Lessons learned from GLOBBIOMASS validation

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with contributions by others ...

GLOBBIOMASS user meeting
Rome, 13. September 2017

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Global Forest Observations Initiative

GOFC-GOLD
Global Observation of Forest Cover and Land Dynamics
Land Cover
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Making use of plot data

1. Many forest plot data have limited suitability for (pixel-based) comparison with biomass map data!
2. Quality criteria implemented reduced plot data significantly but issues remain
3. Increasing spatial detail increases variability:
   - Plots covering larger area more suited
   - Geolocation uncertainties have major effects
   - Little tropical experiences for comparing or combining large area biomass maps with NFIs
4. Current approach is using aggregate data

Making use of plot data

1. Towards full characterization of uncertainties in plot data:
   - Measurement errors, use of tree-level data, geolocation, allometry, …
   - Which regions and forest types are undersampled
2. Restricted access to available plot data/networks remains an issue (need for transparency, open science etc. is starting to change that):
   - Partnership with FAO and countries
3. Assessing spatial variability (i.e. LIDAR)

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Different needs for calibration and validation

1. GLOBBIOMASS initially underestimated the need for calibration reference data:
   - Allocated 50% of the validation reference database for calibration purposes
2. Calibration and validation serves different purposes:
   - Calibration: establish relationships between forest height, structure and biomass, parametrize models, to estimate biomass over larger areas (i.e. GEDI)
   - Validation: requires consideration from producer (CEOS WGCV) and user (often overlooked)

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Users: different uncertainty characterization

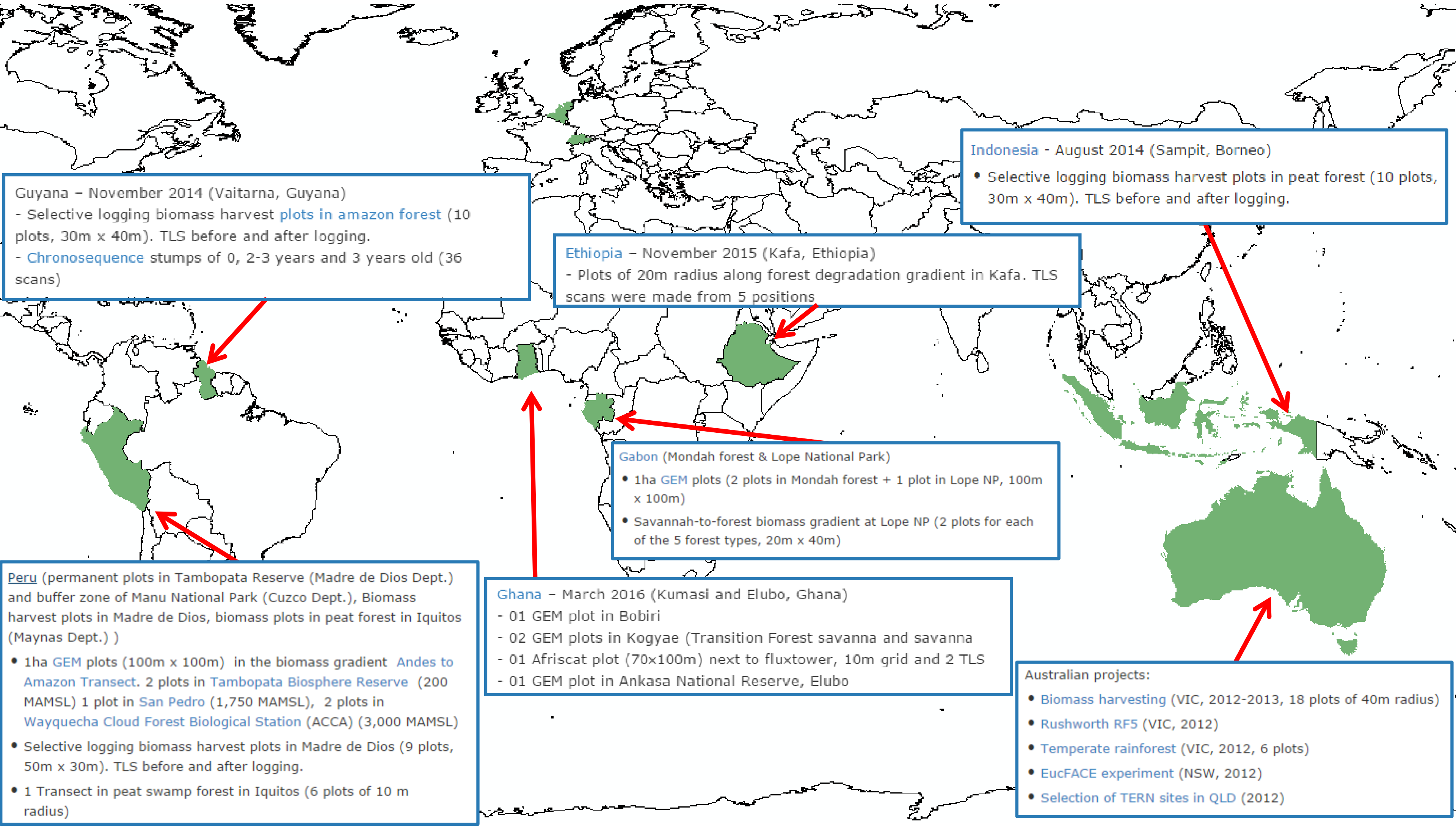
Take UNFCCC requirements as example:

1. GCOS/ECV:
   - climate users: global, coarse resolution, benchmarking, totals etc.
   - Tropical forest sink: use biomass map as proxy for forest age (Chazdon et al., 2016)
2. National GHG inventories:
   - Integration with available plot data/NFIs
   - Forest type/national averages or totals
   - Uncertainty characterization for (sub-) national forest emissions estimation (reduce bias)
3. Enhancing transparency: comparability, open-source, independent assessments

Remarks

- Just re-using available plot data is limited- space-based biomass mapping community to be vocal and clear about requirements:
    - Uncertainty in plot data (biomass, geolocation)
    - Better data for calibration (not just biomass)
    - Transparency and open access
    - Identify under-sampled areas
- Use partnership with users (i.e. NFIs – sustainability in tropics)
- New opportunities: TLS, LIDAR-drones …

Terrestrial laser scanning campaigns (WU)



Guyana – November 2014 (Vaitarna, Guyana)
- Selective logging biomass harvest plots in amazon forest (10 plots, 30m x 40m). TLS before and after logging.
- Chronosequence stumps of 0, 2-3 years and 3 years old (36 scans)

Ethiopia – November 2015 (Kafa, Ethiopia)
- Plots of 20m radius along forest degradation gradient in Kafa. TLS scans were made from 5 positions

Indonesia - August 2014 (Sampit, Borneo)
- Selective logging biomass harvest plots in peat forest (10 plots, 30m x 40m). TLS before and after logging.

Gabon (Mondah forest & Lope National Park)
- 1ha GEM plots (2 plots in Mondah forest + 1 plot in Lope NP, 100m x 100m)
- Savannah-to-forest biomass gradient at Lope NP (2 plots for each of the 5 forest types, 20m x 40m)

Peru (permanent plots in Tambopata Reserve (Madre de Dios Dept.) and buffer zone of Manu National Park (Cuzco Dept.), Biomass harvest plots in Madre de Dios, biomass plots in peat forest in Iquitos (Maynas Dept.))
- 1ha GEM plots (100m x 100m) in the biomass gradient Andes to Amazon Transect. 2 plots in Tambopata Biosphere Reserve (200 MAMSL) 1 plot in San Pedro (1,750 MAMSL), 2 plots in Wayquecha Cloud Forest Biological Station (ACCA) (3,000 MAMSL)
- Selective logging biomass harvest plots in Madre de Dios (9 plots, 50m x 30m). TLS before and after logging.
- 1 Transect in peat swamp forest in Iquitos (6 plots of 10 m radius)

Ghana – March 2016 (Kumasi and Elubo, Ghana)
- 01 GEM plot in Bobiri
- 02 GEM plots in Kogyae (Transition Forest savanna and savanna
- 01 Afriscat plot (70x100m) next to fluxtower, 10m grid and 2 TLS
- 01 GEM plot in Ankasa National Reserve, Elubo

Australian projects:
- Biomass harvesting (VIC, 2012-2013, 18 plots of 40m radius)
- Rushworth RF5 (VIC, 2012)
- Temperate rainforest (VIC, 2012, 6 plots)
- EucFACE experiment (NSW, 2012)
- Selection of TERN sites in QLD (2012)

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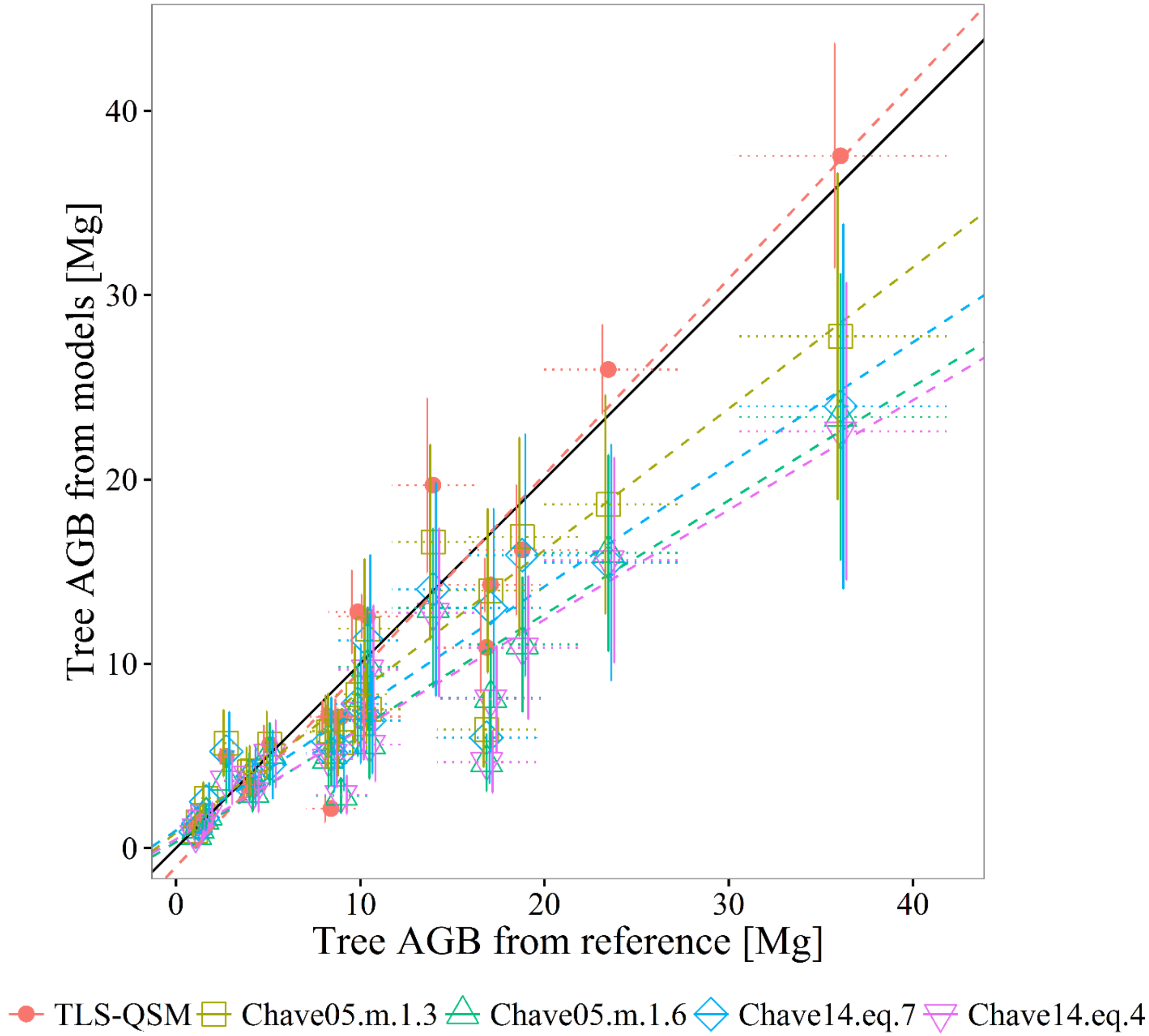
http://www.wageningenur.nl/lidar

- TLS LiDAR and 3D reconstruction models versus pantropical allometric models*
- 29 destructively harvest trees from Indonesia, Peru and Guyana
- Underestimation of biomass in allometric equations for large tress



Gonzalez de Tanago et al., (in press). Estimation of above-ground biomass of large tropical trees with Terrestrial LiDAR, MEE

Recent campaign with Guyana Forestry Commission

- Aim: underpin a new national allometric equation for forest carbon using terrestrial laser scanning
- Jan./Febr. 2017

DBH class	# scanned	# Species	# destruct. measured	# Species
20 – 40	22	17	6	6
40 – 60	23	18	5	5
60 – 80	22	13	5	5
80 - 100	22	17	5	5
+100	18	14	5	5
Total	107		26	

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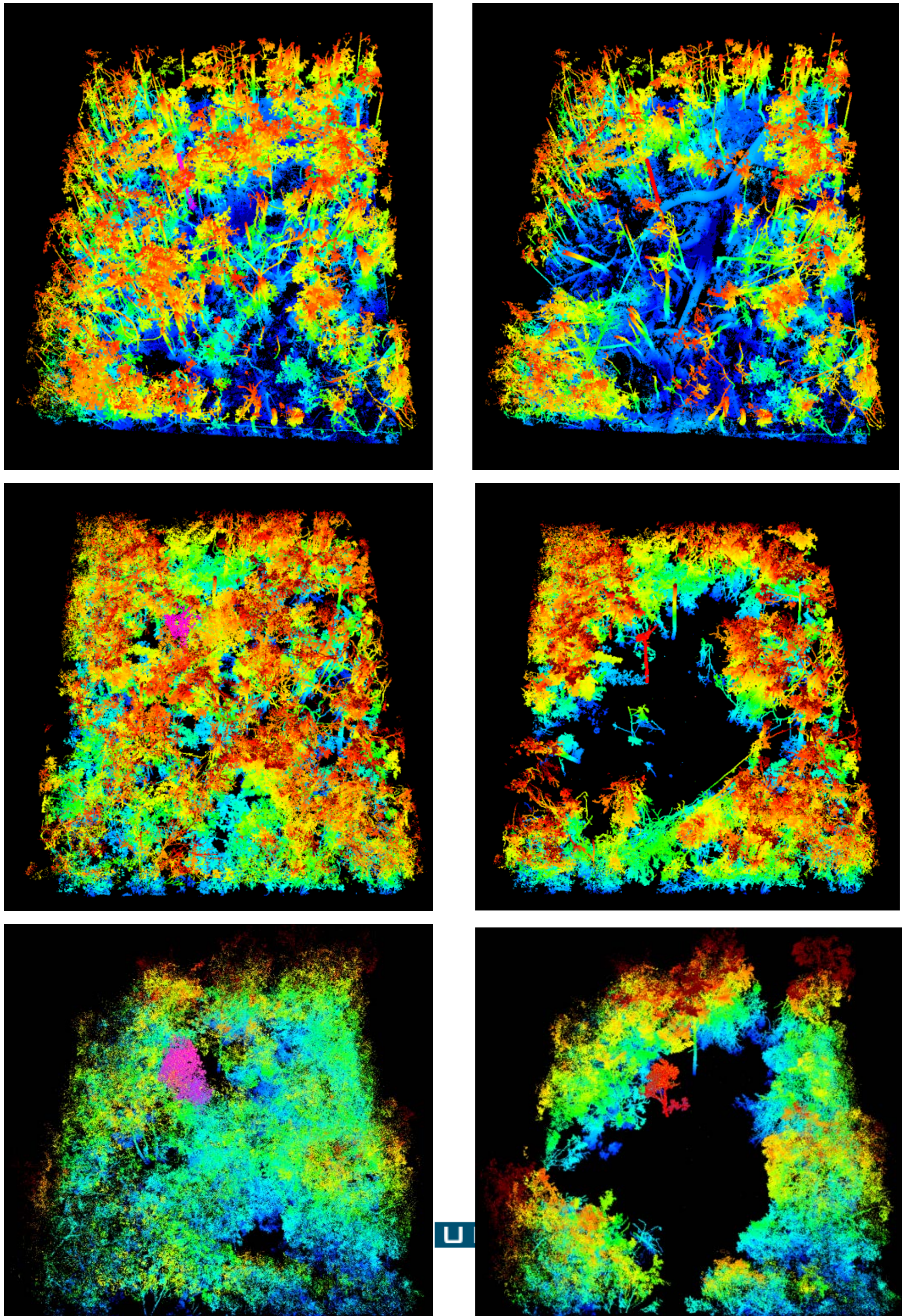
SilvaCarbon

Guyana Forestry Commission

Quantifying forest change due to disturbances

TLS Pre-harvest

TLS Post-harvest



0-12 m height

12-25 m height

25-40 m height

Logging experience in Peru, Indonesia & Guyana
Credit: Jose Gonzales, WUR

Riegl Ricopter/VUX-1 LiDAR!

- **“low density flight”:**
- ~400 points/m2 / 30 mins = 25-30 ha
- 4 battery packs - > ~100 ha/day
- **“high density”:**
- ~7000 points/m2

www.wur.eu/uarsf

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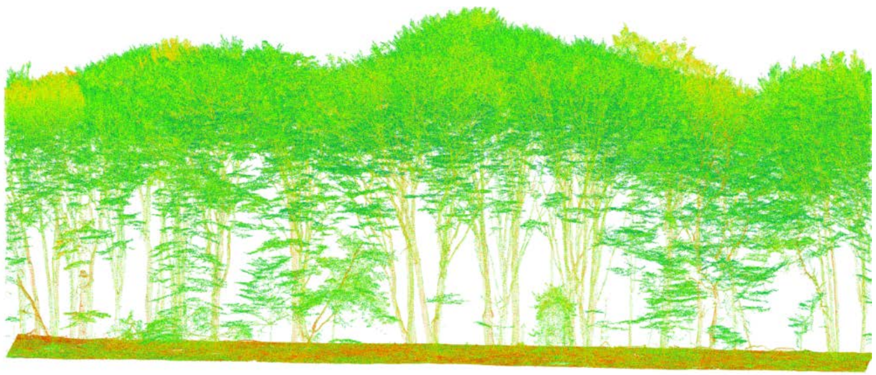
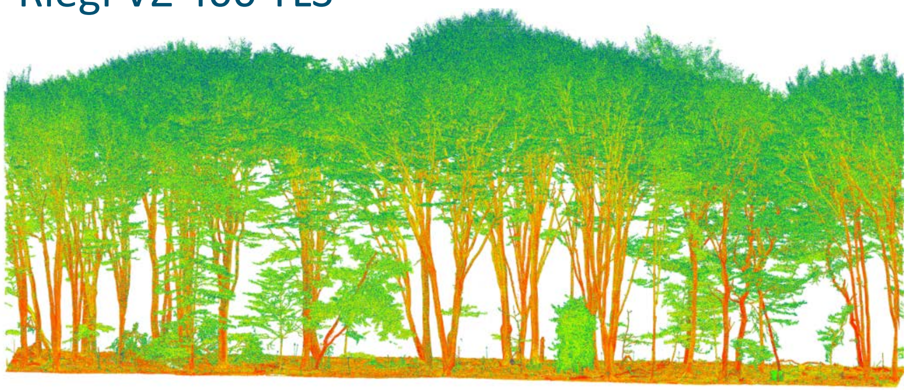
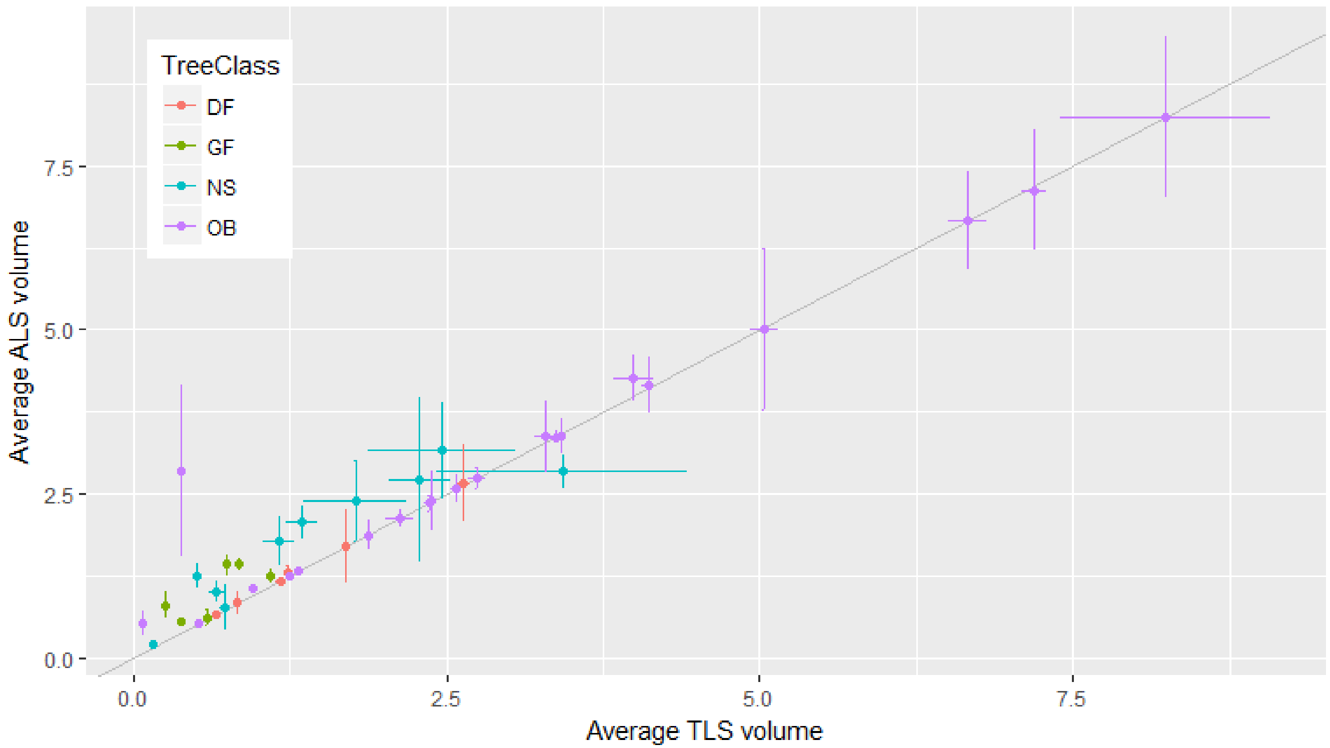
Tree volume Riegl drone versus TLS

Riegl Ricopter VUX-1 drone



Riegl VZ 400 TLS

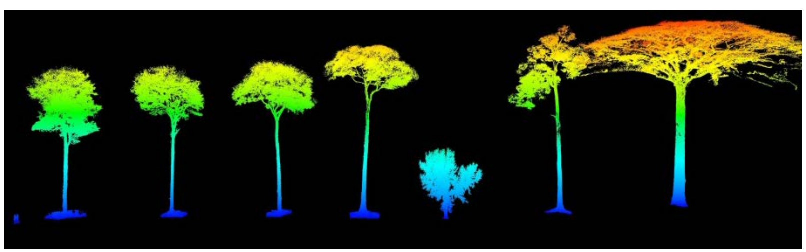




DF = Douglas Fir,
GF = Giant Fir,
NS = Norway Spruce,
OB = Old Beech and Oaks

Brede et al., (in revision), Sensors

Thank you…



For more information and contact:

Terrestrial laser:
www.wageningenur.nl/lidar

Global biomass:
www.wur.eu/grsbiomass

Drone facility (certified):
www.wur.eu/uarsf

Storymap on LiDAR fieldwork

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