SynCER: Synthesising post-disturbance carbon emissions and removals across Brazil's Forest Biomes

29th to 31st October 2025

Background: The Brazilian National Greenhouse Gas Inventory (NGHGI) has had a long-standing, thorough inclusion of carbon gains in secondary forest across its diverse biomes. Over the last few years, there has been a surge in research quantifying carbon losses and gains following different types of disturbance, from large-scale deforestation to degradation processes, causing partial forest losses, such as through fire, selective logging, fragmentation, edge effects, and natural processes including drought and windthrow. Much of this research has been focused in the Amazon, Brazilian Biomes such as the Atlantic Forest, and increasingly pan-tropically through the careful integration of remote sensing estimates. The increased availability of remote sensing data has spanned from local-scale terrestrial/aerial data to regional estimates from satellite based data such as LiDAR, Radar data, integrated with long-term optical data. Additionally, there has been a movement towards integrating these remote sensing data with long-standing, single National Forest Inventories and other permanent field plots with repeated measurements to provide details on post-disturbance carbon dynamics at higher spatial resolution. Such estimates are crucial to improve the complete representation of the carbon budget, and the integration of these processes in national reporting such as NGHGIs and Forest Resources Emission Levels (FRELs), as well as influencing potential local and regional protection and restoration efforts.

With the emergence of new estimates of carbon losses and gains following disturbance, comes the need to understand how these estimates compare across various data sources, regions, and forest types to highlight how and for what practice methods and associated estimates can be best applied.

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Workshop Objectives:

1. **Strengthen partnerships** between research scientists and applications community to enhance future collaborations for outstanding, novel and diverse research integrated into application-based science concerning forest degradation and regrowth.
2. **Explore** the **development and remaining knowledge/information gaps** in the research on post-disturbance forest dynamics.
3. **Follow up studies/papers** exploring the the points found in (2), such as synthesizing the best available estimates of carbon losses and gains following disturbance/regrowth across Brazil's biomes.

Location & Date: INPE (São José dos Campos) with some online participants; Wednesday 29th to 31st October 2025

Contact: Dr Viola Heinrich (GFZ) (viola.heinrich@gfz.de), Luiz Aragao (INPE) (luiz.aragao@inpe.br

Key words and abbreviations: SynCER (SYNthesising post-disturbance Carbon Emissions and Removals across Brazil's Forest Biomes); C (carbon); RS (remote sensing); EO (earth observation); TFFF (Tropical Forests Forever Facility); NGHGI (National Greenhouse Gas Inventory)

Summary of the Workshop:

Overall, the workshop brought together 56 in-person participants, from 14 international and 14 Brazilian institutes, bridging the gap between researchers and applications scientists and policy experts. A range of advances were discussed, such as the national and global satellite-based products available for monitoring secondary forest. Field data scientists discussed the unique position of their work to explore important biodiversity and species composition developments and secondary forest recovery. Policy and inventory experts such as from the Food and Agricultural Organisation (FAO), the Global Forest Observations Initiative's (GFOI) Research & Development Component, and Brazil's Ministries and associated partners provided their insights to scientists to help advance how results from research on secondary forest carbon accumulation can be better integrated into national and jurisdictional carbon credit reporting and National Greenhouse Gas Inventories.
Overall, the workshop highlighted four potential avenues for further exploration and addressing Objective 3:

- Discrepancies in secondary forest and age datasets in Brazil
- Comparing AGB regrowth rates from multiple data sources across Brazil's biomes
- Assessing the permanence of current regrowth rates due to temporal and spatial patterns of climate change and ongoing disturbances.
- ESA BIOMASS data with reference data to show feasibility in Brazil & beyond for assessing disturbance and regrowth.

Day 1

Mapping Secondary Forest - where are they regrowing according to what dataset? (Session 1.2)

Numerous existing and upcoming remote sensing-based datasets mapping secondary forest were discussed: (i) TerraClass, (ii) MapBiomas, (iii) Joint Research Council's (JRF) Tropical Moist Forest dataset, (iv) as well as a new product in development from Ctrees. The JRC and GFZ introduced first results from a **validation and reference dataset effort**, showing overall high accuracies in forest maps, but with persistent challenges in distinguishing degraded and regenerating areas, resulting in low accuracies for these categories. Using multiple sensors would help with the interpretations. When the above datasets are compared at pixel scale, there are **considerable discrepancies** amongst the datasets at pixel scale, especially for young forests (< 10 years).

Key discussions in this session involved the differences between the datasets, especially in their extent and age detection, and crucially potential **differences in the definitions**. It was highlighted that often the definition of forest age is based on when vegetation reaches the structure of natural forest, which can occur years after regrowth begins. There was strong support for efforts to bring clarity in understanding differences between the datasets, outlining the definitions, senors, and approaches used and to move towards **explaining and harmonising the observed differences**.

Linking Field, Airborne Lidar Scanning (ALS) and satellite data of secondary forest (Session 1.3)

The session focused on advances in **carbon stock estimation, fire impacts, and forest recovery in Brazil's tropical and Atlantic forests**. Researchers presented new **methods to reduce uncertainty in carbon calculations**, including **LiDAR-based models** and **specific equations for restoration areas**, which yield higher accuracy. Studies on **fire impacts in the Amazon** showed that even low-intensity fires can cause long-term biomass loss with limited recovery, highlighting the role of **remote sensing** in monitoring these effects. Analyses of **secondary forest recovery** revealed that **landscape connectivity, age, and climate** strongly influence regeneration, while fragmentation and land use slow it down. In the Atlantic Forest, **connected forests** were found to sequester up to **three times more carbon** than isolated ones. The session concluded with the introduction of **deep learning approaches** for mapping **canopy height** to improve estimates of **biomass and carbon stocks** over time.

Keynote speeches (Session 1.4):

Thelma Krug (INPE): Dr Krug began with a brief overview of why she believes that although COP30 will be hosted *in* a forest, it should not be considered a 'forest COP'. Why? Because **deforestation and agriculture** "only"contribute **~20% of global CO_2 emissions**; the majority still comes from the **energy and industrial sectors**. Forests and agriculture are among the **most climate-vulnerable systems**, facing risks such as fires and extreme weather that are difficult to control in large tropical countries. Forests are therefore not decoupled from the largest greenhouse gas emissions from fossil fuels. Discussions focused on **climate finance mechanisms** and carbon accounting challenges. Participants examined the **Tropical Forests Fund (TFFF)**—a new investment mechanism supported by Brazil and several other tropical and developed countries—to **finance the protection of standing forests**. The session also discussed the **complexities of carbon accounting**, including how **forest conservation is not always classified as mitigation** unless it demonstrably prevents deforestation. Concerns were raised about **temporary carbon credits** and the issue of **non-permanence** in CO_2 removal, as well as the need for continuous monitoring to ensure credibility in carbon markets.

Frank Martin Seifert (ESA): Dr Seifert introduced the **European Space Agency's Biomass Mission**, launched in April 2025. This is the **first civilian satellite with P-band radar**, capable of penetrating forest canopies to measure **biomass and forest structure** with high precision. The mission will cover tropical regions and parts of Siberia, providing detailed information on forested and non-forested areas. It will also collect data on **ice morphology, desert topography, and oceanic and ionospheric conditions**. While annual biomass change detection will remain challenging, the mission is expected to **significantly reduce uncertainties** in global carbon sink estimates and support more informed climate policy and monitoring efforts. Quantifying emissions from degradation and potential recovery in carbon in secondary forest will be particularly interesting, with great potential for unique research avenues.

Key Points from breakout group discussions:

Topic	Group 1	Group 2	Group 3
Main Focus	Conceptual definitions, forest types, reference data needs	Improving detection and characterization of secondary forests	Classification accuracy, methodological consistency, and practical mapping solutions
Core Problem Identified	Lack of consensus on what defines "secondary forest" and inconsistencies in forest age data	Mapping products fail to capture the diversity and structure of secondary forests, especially younger stages	Optical data limitations and confusion between degraded and secondary forests
Recommend-ations	• Harmonize definitions of "secondary" vs. "vegetation"• Separate forest types (terra firme, deciduous, flooded)• Focus analyses on areas where datasets converge• Tailor reference data to application (carbon, area, policy)	• Investigate discrepancies among mapping products• Use multi-sensor data (LiDAR, radar, hyperspectral)• Align field methods (plot size, measurement techniques) with remote sensing	• Incorporate detection "lag" (1–5 years) into mapping methods• Use PRODES mask to constrain secondary forest mapping• Stratify across multiple datasets (MapBiomas, TerraClass, BiomasBR)
Data and Methods	Advocate for stratified reference datasets to serve different goals (e.g. carbon estimates, policy use)	Stress integration of remote sensing with consistent field validation; need for long-term monitoring	Recommend fixed annual mapping date and a national protocol for comparing datasets

Challenges Highlighted	Multiple definitions and data inconsistencies hinder comparability	Young secondary forests poorly detected; limited field calibration	Seasonal variation, repeated degradation events, and need for temporal consistency
Proposed Outcomes	Framework for harmonizing concepts and reference data collection	Improved understanding of product convergence and ecological variability	Creation of a **national mapping protocol** ensuring temporal and methodological consistency

<u>Emerging themes:</u>

- **Common definitions** and conceptual alignment on what constitutes secondary forest, its age, and regrowth thresholds.
- **Integration of multiple data sources** (optical, radar, LiDAR, hyperspectral) to overcome sensor limitations and improve detection accuracy.
- **Temporal consistency** in mapping and monitoring methods, accounting for detection lag and ensuring comparability over time.
- **Use of stratified reference data** tailored to different applications (e.g., carbon estimates, area monitoring, policy).
- **Development of a protocol** to strengthen comparability, considering end user needs and which user community the dataset satisfies.

Day 2 - Quantifying Secondary forest regrowth rates: A synthesis

Biomass datasets and missions (Session 2.1)

Numerous existing and upcoming remote sensing-based datasets quantifying Aboveground Biomass (AGB) were discussed. The progression of AGB maps for the Amazon through time and integrating different data strands, including LiDAR air-borne data was introduced, as well as the importance of estimating the a**ssociated uncertainty by including different levels of data resolution**. National maps produced by INPE have great value for **reporting** (NGHGI and FREL). While the Amazon is generally mapped in terms of AGB, **Cerrado biome has less standardised data**. By integrating numerous sensors e.g. ALOS PALSAR and airborne lidar, we can move towards accurate AGB maps for this biome too, which is being expanded across other countries too e.g. Colombian Amazon. New advances on how to assess temporal changes in global AGB maps were introduced, including an early comparison of looking at **linear trends from ESA-CCI biomass data** to quantify the rates of AGB gain/loss in secondary forests, and how this compared to previous studies. Limitations and things to consider include: assessing uncertainties of change at the pixel level, which can be avoided by aggregating the data both spatially and temporally.

Early comparison of ESA's BIOMASS data (L1 data) with in-situ data in Brazil shows **promising results and that the P-band signal** increases with forest age, avoiding early saturation. Early results from the **NISAR mission** (launched in 2025 too) were also introduced, highlighting its potential to **distinguish different forest types** and associated biomass, with efforts underway to harmonise NISAR, GEDI and data from ESA. New pan-Amazonian annual AGB maps (2019-2022), integrating optical and LiDAR in a convolutional neural network (U-net), and using annual training data will be available soon.

Discussions moved to specific mapping of AGB in secondary and degraded forests, in which reference datasets are currently lacking. As such global AGB maps often do not capture the **wood density shifts** associated with early succession, and can thus lead to a biomass overestimation. Calls for better stratified sampling in young, disturbed, burnt and selectively logged forest. A new machine learning method for **mapping cecropia - pioneer species** - was introduced using World-View-3 data, with the aim to incorporate species composition and successional dynamics directly into AGB models.

Metrics for identifying secondary forest success (Session 2.2)*

**(summary does not follow chronological order of session on the day due to the technical issues we faced that day)*

Discussions moved towards quantifying regeneration success, beginning with methods for estimating **AGB accumulation,** using disturbance history and integrating this with a static AGB map. Results were shown for a new **1-degree model** of pan-tropical regrowth rates. A detailed study for **Para state**, showed that **fire (recurrence) in secondary forest significantly reduced regrowth rates**, with different regions of the state affected differently.

Across Brazil, there are numerous data sources available for mapping secondary vegetation, which are crucial for key policies such as the National Vegetation Recovery Plan (**Planaveg**: recover 12 million hectares of native vegetation by 2030), and the commitments from the UN's 15th Biodiversity Conference (COP15) to **restore at least 15% of degraded areas** of terrestrial, inland, coastal and marine ecosystems. **Key metrics include**: area, core area, vegetation age, fractal dimension index, distance to nearest neighbouring vegetation as well as land tenure. About 30-40% of the total secondary vegetation in Brazil is between 5-20 years old (young).

Understanding secondary success **beyond the biogeochemical processes** is crucial. **Biophysical processes**, such as heat, water and wind fluxes are vital to understanding secondary forest climate regulation impacts. Different land covers have different biophysical fluxes (moisture, latent and sensible heat), which are crucial to understand how secondary forests regulate local climate, in comparison to primary forests. Compared to primary forest, the **average annual accumulated precipitation is generally lower in secondary forest**. In older secondary forest, precipitation patterns begin to mirror primary forest ones.

Finally, presentations moved towards showing the importance of field data, and understanding environmental conditions and anthropogenic factors across space in secondary forest. For example, are wetter regions in the Amazon more strongly affected by anthropogenic impacts than drier ones, because species did not evolve with fire? Understanding the interaction between climatic and land-use gradients is crucial. While regrowth rates may be fast, wood density in early successional stages is likely low. Overall, vegetation structure recovery (basal area, height and ultimately AGB) also depends on the duration of land use prior to regrowth.

There are many metrics to monitoring regeneration success and ecological integrity. By integrating SF plots across the Amazon, it is possible to look beyond AGB and towards other metrics such as stem density, basal area, species composition, richness and diversity. This data can be used to set reference values for regeneration success to guide restoration outcomes and support effective implementation. Highly degraded primary forests still store more AGB than secondary forest, the size of remaining trees is crucial to regeneration success, with drought reducing growth. Biodiversity, including birds and dung beetles grows alongside carbon as forests recover.

Key Points from breakout group discussion:

The afternoon saw the whole group discussing potential, tangible outputs from this workshop:

- Discrepancies in secondary forest and age datasets in Brazil
- Comparing AGB regrowth rates from multiple data sources across Brazil's biomes
- Assessing the permanence of current regrowth rates due to temporal and spatial patterns of climate change and ongoing disturbances.
- ESA BIOMASS data with reference data to show feasibility in Brazil & beyond for assessing disturbance and regrowth.

To guide the production of secondary-forest data in Brazil, it is essential to clarify the main objectives and uses of these datasets—such as public policies, national inventories, and reporting. Producing useful datasets requires consistent definitions of forest and secondary forest, harmonized across biomes, sensors, and mapping products (TMF, TerraClass, MapBiomas). An independent reference dataset is needed to support comparisons and ensure alignment in area estimates, disturbance detection, and age classification.

Secondary forests must be considered **beyond carbon**, incorporating additional indicators such as ecosystem services. For carbon accounting, regrowth rates must be accurate, comparable, and stable across space and time that go beyond "Tier 1". These rates should reflect biome-specific conditions, differences in measurement methods, disturbance histories, and landscape context. Climate factors such as water deficit and temperature—both expected to intensify—strongly influence growth dynamics and must be included in analyses. Disturbance type, recurrence, species composition changes, and shifts in wood density further complicate biomass trajectories.

There are recognized discrepancies between field data, chronosequences, and remote sensing estimates. Chronosequences show slower recovery, while remote sensing may overestimate biomass in areas where species turnover leads to lower wood density. These mismatches must be understood and explicitly considered depending on the intended application, and consider biomes beyond the Amazon. Other biomes have their own challenges and data needs.

To support inventories, TFFF, and REDD+, data must follow established rules (e.g., inclusion of below-ground biomass), and sampling designs must be adequate for each biome. Integrating Earth observation and field data is essential, especially where field measurements are limited. Multi-scale assessments are required to address different policy and scientific questions.

Short-term priorities (3–5 years) include practical, feasible steps: comparing major datasets, developing biome-specific regrowth rates, identifying main sources of uncertainty, and prioritizing where additional field data or targeted studies are needed. Scenario analyses using climate projections and fragmentation trends can help assess future risks and identify low-risk landscapes for carbon storage. Process-based demographic models can support these assessments, though they involve higher uncertainty.

Day 3 - Towards integrating synthesized regrowth rates and methods into policy (GFOI-led)

Accounting for carbon removal/fluxes in secondary forests for MRV process: Advances, needs and challenges (Session 3.1)

On the final day, the focus shifted towards the policy perspective, beginning with an overview of how forest degradation and regrowth is included across tropical countries. Overall, C removals are the least reported REDD+ carbon flux, with **about 62%, 40% of countries reporting removals from afforestation/reforestation and standing forest, respectively.** But this is rapidly changing. Generally, estimates from REDD+ and NGHGI are aligning but with some differences at country level. Removals across Standards are considered differently and also across country applications. New technologies, such as improved imagery and EO-derived products as well as improved methodologies can help, e.g. integrating NFI to create forest types maps. Overall, it is crucial to consider **what countries need/want** in relation to Science/research needs.

Presentations moved to focusing on Brazil, introducing Monitoring Reporting and Verification (MRV) - a set of technical processes aimed at ensuring transparency, consistency and credibility of NGHGI. There have been numerous **scientific advancements that could increase the level of detail** (e.g. IPCC 'Tiers), advancements of knowledge and reduce the level of uncertainty for the MRV/reporting system in Brazil and beyond. These studies have the potential to be included into an integrated MRV system for Brazil, integrating NGHGI, the national FREL and national and sub-national jurisdictional REDD+ programmes. This set the stage for broader discussions about the **challenges of incorporating emerging data**—particularly the need for more diverse and region-specific regrowth and removal rates. Participants emphasized that national inventories require consistent methods, clear definitions, and robust reference data to make use of Earth observation or modeling-derived growth rates, especially since current emission factors are too generalized.

The temporal advances of Brazilian NGHGI reporting to the UNFCCC was introduced, as well as future submissions, such as the 5th National COmmunication in 2026. The presentation gave an overview of what is reported across different biomes, and potential **improvements including a review of the activity data and carbon stocks and removal factors** used. Key challenges remain monitoring regrowth and degradation and ensuring temporal consistency and applying a suitable emission/removal factor to consider age, vegetation type and climate regime. At Jurisdictional REDD+ scale, which are included in the FREL submissions, discussions focused on the drivers of degradation and how these are included, which varies slightly from the NGHGI. Finally, a project-level example of REDD+ was given, highlighting the ways in which disturbance is monitored and how **project-specific regrowth rates are derived and needed** given the unique situation of the respective afforestation/revegetation sites. At J-REDD+ levels several additional challenges were raised, including the annual mapping of secondary forest, and an appropriate accuracy assessment of these data.

Key Points from breakout group discussions:

The three discussion groups converged on the need to align datasets for secondary forests and carbon accounting with clearly defined user needs in Brazil. These users range from NGHGI and policy makers to civil society, restoration initiatives, and regional or project-level actors. A recurring message was that data systems must be designed as part of an ongoing process—**transparent, consistent, and fit for purpose**—rather than as isolated scientific products. **Bringing clarity across core datasets** (such as forest area, age, and definitions) is essential to ensure that results from different analyses are comparable and usable, particularly for national reporting and MRV systems.

All groups highlighted major conceptual and methodological **challenges around defining secondary forests**, vegetation stages, degradation, and regrowth. Definitions vary across datasets and biomes, including how forest age is assigned, how early regeneration stages are treated, and how repeated disturbances affect carbon dynamics before forests reach arboreal structure. These issues are compounded by **biome-specific dynamics**: fire may be a natural or management-related process in some regions but a major degradation driver in others; the same vegetation type can have very different biomass values across biomes; and recovery pathways differ depending on prior land use, climate, soils, and disturbance history.

There was strong agreement that **current static emission and removal factors are insufficient.** Groups emphasized the need to move toward growth curves and dynamic regrowth factors that better reflect forest recovery over time, potentially enabling Tier 2 or higher reporting. This requires integrating multiple data sources, particularly combining remote sensing time series with NFI and field data. Remote sensing can help stratify landscapes, identify trends, and scale field-based information. In the short term, using **existing curves and rates was seen as pragmatic**, while planning methodological improvements for future NGHGi cycles. Crucially, there should be a move towards better harmonise approaches from NGHGI, FRELs and other reporting.

Completeness of information, even when uncertainty is high, was considered more important than excluding processes such as degradation, fire, or delayed emissions. Groups noted the current **difficulty of accounting for degradation in forests**, especially outside the Amazon. Better treatment of transitional areas, repeated disturbances, and fire impacts, both immediate and delayed, was identified as a priority. Participants also stressed the importance of identifying **where uncertainties are largest,** so that future field campaigns and research investments can be better targeted.

Finally, participants emphasized the need to **look beyond carbon alone**. Secondary forests provide multiple ecosystem services, influence biodiversity, and interact with climate extremes such as droughts and floods, which are expected to intensify. Long-term thinking about **"forests of the future"** is needed, including how species composition, wood density, fragmentation, and climate change will shape carbon stocks and fluxes. To support this, groups suggested **improved communication across sectors**, more accessible documentation, stronger regional collaboration within Latin America, and the development of informal but sustained technical networks **to bridge science, policy, and implementation**.

Participant List

	Name	Organisation	In-person/Online
1	Alexandre Avelino	MMA	In-person
2	Aline Daniele Jacon	UFSCar	In-person
3	Aline Pontes Lopes	re.green	In-person
4	Ana Talita Galvão Freire	UFMA	In-person
5	Andre Giles	UFSC	In-person
6	Angélica Faria de Resende	USP	In-person
7	Barbara Costa	MapBiomas/IPAM	In-person
8	Bruna Henrique Sacramento	INPE	In-person
9	Carla Ramirez	FAO	In-person
10	Catarina Jakovac	UFSC	In-person
11	Celso Silva Junior	UFMA/IPAM	In-person
12	Daniela Requena Suarez	GFZ	In-person
13	Débora Giancola Tomiatti	INPE	In-person
14	Erison C. S. Monteiro	INPE	In-person
15	Fabricio Pires Chagas	UFMA	In-person
16	Frank Martin Seifert	ESA	online
17	Graciela Tejada	Geonoma	In-person
18	Hannah Graham	GFZ	In-person
19	Henrique Luis Godinho Cassol	Geonoma	In-person
20	Igor Santiago Broggio	Vale Institute of Technology	online
21	Iris Roitman	PNUD	In-person
22	Isabela Noronha	Geonoma	In-person
23	Isadora Haddad	INPE	In-person
24	Jean Ometto	INOE	In-person
25	Juliana Leroy Davis	PUND	In-person
26	Liana Anderson	INPE	In-person
27	Luan Moldan Motta	MMA	In-person
28	Luiz Aragão	INPE	In-person
29	Martin Herold	GFZ	In-person
30	Matheus Pinheiro Ferreira	ESALQ/USP	In-person
31	Mikhail Urbazaev	GFZ	In-person
32	Pedro Brancalion	USP	Online
33	Polyanna Bispo	University of Manchester	In-person
34	Ricardo Dalagnol	Ctrees	In-person
35	Rita Von Randow	INPE	In-person
36	Roberta Cantinho	MMA	In-person
37	Rodrigo Lacerda Brito Neto	INPE	In-person
38	Rodrigo Oliveira do Nascimento	UFRA	In-person
39	Scott Barningham	University of Exeter	In-person

40	Silvana Amaral Kampel	INPE	In-person
41	Thais Rosan	University of Exeter	In-person
42	Thelma Krug	INPE	In-person
43	Vinicius Peripato	INPE	In-person
44	Viola Heinrich	GFZ	In-person
45	Yhasmin Mendes	FAO	In-person
46	Savanah Freitas	INPE	In-person
47	Marcos Longo	INPE	In-person
48	Renata Francoso	Serviço Florestal Brasileiro	In-person
49	Gilney Bezerra	Gamma	In-person
50	Clement Bourgoin	JRC	online
51	Danielle Celentano	ISA	online
52	Gabrielle Pires	Universidade Federal de Viçosa	online
53	Joao Carrieras	JRC	online
54	Lais Rosa Oliveira	Universidade Federal de Viçosa	online
55	Maurizio Santoro	Gamma	online
56	Rene Beuchle	JRC	online
57	Sassan Saatchi	Ctrees	online
58	Simon Besnard	GFZ	online
59	Susan Cook-Patton	TNC	online
60	Flavia de Souza Mendes	Planet	online
61	Yidi Xu	LSCE	online

Summary Agenda

Time	Topic	Moderator (Speakers)
	Day 1	
9-9.30	Session 1.1: Welcome and Objectives	Luiz Aragao (Lúbia Vinhas & Frank Martin Seifert, Viola Heinrich)
9.30 - 10.45	Session 1.2: Mapping Secondary Forest - where are they regrowing according to what dataset	Viola Heinrich (Silvana Amarall, Bárbara Costa, Joao Carrieras & Clement Bourgoin, Hannah Graham, Ricardo Dalagnol)
11.15 - 12.30	Session 1.3: Linking Field, ALS + satellite data of secondary forest	Mikhail Urbazaev (Pedro Brancalion, Aline Pontes-Lopes, Aline Jacon, Thais Rosa,Matheus Ferreira)
14.00 - 15.30	Session 1.4: Keynote addresses	Viola Heinrich (Thelam Krug & Frank Martin Seifert)

15.30 - 17.00	Workshop breakout groups	Luiz Aragao, Thais Rosan & Martin Herold
Day 2		
9.00 10.30	Session 2.1: (1) Biomass datasets + missions; (2) Estimates of carbon accumulation from various approaches	Daniela Requena Suarez (Jean Ometto, Pollyanna Bispo, Mikhail Urbazaev)
10.40 - 13.00	Session 2.1: (1) Biomass datasets + missions; (2) Estimates of carbon accumulation from various approaches + Session 2.2 Other metrics for identifying secondary forest success	Hannah Graham (Maurizio Santoro, Yidi Xu*, Scott Baringham, Isadora Haddad, Débora Tomiatti, Gabrielle Pires & Lais Oliveira, Sassan Saatchi) * Due to technical difficulties this talk was not possible, slides available online.
14.00 - 15.30	Session 2.2 Other metrics for identifying secondary forest success	Hannah Graham (Catarina Jakovac, Andre Giles, Rodrigo Oliveira)
15.30 - 17.00	Workshop in plenary	Martin Herold
Day 3		
9.00 - 10.30	Session 3.1: Accounting for carbon removals/fluxes in secondary forests for MRV process - advances, needs and challenges	Daniela Requena Suarez (Carla Ramirez & Yhasmin Mendes, Celso Silva Junior, Iris Roitman, Roberta Cantinho, Henrique Cassol & Graciela Tejada)
11.00 - 12.30	Workshop in breakout groups	Daniela Requena Suarez, Yhasmin Mendes, Celso Silva Junior
14.00 - 15.30	Summary from breakout groups and finary wrap-up	Viola Heinrich & Luiz Aragao

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