Location
Ås, Norway

Scanned
Forests

Scan size
250 square meter plots

Scan time
Approx. 10-20 minutes per scan

Industry
Forestry

SFI Smartforest

The SFI SmartForest is a part of the Centres for Research-based Innovation scheme of the Research Council of Norway and aims to position Norway's forestry sector at the forefront of digitisation by 2028.

The primary goal of the 8-year research centre is to improve the efficiency of the Norwegian forestry sector by enabling a digital transformation, using innovative technologies. SmartForest aims to increase productivity, reduce environmental impacts, and review other significant climate benefits.

SmartForest is focusing on silviculture, forest operations, wood supply, and the overall digital information flow. The hope is to bring industry 4.0 to the Norwegian forestry sector by having a free flow of information and real-time communication, through innovative and enabling technologies.

The interconnectivity of data and technology will not only result in the long-term success of the forestry sector in Norway but also contribute to limiting potential environmental impacts.

LiDAR is one of the enabling technologies that will help SmartForest collect accurate data for ground truthing. The point cloud is forming a basis for deep learning models that can eventually apply to much larger mapped areas.

> Scanning with the ZEB Horizon is a very efficient way to collect ground truth. Eventually, we want to use it for large-scale mapping applications."

Stefano Puliti, Research Scientist for NIBIO

Why is mobile LiDAR required?

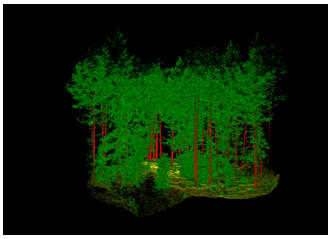
The forest is dense with trees, the floor is often rough terrain, and it is usually hidden beneath a thick canopy of vegetation. To capture 3D models of the forest, SmartForest need a mobile LiDAR solution that can map from the ground and a UAV-based LiDAR solution to capture properties of the tree canopy.

Data acquisition is only one part of a larger workflow that can include segmentation algorithms, allowing for further exploration of the physical attributes of individual trees such as tree height and distribution. It's important for the data to be precise, to ensure accurate monitoring of the forest.

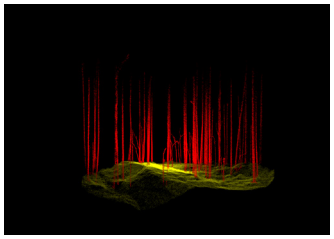
An obvious solution was a static-based terrestrial laser scanner, however, despite the accuracy levels being incredibly high, the speed of capture was impeded by the need for several scans in one area. As the project progresses and the need for scanning larger areas increases, TLS becomes a less likely option.

Another choice was a UAV-based solution that can capture large areas in a short period of time. Though SmartForest works with UAV to capture the forest canopy, it's less effective at penetrating thick vegetation to collect forest floor and trunk data than it is from the ground.

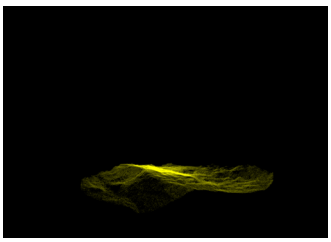
After looking around the market, SmartForest opted to try mobile laser scanning as a solution that could quickly capture ground data to an accuracy high enough for their needs.



Vegetation, trunks & ground



Vegetation segmented out



Vegetation and trunks segmented out

Working with GeoSLAMs ZEB Horizon

SmartForest chose GeoSLAMs ZEB Horizon scanner for its speed of capture, ease of use, and mobility. Projecting 300,000 laser points per second with a range of up to 100 meters, the scanner produces dense point clouds of large areas, in a short period of time. The accurate point cloud includes the forest floor, debris, tree trunks, and thick vegetation.

Frequent data acquisition is a key part of SmartForests plans and GeoSLAMs Handheld LiDAR scanner, alongside UAV data capture help to achieve this. The ZEB Horizon's ease of use makes data acquisitions a repeatable task and the high accuracy of data provides a foundation for deep learning models.

The point clouds are processed in GeoSLAMs software package and imported in 3rd party solutions, where sophisticated algorithms are applied to segment the data. Automatic segmentation of the tree trunks allows for easier tree counts and tree segmentation provides precise forest inventory, down to the individual tree. The digital separation of trees will lead to the extraction of features for such as wood quality, biomass, and other ecologically relevant variables.

Conclusion

The long-term plan for the SFI SmartForest is to bring industry 4.0 to the Norwegian forestry industry, using emerging and enabling technologies. Handheld LiDAR scanning has been identified as an efficient way to map the forest from the ground, providing accurate point clouds which serve as the basis for deep learning research opportunities.

The SFI SmartForest hopes to use GeoSLAMs ZEB Horizon for other applications in the future, having seen the versatility of the scanner.