



ORGANISERS



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TIME TABLE

27 Sept – 1 Oct

	MONDAY	TUESDAY	WEDNESDAY
08:30		Registration	
Morning 09:00 – 13:00	Benchmark	Conference Opening	Orals 7 & 8
		Orals 1 & 2	Coffee Break
		Coffee Break	Pico 1 & 2
		Keynote Session 1	Coffee Break
		Keynote Session 2	
Afternoon 13:00 – 18:00		Lunch break	Lunch break
		Orals 3 & 4	Orals 9 & 10
		Coffee Break	Coffee Break
		Orals 5 & 6	Orals 11 & 12
Evening from 18:30	Early Registration		
	Ice Breaker	Panel Discussion	Conference Dinner

keynote
session

oral
session

pico
session

lunch

coffee
break

THURSDAY

FRIDAY

Orals 13 & 14

Coffee Break

Pico 3 & 4

Coffee Break

Keynote Session 3

Lunch break

Orals 15 & 16

Coffee Break

SilviLaser Benchmark
Report + Closing Session

Benchmark

Morning
09:00 – 13:00

Afternoon
13:00 – 18:00



	LOBBY	ROOM 1	BALLSAAL 4
08:30	Registration		
9:00		Conference Opening	space for meetings / breakout sessions / ...
9:30		Oral 1: Benchmarks / open data sets	
11:00			
11:30		Keynote Session 1	
13:00			
14:00		Oral 3: LS supporting FIs I	
15:30			
16:00		Oral 5: LS supporting FIs II	
17:30			
18:15		Panel Discussion	
-	Keynote speakers: Dr. Elisabeth Johann, Forester Dr. Anssi Pekkariinen, Senior Forestry Officer		
19:45	Additional debaters: Dr. Peter Mayer (BFW) Dr. Klaus Scipal (ESA)		

keynote
session

oral
session

pico
session

lunch

coffee
break

ROOM 2	FOYER	EXPO	
	Coffee		
Oral 2: Tree growth / yield monitoring / modelling			9:00
			9:30
	Coffee break		11:00
			11:30
	Lunch break	RIEGL, Hexagon, Greenvallley International, Topo Lynx, Envirosense, Forest design, Umweltdata, TU Wien GEO - OPALS	13:00
Oral 4: Tree species			14:00
	Coffee break		15:30
Oral 6: Forest structure			16:00
	Drinks + finger food		17:30
			18:15
			-
			19:45



Presenter/Title

ROOM 1

Benchmarks / open data sets 09:30 – 11:00

Oral 1

- 48 **H. Bartholomeus:** Comparing portable MLS to TLS and UAV-LS derived individual tree parameters
- 11 **U. Bacher:** Airborne LiDAR System Optimisation for Foliage Penetration
- 37 **V. B. Verhoeven:** Quantifying TLS Data and Diameter Estimation Uncertainty
- 16 **D. Schraik:** A method to estimate silhouette to total area ratio (STAR) from TLS point clouds
- 86 **J. Schäfer:** Generating synthetic laser scanning data by combining forestry inventory information, a tree point cloud database and an open-source laser scanning simulator
- 82 **S. Puliti:** A new drone laser scanning benchmark dataset for characterization of single-tree and forest biophysical properties

KN S1

- Juha Hyypä:** Recent developments with mobile laser scanning for forestry applications
- Mike Wulder:** Air- and spaceborne lidar data as reference for satellite-based forest parameter retrieval and mapping over space and time
- RIEGL:** How to make best use of RIEGL's Ultimate LiDAR Technology in forestry

Laserscanning supporting Fls I 14:00 – 15:30

Oral 3

- 50 **D. Kükenbrink:** Close-Range Remote Sensing for National Forest Inventory Applications - A Comparison of Terrestrial and Airborne Approaches
- 74 **A. Bornand:** Terrestrial laser scanning for forest inventories: Tree volume and biomass estimation using extended allometric models
- 36 **H. Persson:** Impact of sample size – empirical results from a hybrid inference two-phase inventory based on dense laser scanning
- 123 **G. Bronner:** Repeatability of TLS-based tree diameters on permanent sample plots
- 45 **S. Zhang:** Unit-level Small Area Estimation of Forest Inventory with GEDI Auxiliary Information
- 30 **A. Tockner:** A new drone laser scanning benchmark dataset for characterization of single-tree and forest biophysical properties

Laserscanning supporting Fls II 16:00 – 17:30

Oral 5

- 114 **H.-E. Andersen:** Using advanced airborne remote sensing as a sampling tool to support forest inventory in interior Alaska, USA
- 75 **N. Pfeifer:** Operationalizing multi-temporal stem volume assessment based on ALS data
- 32 **P. Varvia:** Gaussian Process Regression for Airborne Laser Scanning Based Forest Inventory: Validation and Parameter Selection
- 76 **R. Mukhopadhyay:** Modelling of Aboveground Biomass Change Using LiDAR Metrics and NFI Field Data: A Case Study of Southern Sweden
- 26 **A. Nothdurft:** Spatial Prediction of Forest Inventory Results from Portable Laser Scanning using Airborne Laser Scanning Data and Spatial Hierarchical Bayes Models
- 80 **A. Sagar:** High Resolution Mapping of Forest Resources and Prediction Uncertainty using Multisource Inventory Approach

Presenter/Title

ROOM 2

Tree growth / yield monitoring / modelling 09:30 – 11:00

Oral 2

- 21 **T. Pitkänen:** Quantifying Tree Crown Plasticity with TLS Data for Improved Individual-tree Growth Models
- 4 **K. Calders:** Quantifying forest dynamics in a free-air CO₂ enrichment experiment using terrestrial laser scanning
- 39 **N. Saarinen:** Crown shape and size of Scots pine affected by thinning?
- 2 **I. Bohlin:** Predicting bilberry yields using ALS and other auxiliary data combined with NFI field plots
- 64 **T. Yrttimaa:** Terrestrial Laser Scanning Reveal Connection Between Changes in Tree Stem Dimensions and Crown Structure
- 35 **M. Campos:** Perspectives on long-term TLS time-series to detect changes in tree crowns

Tree species 14:00 – 15:30

Oral 4

- 70 **B. C. Budei:** Effect of variability of normalized differences calculated from multi-spectral lidar on individual tree species identification
- 57 **S. Briechle:** Deep Learning-based classification of tree species and standing dead trees using Silvi-Net
- 119 **A. Kato:** CDeep learning with 3D laser data to identify tree species
- 99 **H. Njimi:** Mapping riparian forest species for biodiversity analysis by fusion of Airborne LiDAR and multispectral satellite imagery
- 7 **L. Huo:** Tree crown segmentation from LiDAR data based on a symmetrical structure detection algorithm (SSD)
- 6 **A. Cimarras:** Vegetation fuel type dynamics and classification using multitemporal LiDAR

Forest structure 16:00 – 17:30

Oral 6

- 13 **E. Kalinicheva:** Vegetation Stratum Occupancy Prediction from Airborne LiDAR 3D Point Clouds
- 3 **N. Tienaho:** Examining Structural Complexity of Scots Pine Trees – A Comparison between Terrestrial Laser Scanning and Photogrammetric Point Clouds
- 107 **S. Schläffer:** ALS based forest information for forest fire danger modelling
- 18 **L. Mehtätalo:** Correcting TLS Estimation for Shading by Other Trees Using a Horvitz-Thompson-like Estimator
- 41 **A. Hudak:** Estimating Surface Fuel Density from TLS and ALS: A Two-Tiered Approach that Accounts for Sampling Scale
- 112 **P. Tompalski:** Characterizing precision benchmarks for stand height and cover estimates derived from existing, conventional, stand-level, photo-based forest inventories

SCHEDULE

WEDNESDAY

29 September



	CITY HALL	ROOM 1	BALLSAAL 4
9:00		Oral 7: Tropical / old forests	space for meetings / breakout sessions / ...
10:15		Pico 1	
11:00			
11:30		Keynote Session 2	
13:00			
14:00		Oral 9: SBL - biomass	
15:30			
16:00		Oral 11: Timber / stem volume from ALS/UAV/TLS	
17:30			
19:00	Conference Dinner		

keynote
session

oral
session

pico
session

lunch

coffee
break

ROOM 2	FOYER	EXPO	
Oral 8: Quantitative structural models		RIEGL, Hexagon, Greenvallley International, Topo Lynx, Envirosense, Forest design, Umweltdata, TU Wien GEO - OPALS	9:00
Pico 2			10:15
	Coffee break		11:00
			11:30
	Lunch break		13:00
Oral 10: Density / structure ALS/TLS			14:00
	Coffee break		15:30
Oral 12: Habitat characterization / biodiversity			16:00
			17:30
			19:00

Tropical / old forests

09:00 – 10:00

ROOM 1

Oral 7

- 87 **I. McNicol:** The Forest Degradation Experiment (FODEX)
- 109 **T. Jackson:** Three attempts to detect changes in tropical forests using repeat LiDAR scans
- 116 **P. Williams:** Structure-Mediated Differences in Foliar Illumination and Their Effects on Diurnal Changes in a Pine Plantation Photochemical Reflectance Index
- 103 **K. Král:** Occupation of Canopy Space in European Temperate Old-Growth Forest observed by TLS

Pico 1

Stem shape / branches / tree detection

- 126 **C. Alvites:** A stepwise approach for deriving timber assortments of trees from Terrestrial Laser Scanning data
- 98 **S. Martin-Alcon:** Assessing the potential of adaptive individual tree detection to improve accuracy of area-based stand density modelling in ALS-assisted forest inventory
- 92 **M. Hollaus:** Branch detection based on TLS data
- 95 **S. Dersch:** Instance segmentation for single tree delineation using drone-based multispectral imagery and lidar data

LiDAR combined with other RS

- 49 **M. Miltiado:** Understanding phenological changes of coniferous forests in Cyprus using time-series of SAR data from 2015 till 2020
- 29 **X. Shen:** Investigating 3-D distribution of bio-chemical traits in tree canopy using UAS based LiDAR and hyperspectral data
- 79 **Y. Pang:** Forest Stand Delineation Using Airborne LiDAR and Hyperspectral Data

KN S2

Amy Neuenschwander:
IceSat-2 for forestry applications

Håkan Olsson: Nationwide ALS-forest products supported by NFIs – current status and future trends

Xinlian Liang: Benchmarking of close-range point clouds for forest observations – What are recorded and what are extracted

SBL – biomass

14:00 – 15:30

Oral 9

- 117 **J. Armston:** NASA's Global Ecosystem Dynamics Investigation (GEDI): Progress towards global mapping of aboveground biomass
- 12 **L. Korhonen:** How to consider the effects of time of day, beam strength, and snow cover in ICESat-2 based estimation of boreal forest biomass?
- 110 **L. Duncanson:** Boreal-wide biomass estimation with ICESat-2
- 105 **R. Leite:** Estimating total fuel load in tropical savanna using NASA's GEDI spaceborne lidar and machine learning
- 83 **I. Indirabai:** Aboveground Biomass Assessment Using GEDI Data across Diverse Forest Ecosystems in India
- 67 **A. Schleich:** Improving GEDI Footprint Geolocation using a High Resolution Digital Terrain Model

Timber/stem volume from ALS/UAV/TLS

16:00 – 17:30

Oral 11

- 10 **L. Noordermeer:** Estimating Timber Volume using Harvester Data and Airborne Laser Scanner Data from Multiple Acquisitions
- 96 **J. Rätty:** Model-Assisted Estimation of Timber Volume by Means of Harvester and ALS Data
- 22 **B. Brede:** UAV-Laser Scanning based Metrics for Individual Tree Volume Estimation across Forest Types
- 81 **Y. Sun:** Stem shape and volume of standing tree based on TLS point cloud inversion mixed-forest management
- 68 **L. Malambo:** Stem Volume Modeling in Eastern Texas Loblolly Pine Forests
- 52 **R. de Paula Pires:** Influence of distance to the sensor on stem detection with car-mounted mobile laser scanner

Quantitative structural models 09:00 – 10:00

ROOM 2

Oral 8

- 14 **R. B. Reckziegel:** Shading effects of trees revealed using TLS and QSMs
- 62 **X. Liang:** GEDI data evaluation and canopy height change analysis--a case study in the Northeast of China
- 5 **L. Terryn:** Quantifying Structural Response in a Through-fall Drought Experiment Using Terrestrial Laser Scanning
- 20 **A. Lau:** Terrestrial LiDAR Derived Allometric Models for Guyana and Suriname

Pico 2

Tree species / classification

- 58 **D. Cosenza:** Species classification of cork oak and stone pine trees using airborne laser scanning data
- 115 **M. Parlow:** Machine Learning for Tree Species Identification from LiDAR & Imagery
- 106 **A. Missarov:** Drone LiDAR remote sensing for mistletoe recognition and monitoring
- 94 **L. Malambo:** Effects of segment length on burned forest classification with ICESat-2 Data

Urban forests

- 128 **S. Bonilla-Bedoya:** Multispectral Images for Urban Forest Monitoring
- 72 **P. Wężyk:** Monitoring of urban forests using 3D spatial indices based on ALS point clouds: a city-level analysis
- 15 **Z. Zhu:** Assessing Tree Green Crown Volume from 3D Laser Scanning Data

Density / structure ALS/TLS 14:00 – 15:30

Oral 10

- 38 **L. Mehtätalo:** Using Stochastic Geometry and Sequential Spatial Point Process Model for Estimation of Stand Density Based on ALS-ITD
- 63 **M. Soma:** Estimation of Spatial Distribution of Leaf Area Density in Canopies from Terrestrial LiDAR Point Clouds
- 108 **J. van Aardt:** Toward a Definitive Assessment of the Impact of Leaf Angle Distributions on LiDAR Structural Metrics
- 102 **M. Sumnall:** Effect of airborne laser scanning pulse density on accuracy in quantifying forest structure using an unmanned aerial vehicle
- 23 **J.-P. Renaud:** Convex hull: Another Perspective about Model Predictions and Map Derivatives from Remote Sensing Data
- 118 **V. Thomas:** Influence of variations in remotely quantified functional traits and diversity on gross primary productivity

Habitat characterization / biodiversity 16:00 – 17:30

Oral 12

- 19 **R. Kuzmich:** Ecologically informed bird habitat characterization with airborne laser scanning
- 44 **A. Iglseider:** The Potential of ALS Data for Habitat Classification in Forest Landscapes - First Results
- 42 **L. Huo:** Estimation of nature conservation value using airborne laser scanning data by deadwood recognition
- 27 **L. Leclerc:** Mapping Natural Regeneration in Canopy Gaps from Seedlings to Saplings in Uneven-Aged Deciduous Forests using ALS Data
- 84 **K. Calders:** Deriving Forest Structural Biodiversity Traits with Terrestrial Laser Scanning
- 17 **T. Ritter:** Modelling the Detection Rate of Terrestrial Laser Scanning in Multi Scan Mode

EXPO

RIEGL, Hexagon, Greenvalley International, Forest design, TopoLynx, Envirosense, Umweltdata, TU Wien GEO – OPALS

THURSDAY 30 September



	ROOM 1	BALLSAAL 4
9:00	Oral 13: Software / sensors / performance	space for meetings / breakout sessions / ...
10:15	Pico 3	
11:15		
11:45	Keynote Session 3	
12:45		
13:45	Oral 15: SBL - structure	
15:15		
15:45	SilviLaser Bench- mark Report	
-	+ Closing Session	
16:30		

keynote
session

oral
session

pico
session

lunch

coffee
break

ROOM 2	FOYER	EXPO	
Oral 14: Tree architecture		RIEGL, Hexagon, Greenvalley International, Topo Lynx, Envirosense, Forest design, Umweltdata, TU Wien GEO - OPALS	9:00
Pico 4			10:15
	Coffee break		11:15
			11:45
	Lunch break		12:45
Oral 16: Innovatios / sensors			13:45
	Coffee break		15:15
			15:45
			-
			16:30



Presenter/Title

ROOM 1

Software / sensors / performance

09:00 – 10:00

Oral 13

- 31 **J. Molina-Valero:** Assessing the ForeStereo sensor and the FORTLS R package for estimating stand variables in mature forests
- 89 **L. Gokl:** OPALS: A Flexible and Efficient Point Cloud Processing Software for Forest Application
- 85 **R. Bülbul:** Performance test of tree segmentation algorithms for WLS point clouds
- 93 **M. Hirschmugl:** Low altitude LiDAR and TLS point clouds for improved tree detection

SLAM

- 101 **J. Chudá:** Evaluation of the Positional Accuracy of Trees Derived Using SLAM
- 33 **F. de Miguel Diez:** Long Range and High-Speed Personal Laser Scanning (PLS) and Simultaneous Localization and Mapping (SLAM) Technology in Roundwood Measurement

Forest height

- 91 **J. Ivanovs:** The Effect of Tree Species and Seasonality on Forest Height Measurements Using an Aerial Laser Scanner – A Case Study in Latvia
- 60 **Y. Pang:** ICESat-2 data classification and canopy height validation – a case study in the northern region of China

Ecology

- 111 **R. Valbuena:** Moving on from Foliage Height Diversity: determining maximum entropy in 3-dimensional variables
- 1 **P. Wilkes:** Characterising understorey Plant Area Index with TLS
- 104 **C. Amaral:** Global Ecosystem Dynamics Investigation data enable structural patterns assessment in Amazon rainforest
- 43 **M. Wang:** Explore the structural diversity of forest edges using spaceborne lidar

KN S3

Gottfried Mandlbürger: The benefits of different LiDAR systems – Full waveform vs. single-photon LiDAR

Guo Qinghua: Developing multiple platform LiDAR systems for scaling forest parameters from plot levels to global levels

SBL – structure

13:45 – 15:15

Oral 15

- 56 **L. Narine:** Estimating canopy cover from ICESat-2
- 78 **M. Urbazhev:** Accuracy assessment of terrain and canopy height estimates from ICESat-2 and GEDI LiDAR missions in temperate and tropical forests: first results
- 88 **C. Amaral:** Assessing the long-term effect of hurricanes on the Caribbean mangrove structure with GEDI L3 data
- 25 **D. MacFarlane:** Exploring the effect of leaves on tree woody surface area estimation with quantitative structural models
- 120 **R. Wynne:** Identifying Secondary Forests in the Brazilian Amazon using Spaceborne Lidar
- 40 **N. Thomas:** Tree Tops to Ocean Bottoms: Using ICESat-2 to Characterize Coastal Ecosystems

SilviLaser Benchmark Report + Closing Session

15:45 – 16:30

Presenter/Title

ROOM 2

Tree architecture

09:00 – 10:00

Oral 14

- 24 **W. Yang:** Assessing Approaches to 3D Tree Reconstruction from Terrestrial Laser Scanning Data
- 69 **T. Zhang:** Leaf-wood separation and tree skeletonization from low resolution and noisy 3-D point clouds
- 77 **V. Kankare:** Terrestrial laser scanning reveals consistent dependencies between mean wood density and tree crown architecture
- 51 **P. Wilkes:** A pan-tropical campaign to link architectural and biophysical traits

Tropical forest

- 34 **Z. Zheng:** Structural Diversity in a Subtropical Forest: A Comparison of Individual Tree- and Pixel-based Approaches
- 46 **J. Scheeres:** Distinguishing tropical forest typologies with UAV LiDAR

Benchmarks / data sets

- 100 **M. D. Nita:** VirtSilv A.I. 3D platform for sustainable forest management
- 90 **K. Slavik:** Challenges to Collaboration in International Research: Lessons from Terrestrial Laser Scanning

Structure

- 8 **X. Liu:** Comparing the vertical structure of tropical forests as seen by space- and airborne lidar and P-band SAR tomography
- 125 **V. Berger:** Application-oriented approach to monitoring the dynamics of avalanche tracks using conventional forest inventory parameters and Lidar-based change detection
- 124 **L. Ender:** Forest stand structure assessment using airborne laser scanning and forest inventory data - working towards a nationwide wall to wall coverage
- 129 **M. Persson:** Precision Thinning - a comparison of stand-level and pixel-level thinning in Norway spruce and Scots pine stands

Innovations / sensors

13:45 – 15:15

Oral 16

- 113 **D. Harding:** CASALS: an Adaptive Lidar and Spectrometry SmallSat for a NASA Explorer Mission
- 97 **M. Mokros:** Mobile laser scanning with iPad Pro LiDAR
- 71 **P. Weżyk:** Can iPad Pro be as reliable as TLS for urban forest inventories?
- 73 **G. Mandlbürger:** A case study for detection and modelling of submerged dead-wood from UAV-borne topo-bathymetric LiDAR point clouds
- 28 **C. Collob:** Forest Inventory with Apple iPad Pro and integrated LiDAR Technology
- 59 **J. White:** Exploring the innovation potential of single photon lidar for operational large-area forest inventories

EXPO

RIEGL, Hexagon, Greenvally International, Forest design,
TopoLynx, Envirosense, Umweltdata, TU Wien GEO – OPALS

RIEGL WAVEFORM LiDAR FOR FORESTRY

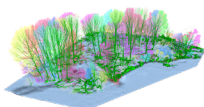


A BROAD SENSOR PORTFOLIO
SERVING ALL LEVELS OF FORESTRY SURVEY



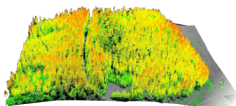
Terrestrial Laser Scanning with the RIEGL VZ-i Series **unrivalled level of detail**

- single tree, stem and branch segmentation
- convex hull of crown
- crown volume, tree metrics, tree height, crown coverage



UAV-based Laser Scanning with the RIEGL VUX- and miniVUX-Series **unrivalled views and flexibility**

- segmented point clouds for display of single trees
- volume models for biomass measurements
- 3D piped model of tree stem



Airborne Laser Scanning with the RIEGL VQ-Series **unrivalled area efficiency**

- growth monitoring by vegetation masks, canopy models, crown coverage, etc.
- underwood and deadfall visualization and calculation
- detailed terrain models



Scan this QR code to get detailed information of RIEGL LiDAR in Forestry.

Explore the full portfolio of proven RIEGL LiDAR Sensors and Systems at www.riegl.com

