Forest-Observation-System.net – towards a global harmonised in-situ data repository for forest biomass datasets validation

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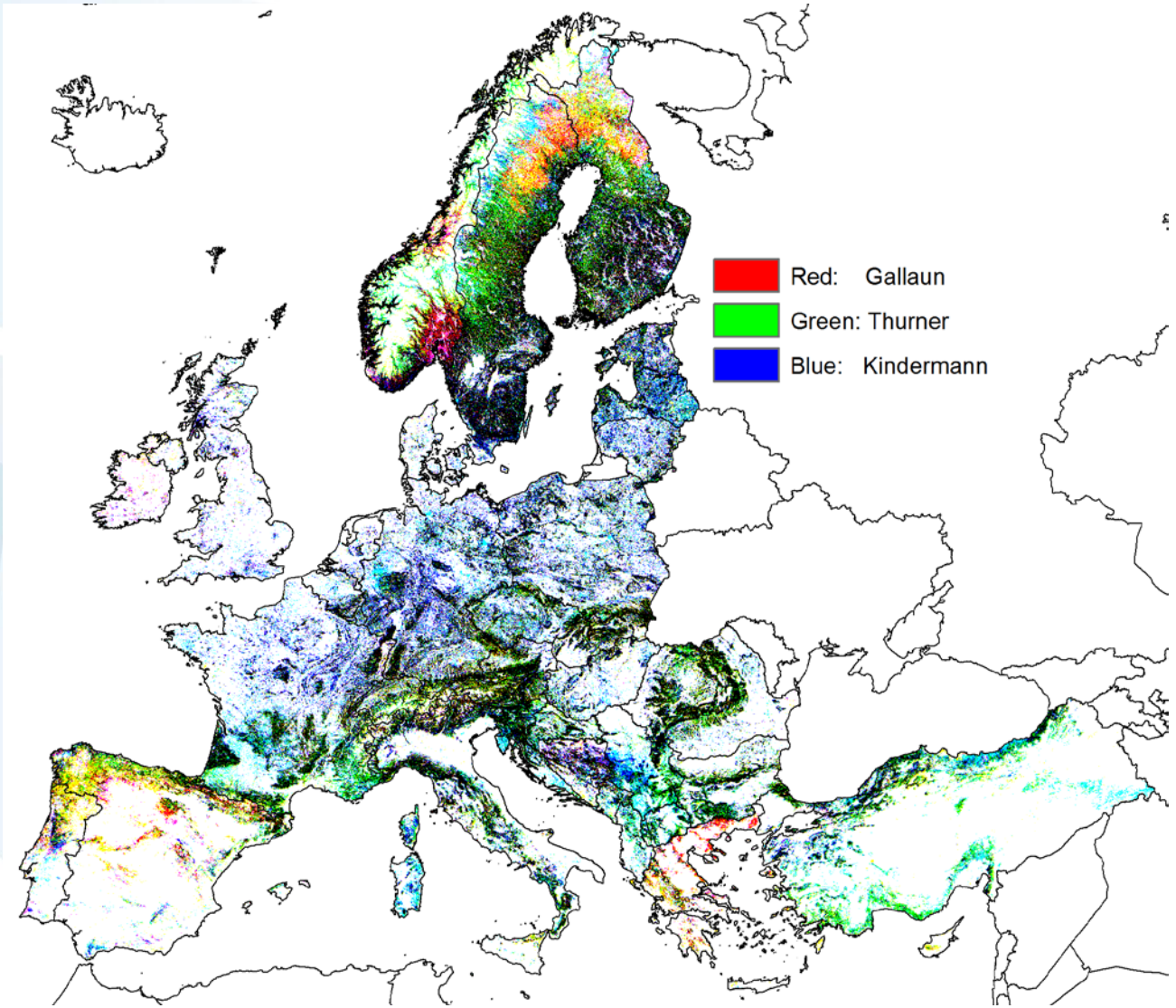
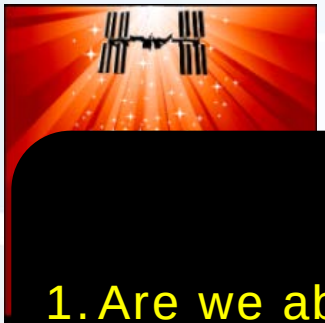
Comparison of three biomass maps for Europe:

White color – all map agree on low biomass, black – all agree on high biomass



3 Spaceborne Missions to measure forest structure



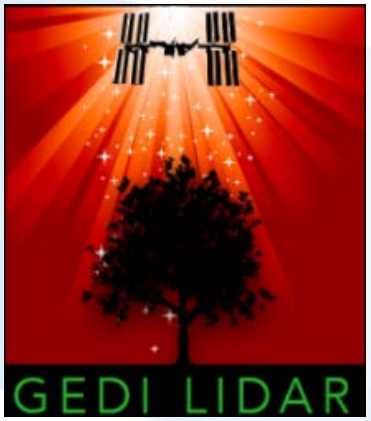
Question:

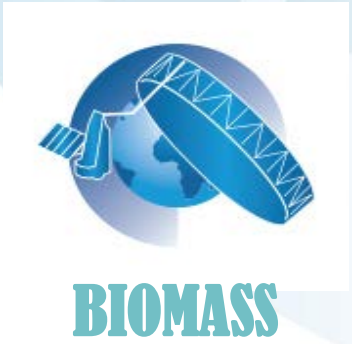
1. Are we able to make best use of these missions?
2. Will users trust remote sensing products?

These missions will deliver measurements of

- forest height
- forest biomass
- biomass change

The 1st Mission?
Global Reference Data





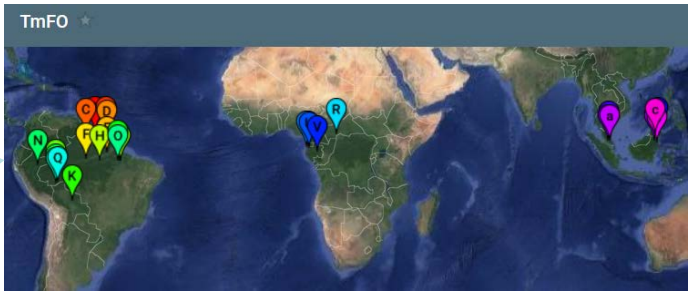
The good news: We don't need to start from scratch

RAINFOR (Red Amazonica de Inventarios Forestales)
500 biomass & dynamics plots

AfriTRON (African Tropical Forest Observation Network)
> 250 biomass plots

CTFS-ForestGEO
61 large dynamic plots,
ca. 30 tropical

TmFO (Tropical managed Forest Observatory)
ca. 490 biomass plots



These networks have a long history and experience building on a network of cooperating partners and mutual trust

IIASA network:
Forest Observatories Partnership

The Background of FOS

(Forest-Observation-System.net)

- Forest-Observation-System.net (FOS) is a "Cyberinfrastructure" to collect and disseminate ground data.
- FOS aims at building an interface between well established, existing ecological networks and the EO community.
- FOS focus is on high quality datasets that are fit for the EO purpose (e.g. geocoded data, plots with a history, etc.) based on traceable and documented requirements.
- FOS collects, but does not distribute tree level data. FOS only distributes aggregated plot level data
- FOS data is available free & open in a unified format.

FOS schedule

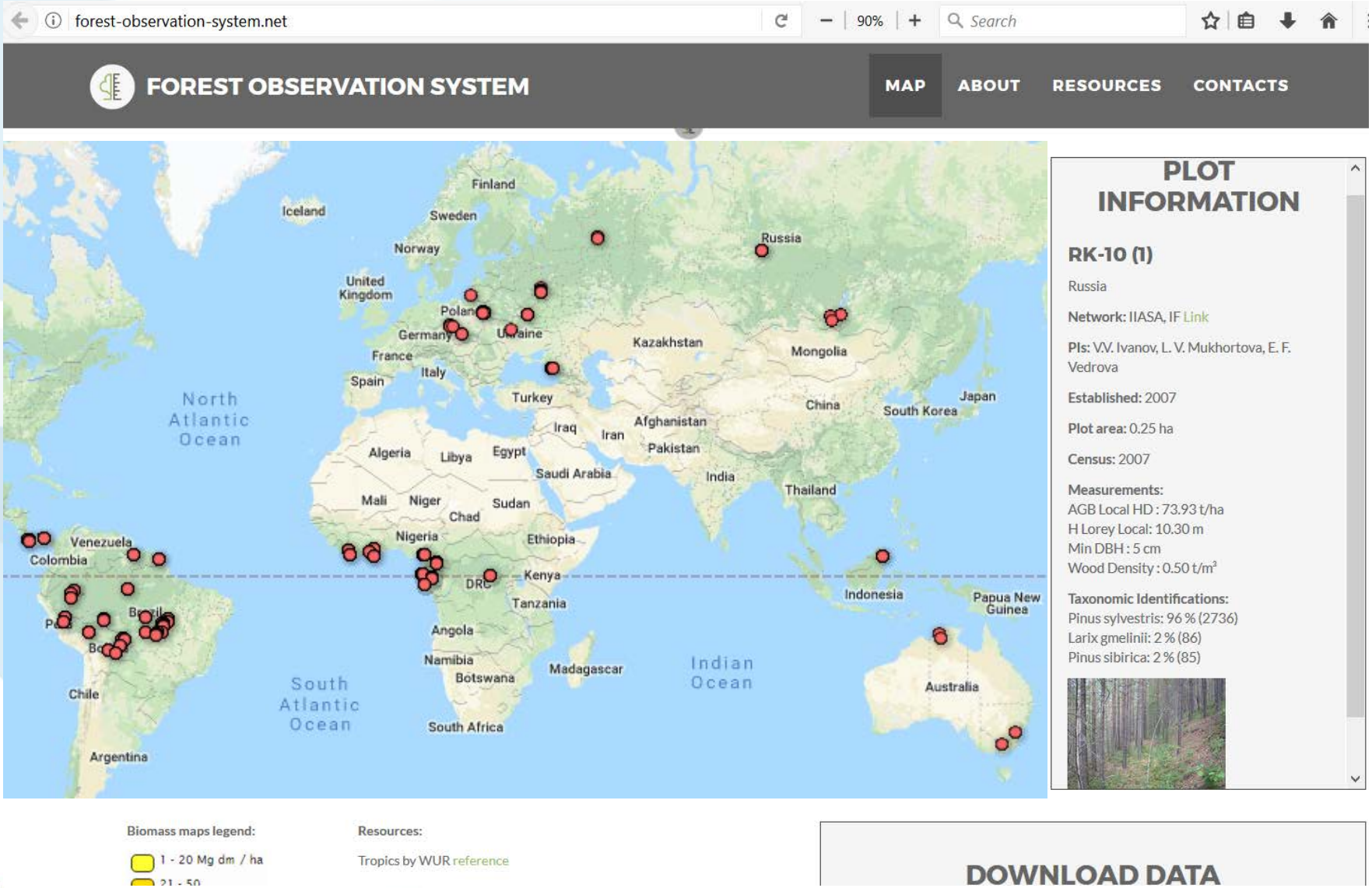
Phase 1 (2016-2017) – Demonstration

- Set up the infrastructure & web portal
- Establish a collaboration with RAINFOR, AfriTRON and CTFS-ForestGEO
- Run the web portal in a Demo mode including first data

Phase 2 (2018 - 2021) – Implementation

- Identify and establish collaboration with other networks (TmFO, AusCover and others).
- Interface upgrade (search, download, etc.)
- Expand to host airborne LiDAR-based biomass maps
- Journal articles – contributor recognition and acknowledgement

FOS: http://forest-observation-system.net



FOS *in situ* data

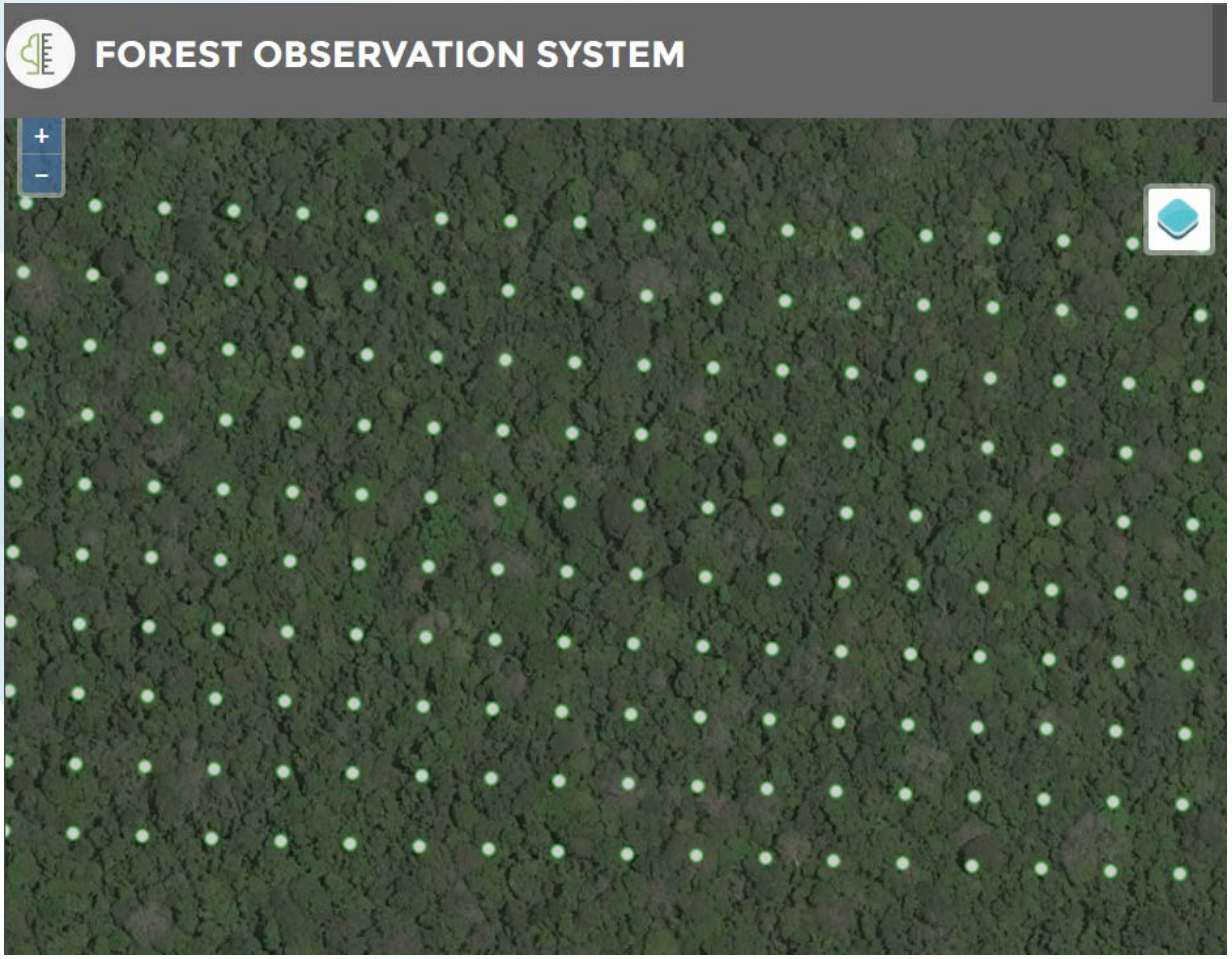
- What are we looking for:
  - Data from permanent plots with the min size of 0.25 ha (preferably 1 ha or large)
  - Every tree (over 10 cm dbh) got species identification and DBH is measured

- Output data at plot level:
  - General characteristics (relief, forest type, disturbances, tree species)
  - Canopy height (top, Lorey's)
  - Above ground live biomass (estimated by allometric model AGB=f(ρ,D,H)

Distribution of sample plots by participating networks

Network	Number of plots	Number of sub-plots	Area, ha
AfriTRON	46	178	45
AusCover	4	4	3
CTFS-ForestGEO	2	300	75
IIASA	126	258	78
RAINFOR	52	288	72
T-Forces	3	12	3
TmFO	17	500	125
unaffiliated	24	105	27
Total	274	1645	428

Smithsonian STFS-ForestGEO site in Panama divided by 0.25 ha plots



H max: 35–56 m

H mean: 22–35 m

AGB:119–415 t/ha

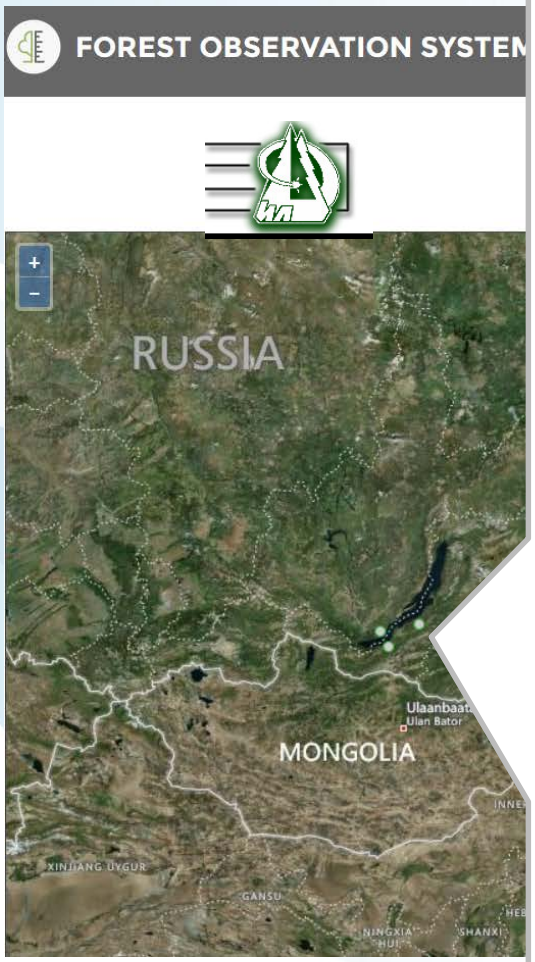
CTFS-ForestGEO

ArfiSAR field complain 2016, Gabon

PlotCode: LNL-07
CountryName: Gabon
Altitude: 306 m
Slope: 7 deg
PlotArea: 1.02 ha
Network: AfriTRON **Link:** **http://forestplots.net**
PI: Simon Lewis, Nicolas Lab
ForestStatus: Secondary for maturing (>50yr)
YearEstablished: 2016
YearLastCensus: 2016
H Average: 19 m; **H Max:** 45
AGB Local HD: 332.1 t/ha
AGB Feldpausch: 343.2 t/ha
AGB Chave: 331.6 t/ha

Taxonimic Identification
187 (65 %) - Aucoumea klaineana
78 (12 %) - Sacoglottis gabonensis
53 (7 %) - Lophira alata
22 (2 %) - Dialium lopense
25 (2 %) - Barteria fistulosa

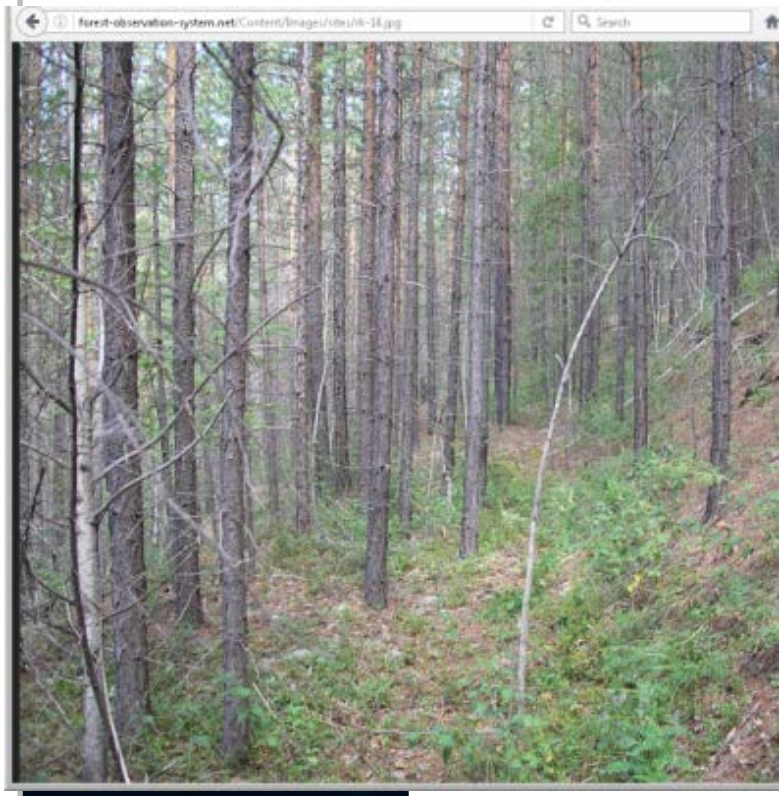
Post-fire forest dynamics and coarse woody debris decomposition investigation



PlotCode: RK-10 (1)
CountryName: Russia
PlotArea: 0.25 ha
Network: IIASA/IF
Link: http://forest.akadem.ru/PerSyst/
PI: V.V. Ivanov, E. F. Vedrova, L. V. Mukhortova
Year: 2007
Image: RK 10

H Average: 10.3 m
AGB Local HD: 73.93 t/ha
Wood Density: 0.495 t/m^3

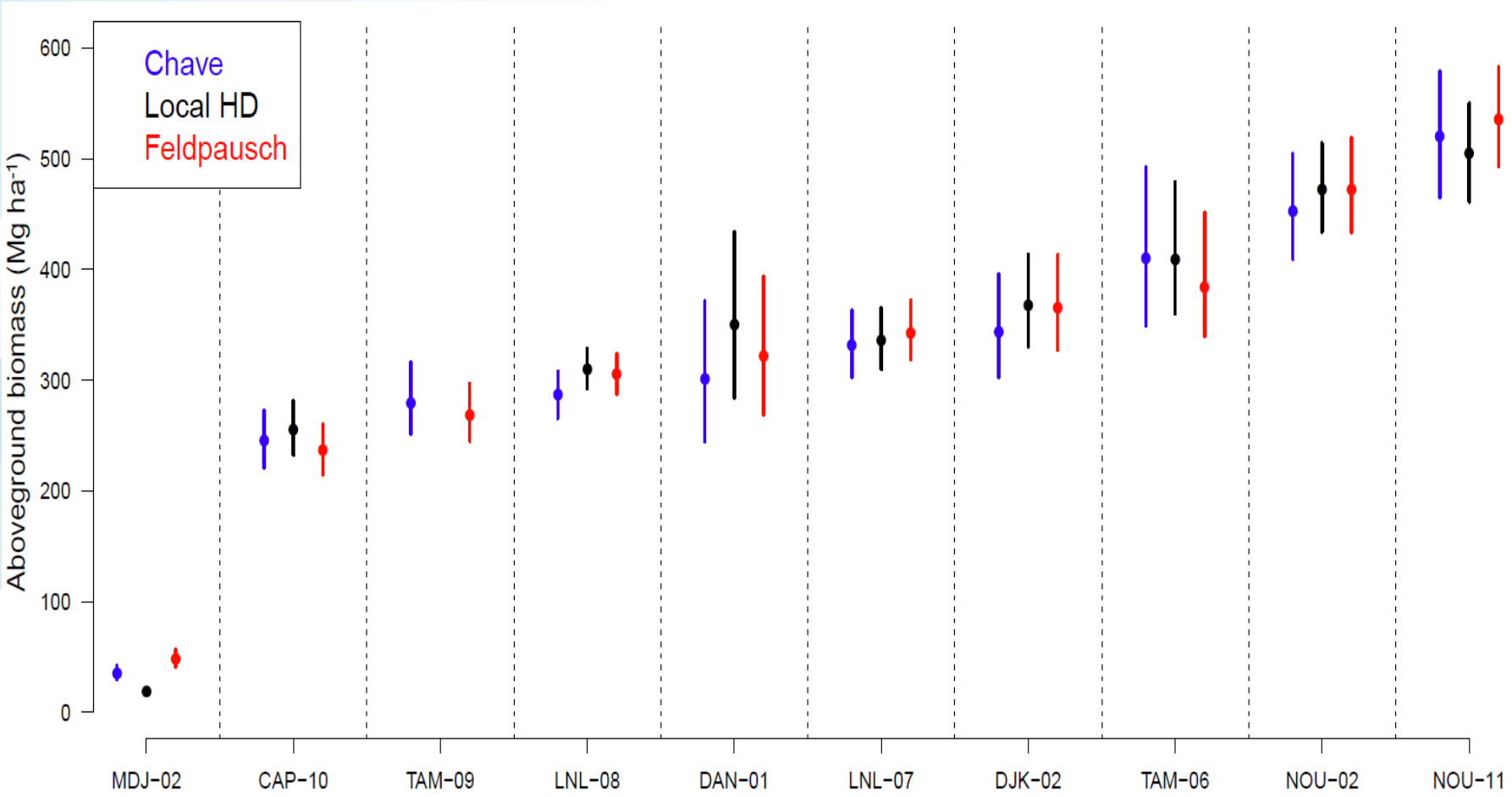
Taxonomic Identification
2736 (96 %) - Pinus sylvestris
85 (2 %) - Pinus sibirica
86 (2 %) - Larix gmelinii



Three 0.25 ha plots in the Caucasus Fir-Beech forest

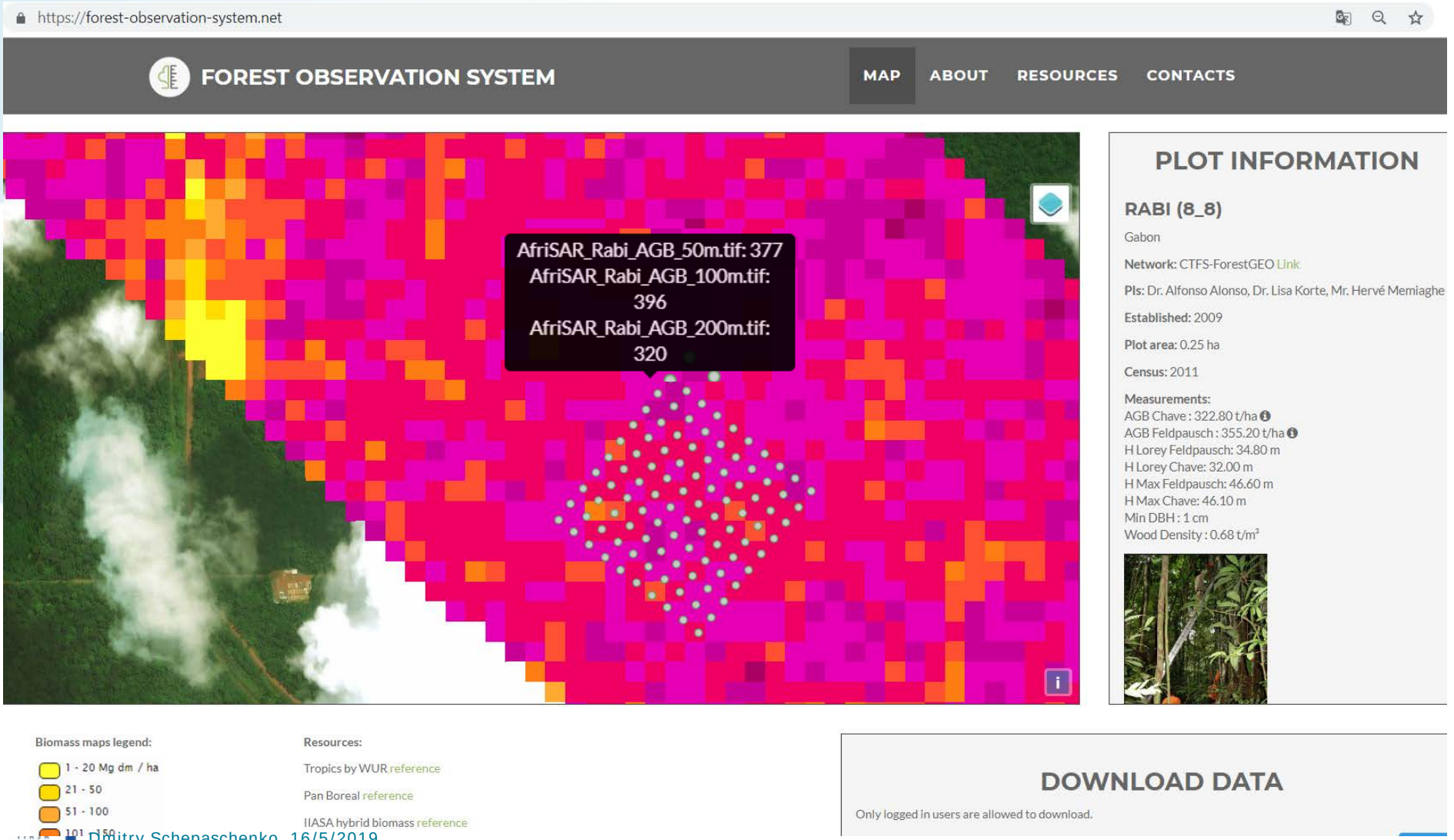
H mean = 22-29m
H max = 48-57m
AGB = 500-700 t/ha

From individual tree measurements to plot-level biomass

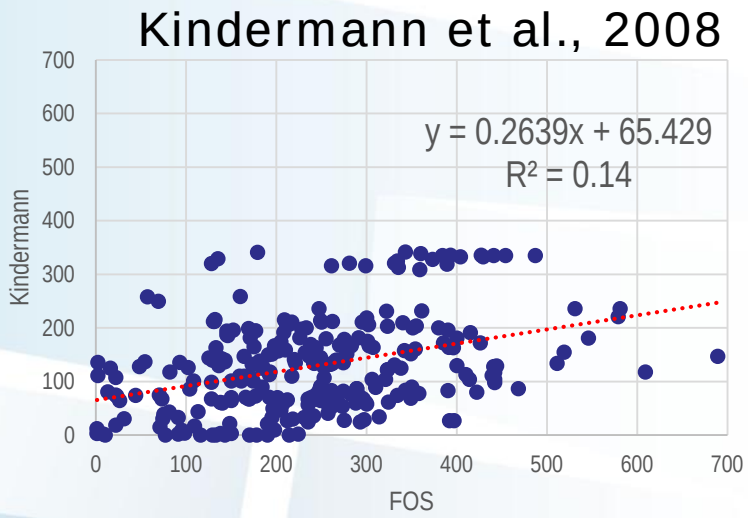


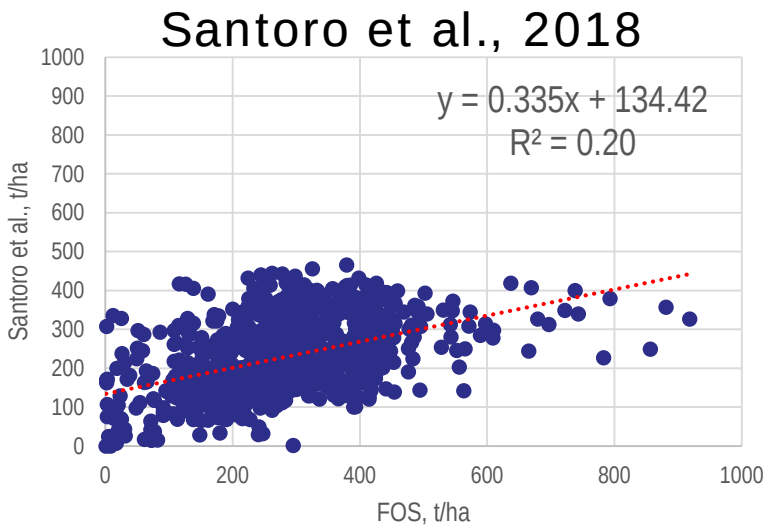
Biomass R-package by Maxime Réjou-Méchain, 2017

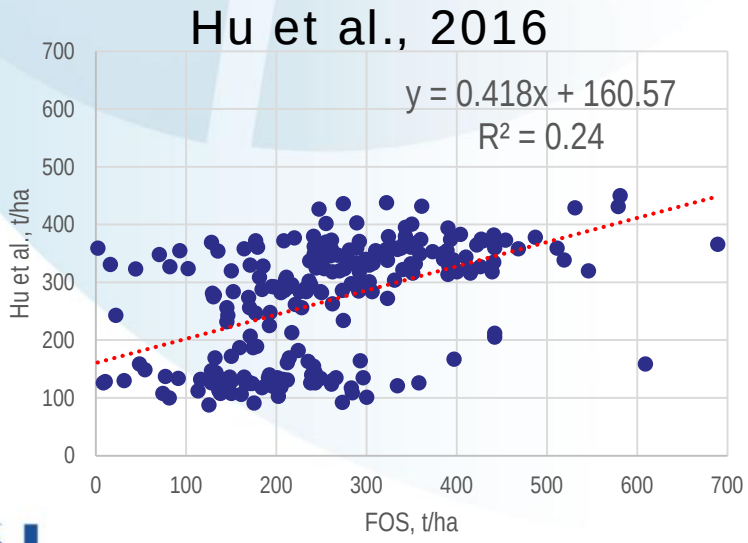
Airborne Lidar-based biomass maps

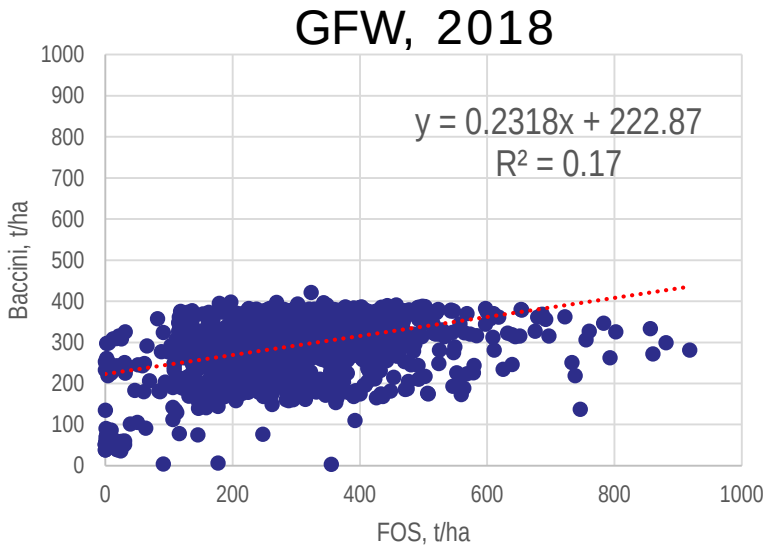


Comparison of FOS plot data with global maps









What next?

- Gathering existing data: AusCover, TmFO, GEDI cal/val, etc.
- Collecting more data:
  - ESA ForestScan project
  - RSF Russian Forest Carbon Observatory
- Providing access to the data: ESA CCI Biomass, ESA EDAV, etc.
- Update BIOMASS r-package for temperate & boreal
- Publications:
  - Jerome Chave et al. 2019 “Ground Data are Essential for Biomass Remote Sensing Missions” *Surveys in Geophysics*
  - Dmitry Schepaschenko et al. FOS data paper (under review)
  - *MDPI Remote Sensing special issue* remote sensing
    “Forest Biomass and Carbon Observation with Remote Sensing”

Thank you for your attention

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rainfor

FORESTPLOTS.NET

AusCover
Remote Sensing
Data Facility

CTFS-ForestGEO

TFO

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