

Earth observation approaches towards spatial GHG inventories

Martin Herold *(on behalf of many)*

herold@gfz-potsdam.de

Evolving requirements towards spatially-explicit estimations

- Increasing requirements and interests by countries
- 2019 refinement of IPCC GPG (guidance on use of EO)
- EC VERIFY project survey: status and needs for spatially-explicit estimation & reporting for national GHG inventories
- Focus on LULUCF sector with a focus on forest-related categories (ref. Regulation (EU) 2018/841)
- 12 replies from national agencies in VERIFY (Ireland, Norway x 2, Austria, Netherlands, Germany, Italy, France, Turkey, Lithuania, Slovenia & Slovakia)

Status and plans for spatially-explicit data

Q.2.2 To what extent is spatially-explicit data currently being used within the preparation of the GHG inventory of your country (n=12)

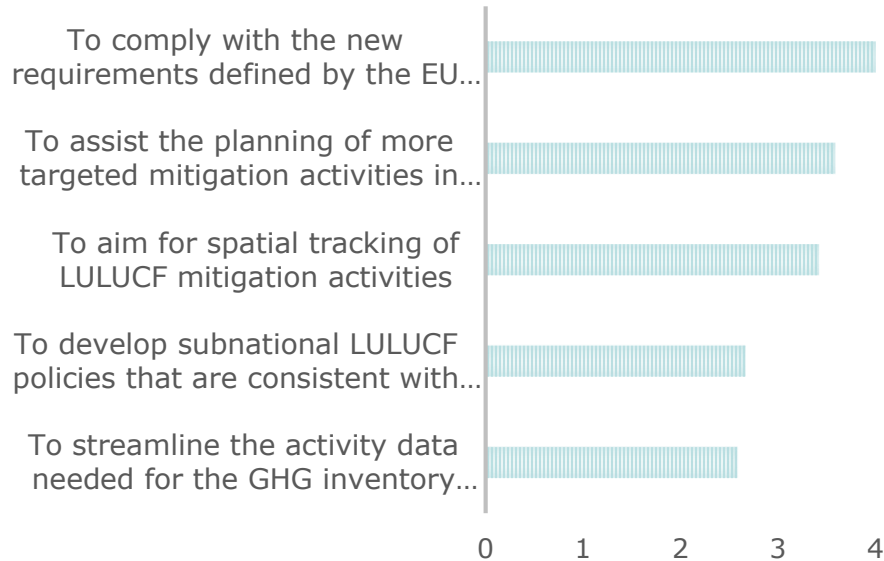
They are used for activity data (land-use, land use change and burned areas)	9
They are used for land management information	6
They are used for biomass/carbon stocks and change	5
They are not used	2

Q.2.3 Do you plan to increase the use of spatially-explicit data within your GHG inventory in the next few years? (n=12)

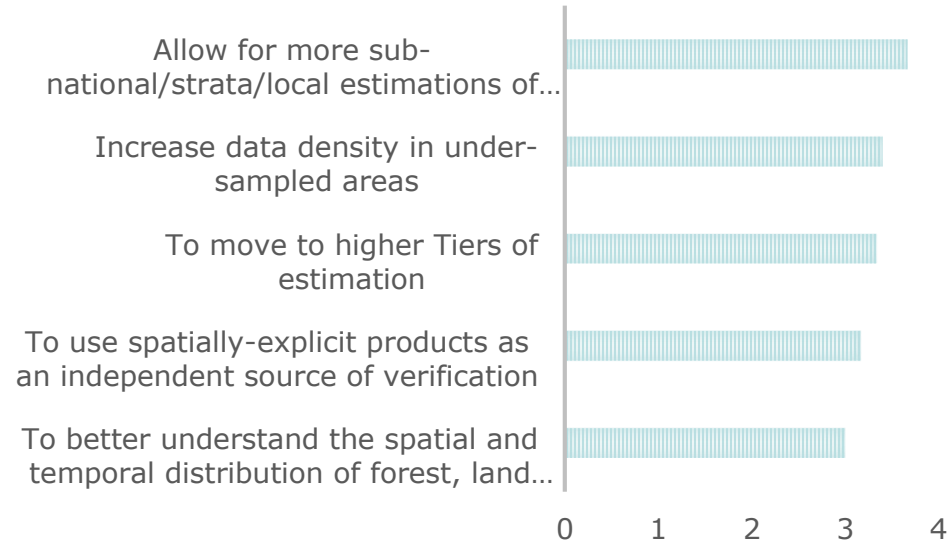
Yes, we plan to increase the use with regards to activity data (land-use, land use change and burned areas)	7
Yes, we plan to increase the use with regards to biomass/carbon stocks and change	6
Yes, we plan to increase the use with regards to land management information	5
Yes, we would like to but have not thought about the details yet	2

Main motivations to further develop spatially-explicit estimations

“Political” motivations



“Technical” motivations



Varying observation needs along the policy cycle



➤ **Awareness/problem definitions (global):**

- Global land change trends/GHGs
- IPCC assessment reports etc.

➤ **Policy options/selection (national):**

- National policies development (NDCs)
- Activities, hotspots for mitigation/adaptation

➤ **Implementation (local):**

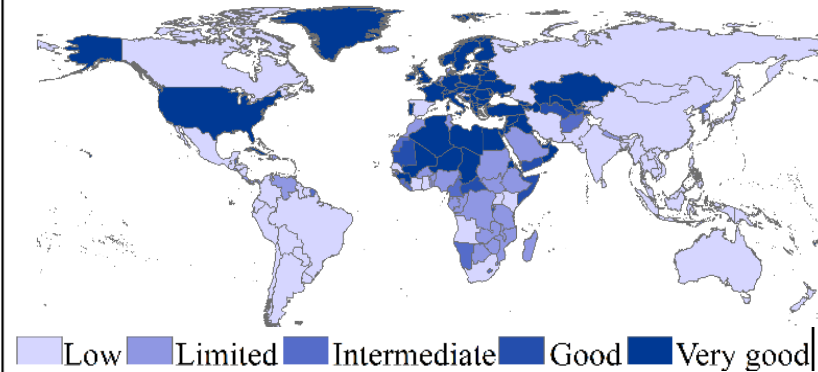
- Local data supporting AFOLU/land management
- Regular progress tracking, transparency

➤ **Evaluation/performance (all scales):**

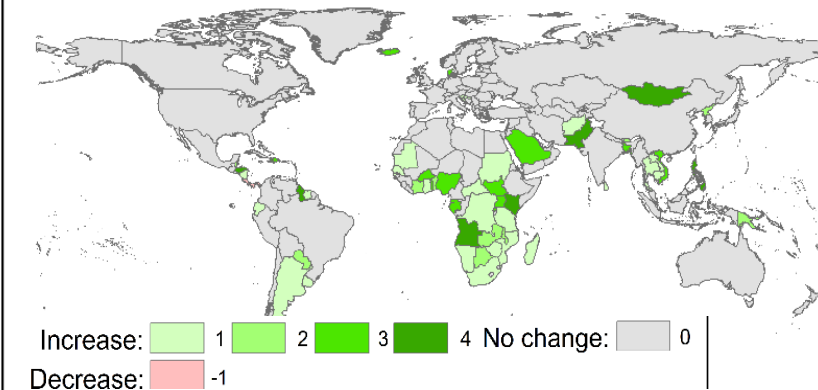
- National: GHG inventories, reporting
- Global stocktake (Paris Climate Agreement)

National Forest Monitoring/Data Assessment – country progress

(1b) Remote sensing capacity 2020



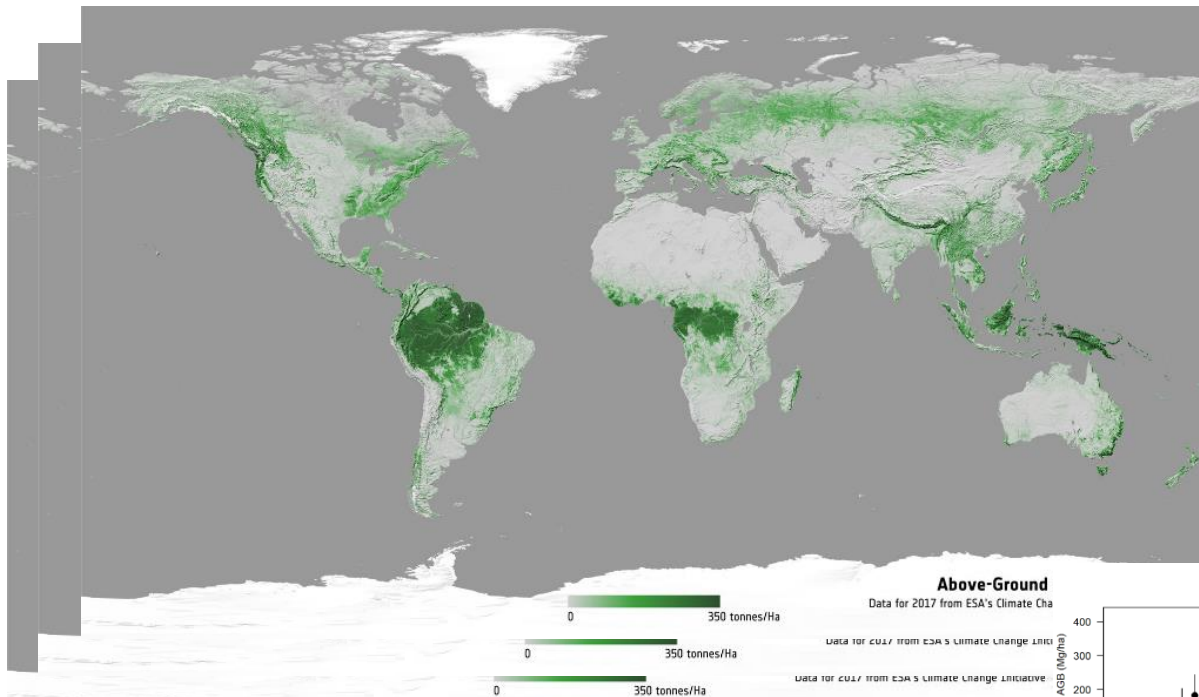
(1c) Capacity changes 2005 - 2020



- Assessment based on FAO FRA 2020 country data analysis
- Continuous improvement in the use of remote sensing data for forest monitoring
- Most improvements in (sub-) tropical countries
- Regional differences
- Importance of both international/expert support/guidance and countries own investments



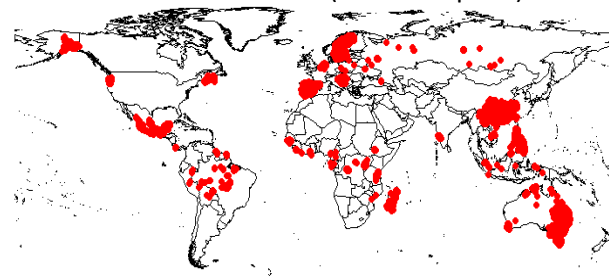
Aboveground biomass monitoring



Global aboveground biomass for 2010, 2017, 2018, 2020 at 100m spatial resolution, <http://cci.esa.int/biomass>

ESA UNCLASSIFIED - For Official Use <http://cci.esa.int/biomass> Santoro et al., 2021, ESSD

Global reference database (~109.000 plots)



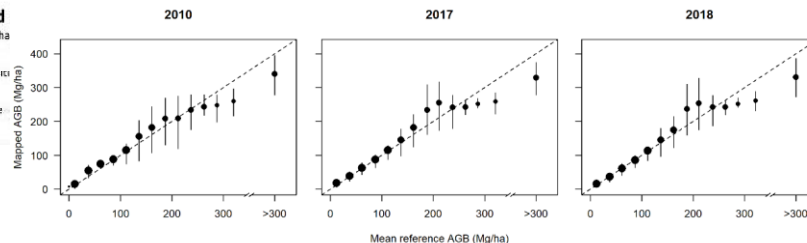
Biomass harmonization for Global Stocktake UNFCCC COP 26 dashboard:

<https://ceos.org/gst/>

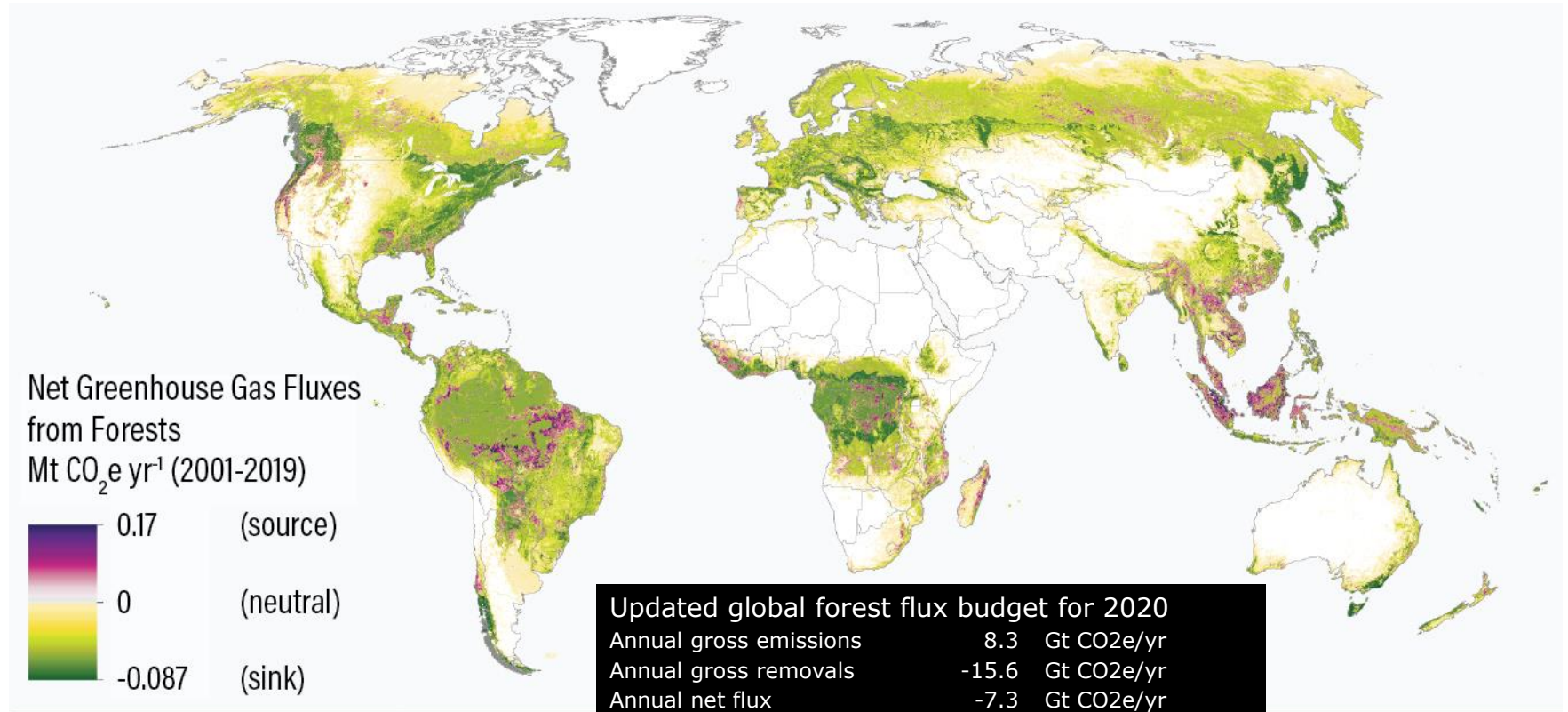
<https://earthdata.nasa.gov/maap-biomass>

Above-Ground
Data for 2017 from ESA's Climate Change Initiative

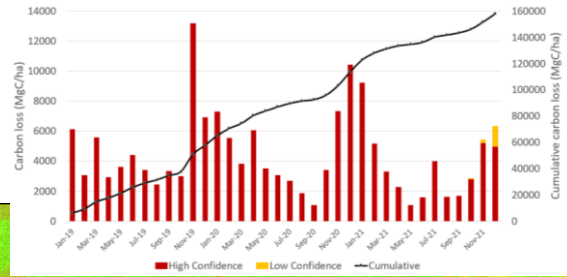
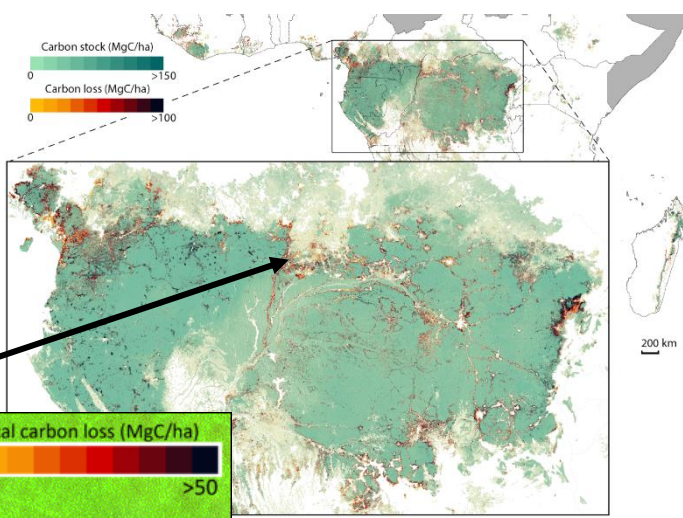
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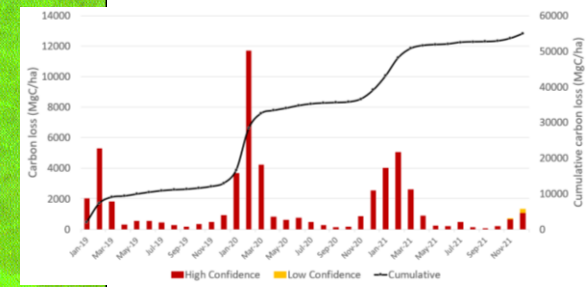
Towards Earth Observation data-driven, spatially explicit forest GHG inventories



Higher frequency/near-real time monitoring for tracking activities – Central Africa



2019 January



Csillik et al. 2022. Nature Coms.EE

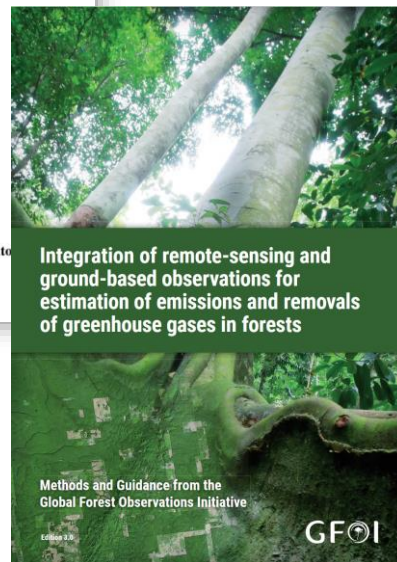
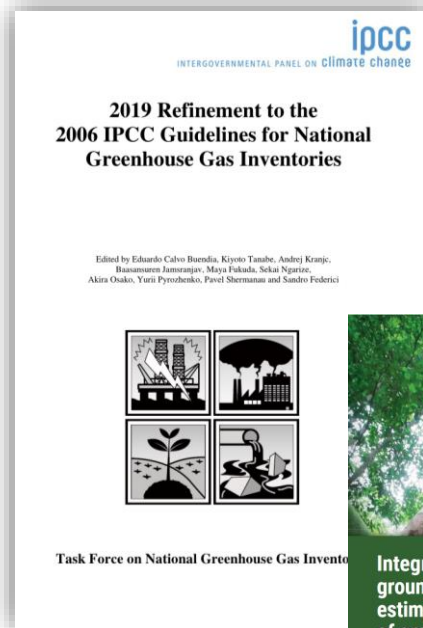
<https://gena.users.earthengine.app/view/raddalert>



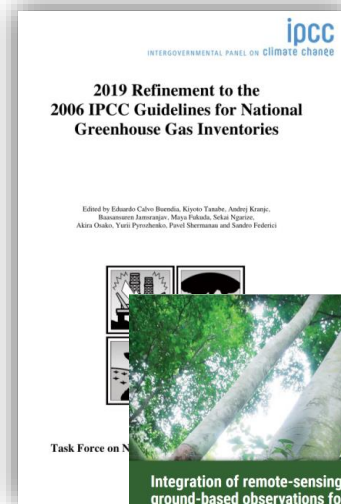
Improved guidance to countries

- Common **reporting and estimation** framework
- Using Earth observations to monitor **land use and forest changes**
- **Stratification** of LU categories to facilitate the estimation of carbon emissions and removals
- Use of **biomass density maps**
- **Estimation of uncertainties**
- Approaches to deal with **evolving technologies**

[GFOI Methods and Guidance Doc \(v3\)](#)

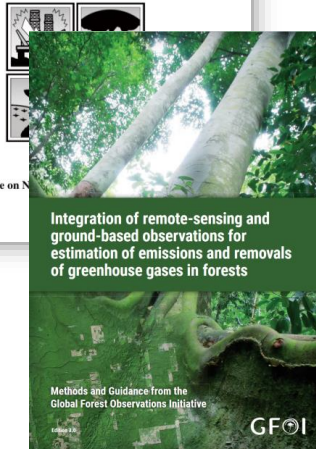


Integration of space-based & on-the ground monitoring

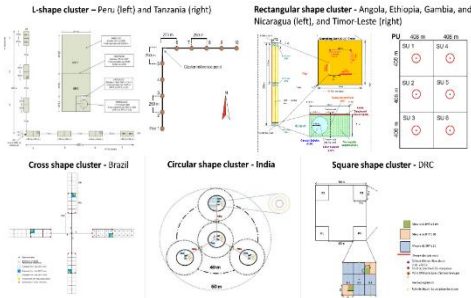


Edited by Eduardo Coto Brando, Kyoto Tanabe, Andrei Kravtsov, Rameshwar Anantaraman, Masa Fukuda, Seka Ngare, Akira Oishi, Yuri Pyryshchenko, Pavel Shevtsov and Sanjiv Patel

Task Force on N



- Country examples on combining national forest inventory/ground-based and space-based (biomass) data for improving national estimation and GHG inventories (GEO-Global Forest Observations Initiative) and global validation
- Coordinated in-situ biomass monitoring using novel sensing concepts (i.e. GEOTREES, STRUCNET)
- Community-consensus approaches for data integration and estimation



Summary: EO-data towards spatially explicit GHG-I

- Evolving opportunities: country interest and needs & better data
 - New requirements for more localized and more frequent estimation and reporting, i.e. Enhanced Transparency Framework, EU regulations ...
- EO data linking with country estimation and reporting based on priorities:
 - Data gaps and reducing uncertainties (i.e. parts of Eastern Europe)
 - Policies & actions - national/EU priority setting and local GHG assessments:
 - Linking monitoring with LULUCF incentives/decentives
 - Supporting implementation and performance tracking
 - Linking national, EU-wide and global approaches (i.e. UNFCCC global stocktake)
- Integrated monitoring perspective:
 - Long-term continuity of EC Copernicus program (EU Council on Copernicus by 2035, June 2022: <https://www.consilium.europa.eu/media/56972/st10070-en22.pdf>)
 - Space- and ground-based data streams as complementary sources
 - Improving integration from bottom up: “super-site” concept for NFI efforts