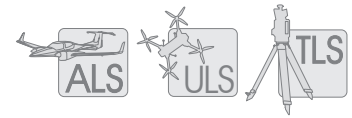


RIEGL LiDAR in Forestry & Precision Agriculture



Various LiDAR Sensors & Systems for Most Challenging Projects



Based on most innovative and proprietary Waveform-LiDAR technology RIEGL laser scanners and systems provide an outstanding high-density point cloud ideally suited for applications in forestry and precision agriculture. Advanced processing algorithms account for a full exploitation of the information included in scan data. Multi-target capability enables excellent vegetation penetration and the computing of detailed terrain models. Point classification is the basis for growth monitoring, height modeling, or the detection of deadfall.

WAVEFORM-LIDAR TECHNOLOGY

RIEGL VQ-1560i-DW
RIEGL VQ-1560 II(-S)
Airborne LiDAR Scanning System for High-Point Density Mapping Applications



RICOPTER
Remotely piloted, fully integrated UAV-based Airborne LiDAR System



RIEGL VZ-400i
High Performance 3D Terrestrial Laser Scanner

RIEGL VQ-480 II / VQ-580 II
Airborne Laser Scanning System for use in small aircrafts, helicopters, or large UAVs



RIEGL UAS-based LiDAR Sensors
for integration in the RICOPTER and various types of renowned UAVs



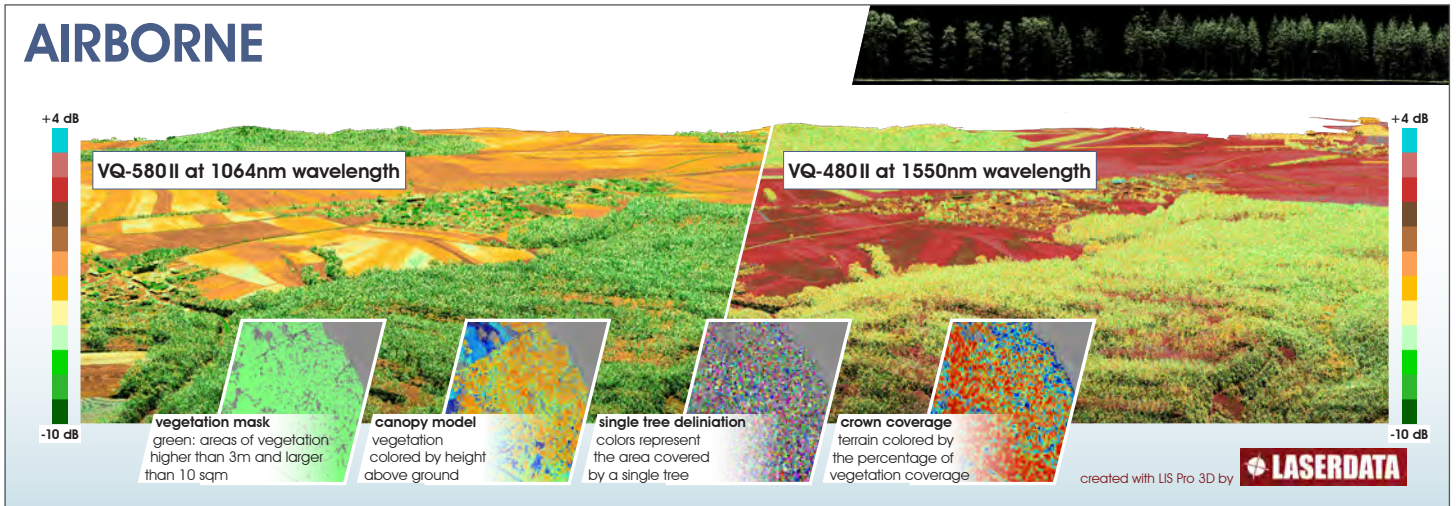
www.riegl.com



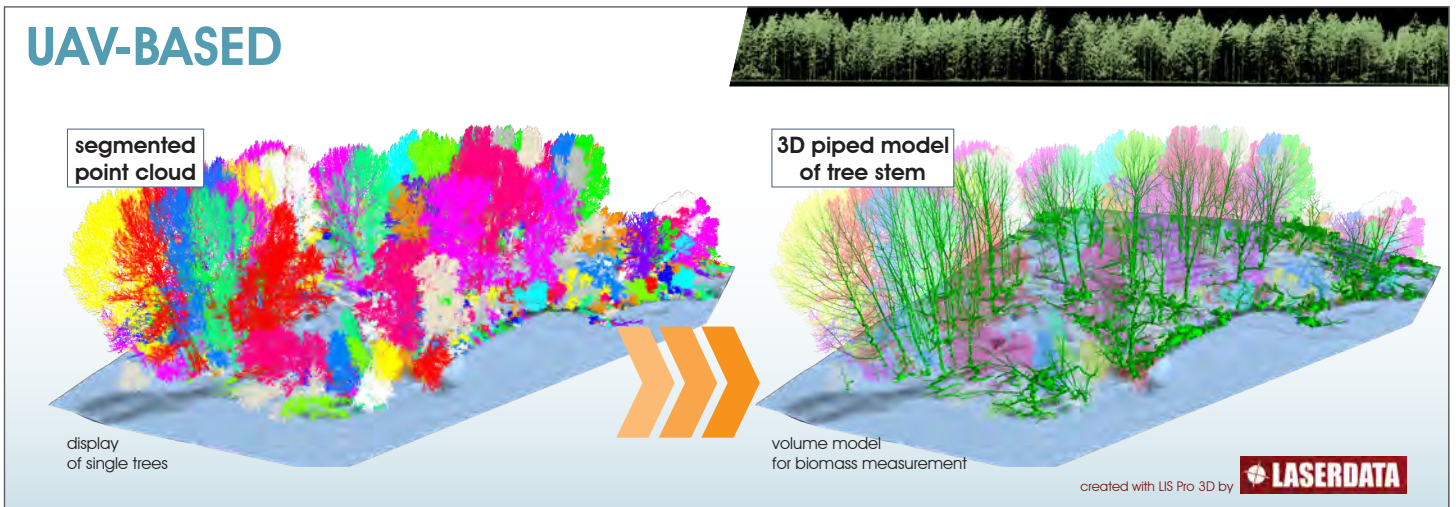
Forestry Applications

Data Acquisition using Airborne, UAV-based, and Terrestrial Laser Scanning

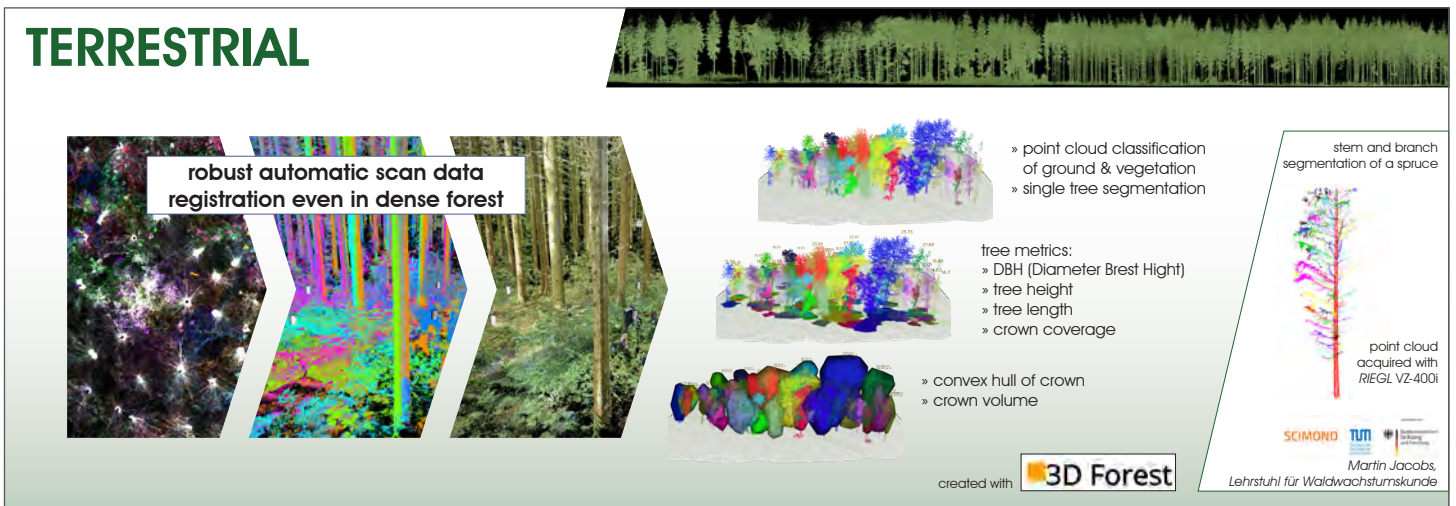
AIRBORNE

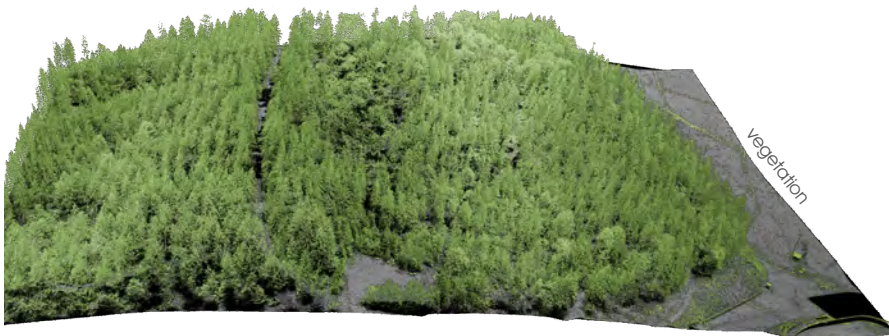
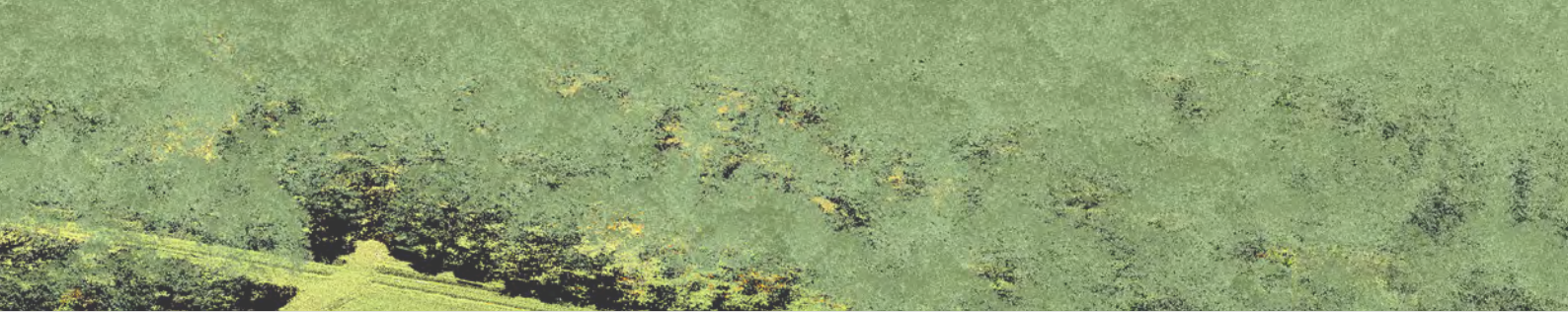


UAV-BASED



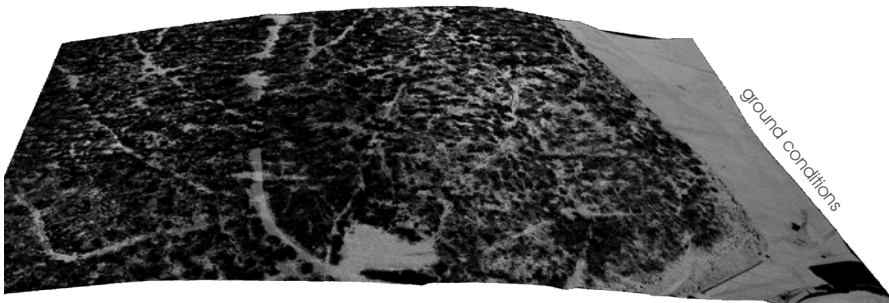
TERRESTRIAL





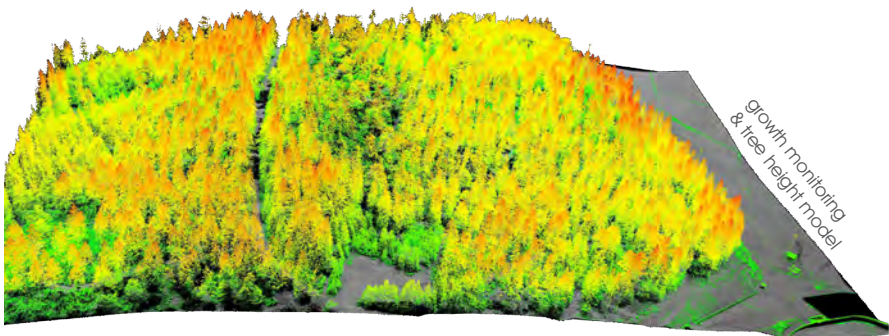
VEGETATION

Due to the extremely high scanning rates the **VUX®-TUAV** provides an outstanding high-density pointcloud, which makes it ideal for forestry applications.



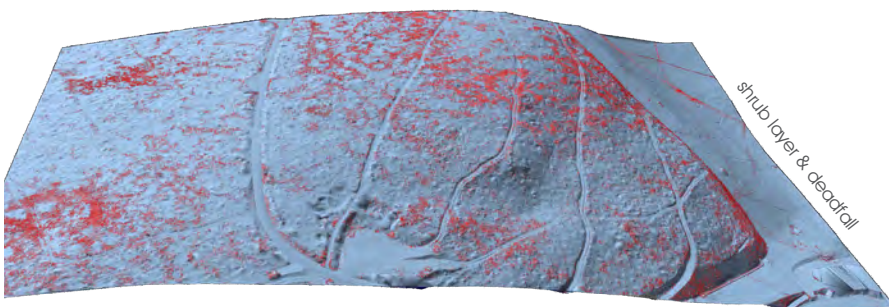
GROUND CONDITIONS

The excellent vegetation penetration rate results in a high number of ground returns that can be used to generate very detailed terrain models. The sample to the left depicts points classified as ground coloured by reflectance.



GROWTH MONITORING & TREE HEIGHT MODEL

All points classified as vegetation can be coloured by relative height above ground. This results in a relative estimation model of the trees revealing regions of low and high vegetation stands. Growth rates can be documented by comparison of height models collected over a period of time.



SHRUB LAYER & DEADFALL

The undergrowth of a forest consists of shrubby vegetation and seedling trees. It plays an important role in the forest eco system and is a habitat for wildlife and birds. The image to the left shows points classified as low vegetation (red) and clearly shows areas of dense natural cover. Furthermore deadwood can be detected in this data layer.



BARE EARTH

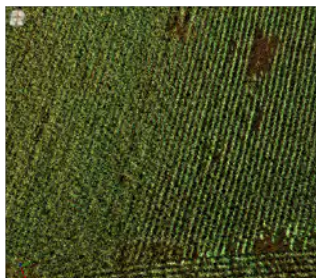
With all vegetation data removed, the remaining points define a very detailed terrain model. This model clearly reveals roads and trenches as well as results of slope instability and erosion.



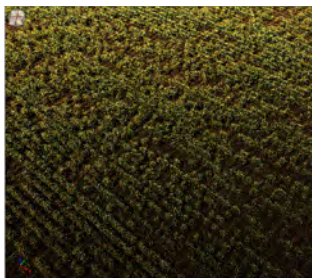
Precision Agriculture Applications



- continuous crop monitoring during growth period
- observation of irregularities in plant growth
- detection of hail damage
- analysis of terrain changes
- yield estimation
- observation of nutrient over- or undersupply
- longterm regular observation of growth characteristics for geological evaluation and classification



corn colored pointcloud



sunflowers colored pointcloud



illustration of penetration capacity

ADVANTAGES OF LASER SCANNING IN VEGETATION MONITORING

By contrast to photogrammetry, which is limited to determining Digital Surface Models (DSM), the technique of laser scanning enables the user to capture data suitable for the generation of DSM and Digital Terrain Models (DTM).

Advanced processing algorithms account for a full exploitation of the information included in scan data. A typical target situation is measuring areas covered by vegetation. Several target echoes resulting from a single laser pulse emission are obtained by echo digitization and subsequently resolved by online waveform processing, resulting in measurement ranges, echo amplitudes, calibrated target reflectance and pulse shape information.

CROP GROWTH

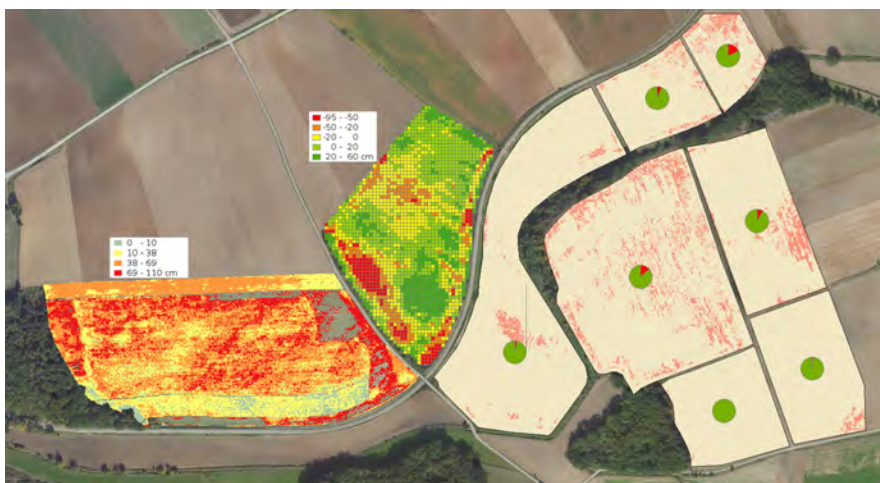
Crop growth and health is closely monitored in Precision Farming in order to minimize the use of fertilizers or irrigation. Airborne laser scanning data enable to observe plant growth – while at the same time displaying changes in ground surface – or to detect areas of irregularities.

FIELD CHARACTERISTICS

While plant height cannot per se be interpreted as a direct factor for yield calculation, irregularities due to, e.g., different soil composure, variety of seed type or damage (e.g., weather-related, caused by storm, hail, or rainfall) can easily be discerned and taken as an indicator for further developments and estimation of yield at harvest.

MONITORING

Constant monitoring of agricultural areas enables early yield estimation based upon differences in plant growth development.



crop stand variations