CEOS Biomass Harmonization Project

Laura Duncanson, UMD

Neha Hunka, UMD

Agenda Item 7.2

SIT Technical Workshop 2024

Sydney, Australia

18th - 19th September 2024

CEOS

Committee on
Earth Observation Satellites

Evolution of Biomass Harmonization

2017-2020: Protocol Development
2021: Protocol Endorsed

Committee on Earth Observation Satellites

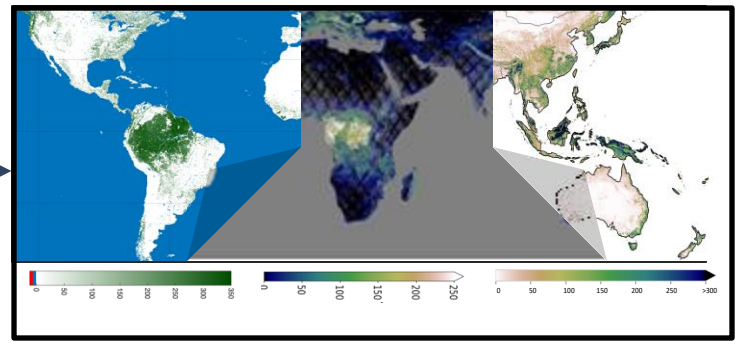
Working Group on Calibration and Validation
Land Product Validation Subgroup

Global Aboveground Biomass Product Validation
Best Practice Protocol

Version 1.0 – 2020

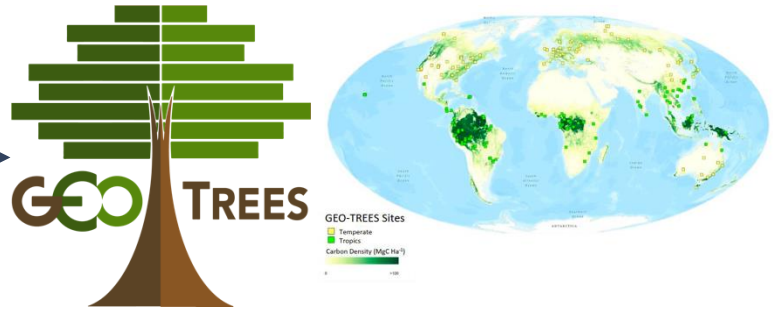
Editors: Laura Duncanson, Mat Disney, John Armston, David Minor, Jaime Nickeson

2021 – present: CEOS Biomass Harmonization Activity
(coordination, intercomparison, uptake)



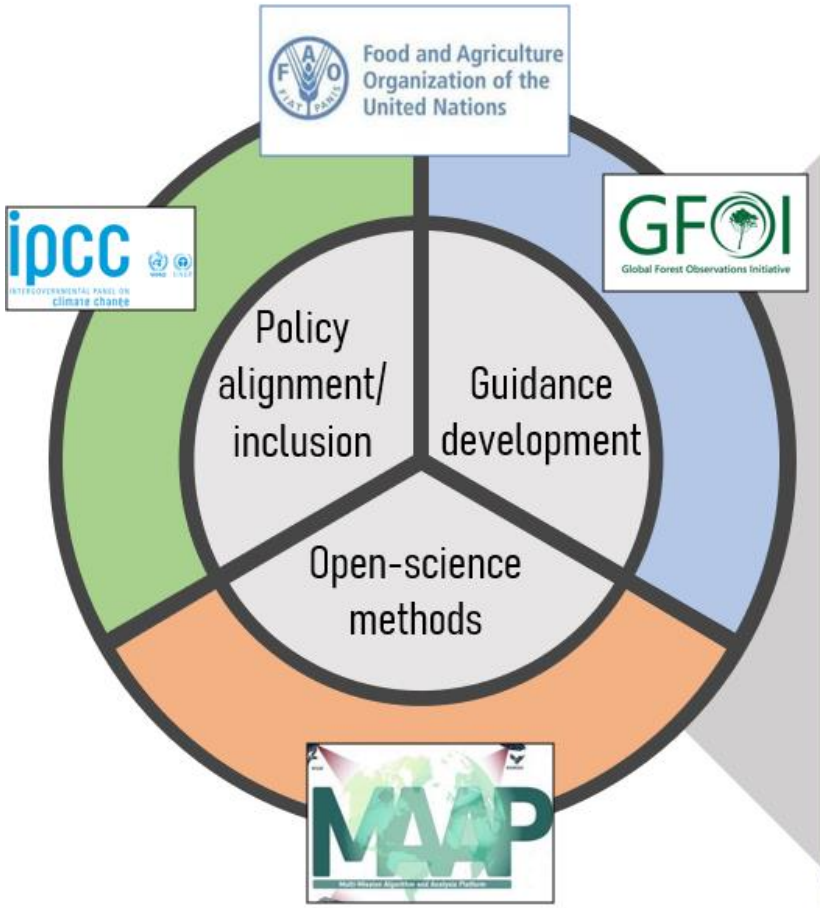
Highlighted needs for:

- CEOS agency coordination on biomass
- Open tools / transparency
- Global biomass reference network
- Guidance on product uptake



2021 – present: GEO-TREES
(global biomass reference network)

Biomass Harmonization Activities



NASA Carbon Monitoring Systems 2022

Emission factors

IPCC Tier 1 AGBD estimates from EO data

Delivers aboveground biomass estimates, in the format of IPCC Tier 1 values for natural forests.

Sourced from **NASA GEDI** mission and **ESA CCI** Biomass initiative, with periodic updates.

Hunka et al., *in review*, Nature Scientific Data

esa GEDI JAXA JRC EUROPEAN COMMISSION

Country cases

Enhancing National Forest Inventories with EO

Delivers **statistically robust** and defensible methodologies to augment ground-based inventories with regular, consistent and up-to-date EO data streams.

Co-developed with in-country partners, ensuring reciprocal knowledge transfer.

Hunka et al., *in review*, Remote Sensing of Environment

WAGENINGEN GFOI USGS UAS

Transparency

Open-source codes for collaboration

Codes are written on the **ESA-NASA Joint Multi-Mission Algorithm and Analysis Platform (MAAP)**, a collaborative cloud-computing environment.

The public Biomass Harmonization Github repository hosts source codes.

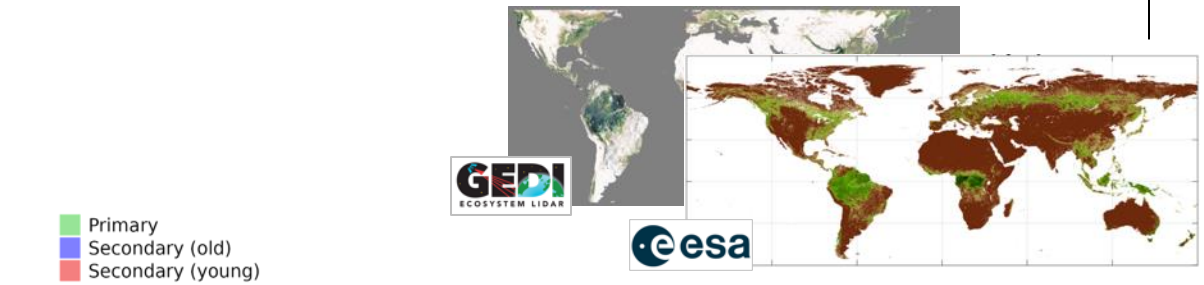
NASA esa

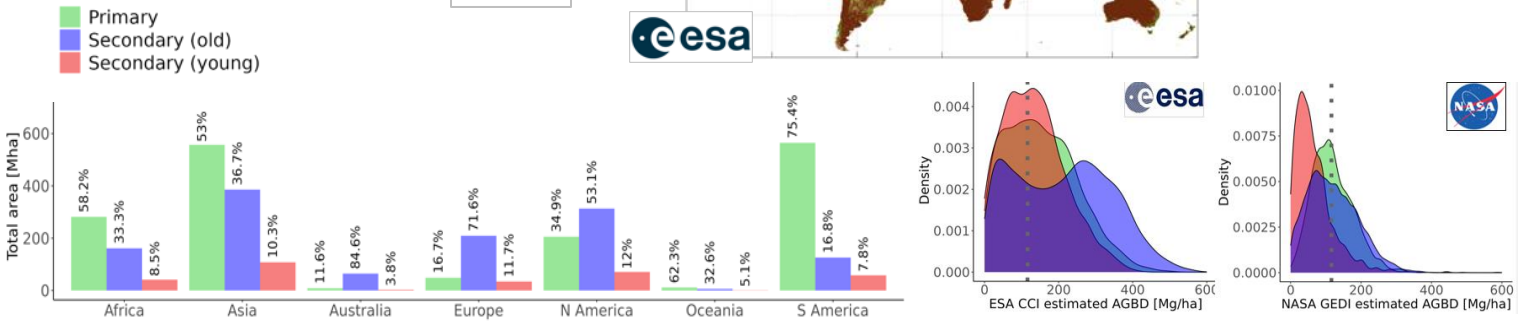
Biomass Harmonization Examples: Creating an EO-based version of IPCC Tier 1 Biomass Estimates

- Example of creating **policy-relevant tables with EO biomass estimates**
- AGBD estimates are provided in the format of Intergovernmental Panel on Climate Change (IPCC) Tier 1 values for natural forests, sourced from NASA GEDI and ICESat-2, and ESA CCI.
- A classification of global forests by ecozones, continents and status (primary, young and old secondary) also provided.
- Open-science activity on the Multi-mission Algorithm and Analysis Platform (MAAP) – ***updatable, reproducible, transparent***
- Collaboration between EO map producers, GFOI, IPCC, others

TABLE 4.7 (UPDATED)
ABOVE-GROUND BIOMASS IN NATURAL FORESTS (TONNES D.M. HA^{-1})

Domain	Ecological zone [1]	Continent	Status/condition[2]	Above-ground biomass [tonnes d.m. ha^{-1}]	Uncertainty	Uncertainty type	References	EO-based AGBD
	Tropical rainforest	Africa	Primary	404.2	120.4	SD	1-12	
			Secondary >20 years	212.9	143.1	SD	5-7, 11, 13-16	
			Secondary ≤20 years	52.8	35.6	SD	9-11, 14, 15, 17	
		North and South America	Primary	307.1	104.9	SD	3, 4, 9, 10, 18-21	
			Secondary >20 years	206.4	80.4	SD	9, 10, 22-28	
			Secondary ≤20 years	75.7	34.5	SD	9, 10, 14, 22, 23, 28-32	





Hunka et al., in revision (preprint available)

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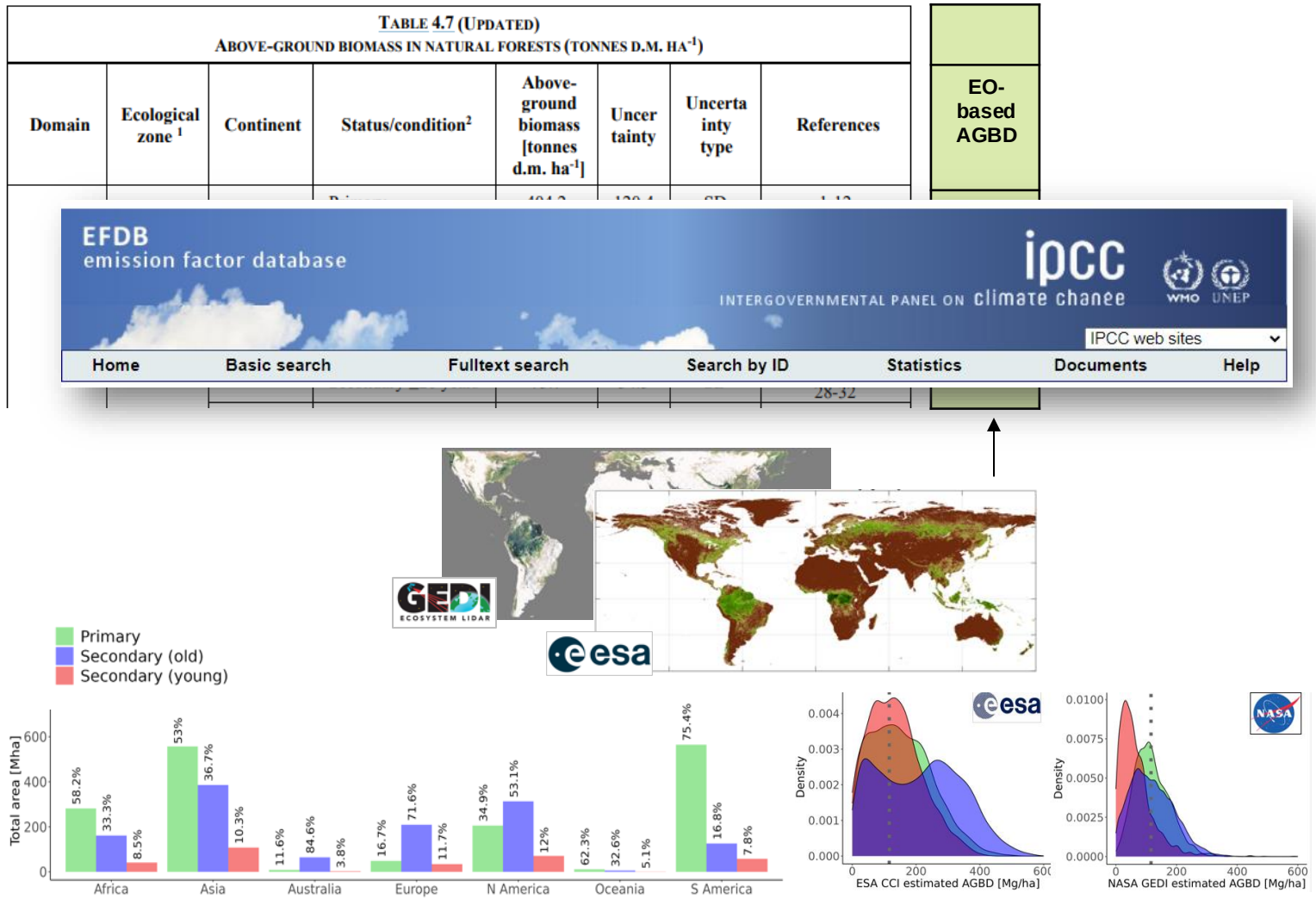


Hunka et al., in revision (preprint available)

Biomass Harmonization: Guidance Documentation for Country Uptake

GFOI SilvaCarbon UNIVERSITY OF MARYLAND

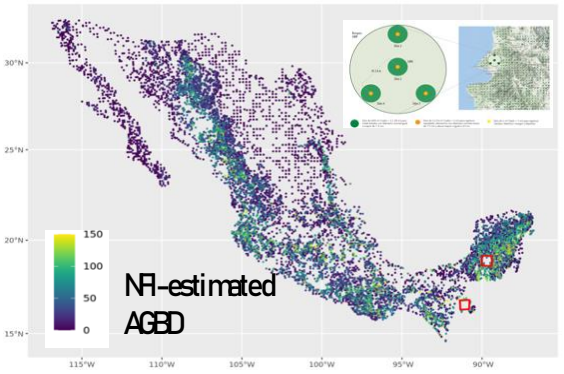
Workshop: Use of space-based biomass maps for policy reporting
20-22 March 2024

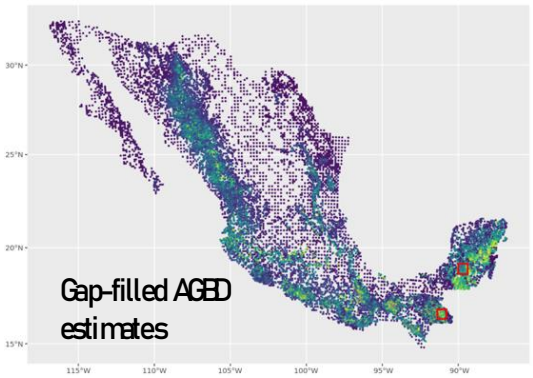
Objective 1: Receive an update from map developers on current methods and approaches to estimating biomass and associated uncertainty, understand policy-level needs for clarity, consistency and transparency on various sources of uncertainty.

Objective 2: Collaboratively review approaches and codes to integrate NFI data and EO-based AGBD (CCI) or forest height (GEDI) estimates. Cases of two countries (Mexico and Mozambique) were demonstrated.

Objective 3: Collaboratively discuss developing a draft of guidance for the above.

https://gfoi-rd.gfz-potsdam.de/workshop-biomass-maps-for-policy

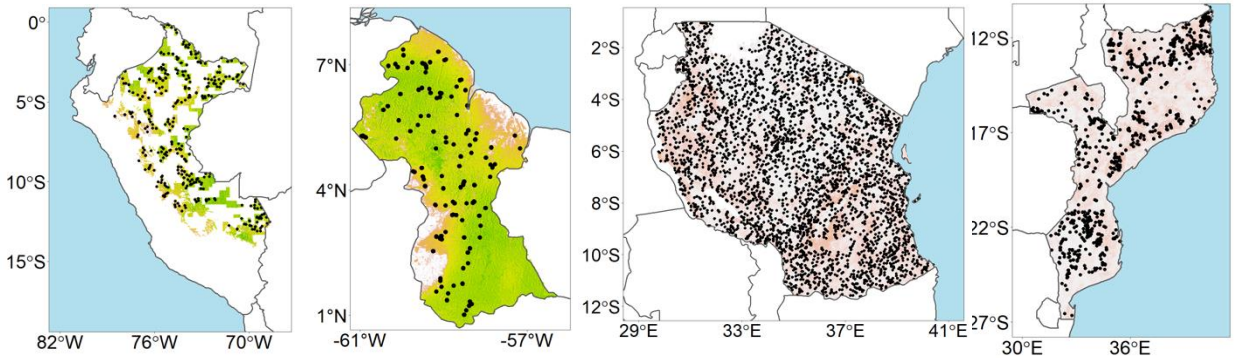




CONAFOR COMISIÓN NACIONAL FORESTAL

NASA

Hunka et al., (in review)



WAGENINGEN UNIVERSITY & RESEARCH

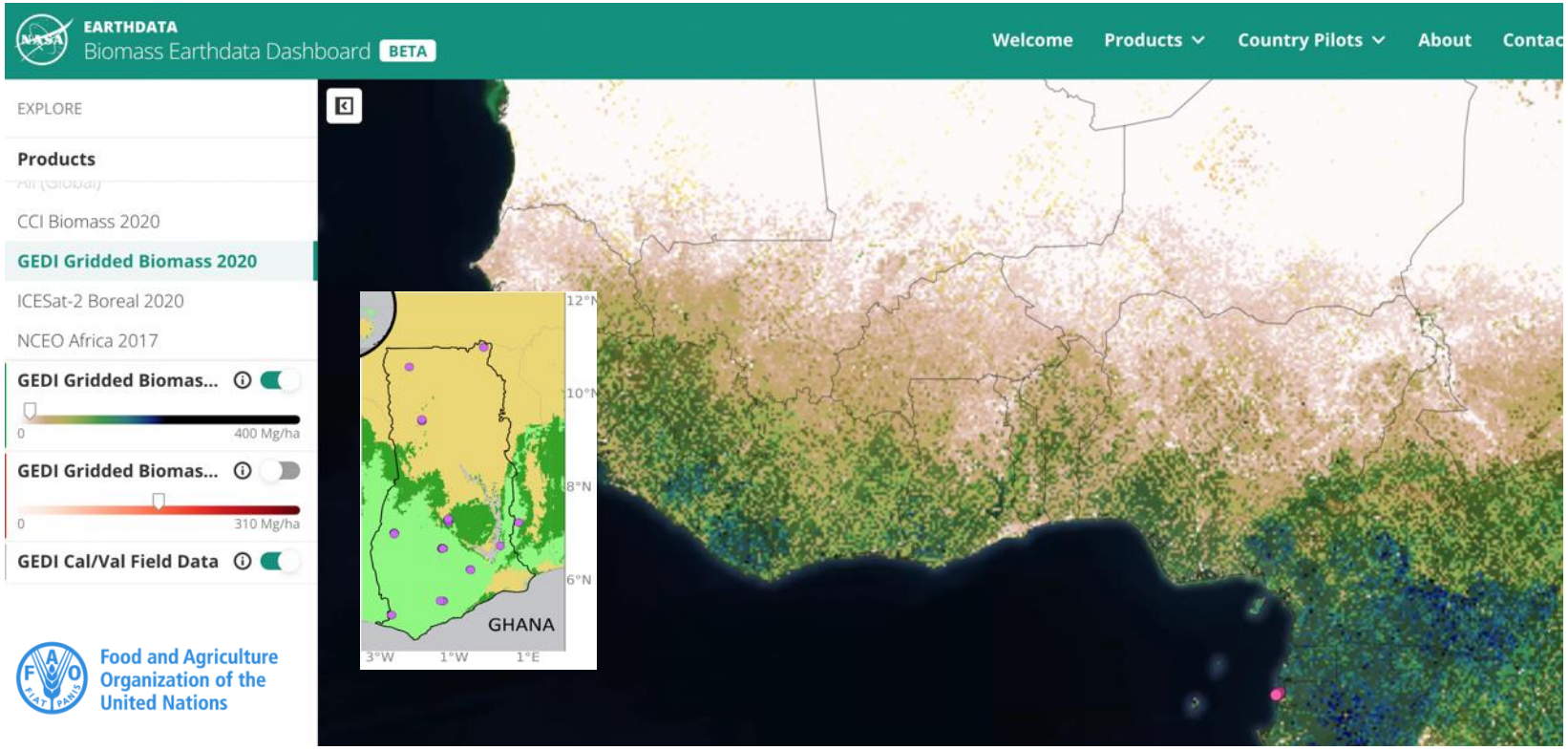
GFZ Helmholtz Centre Potsdam

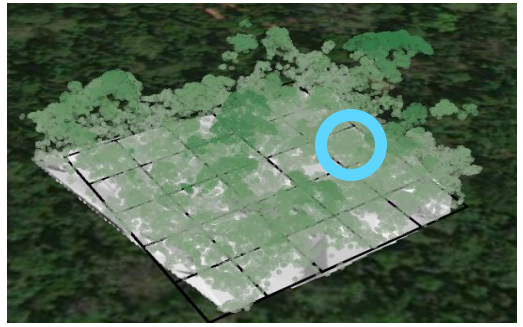
Málaga et al., (2024)

Biomass Harmonization:
Country Use Cases, Ghana / West Africa

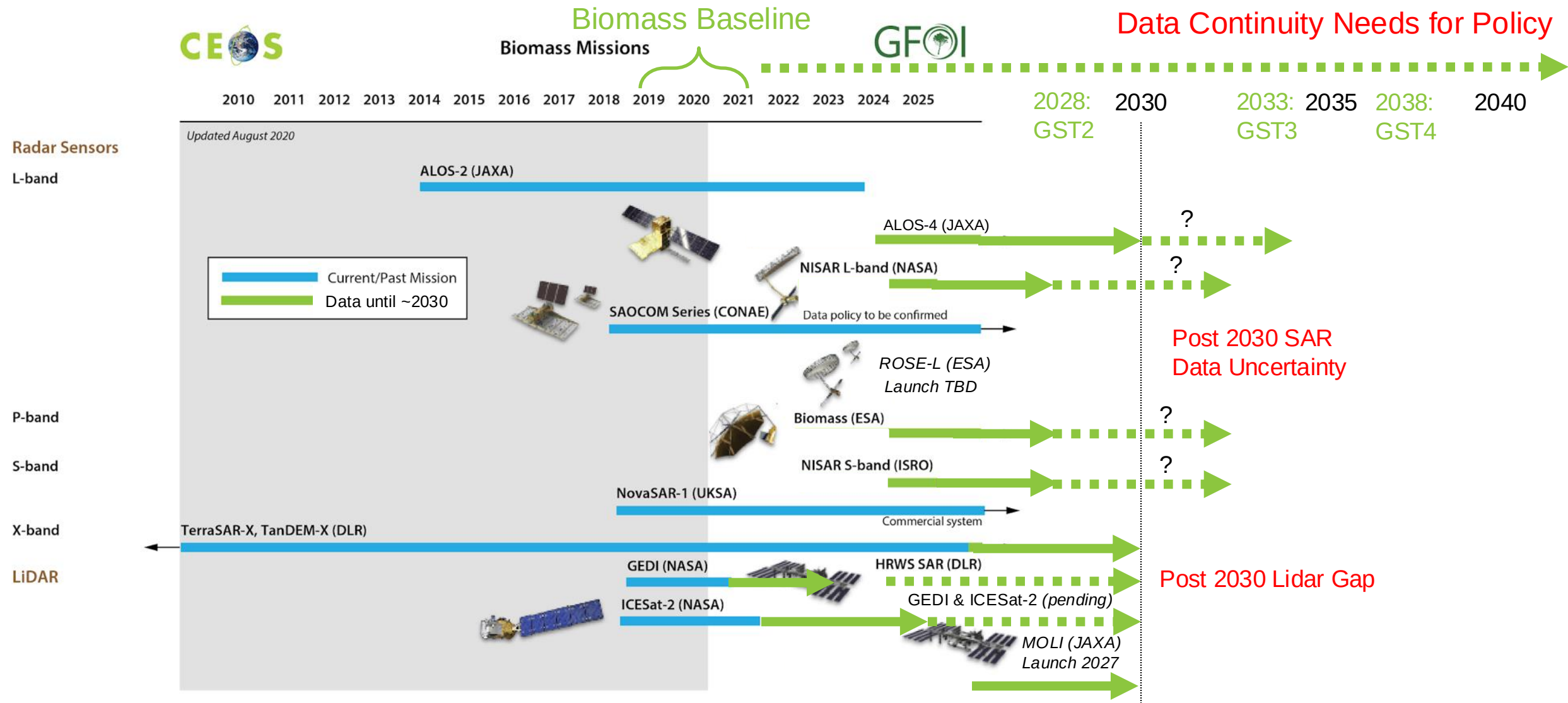
Objectives:

- FAO supported effort to use GEDI Biomass Data toward national reporting in West Africa.
- 5-year collaborative product 'Global Transformation of Forests for People and Climate: a focus on West Africa' between UN FAO, SIDA, ECOWAS
- Little forest biomass data are available in the 15 participating West African countries – can we use GEDI to gap-fill?
- **Collection of regional reference data critical to calibrate / validate GEDI**
- **Showcase how EO-based estimates can be used to fill gaps in current guidance in the policy domain**, such as biomass estimates in lands outside 'forests' and EO-based estimates for refining IPCC Tier 1 defaults.





CEOS Biomass Missions: Trust in Data Continuity



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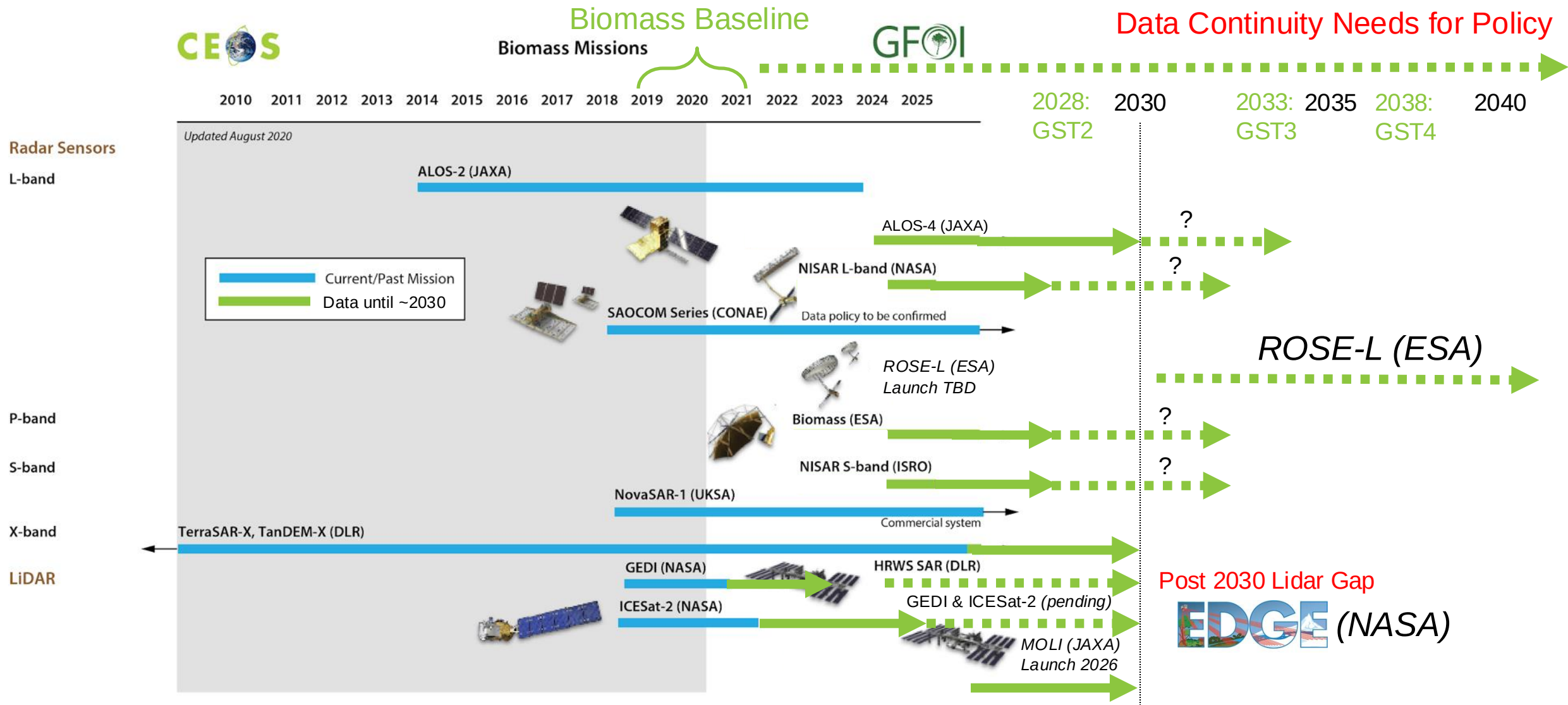

GEO-TREES will enable biomass product validation

Updated Reference Data Remain Critically Important for Improved Biomass Mapping

Field, Terrestrial Laser Scanning (TLS) and Airborne Lidar are actively being collected and will serve as validation data for any new and upcoming EO biomass maps from CEOS agencies.
5-year repeat acquisitions are required to validate change.
$12M USD from Bezos Earth Fund, $12M from Gordon and Betty Moore Foundation (new!)

.

This network needs ongoing support from CEOS agencies, both for data acquisition, and coordination with missions.

https://geo-trees.org/project/

GEO-TREES will enable biomass product validation

"All the News That's Fit to Print"

The New York Times

THE WEATHER
Today, sunshine mixing with clouds, a little warmer, high 77. **Tonight,** clear, calm and cool, low 58. **Tomorrow,** plenty of sunshine, warmer, high 80. Weather map is on Page D8.

VOL. CLXXIII .... No. 60,272 © 2024 The New York Times Company MONDAY, SEPTEMBER 9, 2024 Prices in Canada may be higher $4.00

Climbing Trees To Find Clues On Warming

Trying to Grasp Carbon Storage in Amazon

By MAX BEARAK

AMACAYACU NATIONAL PARK, Colombia — With the help of a small rope tied around his ankles, Eugenio Sánchez, lithe at age 50, shimmied himself all the way up a towering tree like a human inchworm, his chest heaving from the exertion, just to pick a few leaves.

The leaves, found only on the highest branches, would help the scientists waiting below identify the species. And that, along with the tree's exact size (or at least as close as one can approximate a tree's size) would tell them something very important: how much carbon it contained.

The team, wearing gumboots caked with mud, were at the beginning of a monthslong process of painstakingly measuring pretty much every woody plant growing on this patch of Amazon rainforest in Colombia, one by one. A census of all 125,000 individual plants with a trunk size at least a centimeter in diameter.

It is part of a new, multimillion-dollar effort in dozens of patches of forest across the world that's aimed at figuring out, to an unprecedented degree of precision, the extent to which forests perform an epic service to humanity by capturing and locking away huge amounts of carbon dioxide, the main planet-warming greenhouse gas.

The Amazon is vast. Nearly 10 Texases would fit in it. Amid that emerald expanse, this infinitesimal patch, less than a tenth of a

Continued on Page A6

PHOTOGRAPHS BY FEDERICO RIOS FOR THE NEW YORK TIMES

Eugenio Sánchez, top, scaling a tree in a patch of Amazon rainforest in Colombia. Scientists are trying to figure out the extent to which forests capture and lock away carbon dioxide. Along the way, the team has also discovered rare species, above.

POLL FINDS RACE FOR WHITE HOUSE IS NECK AND NECK

A TIMES/SIENA SURVEY

Voters Still Unsure About Harris, but Trump's Base Holds Firm

By JONATHAN WEISMAN and RUTH IGIELNIK

Former President Donald J. Trump and Vice President Kamala Harris enter the homestretch of the campaign in a tight race, and with their only scheduled debate looming on Tuesday, Ms. Harris faces a sizable share of voters who still say they need to know more about her.

A national poll of likely voters by The New York Times and Siena College found Mr. Trump leading Ms. Harris, 48 percent to 47 percent, within the poll's three-percentage-point margin of error and largely unchanged from a Times/Siena poll taken in late July just after President Biden dropped his re-election bid. Mr. Trump may have had a rough month following the president's departure and amid the burst of excitement that Ms. Harris brought Democrats, but the poll suggests his support remains remarkably resilient.

The national results are in line with polls in the seven battleground states that will decide the presidential election, where Ms. Harris is tied with Mr. Trump or holds slim leads, according to New York Times polling averages. Taken together, they show a tight race that remains either candidate's to win or lose.

Only a little over eight weeks remain in the shortest presidential election in modern American his-

Link to New York Times article on Colombian GEO-TREES site here.

https://geo-trees.org/project/

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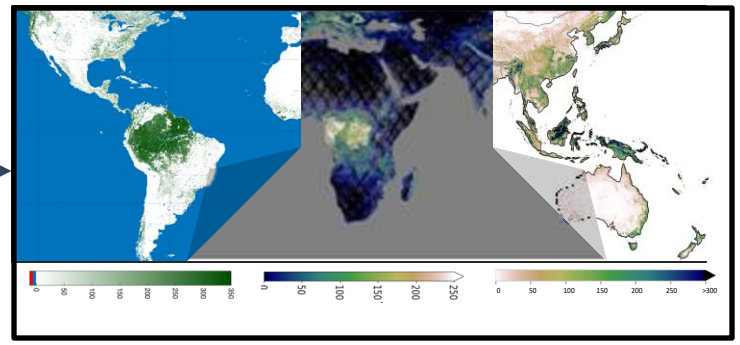

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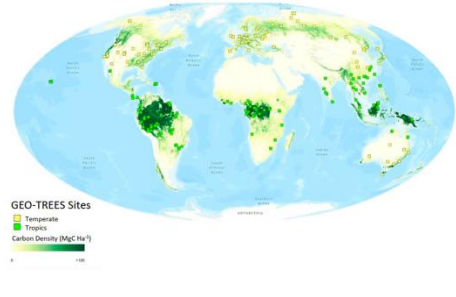

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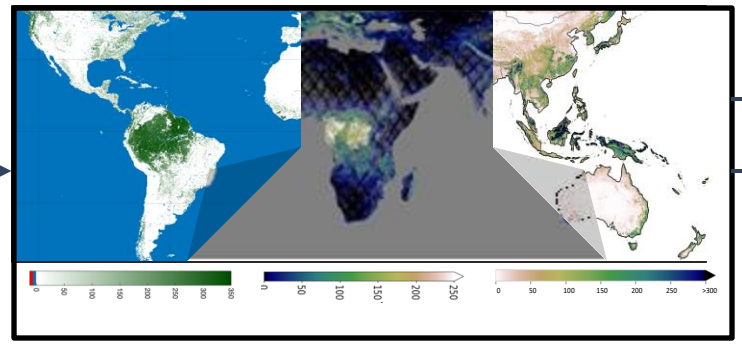

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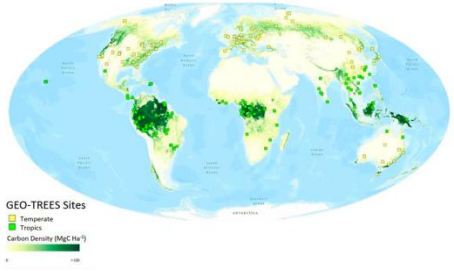

Future Activities

2025-2028
Toward integration of EO biomass maps in national reporting for GST2

2025 and onward:
Global Biomass Product Validation

Ongoing:
Reference network expansion, resampling every 5 years

GEO-TREES will enable biomass product validation

Updated Reference Data Remain Critically Important for Improved Biomass Mapping

GEO-TREES Reference Data

GEO TREES

Transparent Product Validation Tools with GEO-TREES

NASA

esa

MAAP

New and Ongoing Biomass Mission Products

NISAR
NASA - ISRO SAR Mission

biomass

GEDI
ECOSYSTEM LIDAR

MOLI

New Activity!

Biomass Harmonization: Summary and Recommendations

- Ongoing work toward product uptake for policy continues:
  - Progress in guidance document writing
  - Expansion of country use cases
- New biomass missions (NISAR, BIOMASS) will expand capabilities but also strengthen importance of harmonization efforts
- New focus on integration with GEO-TREES toward transparent global biomass product ***validation***

Long-term support of CEOS agencies is critical:

please support researchers, fund and/or target sites.

Thank you

Biomass Harmonization Team:

For Supporting Biomass Missions and/or GEO-TREES: