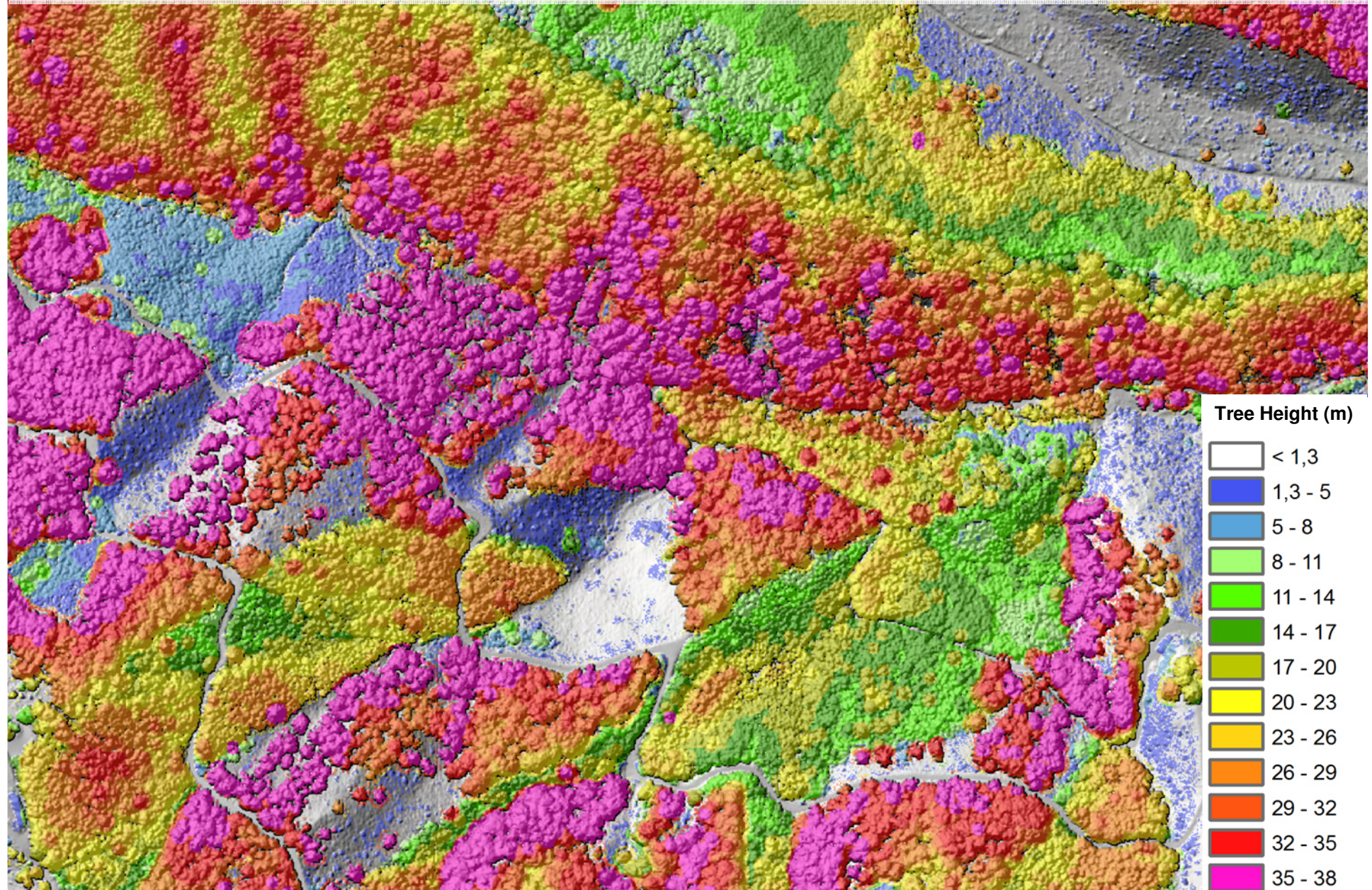
.... not necessary

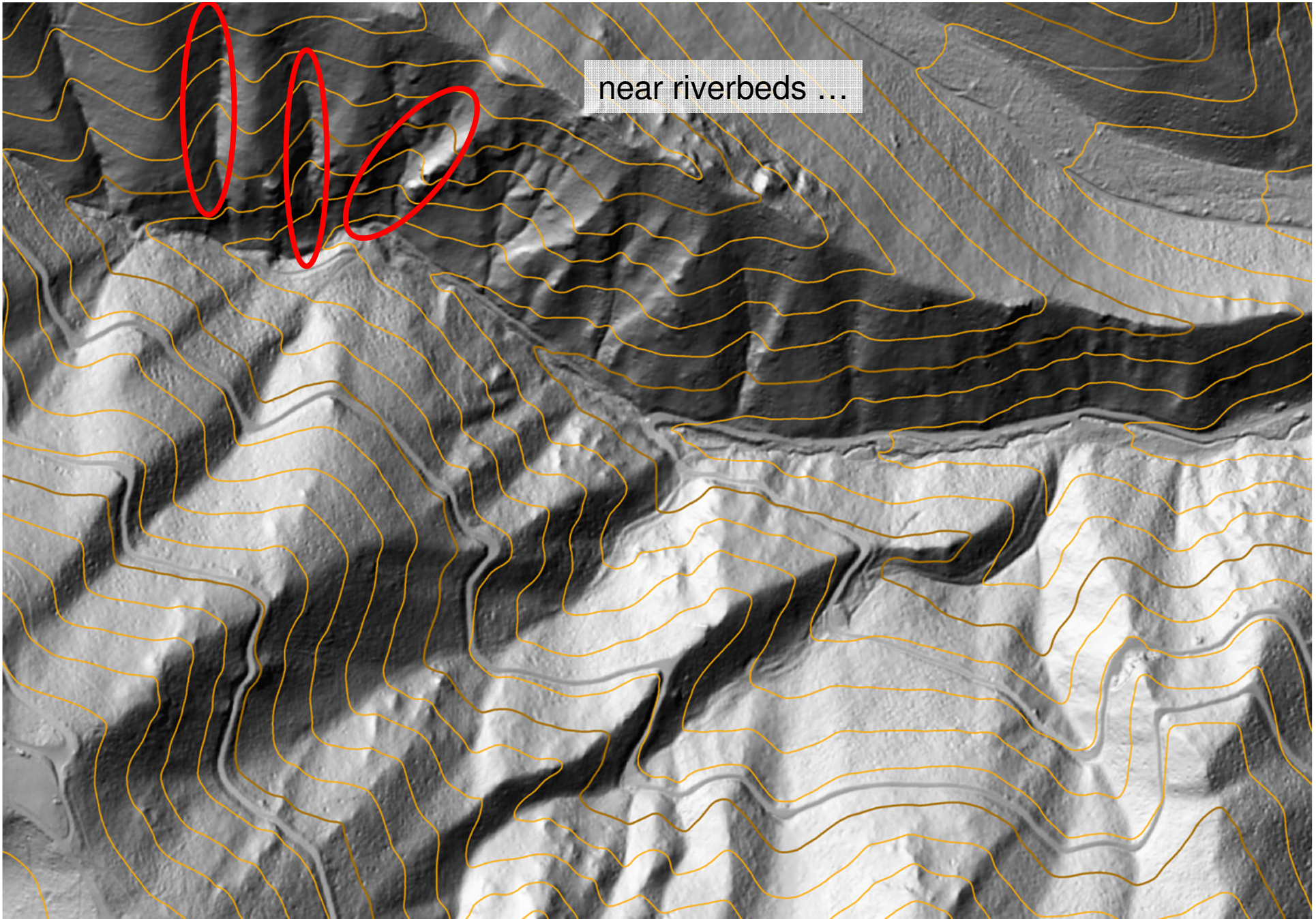
but why should Google not try to map trees?

At least a **Canopy Height Model** of the planet ...

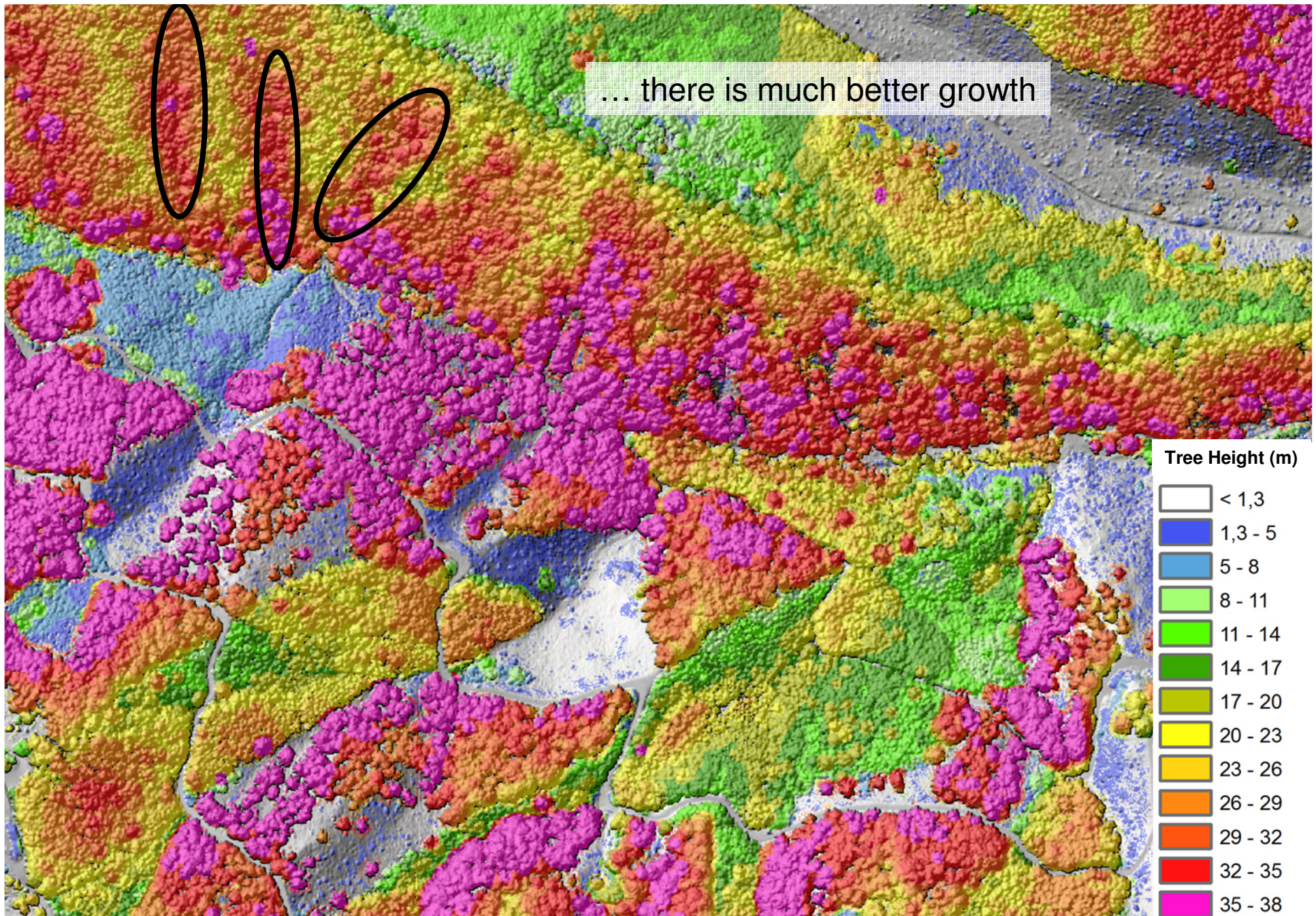
... could significantly reduce illegal logging !!!

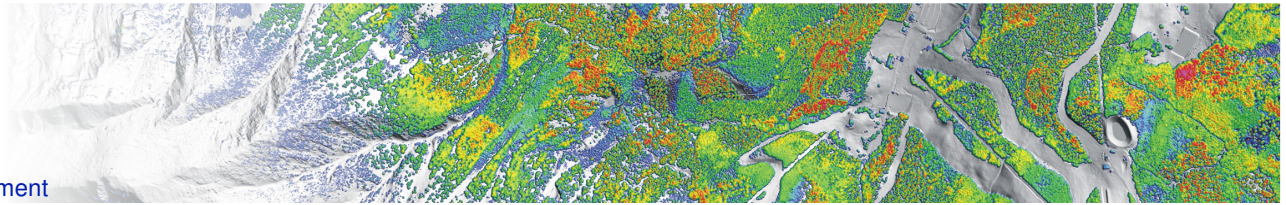
Canopy Height Models from Aerial Laserscanning or Image Matching



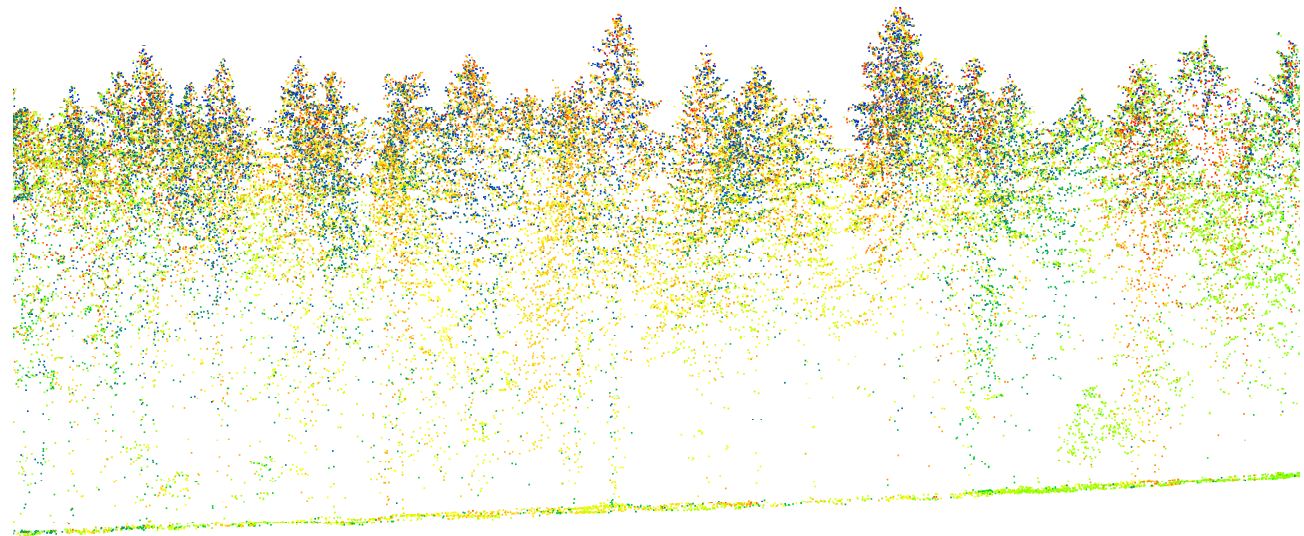
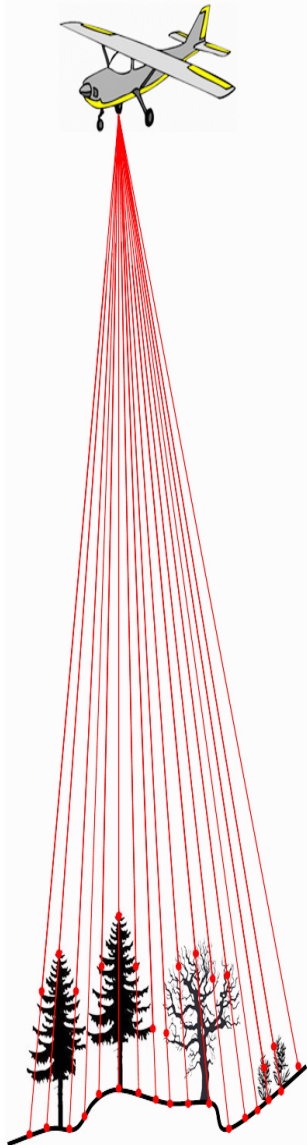


near riverbeds ...

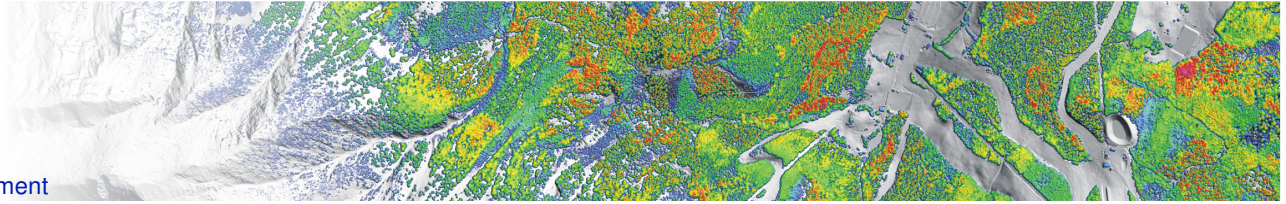




Point Cloud from Aerial Laserscanning



- wall-to-wall coverage
 - 2 – 16 pulses per m²
- **Canopy Height and Tree Top Recognition**



Reference to Cooperation Partners

- Umweltdata Ltd. since 1988 (Forest Inventory, Remote Sensing, Mapping, Forest Management Planning)

15 years of experience with LIDAR data in forest inventory

Günther Bronner, Boris Jawecki, Martin Keuschnigg



- Joanneum Research (Remote Sensing)

Mathias Schardt, Manuela Hirschmugl

- E.C.O. (Monitoring of Biodiversity, Management of Protection areas)

Hanns Kirchmeir, Michael Jungmeier

- Aeromap (Aviation and Aerial Remote Sensing)

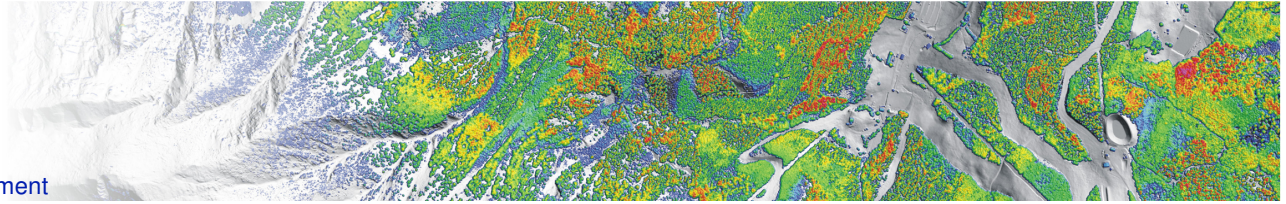
Roland Wack, Thomas Meißl

- Technical University of Vienna (GEO)

(Norbert Pfeifer, Markus Hollaus, Martin Wieser)

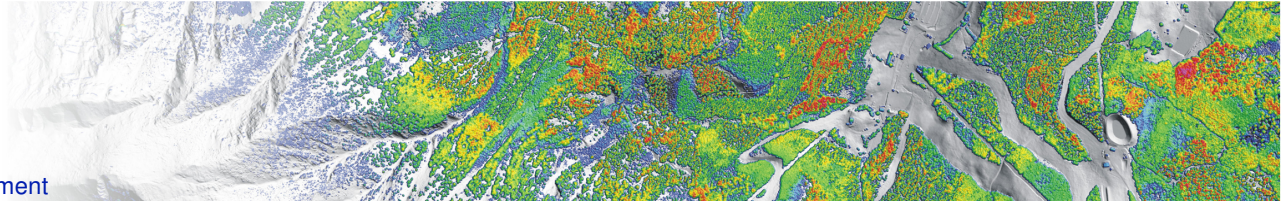
- Riegl Laser Measurement systems
Aerial, Drone- and Terrestrial LIDAR

Martin Pfennigbauer, Nikolaus Studnicka, Bernhard Groiss



Canopy Height Models (CHM)

- Significant optimization of forest inventory cost / benefit ratio
- Streamline inventory, mapping and Forest Management Planning
- Allow quick and easy updates
- Integrate economical and ecological sustainability criteria
- Most accurate carbon mapping available



Canopy Height Models (CHM)

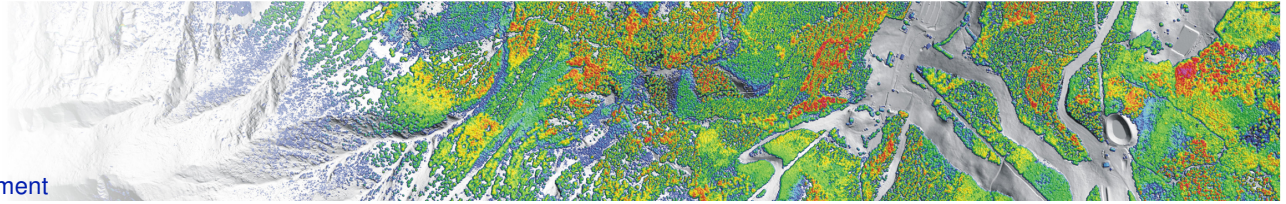
➤ **Good practise in Forest inventory can accurately describe the Problems.**

➤ **Only good practise in Forest Management can change things for the better !**

➤ **Allow quick and easy updates**

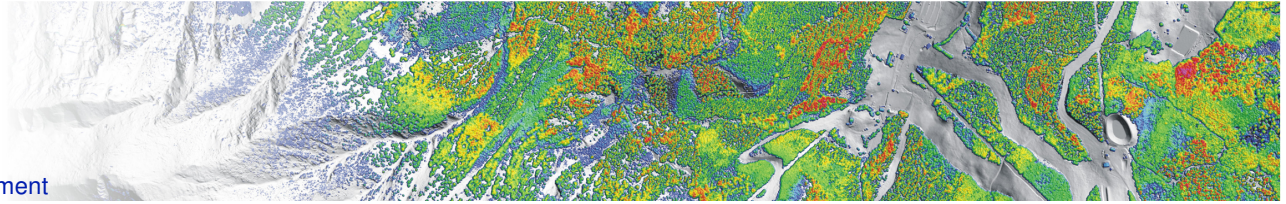
➤ **Integrate Streamlining Remote Sensing, Forest Inventory, Mapping and Manangement Planning is a triple win-win-win situation.**

➤ **Most accurate carbon mapping available**



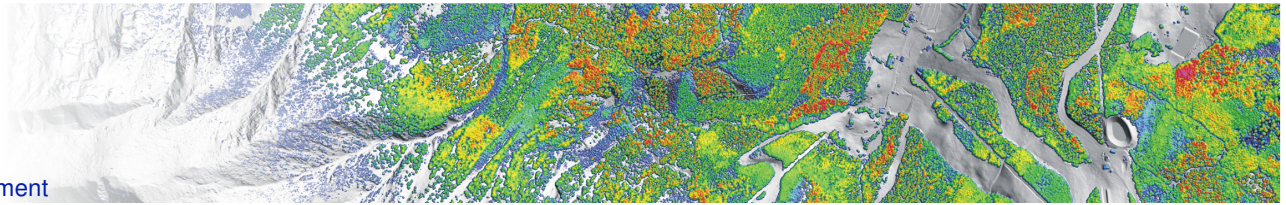
CHMs are too expensive?

- Airborne Laser Scanning (ALS) for whole forest area in Romania is about 10 Mio €
- Update by low cost CHMs from Image Matching (side product of ortho-images)
- NFI costs can be cut into half
- Mapping by fieldwork is always ways more expensive and less accurate!



1000 Excuses ...

- ... we do not dare to use new technology
=> it is state of the art, operationally tested
- ... we rather want to employ local people for fieldwork => use them for management!
- ... military people would not allow us to fly
=> all defence-relevant geo-data can be captured by satellite
- ... we do not want to be as transparent
=> funding should make CHMs a standard



Romanian forest ranger shot dead in “Mafia style” killing amid spike in illegal logging

De [Universul.net](#) - 18 octombrie 2019



CELE MAI CITITE

Kovesi i-a trimis notificare lui Gâdea. Directo
3 are 15 zile la dispoziție...

[George Grigoriu](#) - 19 octombrie 2019

BREAKING| Cuc, autodenunț în direct: Am în
într-adevăr, pe Mezei ce parlamentari zboar...

[George Grigoriu](#) - 18 octombrie 2019

Bișniță cu candidați. În ce constă afacerea V
Bruynseels, câți bani sunt în...

[Mihai Ispas](#) - 18 octombrie 2019

Ce-i cerea Răzvan Cuc Mădălinei Mezei pe S
uitati-vă dacă a plecat vreunul...

[Alexandru Leman](#) - 18 octombrie 2019

Eugen Nicolicea: DNA nu are competența de
pe Răzvan Cuc. Mădălina Mezei...

[Alexandru Leman](#) - 18 octombrie 2019

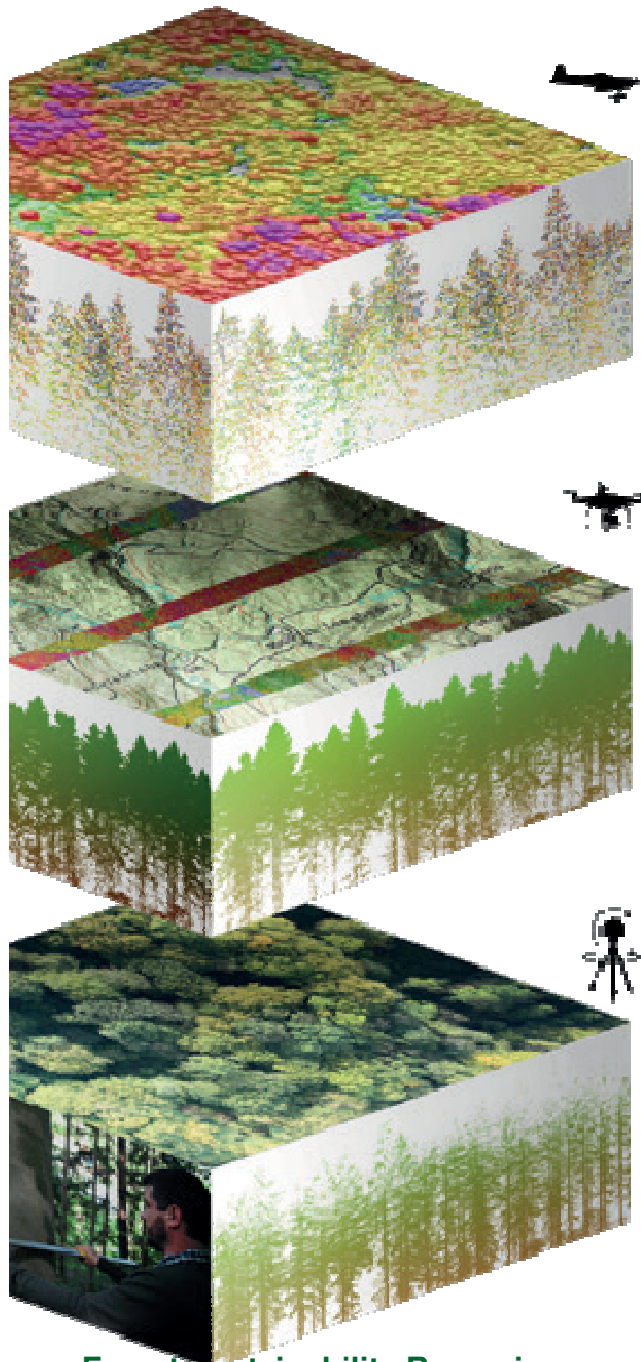
AR TREBUI USR SĂ INTRE LA GUVERN ALĂTURI DE PNL?

DA (57%, 393 VOTURI)

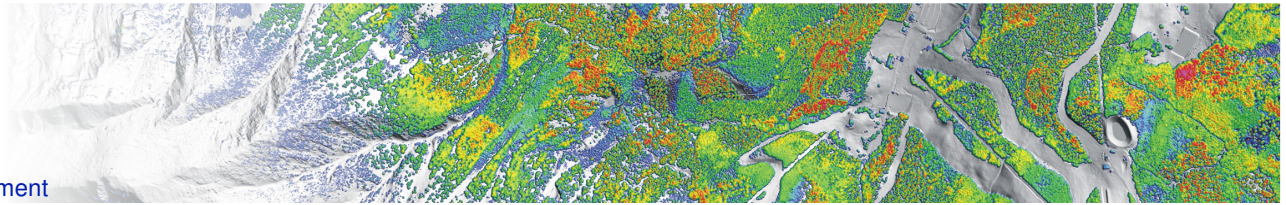
NU (43%, 298 VOTURI)

Total voturi: 691

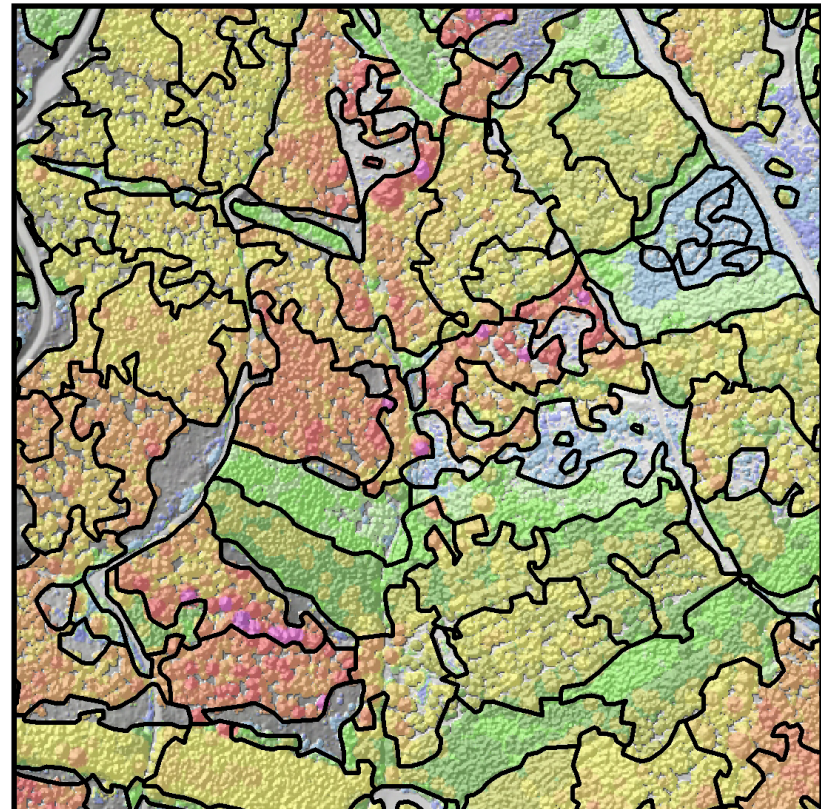
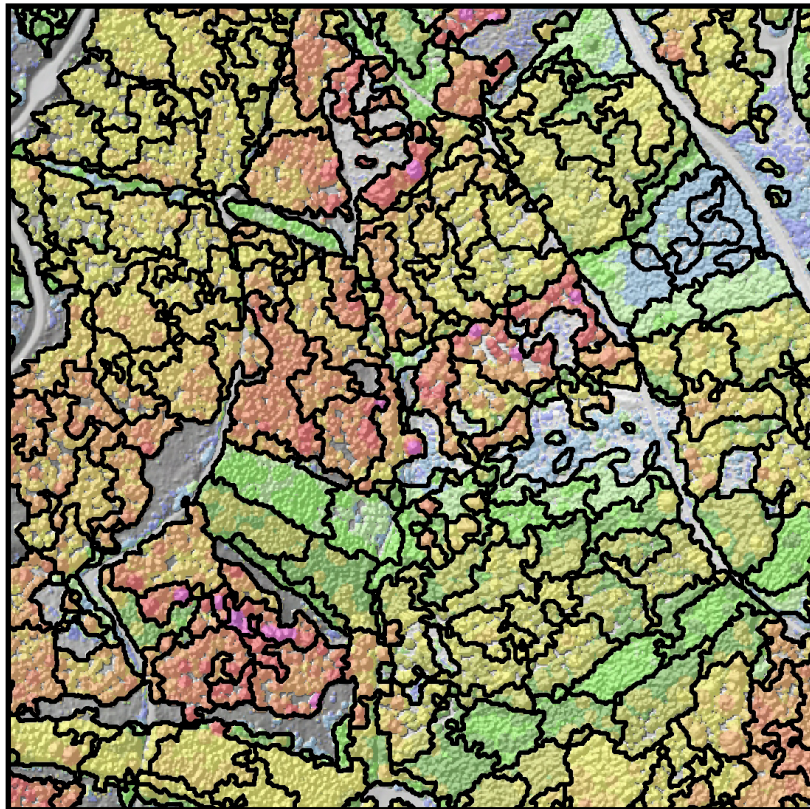


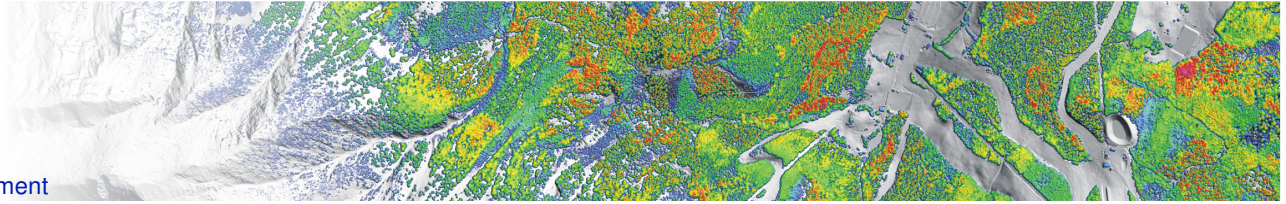


- **Phase I**
Aiborne Laser-Scanning
wall-to-wall coverage
- **Phase II**
stripes in low altitude
drone, ultra-light plane
- **Phase III**
TLS and / or Fieldwork

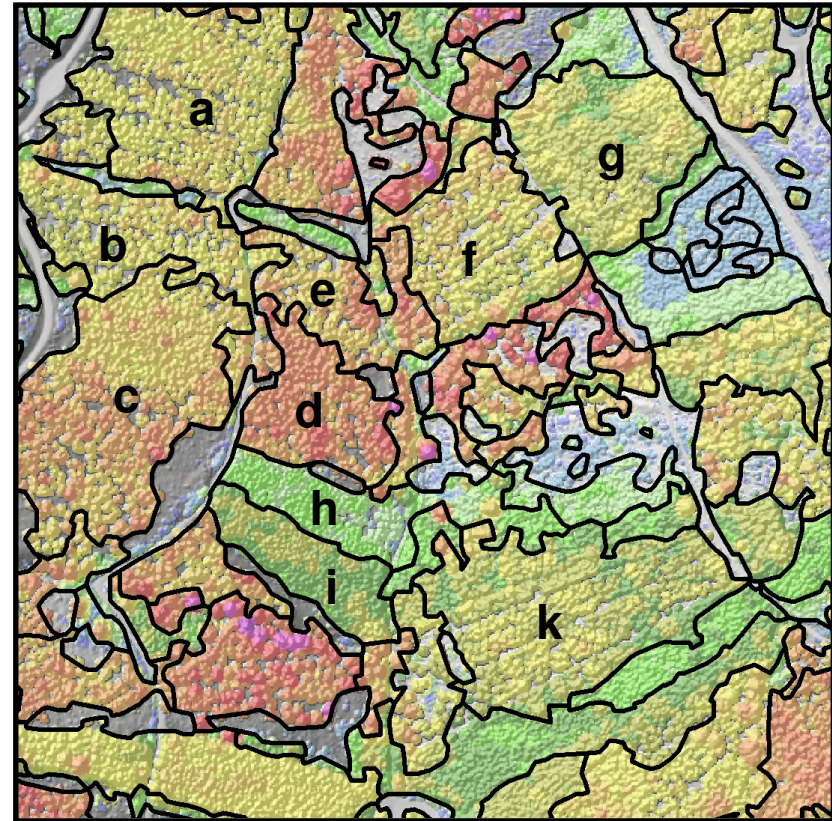
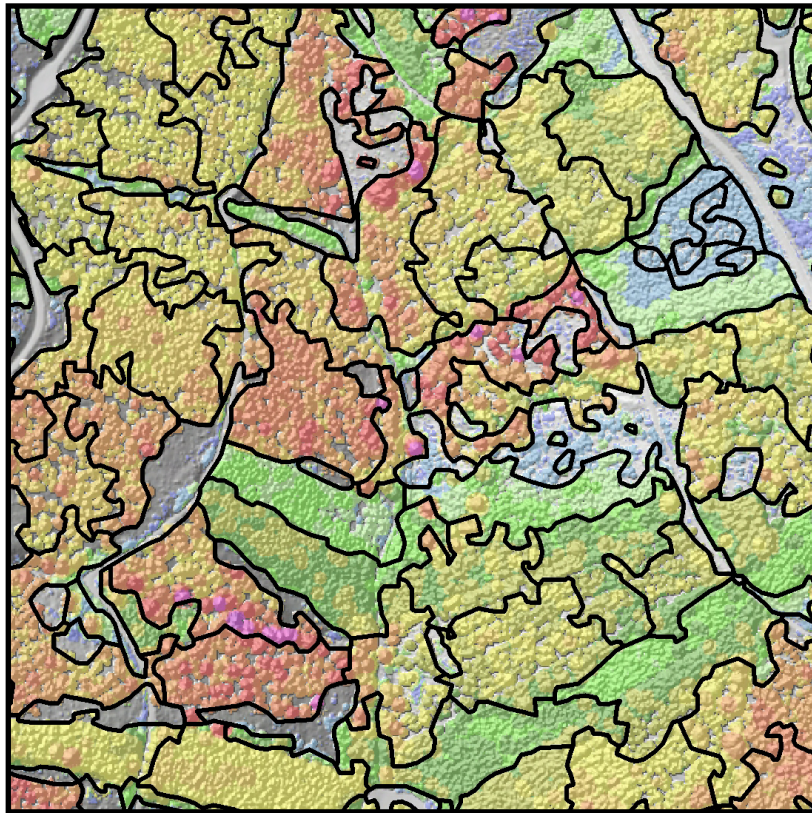


Automatic Segmentation of Canopy Height Models (i)

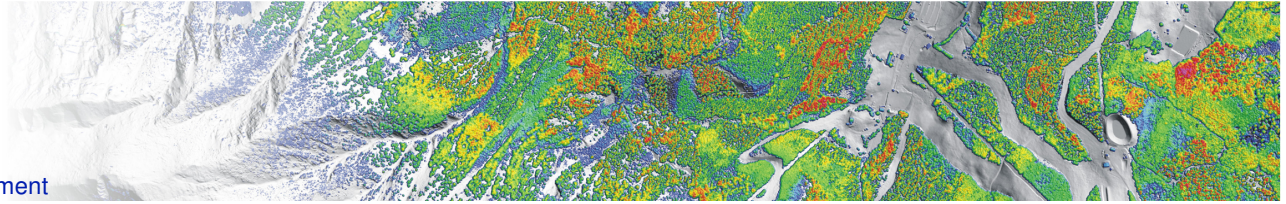




Automatic Segmentation of Canopy Height Models (ii)



step by step augmentation of forest stand polygons



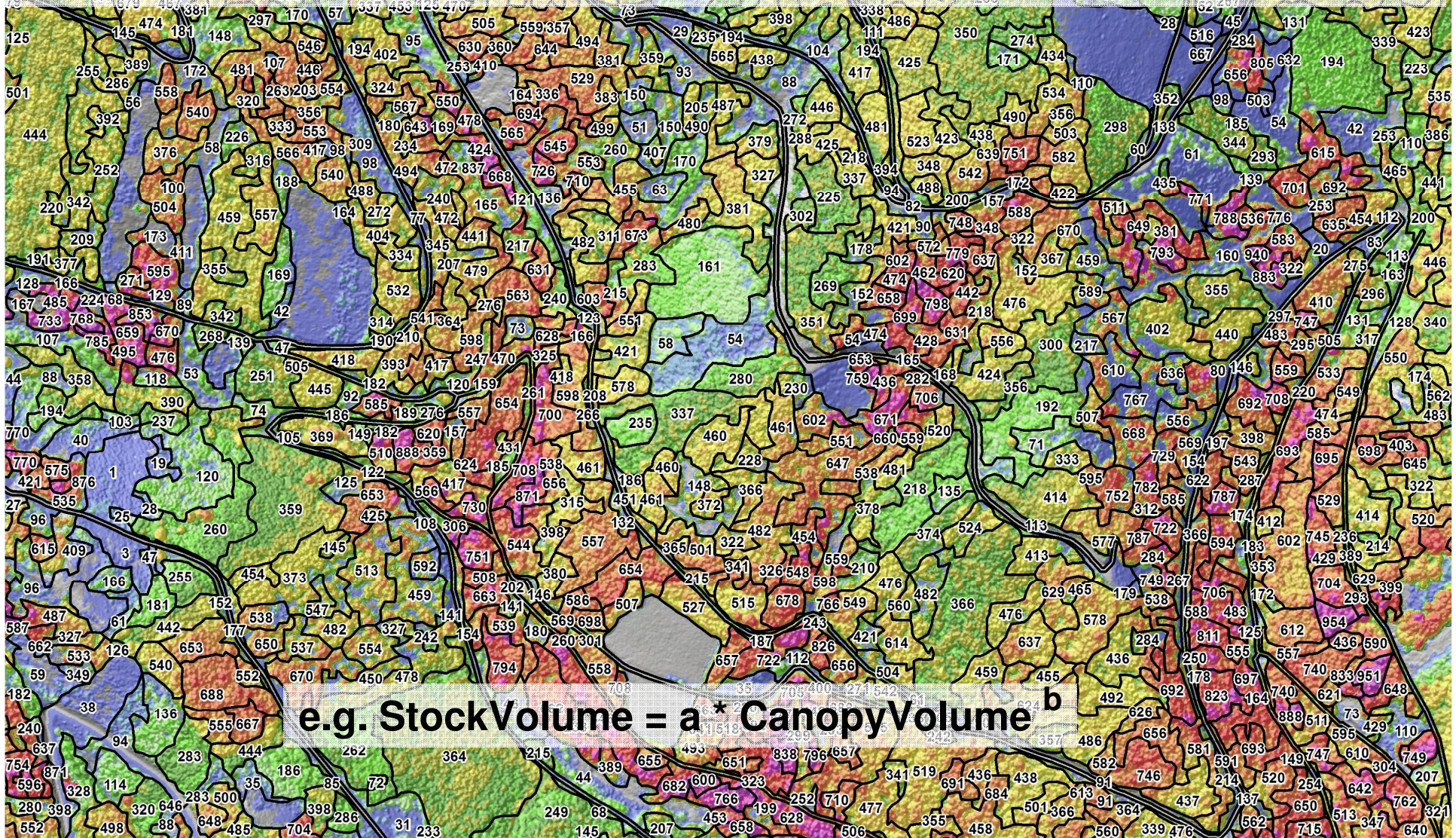
Temporary sample plots on segments

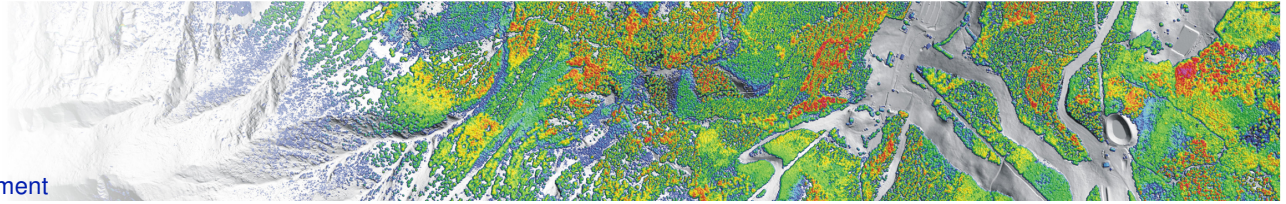
Stratification / classification strategies based on CHM segments are applied for optimization of sample plot design.

Efficiency factor 4-5 !!!



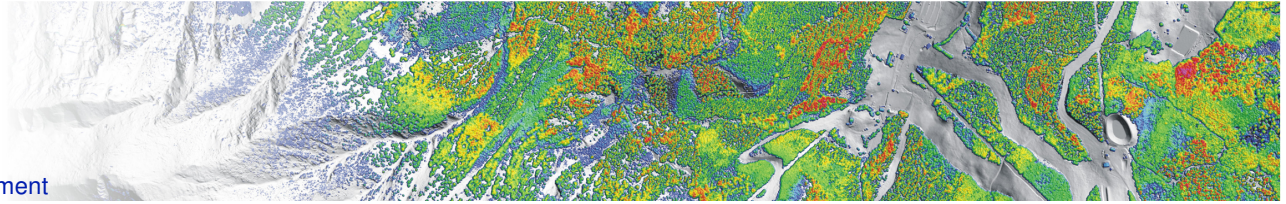
Mapping 1 Mio hectares of forest in Styria by Joanneum Research (2014)





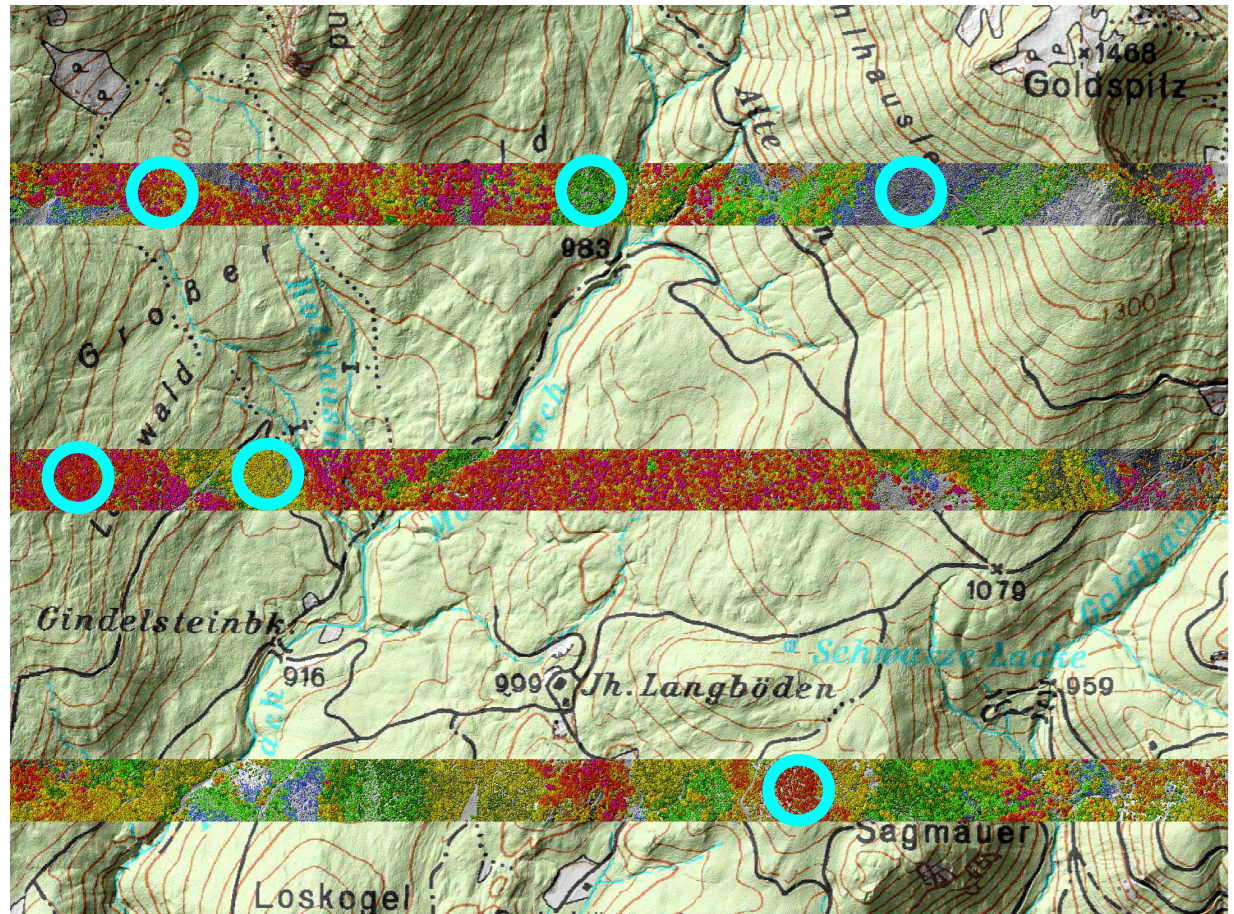
CHM-based Forest Resources Mapping

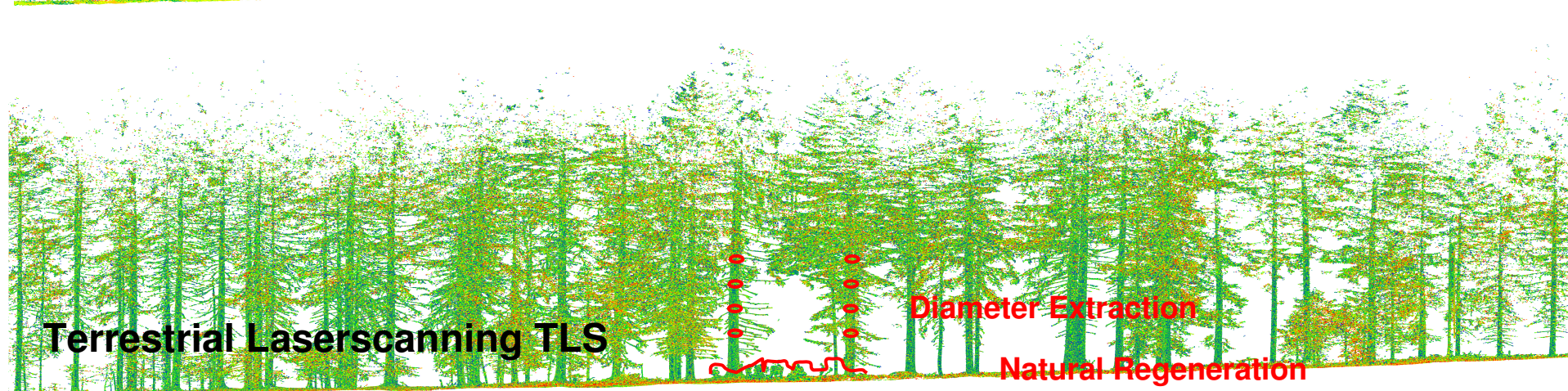
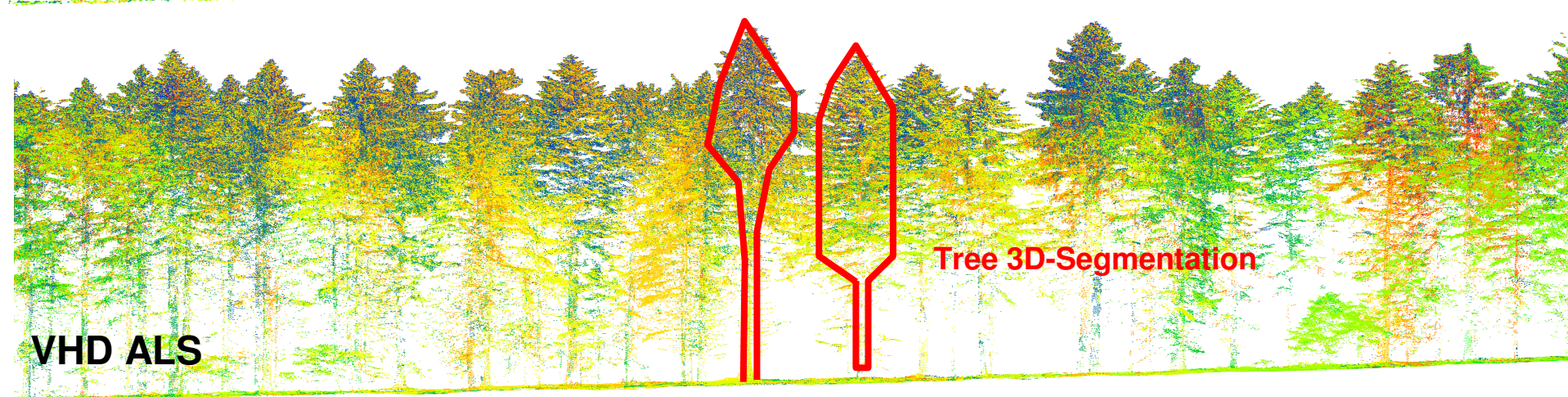
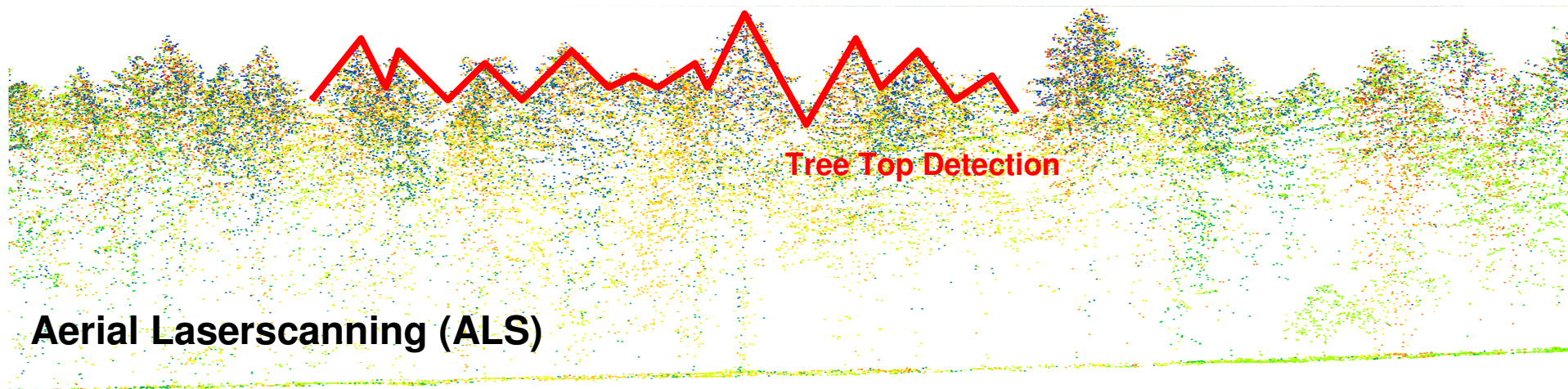
- Sock volume (calibrated by sample plots)
- Tree height
- Stand density
- Trees per hectare
- Vertical structure
- Tree species from aerial or satellite images (coniferous percentage)
- Altitude, exposition, slope, topography

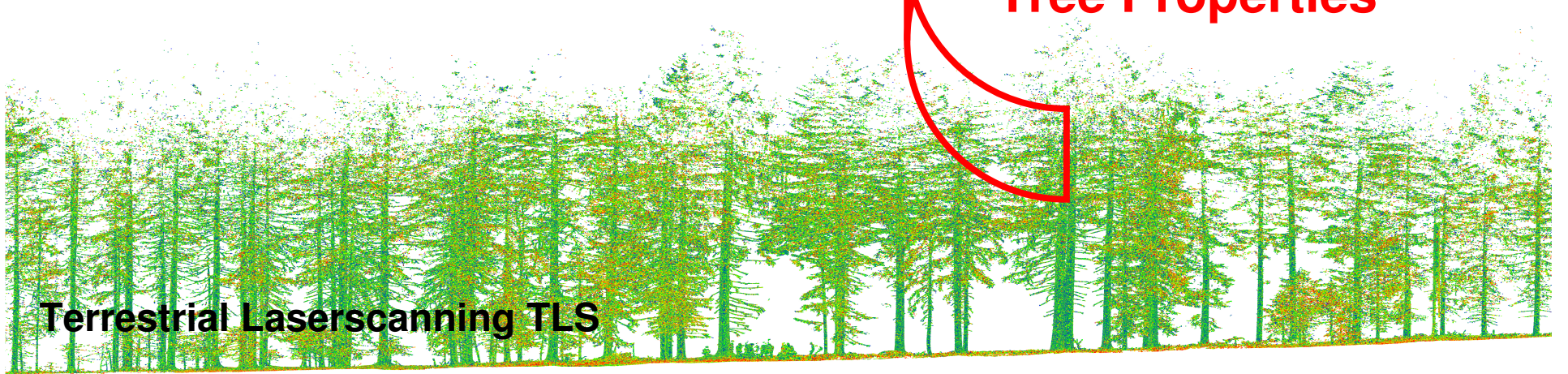
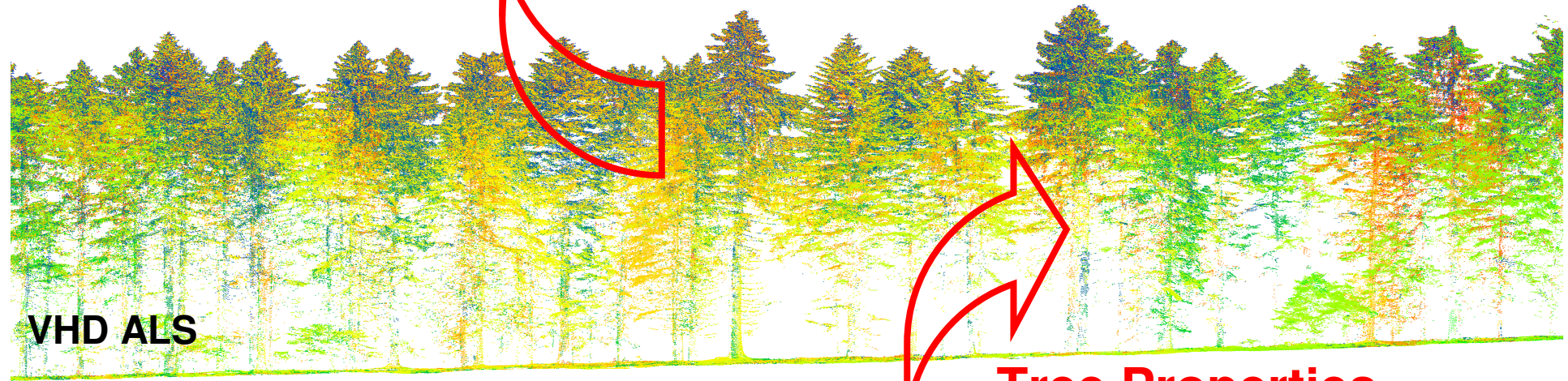
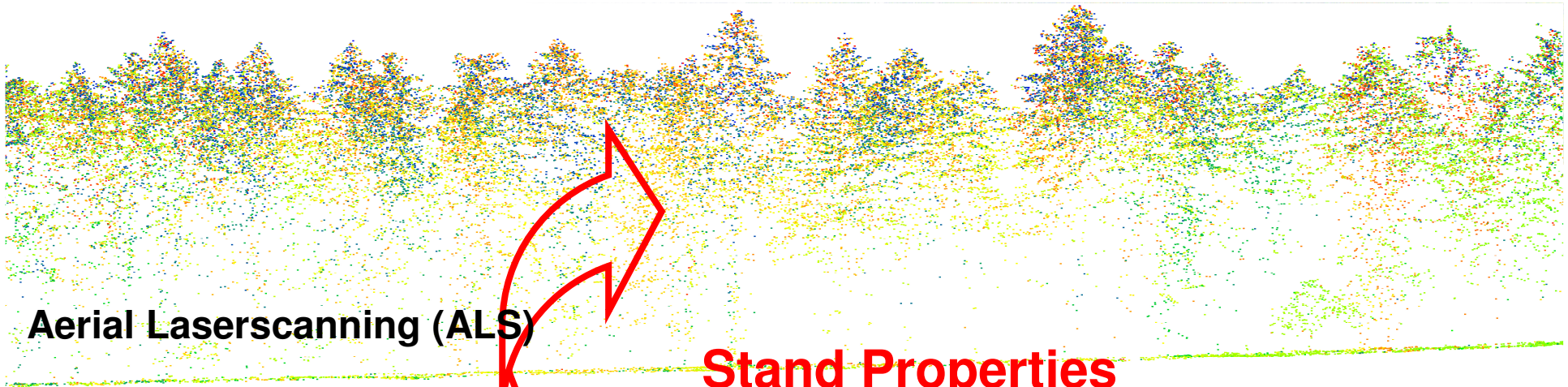


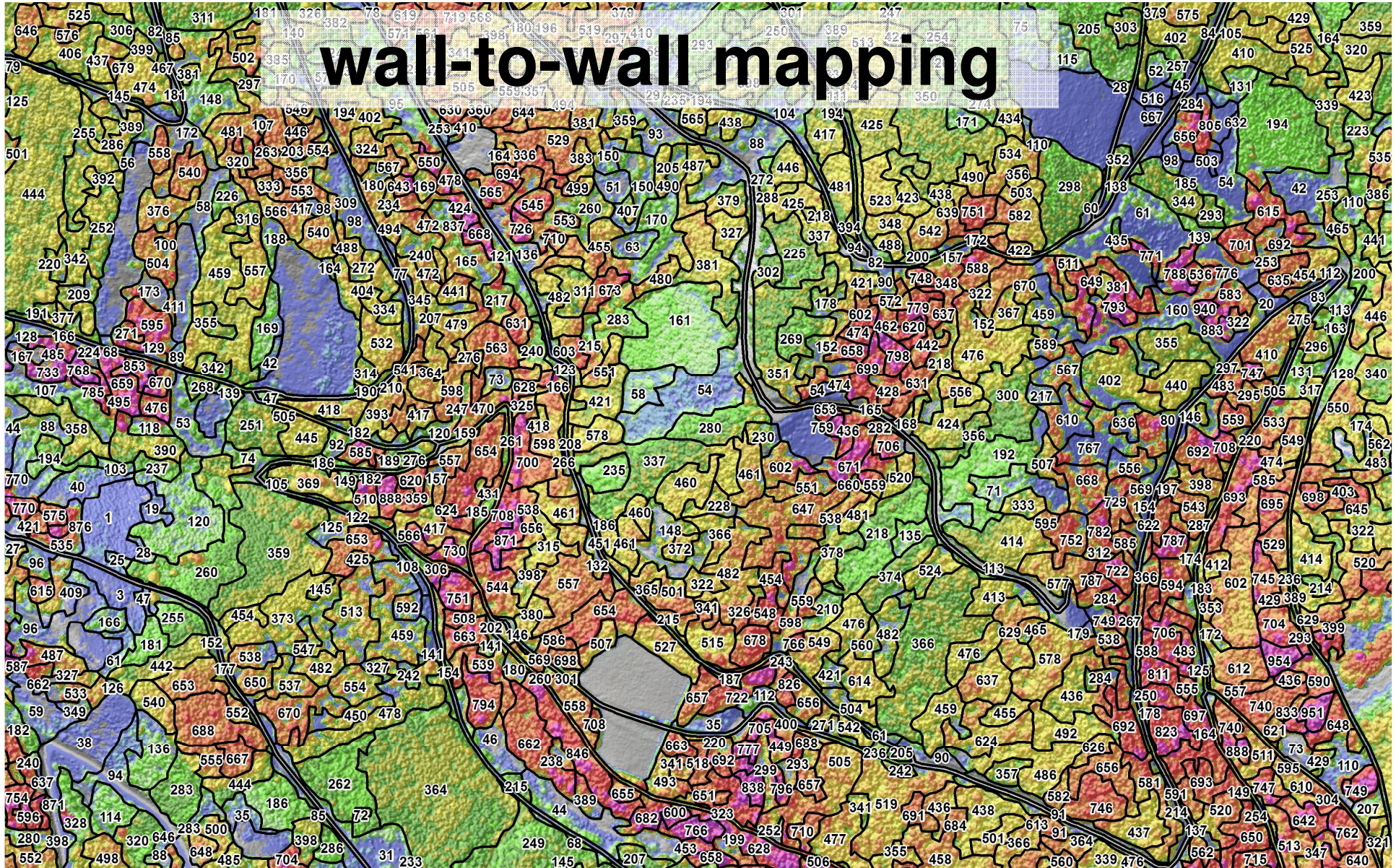
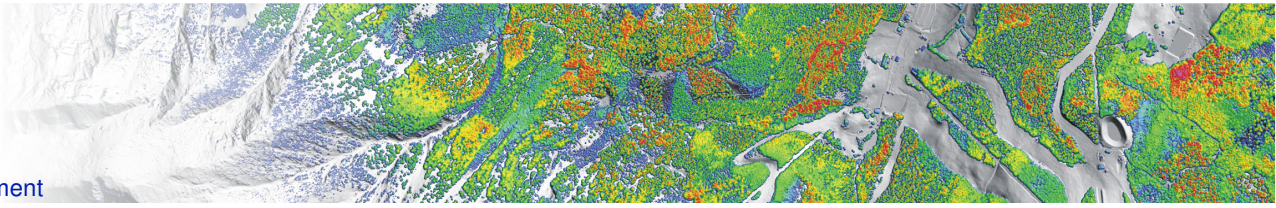
(NFI-based) 3-Phase Inventory

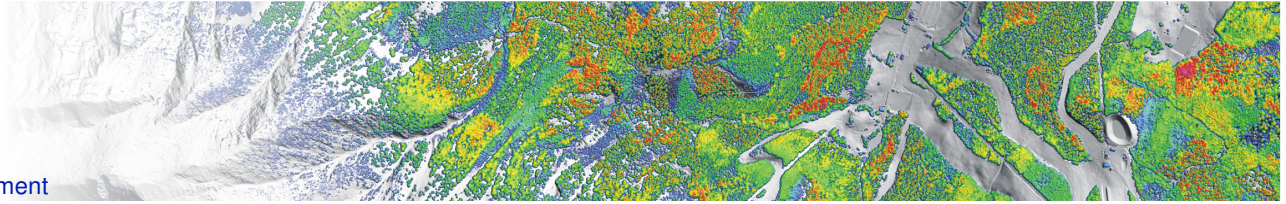
Stripes with very high resolution ALS data allow single tree modelling, recognition of vertical structure, dead-wood detection and identification of natural regeneration.





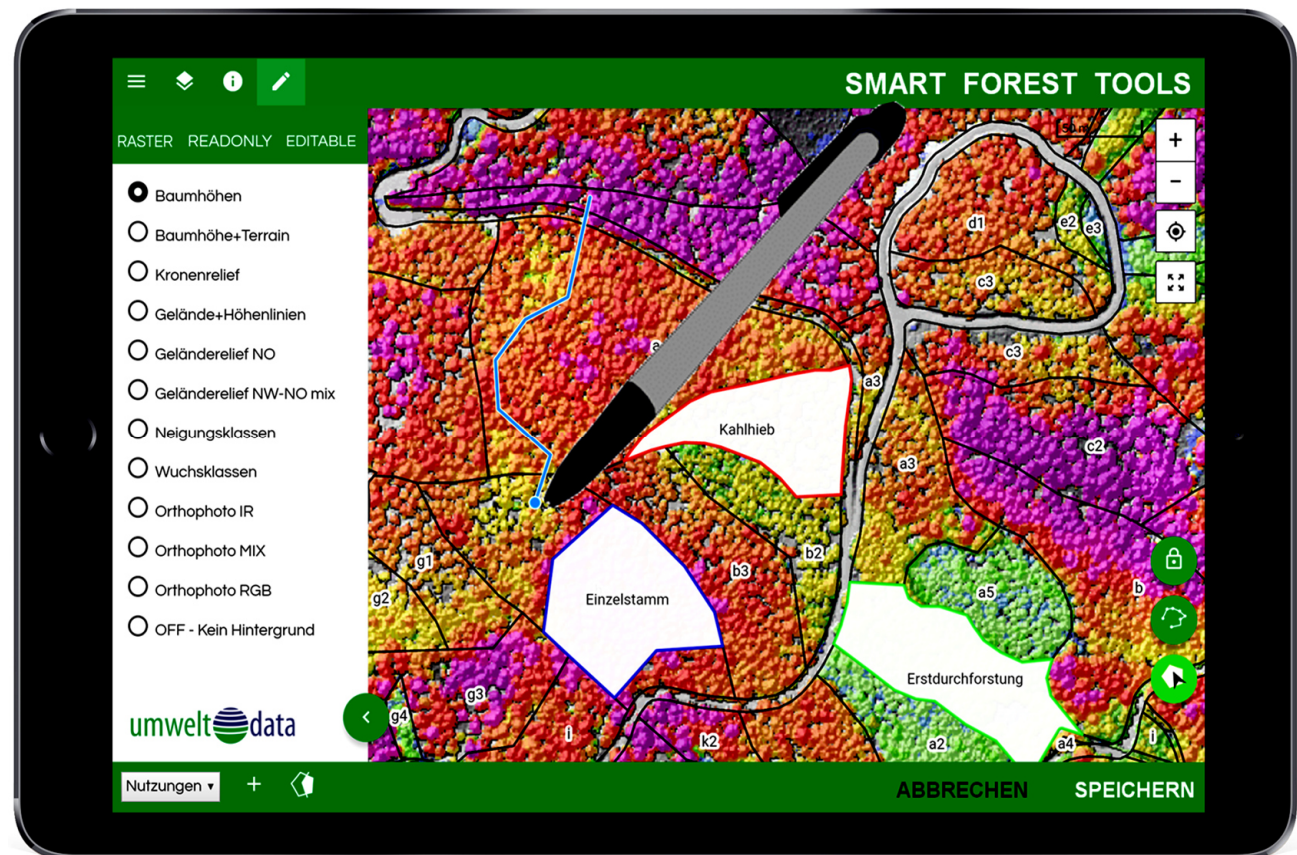


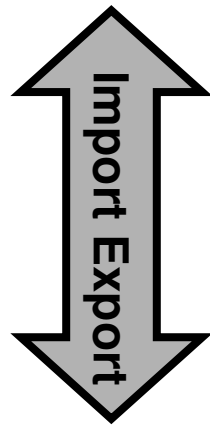
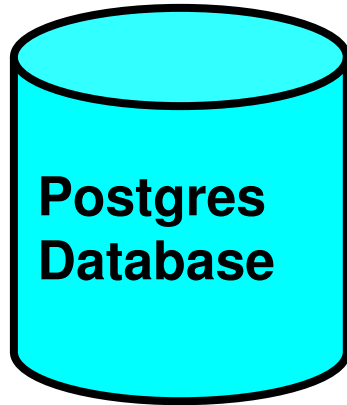
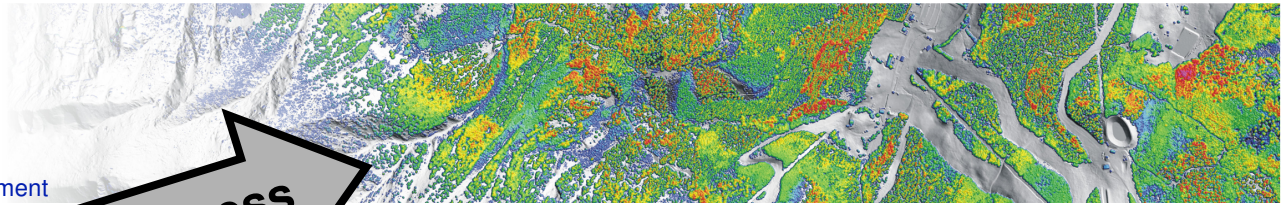




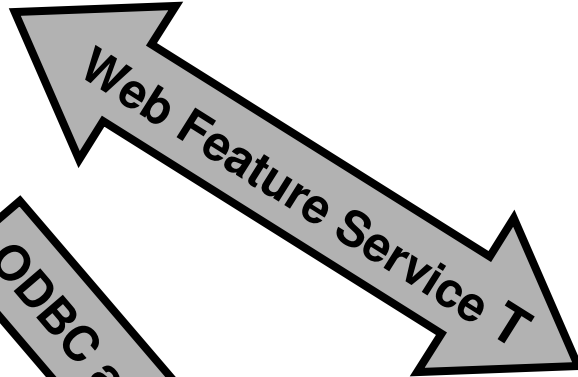
Smart Forest Tools, our shortcut to Forest Management Planning

- user-friendly
- flexible
- responsive
- off-line enabled
- single trees enabled
- multi-user

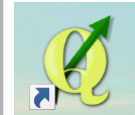




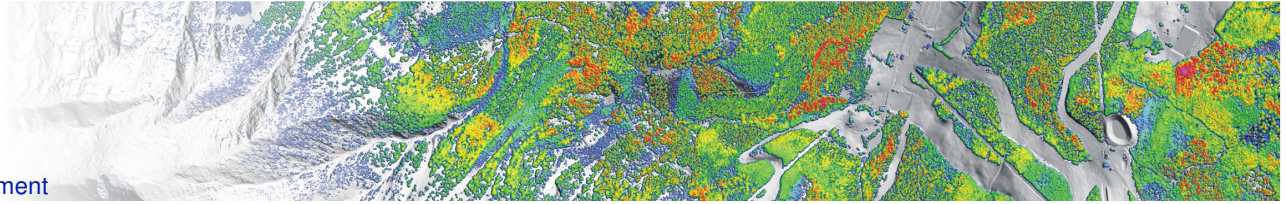
Shape-files
GPX-files
Tables



Quantum GIS
Arc GIS
Dektop GIS



Reports
Excel-Tables



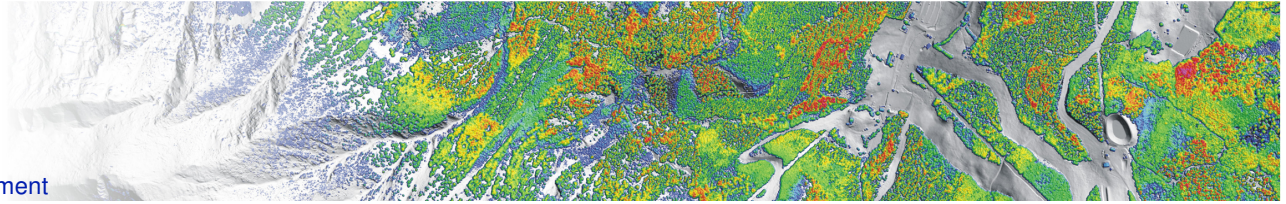
- Good Practice in National Forest Inventory **can describe problems**
- Good Practice in Forest Management **can solve problems**
- Canopy Height Models and Forest Resources Maps will
 - i) enable good forest management
 - ii) reduce costs of NFI
 - iii) are state of the art (1Mio ha Styria!)
- **Forest Transparency stops illegal logging!**



Thank you for your attention!!

Günther Bronner g.bronner@umweltdata.at
Professional background and experiences

- **Austrian State Forest Agency, 1983-2000**
Forest Management Planning, Inventory, GIS and Remote Sensing
- **Head of Umweltdata Ltd. Since 2001**
Forest Sustainability :Monitoring :Mapping :Modeling :Management
- **>100 Forest Inventory projects, >70,000 sample plots, 1 Mio ha**
- **>200 Forest Management Planning projects >1000ha**
- **Operational usage of LIDAR data since 2006**
- **Rapid forest inventories for land acquisition due diligence**
- **Monitoring of wildlife influences and damages**
- **Growth models and monitoring on plantations (AT, Brazil)**
- **Several R&D projects, Drones in Forest Inventory**
- **Operational Terrestrial Laserscanning in Forest Inventory**
- **Silvilaser 2010, 2012, 2013, 2017, 2019; ForestSAT 2016, 2018**



Added Value

- Maximum Transparency in Forest Resources
- Accurate carbon mapping
- Shortcut to Forest Management Planning
- Integration of Nature Protection, Carbon and Biodiversity Issues (ready for FSC-Certification)
- Forest Sustainability Assessment and Monitoring by Evaluation of Spatial Harvesting Patterns
- Interfaces to Forest Growth Simulation
- Cost-efficient Data Update Strategies