DUE GlobBiomass

Vol. 01

Minutes of the 3rd User Workshop

11.-13.09.2017 FAO Rome, Italy

Revision History

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58	Vollrath	Andreas	FAO	Germany	AVH
59	Wayson	Craig	USDA Forest Service	US	CWN
60	Wilkes	Phil	UCL	UK	PWS

Final GlobBiomass User Consultation Meeting
11-13 September 2017, FAO - Rome, Italy
Final Agenda (8-Sep-2017)

Monday, 11 September 2017 *Venue:* **German Room**	**DAY 1 – INTRODUCTION**
11:00-13:00 11:30-12:45	Registration Lunch (On your own, FAO Cafeteria)

13:00-14:00 *Chair: Doug Muchoney*	**Opening and Welcome**
Hiroto Mitsugi	Welcome from FAO's Forestry Department *(10 min talk)*
René Castro	Welcome from FAO's Climate, Biodiversity, Land and Water Department *(10 min talk)*
Frank Martin Seifert	Welcome from ESA *(10 min talk)*
Chris Schmullius 13:50 - 14:10	Introduction to the GlobBiomass Project *(10 min talk)* Short Tour de Table

14:10-15:10 *Chair: FM Seifert*	**Agency Support to Global Biomass Monitoring**
Anssi Pekkarinen	FAO Overview on Global Forest Resources Assessments and GFOI Activities *(15 min talk + 10 min for questions)*
Josef Kellndorfer	NASA's Terrestrial Ecology and Carbon Program *(15 min talk + 5 min for questions)*
tbd	JAXA's Kyoto & Carbon Initiative *(15 min talk)*

15:10-15:30	Coffee Break

15:30-18:00 *Chair: Chris Schmullius*	**Overview of GlobBiomass Methodological Advances**
Shaun Quegan	Algorithm Development Overview *(20 min talk + questions)*
Heiko Balzter	Regional Products Overview *(20 min talk + questions)*
Oliver Cartus	Global Biomass Retrieval *(20 min talk + questions)*
Maurizio Santoro	Global Biomass Map Products *(20 min talk + questions)*
Nuno Carvalhais	GSV to AGB Conversion for Carbon Modelling *(20 min talk + questions)*
17:45-18:00	Conclusions of Day 1

19:30	Joint Dinner at www.RistoranteOrazio.it

Tuesday, 12 September 2017 *Venue:* **German Room**	**DAY 2 – INTERNATIONAL ACTIVITIES**
09:00-10:40 *Chair: Anssi Pekkarinen tbc*	**International Programme Presentations on Global Implementations I** *(5 x 15 min + 5 min for questions each)*
Julian Fox FAO	National Forest Monitoring and REDD+ at FAO
Naikoa Aguilar-Amuchastegui WWF	Biomass Needs for Forest Protection
Marion Karman Forest Stewartship Council	Monitoring Needs for Forest Certification
Craig Wayson USDA Forest Service	The SilvaCarbon Program: Past, Present and Future
Nancy Harris World Resources Institute	High resolution global forest carbon monitoring for the 21st century
10:40-11:00	Coffee Break
11:00-12:40 *Chair: Thuy Le Toan*	**International Programme Presentations on Global Implementations II** *(5 x 15 min + 5 min for questions each)*
Thuy Le Toan CESBIO	Status of the BIOMASS Earth Explorer Project
Josef Kellndorfer EARTH BIG DATA, LLC	Preparation for the NiSAR Mission
Saurabh Channan GLCF, Univ. of Maryland	NASA LCLUC Program: Landsat resolution tree and water cover products
Martin Herold Wageningen University	TOPC/GCOS
Brice Mora Communication & Systems	Research and User Support Service *(an "Infrastructure" presentation of next session – due to time constraints here)*
12:40-14:00	Lunch

14:00-14:40 *Chair: FM Seifert*	**Infrastructures for Global Implementations** *(2 x 15 min + 2 x 5 min for questions each)*
Erik Lindquist FAO	Open Foris, SEPAL
Tuomas Häme VTT Finland	Forestry TEP
14:40-16:00 *Chair: Heiko Balzter*	**Regional GlobBiomass Implementations I** *(15 min developers + 15 min replies from users + 10 min discussion)*
Pedro Rodriguez Veiga	GlobBiomass MEXICO Case Study
Maria Isabel Cruz Lopez	Use of biomass products in ecosystem monitoring and early warning systems in CONABIO-Mexico
Stéphane Mermoz /Alexandre Bouvet	GlobBiomass SOUTH AFRICA Case Study
Renauld Mathieu	Biomass Mapping Programme in southern Africa (CSIR)
16:00-16:20	Coffee Break
16:20-18:00 *Chair: P Rodriguez-Vega*	**Regional GlobBiomass Implementations II**
Agata Hoscilo	GlobBiomass POLAND Case Study *(15 min)*
Krzysztof Sterenczak	National Polish User Perspective and Activities (FRI) *(15 min)* *10 min discussion*
Johan Fransson	GlobBiomass SWEDEN Case Study incl. User Perspective *(20 min talk + 10 min discussion)*
Anna Berninger	GlobBiomass KALIMANTAN Case Study incl. User Perspective *(20 min talk + 10 min discussion)*
18:00-18:15 *Chairs: Seifert + Schmullius*	**Summary on major statements of Day 2:** - Requirements - Policies - Methods - Monitoring GlobBiomass Data Dissemination *(5 min demo)*
Carsten Pathe	
18:30	***Sundowner in FAO Cafeteria***

Wednesday, 13 September 2017   DAY 3 – COUNTRIES + VALIDATION
Venue: **German Room**

09:00-11:00 *Chair: Danae Rozendaal*	**Country Implementations including validation strategies** (6 x 15 min talks + 3 min for questions)
09:00 Richard Lucas, UNSW + CSIRO	Australian Biomass Mapping Activities (via remote connection)
09:18 Jean Ometto, INPE	Results of the Lidar Campaign over Amazon, Brazil
09:36 Phil Wilkes UC London	Lidar in situ measurements in support to biomass validation
09:54 Marcela Olguin, CEC	National Mexican User Perspective and Activities (CONAFOR and Commission for Environ-mental Cooperation): Enhancing forest carbon monitoring and GHG emissions projection using a systems approach: lessons learned from Mexico
10:12 Svein Solberg NIBIO, Norway	Mapping and quantification of the residual land sink and other forest fluxes of the global carbon budget based on InSAR data from Uganda, Tanzania and Colombia
10:30 Valerio Avitabile JRC	Assessing forest biomass maps in Europe using harmonized national statistics and inventory plots
10:48-11:10	Coffee Break
11:10-12:00 *Chair: Chris Schmullius*	**Country Implementations including validation strategies** (5 x 15 min talks + 3 min for questions)
11:10 Kristian Milenov, ASDE	Strengthening Global Forest resilience and user oriented services – Proposal from the Bulgarian Agency of Sustainable Development and Eurointegration
11:28 Sergey Bartalev, IKI	An overview of forest mapping and monitoring in Russia using Earth observation
11:46 Edward Mitchard University of Edinburgh	Calibrating, validating and encouraging the use of maps of above-ground biomass and biomass change across tropical forests and savannas: SEOSAW & FORESTS 2020
12:04 Heiko Balzter University of Leicester	Earth Observation of forests to support the UN sustainable development goals

12:22 Anatoly Shvidenko, IIASA	SPECIAL TALK - Forest life biomass assessment: Glance of a forester and modeler
12:40-13:40	Lunch
13:40-14:50 *Chair: Martin Herold*	**GlobBiomass Validation Session**
13:40 Danae Rozendaal, WUR, Netherlands	GlobBiomass Validation *(20 min + max 10 min for questions)*
14:10 Dmitry Schepaschenko IIASA, Austria	GlobBiomass Validation in Russia, ESA's Forest Observation System and IIASA's Biomass Geo-Wiki *(20 min talk + max 10 min for questions)*
14:40 Martin Herold, WUR	Lessons Learned *(10 min)*
14:50-16:00 *Chairs: Seifert+Schmullius*	**Discussion on Summary and Recommendations**
14:50-15:30 All participants	Summary on - Validation Strategies, - Recommendations for measurement and product synergies, - Suggestions for international, trans-agency concerted actions.
15:15-15:30 (during session)	Parallel Coffee Break
15:30-15:45	Feedback from Advisory Board
15:45 – 16:00 Schmullius, Seifert, Muchoney	**Closing Remarks**

11.09.17   Task 1: Opening and Welcome

Issues & Discussion	1. Douglas Muchoney - Introduction from FAO / - Presentation / round the table of different staff, which are working relating Biomass estimation 2. Hiroto Mitsugi – Welcome from FAO`s Forestry Department</em></strong></p><ul><li>Welcome from FAO</li><li>Wishing a nice meeting</li></ul><p>3. <strong><em>Renè Castro – Welcome from FAO`s Climate, Biodiversity, Land and Water Department 4. Frank Martin Seifert – Welcome from ESA - welcome from ESA - ESA involved in Forestry and Biomass - P-Band sensor for biomass will be launched in 07/2021 - Look at essential climate variables since 2009 - Looking forward into 3 interesting days 5. Christiane Schmullius – Current Status of GlobBiomass - See presentation - GlobBiomass – overview / project structure / - Thanks Doug to host us - We are going to present and looking for our products Products: - Global maps: resolution 150-500m anc accuracy expected 70% - Regional maps: resolution 50-150 m and accuracy expected > 80% + validation maps - Platform for data sharing and validation - Stratification and standardization of maps - Presentation of the Project Structure - Presentation of the whole GlobBiomass project team – tour the table – - Thanks to FAO to host us for this final User Consultations Meeting

11.09.2017   Task 2: Agency Support to Global Biomass Monitoring

Issues & Discussion	6. *Ansi Pekkarinen – FAO Overview on Global Forest Resources Assessments and GFOI activities*
	- See presentation - Team leader of the global forest assessment - Will increase the cooperation for the three communities, FRA, GFOI and GlobBiomass - FRA reports many different variables 170 national correspondence in national work (FRA - New FRA platform for data submission - As easy as possible - Global score set of forest-related indictors - Global Forest Survey – project for open access field inventory database - For data compilation and collection to combine remote sensing and field inventory data - GFOI - International assistance to developing countries on forest monitoring and GHG accounting - Founded on GEO in 2011 - Lead partners: Australia, Norway, USA, FAO & CEOS - Open to new partners - GFOI components: Capacity building Methods and guidance, space data coordination, R&D Coordination, GFOI Leads and Office - Provided operational guidance on MRV for REDD+ - GFOI Phase is being developed - New component: data component - KMV – how you can merge the data? - APN – depends from the definitions – a lot of work – use the national expertise - VAE – data should have the location information – how the data could still be used? - CS – connection between the German supported Global Forest Survey – is there? - APN – they produce some data at the national level - CS – we produce GSV – we would need much more structural in-situ information
	7. *Josef Kellndorfer – NASA`s Terrestrial Ecology and Carbon Program*
	- See presentation - Earth science instruments of ISS presented - Questions from NASA regarding - Research and analysis - How can carbon cycle and ecosystem Sciences improve? - Do changes to ecosystems impact? - Presenting the Terrestrial Ecology Program - Presenting the GEDI (Global Ecosystem Dynamics Investigation) - Launch should be late 2018 - NISR mission quick presented – launch late 2020 or 2021

8. *Tbd – JAXA`s Kyoto & Carbon Initiative*

- See presentation
- 3yr mission with consumables for 5+
- geoCARB selected for EVM-2 – short presentation
- overview on NASA`s research activities
- APN - different between ICESAT I and ICESAT II?
- JKR – largest difference in technology
- CT – will the airborne data be free available?
- JKR – yes
- CS – is it only US program or also pan-arctic – is there any cooperation with Russia
- JKR – north American program

9. *Christiane Schmullius – on behalf of Ake Roseqvist – ALOS Kyoto & Carbon Initiative*

- See presentation
- K&C supported JAXA`s activities
- Presentation different forest theme projects
- Presenting different homepages;
- Pointed out some important topics; e.g. systematic acquisition planning;

11.09.2017   **Task 3: Overview of GlobBiomass Methodological Advances**

Issues & Discussion	**10.** *Shaun Quegan – Algorithm Development Overview*

- See presentation
- Overview about the methodology for regional and global mapping
- Regional mapping: 2005,2010, 2015
- Representing the best biomass estimates;
- Functions of the ATBD: concise description of the data and methods used to produce the various maps and products
- Presenting the structure of the ATBD for global and regional biomass mapping
- Datasets, methods, products descriptions
- Regional comparison: biomass ranges – radical difference between the sites;
- Regional comparison: methods – all different in their primary method, but all used PALSAR mosaics; large differences using reference data;
- Accuracy assessment presenting for each region
- General features regarding accuracy:
- overestimation at low biomass ranges
- Underestimation at high biomass ranges (not South Africa)
- Roughly constant residual error – after bias correction across all biomass ranges;
- Global accuracy: due to error propagation involving radar backscatter measurement errors, errors due to model based inversion and geocoding and resampling inaccuracies
- CWS – idea to use same approach, e.g. for Mexico and Sweden…
- PRV –will come back in his presentation about small Round Robin study
- TLT – need to improve the differences of datasets in different regions

11. *Pedro Rodriguez Veiga on behalf of Heiko Balzter - Regional Products Overview*

- See presentation
- aim: best possible estimates
- presenting overview in WP 5000 / activities / deliverables
- showing the study areas + forest types
- showing the datasets for application, training, validation
- showing the AGB epoch maps for the different regions for 2010
- validation example Sweden stratified by AGB class
- talking about Bias on AGB estimation / Bias correction
- showing the comparison to the global products from Baccini, Saatchi, LiDAR and GlobBiomass
- 2005/07, 2010, 2015 are available for all study regions;
- Used different methods, chose radar + optical data and geo-morphometric from DEM
- VAE – what did you have done regarding the Bias correction?
- PRV – tried to correct – in some teams worked, in some teams not
- PRV – case of Mexico – have n-kind of parameters and need to decide…
- SQ – be very careful with the same mean of bias correction
- CS: need other in-situ information to have better estimates – problem is in the in situ data…

12. *Oliver Cartus – Global Biomass Retrieval*

- See presentation
- Datasets: which are globally available – ALOS PALSAR, Envisat ASAR, IceSAT GLAS + Landsat, Modis, CCI land cover, FAO ecoregions
- Models that are applicable globally
- Approaches that minimize the need for in situ data
- Product – GSV mapping product – conversion into AGB afterwards;
- Presenting the developed methods: direct upscaling / two-stage upscaling / semi-empirical approaches
- Presenting the GlobBiomass retrieval algorithm
- Presenting the BIOMASAR-C and BIOMASAR-L algorithm
- Derivation of transmissivity as function of canopy density and GLAS height,, linked to GSV
- Presentation of GSV of Densest Forest Maximum Retrievable GSV
- Showed the BIOMASAR-C/L – error model
- Showed the BIOMASAR-C product at 25m and the BIOMASAR-L-product at 25m
- Referred about the limitations of L-band sensitivity to GSV/AGB mapping
- Presented the merging rules of the maps
- 1. Sensitivity of C- and L-band to GSV – identifying local inconsistencies
- Presenting the combined GSV map – (almost) final map (100x100m2 pixel posting)
- CT – are the transmission values coming from model?
- OC – coming from each footprint – there are some assumptions

13. *Maurizio Santoro – Global Map Products*

- See presentation
- First version was produced in March 2017 and distributed the map internally
- In the meantime Gamma produced the 2nd version
- The 2nd version will be presented at this meeting (GSV map) – from August 2017
- Devil in the details… -
- Presenting of latitudinal profiles of GSV estimates
- Derivation of different BCEF (conversion factors)
- Assessment of estimates: validation using plats of the biomass database at WUR
- Comparison with in situ observations available at GlobBiomass regional partners and users
- Comparison with inventory-based estimates – provincial and national scale
- Comparison with global statistics by FAO
- Cross-comparison with other EO estimates
- Presentation of strengths and weaknesses:
- Represents well the level of biomass
- Flaws occur in correspondence of marked topography
- Very local artefacts occur in correspondence of: (tree cover set to 0, image banding in PALSAR mosaic or ASAR retrieval…
- Showed different examples for assessment
- Discussed the GSV vs FAO FRA 2010 country statistics
- Showed the global GSV statistics
- Reference year 2010 +/-1 year, spatial resolution 100m
- Each pixel is characterized by accuracy statistics
- Availability: public, beginning 2018, before internal
- **Presenting the global map deeper in different parts of the world sliding with google maps**
- JKR – making measurements on the ground and compare it with the map
- MS – need a lot of local knowledge from the people

14. *Nuno Carvalhais – GSV to AGB Conversion for Carbon Modelling*

- See presentation
- Presenting the workflow from GSV to AGB: after Thurner et al. 2014
- Speaking about wood density, understanding of wood density as fundamental to diagnosing AGB
- Showing different factors associated to WD variations
- Environmental conditions determine the abundance of fast versus slow growing species, hence shaping the wood density
- Presenting GSV to AGB: local to global
- TRY – a global database of plant traits / 2nd generation of data pooling
- Methods: machine learn approach – e.g. random forest / done an experiment with and without TRY gap-filled data
- Presenting of the statistical covariates: depends from climate, soils and terrain variables, primary productivity and water fluxes, vegetation properties;
- Showed global results and presented deeper insights in different regions (Amazon and Siberia)
- presented the wood density for the Amazon area and discussed the differences;
- result: upscaling from GSV to AGB
- can be approximated using PFT (plant functional types) & environmental predictors
- approach and data sources for training influence the model fitness very large
- need independent datasets for evaluation!
- Further thoughts: ontogeny versus phylogeny
- Using global in situ datasets (regional datasets, TRY, GBIF, GFBI)
- ASO – results only for trees?
- NC – yes
- ASO – how many pft in your general calculation has been used
- NC – not more than 10/12
- TLT – would recommend NOT to go to AGB via the wood density, since in some of these models the wood density is implicitly embedded in the radiative transfer model parameters
- NC – it is worth evaluating issues of equifinality related to the modelled spectral response under different conditions (stem mass, stem density, wood density)
- TLT – should divide by Biome or kind of trees for evaluation – need the stratification!!
- NC – yes. The main challenge is the importance of the ground datasets
- JKR – appreciate the comments from TLT about the wood density, but need different density classes
- JKR - in previous experiments the best correlations with the SAR signal was with the basal area weighted height

11.09.2017   **Task 4: Conclusion of Day 1**

Issues & Discussion	- FMS – in the afternoon presented the very assense of GlobBiomass - FMS – good discussion regarding wood density - FMS – will follow tomorrow with the international activities and the regional activities in the afternoon

12.09.2017   **Day 2 – International Activities**

12.09.2017   **Task 5 – International Programme Presentations on Global Implementations**

Issues & Discussion	*1. Julian Fox – National Forest Monitoring and REDD+ at FAO*
	• See presentation
	• Has spoken about NFM counties and the support
	• Moreover about REDD+ and PNG MRV (Collect Earth and Terra PNG)
	• Showed something about the national forest inventory
	• http://png-nfms.org/portal/
	• PRV – source for emission factors
	• JFX – UNFCCCC Forest reference
	• FKR – use cases – helping in stratification for inventory data -/ biomass change monitoring / direct measurements
	• FKR – they can help us to get in more details
	2. Naikoa Aguilar Amuchastegui– Biomass Needs for Forest Protection
	• See presentation
	• Will improve biomass estimation methods
	• Showed forests in the INDCs
	• Showed the long-term decline of the Amazon carbon sink
	• Presented the evaluation of climate-related carbon turnover processes in global vegetation models for boreal and temperate forests
	• Conclusion: need for a broader user base with more capacity building for users
	3. Marion Karmann – Monitoring Needs for Forest Certification
	• See presentation
	• Overview about the FSC
	• Setting standards and bring different people together, with different interests and looking for their social aspects
	• Product labelling (FSC standard) system to support users to find ecological products
	• FSC – third party certification with annual field audits, have 1500 forest management entities = 200 million ha worldwide / 80 countries for forest production
	• FSC user groups: prime user groups (Forest managers, Certification bodies, accreditation services, FSC – Monitoring and Evaluation, Management and Marketing decisions
	• Other user groups: researcher, indigenous people, NGOs (WWF), retail sector, investment sector
	• Information needs: conservation zones, protection areas, areas subject to rights and people…
	• FSC needs: additional independent monitoring / evidence of maps for certified areas; need cheap and easy solutions for easy access and interprete, public available, but allowing data protection
	• MK "We need information, not data!"
	• FSC is not a research organization, WWF is the "big brother" of FSC
	• KMV – looking for partners who need maps from satellite images
	• PRV – FSC is a national standard? – MKN, yes

Issues & Discussion	**4. _Craig Wayson – The SilvaCarbon Program: Past, Present and Future_**

- See presentation
- Building Capacity worldwide in measuring, monitoring, managing forest and terrestrial carbon applications/monitoring
- Technical cooperation program of the US Government to build capacity worldwide
- Key characteristics: interagency from multiple US agencies / needs based: fills technical capacity gaps,
- Silvacarbon will use improved information related to forest and terrestrial carbon
- Involved: USAID, US Department of State , USFS, USGS, EPA, NASA, NOAA, Smithsonian Institution
- SilvaCarbon is the primary US contribution to GFOI, with USGS and USAID as lead representatives
- Who is involved: US global change initiative (GFOI, country partners and different academia programs
- Where: Africa, Asia, Bangladesh, Vietnam, Latin America + a global level program
- What does SilvaCarbon do?: integration of Remote Sensing, Forest Inventory and GHG Inventory
- Collaboration with GFOI

5. _Nancy Harris – High resolution global forest carbon monitoring for the 21st century_

- See presentation
- Showed the global carbon fluxes worldwide
- What do we need to improve a global carbon monitoring system?
- Global tree cover loss and gain
- AGB map global / Showed a map from Woods Hole Research Centre (from 2000 and a 30m product)
- Tropics: field biomass from LiDAR
- Global map: field biomass to LiDAR
- Attribution about global biomass lost / Deforestation /
- Working on a supervised classification model that distinguishes between the loss of trees in forest land us versus the conversion of natural forests to a non-forest use
- Sequestration in natural and plantation forests
- GHG accounting (all pools, gross + net)
- IPCC Guidelines: "Gain-Loss" Method – publication
- JFX – movement on national level, e.g. Indonesia – from global to national?
- NHS – regions use their own data and the WRI is looking how they can compare with the own used data
- ICL – how do you work on service to provide the information for users?
- NHS – terms of REDD+, provide by putting out the own data

12.09.2017   **Task 6 – International Programme Presentations on Global Implementations II**

Issues & Discussion	**6.** *Thuy Le Toan – Status of the BIOMASS Earth Explorer Project* • See presentation • Research studies established relationships between radar measurements and above-ground data showed biomass • Biomass mapping using L-band ALOS-PALSAR • What SAR system to measure biomass of all forest biomes • ESA 7th Earth Explorer mission • To observe forests of different biomes but focus is on tropical forests, • Will map global forest biomass and forest height • Crucial information in the tropics • Combines PolSAR, PolinSAR, TomoSAR • Recent AfriSAR campaign in Gabon, Africa • Key parameters presented and the global coverage strategy, • Work in progress: algorithm development, working on sustainable Forest Observing System (network of ESA, NASA, GEDI, , preparing for use in future products **7.** *Josef Kellndorfer – Preparation for the NiSAR Mission* • See presentation • NASA-ISRO partnership – SAR Mission Concept inspired by the decadal survey • Presented NISAR characteristic • Ice, fire and biomass observation together in one mission • Launch date: no earlier than December 2020 • L-Band: JPL/Alaska Satellite Facility / S-Band: ISRO • Pushing 100TB/day • Presented the instrument • Showed instrument features • Planned acquisitions: background land, Ice, Sea Ice Dynamics, Urban areas, US Agriculture, Himalayas, India agriculture, India Coastal Ocean, Sea Ice Types, • Presented possible objectives of a Cal/Val element • Current in Phase C: subsystem developments and instrument prototyping • NISAR will provide a rich time-series of data globally for science and applications research on land an ice.

8. *Saurabh Channan – NASA LCLUC Program: Landsat resolution tree and water cover products*

- See presentation
- using LEDAPS in different tiles
- global surface reflectance products from Landsat
- 1. Tree Cover Products
- 30m Tree Canopy Cover Product
- 2000, 2005, 2010 and 2015 are available for download
- Fusion of Landsat, Sentinel 1 and 2
- Showed an application: Philippines forest monitoring and the worldwide water cover product
- www.terrapulse.com /
- SB – how do you use Sentinel 1 and 2 to fill the data
- SCN – fill the gaps in the images in post-processing

9. *Brice Mora – Research and User Support Service (RUS)*

- See presentation
- RUS service by the European Commission
- Research and User support are the aim
- Foster the handling and processing of data
- Free service, access to free data and ICT resources
- Specialized user helpdesk and training sessions in Europe
- Users are from research, academia, private, expert users, university classes to use Sentinel core products with own algorithms, FOSS or COTS
- Target users are within the EU
- Service will open next week
- RUS service. Sentinel and Copernicus contributing missions data, toolboxes and software for data processing and prototyping, virtualised and scalable computing resources
- RUS support per e-mail and chatroom
- Training sessions from 1 day to a full 5-day course
- Project until July 2022
- Non-commercial activities, free access, training
- RUS is for R&D and teaching;
- Funding for coming 2 years , if a baseline of users is met, extension possible

10. *Martin Herold – Evolving UNFCCC requirements for biomass mapping from space: GCOS/TOPC, IPCC, GFOI*

- See presentation
- ECV Biomass – needs from 2016 GCOS implementation plan
- Also Above ground biomass included
- Is well documented
- IPCC 2019 refinement of Good Practice Guidelines
- Paris agreement: enhancing transparency
- Presented different GCOS actions related to ECV Biomass
- Important issues:
- develop guidance on how to use biomass density maps generated from remote sensing data
- Update default values for BEF/BCEF and root / shoot ration and carbon stocks
- Updating of biomass defaults / updated default values / enhancing transparency
- Presented recommendations for biomass mapping from space
- GFOI – R&D coordination : assessing country needs to define R&D priorities and stimulate research and funding
- www.gofcgold.wur.nl/redd/training-materials
- www.gfoi.org
- www.gfoi.org/rd

12.09.2017   Task 7 – Infrastructures for Global Implementations

Issues & Discussion	**11. *Eric Lindquist – Open Foris, SEPAL***
	• See presentation
	• was showing the SEPAL platform
	• presenting the Open Foris SAR toolkit
	• 3rd year, 5 people team
	• Can choose pixel per pixel and get the information
	• Also follow all processing steps
	• CS – are there any synergistic tools in your system
	• ELT – working on it, have a test system on the background
	• SBV – was it real time processing? – yes
	• CS – are the Sentinel data 10 m resolution – depending from the bands
	• CT – are there often for free of charge for education
	• ELT – need to pay for the server using, but not for the data
	•
	12. *Tuomas Häme – Forestry TEP*
	• See presentation
	• One-stop shop for forestry remote sensing services
	• Concept presented
	• http://forestry-tep.eo.esa.int
	• Development of project in 2015-207 + warranty period until March 2018
	• Talked about the 3 user scenarios and presented the services and toolboxes
	• Gave information about the platform handling and user support
	• Costs and sustainability: development paid from ESA, afterwards pay per use model
	• Active training program for introductory and advanced training

12.09.2017   **Task 8 – Regional GlobBiomass Implementations I**

Issues & Discussion	**13. _Pedro Rodriguez Veiga – GlobBiomass MEXICO Case Study_** • See presentation • Presentation of 2 study areas, Yucatan and Central Mexico • Talked about the bioms in Mexico • Showed an overview about the In-situ AGB data • Overview about the used data • Used Sentinel-1 annual composites • Used Landsat 7/8 data • ALOS PALSAR / ALOS-2 PALSAR 2 mosaics with striping effects (needed to correct) • Used the MaxEnt classifier for the AGB derivation • Showed the 3 maps from 2005/2007 / 2010 / 2015 including validation • Compared to pantropical maps from Avitabile 2016, Saatchi 2011 and Baccini 2012 • Issues: residual scan line corrector effects due to the use of Landsat 7 • Land cover product used to mask urban areas excludes • No forest mask used • Co-registration issues recently found in a couple of tiles from ALOS PALSAR mosaics in Yucatan • Problems with mangroves • Change mapping: different kind of challenges • Showed the change maps and showed some examples • Validation: used inventory data at state level, high resolution imagery and long term ground measurements • Outlook validation is still ongoing • PRV is looking to the uncertainty during the validation

14. *Maria Isabel Cruz Lopez - Use of biomass products in ecosystem monitoring and early warning systems in CONABIO-Mexico*

- See presentation
- CONABIO is a National Commission for Knowledge and Use of Biodiversity
- Mexican Mangrove Monitoring System
- Early Warning System for Forest Fire
- Land Cover Monitoring System
- Under development: wetlands, forests
- Used the maps to identify changing areas in the mangrove monitoring system – used the maps from UoL
- Showed different examples using the mapping products from UoL and compared
- Want to use time series for the identification of cloud forest
- Have an early warning system for forest fire
- Uses of the AGB mapping products:
- Challenges: evaluate 2015 map in order to identify the reason of difference
- Information about validation by areas or vegetation type
- Due to variability in pixel level a) is it recommendable aggregate them
- FMS – look into the JAXA global mangrove project
- HB – think about a specific way for AGB
- HB – need to see where are real errors and what are artefacts in the 2015 map

15. *Stéphane Mermoz GlobBiomass SOUTH AFRICA Case Study*

- See presentation
- presentation of the South Africa regional site
- different landscapes in the area
- methods described (multi-image filtering – Byes approach – error budget and biomass uncertainty mapping
- showed the used data, ALOS 1 and 2, in situ AGB plots and LiDAR-based AGB maps
- field trip 2015 in Krueger National Park
- presented the AGB mapping products from 2007, 2010, 2015
- used the LiDAR data 50/50% for calibration and validation
- Presented the validation for 2007, 2010,
- Think, that the 2010 mapping product is better than the product from 2007
- Change mapping showed and interpreted

Issues & Discussion	**16.** *Renauld Mathieu - Biomass Mapping Programme in southern Africa (CSIR)*
	• See presentation
	• Mapping woody cover / biomass in South Africa
	• Had 2 drastic vegetation changes:
	• Bush encroachments affects 10-20 M ha in SA, 5-6% tree cover increase per decade
	• Woody alien invasive affects add 10 M ha in SA & Lesotho
	• National Program project - national woody vegetation monitoring system for ecosystem and value-added services 2016-2019
	• Architecture of national woody vegetation mapping presented
	• Start from field plots + LiDAR data, woody cover & height metrics = Lidar biomass maps
	• Busy on collecting regional datasets for LiDAR
	• Methodology: using also water cloud model with C-band / Sentinel-1 data / SAR + Lidar data
	• Showed Random Forest vs Bayesian / MIPERS approach
	• Change Mapping: GlobBiomass product: in 2015 has striping effects;
	• MU – do you propagate the error from field data?
	• RME – not yet
	• MS – wondering from global perspective – how can we get feedback from this kind of information for the global product;
	• RME – don`t know how to do it but will try an assessment
	• CS – SA marvellous country to demonstrate stratification example
	• CS – one of the obvious task – to look for land cover stratification
	• CS – should discuss this evening – how our products are being used in future
	• TLT – we have to identify which is extrapolable
	• FMS – thanks for showing you work on the C-band data
	• FMS - Should look to the low biomass level up to 20 t per ha
	• RME – C-band has good potential
	• NAU – working in Tansania with Erik Nesset – could be also interesting
	• NAU – using allometries from LiDAR?
	• RME – used the product
	17. *Kristian Milenov - Strengthening Global Forest resilience and user oriented services – Proposal from the Bulgarian Agency of Sustainable Development and Euro Integration*
	• See presentation

12.09.2017   **Task 9 – Regional GlobBiomass Implementations I**

Issues & Discussion	*18.* *Agata Hoscilo - GlobBiomass POLAND Case Study / Krzysztof Sterenczak National Polish User Perspective and Activities*
	- See presentation - Presented the forest characteristic, reference data, GSV-AGB conversion - showed the AGB 2005 & 2010 mapping products - AGB 2015 – pre-processing, method, mosaicking, water and urban mask, - Talked about the reference data – 70% of plot data for training, 30% for validation - Showed the maps for 2005, 2010, 2015 2015 shift between ascending and descending - Accuracy Assessment: underestimation of higher biomass, overestimation of lower biomass - From user perspective – comparison with the stand level - Validation from stand level and compartment level - Results showed for independent validation AGB 2010 / also done for 2015 - Forest changes: Differences between products – pixel based changes - AGBest,min = AGBest-RMSE - AGBest,max= AGBest+RMSE - Presented the biomass changes 2005-2015 *19.* *Krzysztof Sterenczak National Polish Forest National Activities* - See presentation - REMBIOFOR project – Remote sensing based assessment of woody Biomass and carbon storage in Forests - Forest National Activities - CS – is the laser validation be operational part of Polish Monitoring - KST – yes, mostly - CS – how do you like the Polish results from GlobBiomass? - KST – management of forest is based on the stands - KST – would calculate from the database - KST – will use the map of state forest - KST – change detection looks really good

Conclusion

20. *Johan Fransson - GlobBiomass SWEDEN Case Study incl. User Perspective*

- See presentation
- Sweden, Krycklan, Remningstorp
- 48 million ha forest, 23,4 ha productive forest
- Presented the kNN method from optical data / Landsat / Sentinel-2
- Showed the optical datasets and the field data from Swedish NFI
- Has spoken about the BIOMASAR Approach from Gamma and showed the Water Cloud Model
- RMSE for Stem Volume Using kNN
- Presented the different products for 2005, 2010 and 2015
- Accuracy Assessment from 2005 vs. 2010
- PALSAR-2 map 2015 for the Remningstorp area
- Showed PALSAR-2 maps from 2010, 2015
- Sentinel-2 product for Remningstorp – 2016 / 1700 NFI plots used
- Change maps – NFI change 2015 – 2010 – 2005
- Underestimate high biomass / overestimate low biomass level
- Uncertainty maps are being completed
- Change maps are being completed
- User perspective:
- Presented different users
- Want to have the highest accuracy maps regardless of methodology and remote sensing data used
- Should be used on landscape perspective and not at a pixel level
- Would like to produce 3D maps
- TH: could you please count the Swedish Forest Area
- JF : it is the forest definition by FAO
- JKR: comment related to biomass change – how would you calibrate the biomass change
- JF: compare one map with one map – differences in biomass change
- JKR have two biomass – each with an error – by differencing you have the difference from 2 errors – would change the approach
- NC – did you like compare the different maps which you produced?
- JF – we do not have dramatic change

21. *Anna Berninger - GlobBiomass KALIMANTAN Case Study incl. User Perspective*

- See presentation
- Presented the area with the different forest ecosystems
- Three training sites across Borneo
- For 2015 showed the data basis (LiDAR, ALOS PALSAR mosaic, Sentinel-1, SRTM and reference AGB data
- Method: nested plots from forest types
- Estimation of biomass and carbon per ha by allometric models (Chave 2005)
- LiDAR height metrics for AGB estimation used
- Used two different models (power and linear model)
- SAR pre-processing showed and the processing and model development
- Have done the ration computation and the texture creation

- After linearization it was used for the linear regression model
- Showed the modification of AGB estimations
- Combined 2 different models to produce the final AGB map
- Presented the change over time
- Overestimation in lower biomass and underestimation in higher biomass
- Similar to former epochs
- Change approach and change products showed – change/no change layer and quantity of change layer

22. *Sandra Lohberger - User feedback Kalimantan*

- See presentation
- Estimated the Carbon emission for 2015
- User feedback from Helmut Dotzauer – relevant project is BIOCLIME and FORCLIME
- Implement sustainable forest management for the people
- Users need AGB per forest class
- AGB per height
- Information about forest condition
- Forest Reference Emission Level for province
- Rehabilitation monitoring
- Need detailed information on methodology, accuracy which is documented in the ATBD
- User feedback from Hendrik Segah
- Is working on Peatland and need forests are essential for human survival
- Need serious impact on health and livelihoods locally and regionally
- including source of information, data constraints, accuracy and gap
- Difficult to find its dataset determine baselines that are useful for indication deforestation and biomass development
- RM – asked about the change approach / overlap / probability for change
- CS – is this process being implemented now at your company and for the users
- SL – it is really like operationally

12.09.2017   Task 10 – Summary on Major Statements

Issues & Discussion	- CS – yearly updates is important - CS – local information is important - CS – local information should be handled by web-portals for free - CS – we need to supply our products - CS – web portals are being developed - CS – open is :stratification, bridge between land cover and biomass, up- and downscaling - CS – we need to think globally and act locally - FMS – have been presentations related infrastructure with interaction of national needs or more broader approach - FMS – platform to put local information on it - FMS – had some requirements – best accuracy and how it was derived is 2nd important - FMS – biomass estimation is more dedicated to forest classes - FMS – could be future work in the direction of using of classification in direction of fine tuning for users - FMS was again an amazing flow of information – very proud of this project

13.09.2017   Day 3 – COUNTRIES + VALIDATION

13.09.2017   Task 11 – Country Implementations including validation strategies

Issues & Discussion	**23. *Carsten Pathe – Live Demonstration of GlobBiomass WebGIS***
	• Presented live the functionality of the WebGIS
	• No discussion
	24. *Richard Lucas - Australian Biomass Mapping Activities*
	• See presentation
	• Showed an overview about the refining of Biomass Estimates for Australia
	• Presented the TERN Library
	• Is working with LiDAR profiles and combines it with Radar data, e.g. ALOS Palsar
	• Showed an estimation example about Mangroves
	• Presented CubeSat and other high resolution estimation of Mangroves
	• No discussion
	• Showed the biomass mapping product and has spoken about the deforestation.
	25. *Jean Ometto - Results of the Lidar Campaign over Amazon, Brazil*
	• See presentation
	• Is showing different biomass maps
	• Has spoken about the field work, the team behind and the validation.
	• Presented the field data from partners and the LiDAR data campaign
	• Showed the validation routines
	26. *Phil Wilkes - LiDAR in situ measurements in support to biomass validation*
	• See presentation
	• Presented 3D measurements of forest structures from LiDAR
	• Required a standard protocol
	• Data are usable for different applications
	• Collected 30+ ha in 10+ countries
	• SQ – what do you do with different species in one ha
	• PW do a generic estimation of tropical forest

27. *Marcela Olguin - National Mexican User Perspective and Activities Enhancing forest carbon monitoring and GHG emissions projection using a systems approach: lessons learned from Mexico*

- See presentation
- Project is finished
- From 2011 to improve modelling tools / methods for monitoring Green House Gas emissions, while being able to assess, project and communicate the effect, that policy decisions have in future
- Showed different activity options / maximise carbon stocks or maximise Carbon uptake
- Presented the case for Mexico: historic 2000 – 2016 / future – until 2050
- Results: importance to reduce deforestation
- County`s mitigation targets should acknowledge state characteristics and components
- Presented the results and the collaborators

28. *Svein Solberg - Mapping and quantification of the residual land sink and other forest fluxes of the global carbon budget based on InSAR data from Uganda, Tanzania and Colombia Nancy Harris – High resolution global forest carbon monitoring for the 21st century*

- See presentation
- Has spoken about the Global Carbon Budget, status 2015
- Showed a case study from Uganda using the height differences from Tandem-X and SRTM C-Band
- presented the ANOVA model
- used land cover and forest cover types for Uganda
- has done a lot of field inventory for Uganda
- modelled INSAR height from Tandem-X world DEM
- calculated INSAR changes versus Landsat changes from 2000-2012
- showed the Tanzania case study and the Columbia case study in detail
- discussed the height change versus cover change
- TLT – what kind of resolution did you used
- SSB – 30x30 m resolution
- SSB – used the average of all pixels for height change
- JKR – height in relationship of tree density and volume would be interesting

29. *Valerio Avitabile - Assessing forest biomass maps in Europe using harmonized national statistics and inventory plots*

- See presentation
- Context presentation: JRC biomass study
- Long term mandate to assess for stock volume, products and modelling of Biomass
- Collaboration with 26 countries to develop comparable forest biomass data using: harmonized definition and common estimation
- Presented the harmonized definition about biomass
- Statistics based on around 500.000 plots (1kmx1km) and a total stock of 4% from national states (14 states)
- Presented different biomass maps for Europe: Thurner, Barredo, Galaun, Kindermann
- Used different forest mask and spatial data
- Discussed maps vs. plots
- Used NFI data and produced plots for 26 countries (1kmx1km)
- Overestimation at low biomass / underestimation at high biomass
- Is looking forward for the GlobBiomass map for Europe
- future: better integration of NFI data with biomass maps
- Spatially: higher resolution
- Thematic: consist forest and biomass definition
- JKR – what`s the right scale?
- VA -1 ha scale very good, also for modelling
- VA – maps can use also for other applications, e.g. management and research

13.09.2017   Task 13 – Country Implementations including validation strategies

Issues & Discussion	**30. *Christiane Schmullius – Activities from University of Jena regarding AGB derivation / Forest biomass validation in Roda area, KNP***
	• Presentation of research activities at University of Jena
	• TLS system
	• ARS Africae
	• Founding of the new DLR institute for data science in Jena
	• Looking for in situ data at the citizen science department
	31. *Sergey Bartalev - An overview of forest mapping and monitoring in Russia using Earth observation – R&D overview*
	• See presentation
	• Need a unified country wide database
	• For Russia the work on remote sensing is very important
	• VEGA platform presented
	• Showed different examples for EO data
	• Used EO data from Winter
	• Produced a land cover map about Russia from MODIS (250m resolution)
	32. *Edward Mitchard - Calibrating, validating and encouraging the use of maps of above-ground biomass and biomass change across tropical forests and savannas: SEOSAW & FORESTS 2020*
	• See presentation
	33. *Heiko Balzter - Earth Observation of forests to support the UN sustainable development goals*
	• See presentation
	• Case study in Kenia with Sentinel-2 data presented with Forest Cover Change Detection
	• Presented the international partnership "Forest 2020" / EASOS /
	• Derivation of forest canopy from LiDAR in California
	• Project about crown structure of diseased trees
	• Rapid detection of deforestation can form an important element in National REDD+ Strategies;
	34. *Anatoly Shvidenko - SPECIAL TALK - Forest life biomass assessment: Glance of a forester and modeler*
	• See presentation
	• Will present was has been done with IIASA with validation
	• Important: what is the source of information?
	• SFM means adaptive Sustainable Forest Management
	• New information background required,
	• Presented classification system of ecosystem functions and the impacts on Russian forest on climate change
	• Has spoken about the consistency of terminology, definitions and classifications

13.09.2017   Task 14 – GlobBiomass Validation Session

Issues & Discussion	*GlobBiomass Validation Session*
	### 35. *Danae Rozendaal - GlobBiomass Validation*
	• See presentation
	• 1. Status of ground database
	• Have done rigorous data quality checks
	• Collaborated with data owners to agree with users
	• 50% of data for calibration / validation
	• New data: 5 provinces in Canada
	• Included also GLAS biomass estimates
	• Presented the assessing effects of spatial scale
	• Will do aggregation to reduce variation – effects from small plot sizes
	• Follow plan A and plan B
	• 2. Preliminary validation of global map
	• Based of 50% of datasets that was used for calibration
	• Next steps: ongoing data acquisition and cleaning
	• Validation based on 0.1 degree averages, based on map pixels associated with plots
	• Last steps: Validation of new version of global map and validation report
	• DR – could work with bigger sets of plots to avoid variations in pixel size and average
	• DR - could present per country
	• PRV – how do you decide between 2 plots –
	• DR – decide after map location
	• MS – have an average about 100x100pixels
	• HB - for the regions have validated after biomass ranges and would do that also in case of the global map
	### 36. *Dmitry Schepaschenko - GlobBiomass Validation in Russia, ESA's Forest Observation System and IIASA's Biomass Geo-Wiki*
	• See presentation
	• Showed the Russian Forest Management Units
	• IIASA validation network in Northern Eurasia
	• Partners in Russia can do validation, but not share data
	• Contribution to GlobBiomass
	• Geo-Wiki.org –tool for dissemination, comparison, forest mask
	• Inventory data for Russia and Ukraine ready for validation
	• NC: what kind of biomass conversion and expansion factors do you use?
	• DSO: BCEF= AGB/GSV http://geo-wiki.org

Conclusion

37. *Martin Herold - Lessons learned*

- See presentation
- …making use of plot data
- Many forest plot data have limited suitability for comparison with biomasss map data
- Quality criteria implemented reduced plot data
- 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
- Current approach is using aggregate data (e.g. LiDAR)
- Towards full characterization of uncertainties in plot data: (measurement errors, use of tree level data, geolocation / which regions and forest types are under sampled
- Restricted access to plot data
- GlobBiomass initially underestimated the need for calibration reference data:
- Calibration and validation serves different purposes
- Take UNFCCC requirements as example
- Re-using available plot data is limited
- Use the partnership with users
- New opportunities: TLS, LiDAR-drones
- Presented terrestrial laser scanning campaigns (WU)
- Showed an example with Guyana Forestry Commission
- www.wageningenur.nl/lidar
- www.wur.eu/grsbiomass
- www.wur.eu/uarsf
- JKR – how can we collaborate with NFI?
- MH – ground data collection should be improved
- CS – Finland is already implemented in TLS survey, Germany too – need to work closer with those people
- NAAI – what comes after GlobBiomass? - Need to implement a project in same kind – datasets should integrate afterwards
- JKR – better inventory helps

13.09.2017   **Task 15 – Discussion on Summary and Recommendations**

Issues & Discussion	*38. Summary on Validation Strategies*
	• PRV - plots for Mexico covering only plots within forest and not for forest / non-forest areas - see most of the plots with zero biomass in Mexico and Spain • DR – all the plots are in forest • FMS –ESA cannot finance a validation network, only stimulate the activities, give a benefit to work together • OAO – Sentinel-data are free for use and the people should work with the data and bring out new data, also for validation, people should share the information; • CS – CCI biomass ITT available to everybody and in situ networks; • CS - CCI biomass should build on the heritage of GlobBiomass • CS ongoing missions could also be interested • CS … networks should be established, needs to coordinate the structure between the communities • CS ned in GOFC Gold as a wonderful platform to stream the information • CD need for a web portal which brings the network together – a tool to exchange the information and uses the minimum costs on an efficient way; • MON: same for Mexico – need to know, also from the feedback from users • JKR – timber industries are complete out of the discussion until now - need to interact with them! • JKR – able to help with inventory data • FMS – 4 years ago at the 1st consultation meeting he told about the same point • FMS – also CS gave offer from SA company to use the data from a company • CS – various from country to country • CS – contact to FSC could be interesting (Marion Karman) • CS – need internationally look, who is doing what? • MH – maybe the GEDI starts to do that • FMS – Biomass, GEDI and GDI missions are upcoming • Recommendations for measurement and product synergies, • Suggestions for international, trans-agency concerted actions.

13.09.2017   **Task 6 – Closing Remarks**

Issues & Discussion	- JKR – great GlobBiomass project - JKR - Biggest challenge – reach the axis to the plot data, use the forest inventory data on an efficient way; - JKR – what are of the end of the day the use cases for all of the biomass products? - JKR - key use case is very important - JKR – need to evaluate how far we come using EO data - JKR - using time series would be the future - JKR – great meeting and project - JKR – with NISAR and GDI next push will come - FMS – thank you to FAO - FMS – thank you for the users and the project team - FMS – almost very intense effort to get the best within the GlobBiomass team - FMS – maps will be made available at the end of the project – need to decide how we are post it - FMS – with Glob-Series we have done the prototypes for CCI - FMS – have done an handshake to the CCI biomass - FMS - looking forward to see people from the consortium and bring the spirit in the new project - FMS – NGO`s will use the biomass products for better protection of the environment

Eveln Malejka

(GlobBiomass Project Management)