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SERVIR: Cross-Comparison of Carbon Emission Estimates Based on Variable Land Use Land Cover Changes within SERVIR Focus Regions

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CONNECTING **SPACE** TO **VILLAGE**

SERVIR is a partnership of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America.

- We work with countries and organizations in the use of free and open satellite data to build resilience to climate change and address its contributing causes.
- We co-develop innovative solutions through a network of regional hubs to improve sustainable resource management at local, national and regional scales.
- We build capacity to address critical challenges in climate change, food security, water and related disasters, land use, and air quality.

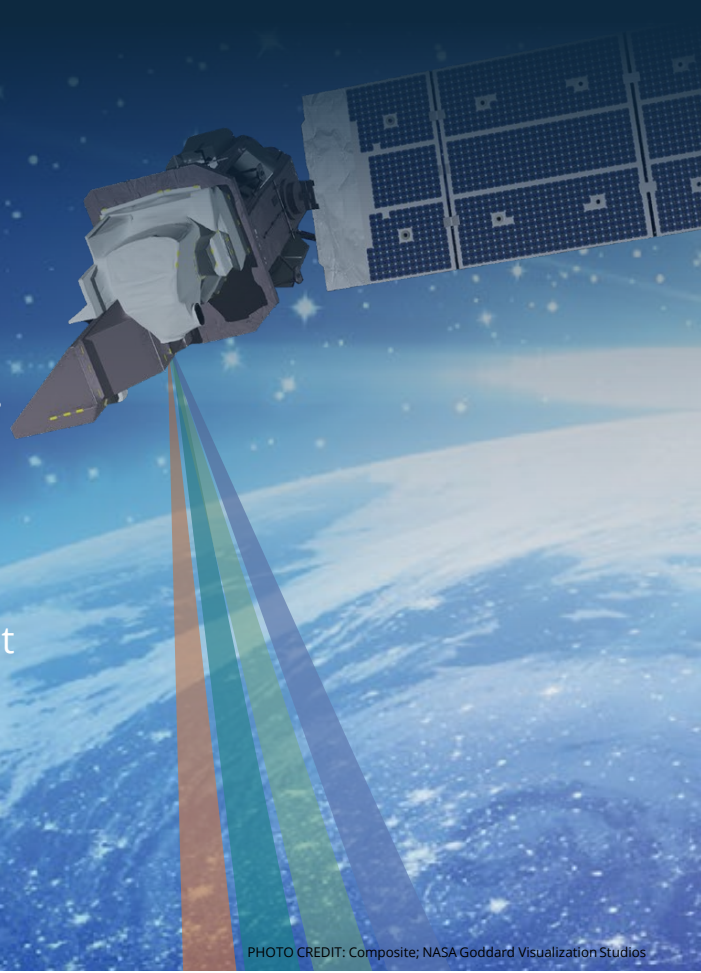


PHOTO CREDIT: Composite; NASA Goddard Visualization Studios

USAID FROM THE AMERICAN PEOPLE | NASA | SERVIR | CILSS | RCMRD | ICIMOD | adpc | ALLIANCE Bioversity International CIAT

SERVIR CArbon Pilot (S-CAP): the big picture

Countries need to monitor + report on CO_2 / GHG emissions

Support Hubs' integration in REDD+ reporting processes

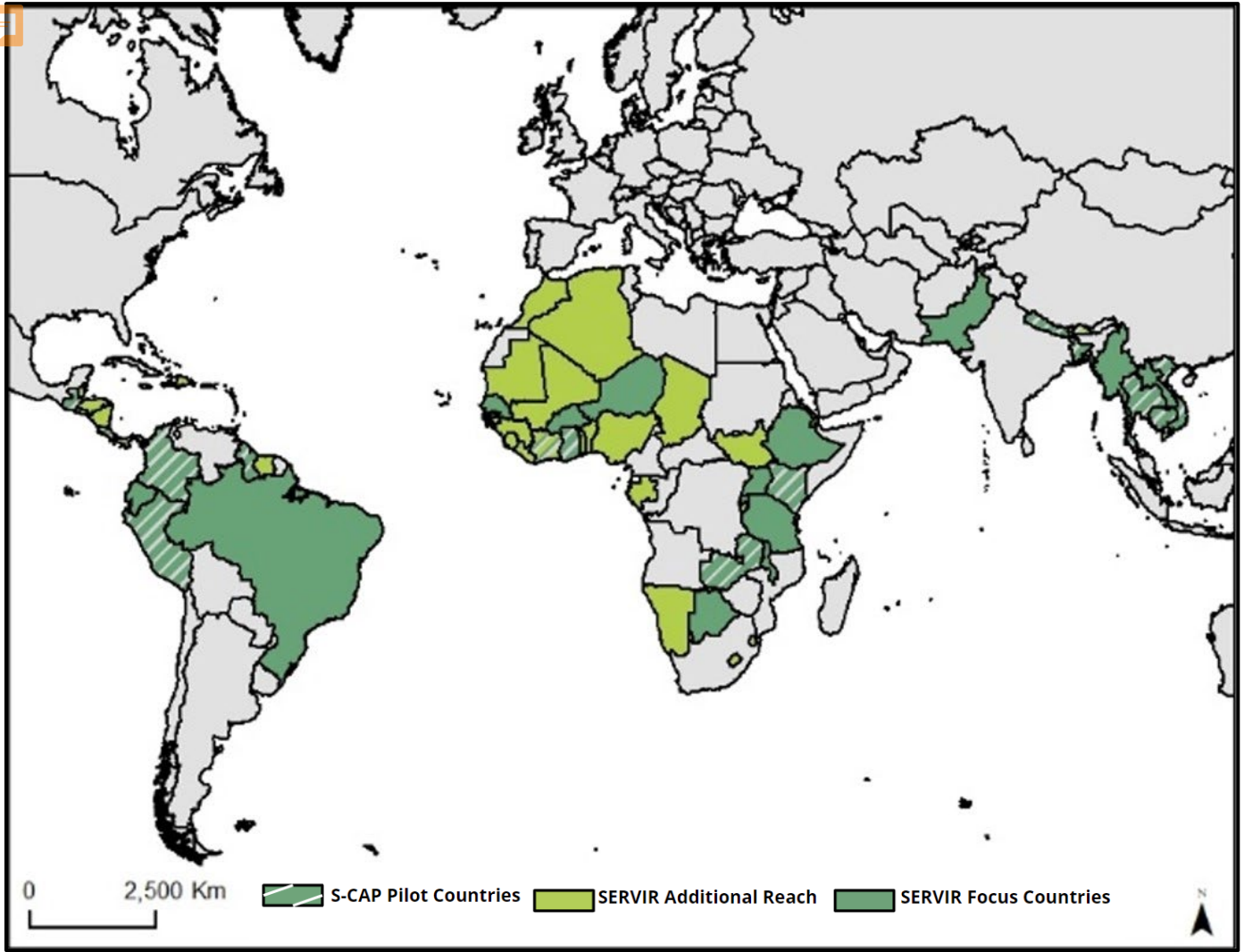
Ensemble approach instead of a single GHG estimate approach

Leveraging [all] available data (LC + AGB) instead of developing our own LC or AGB products

Simple transition from LC data to GHG emission estimation

Hub integration of GHG emission estimates into their LC services

PHOTO CREDIT: EarthKAM



Pilot Countries

Americas

- Guyana

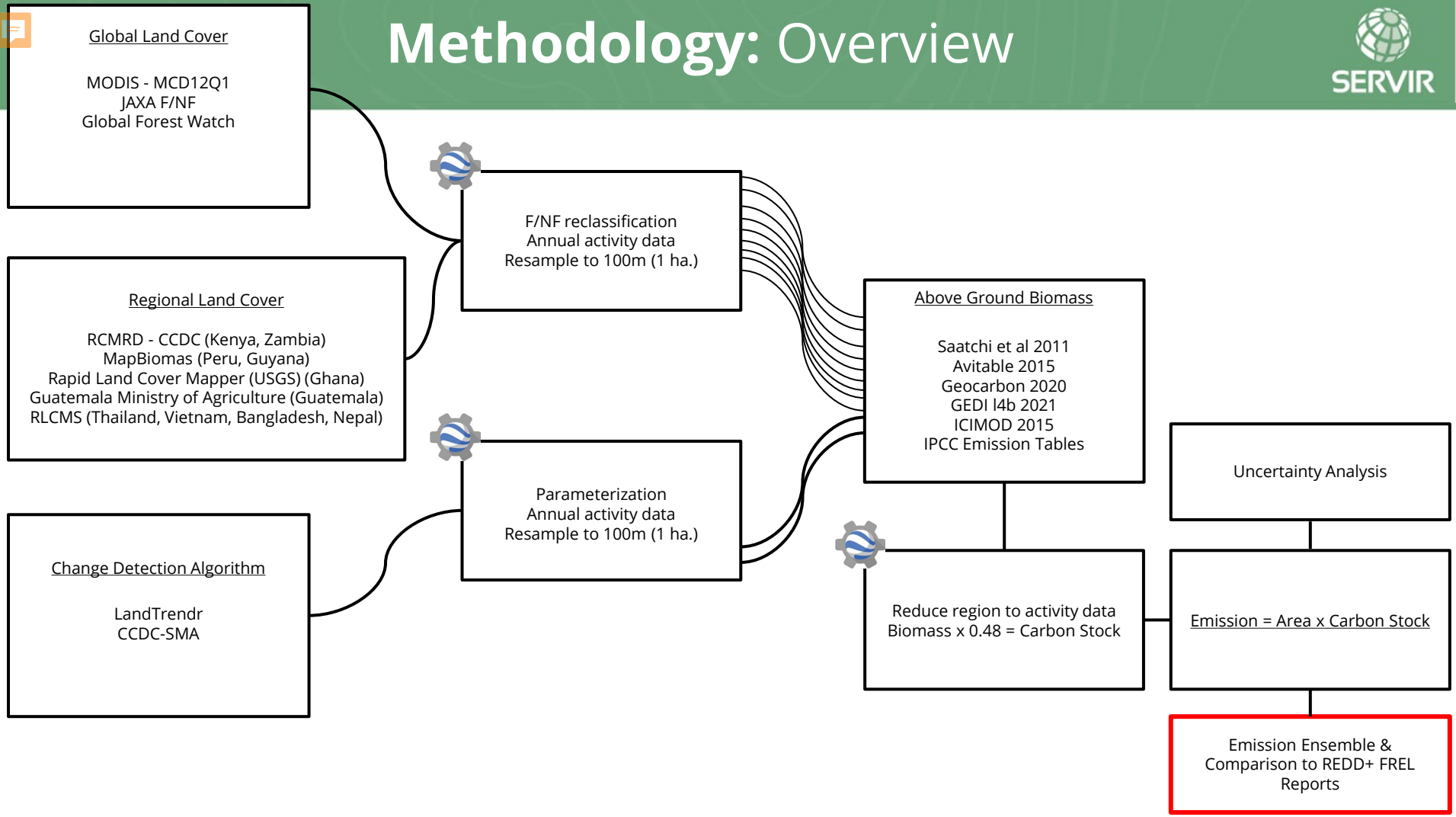
Africa

- Ghana
- Zambia

Asia

- Bangladesh
- Thailand

Methodology: Overview



Activity Data - Guyana Results

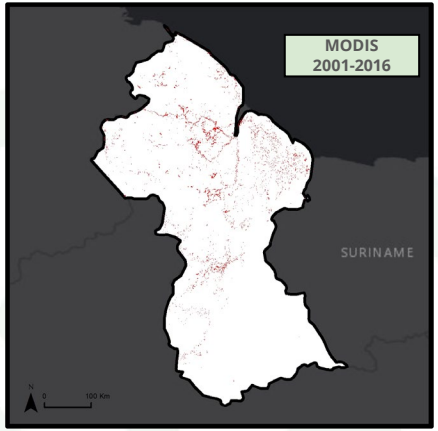
Global

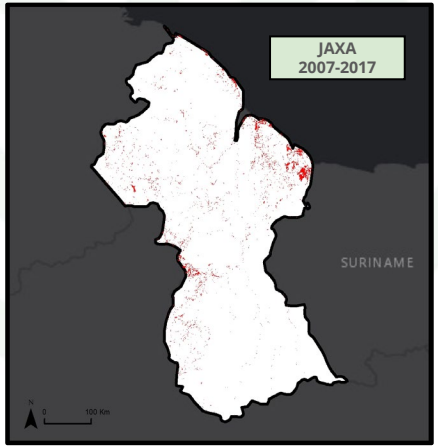
21,924.83 ha
Annual deforestation

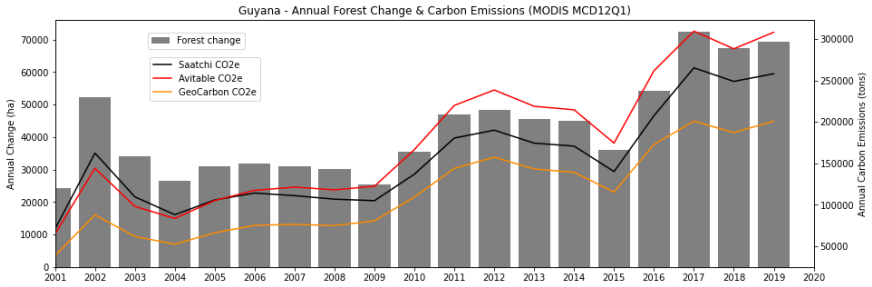
37,705.40 ha
Annual deforestation

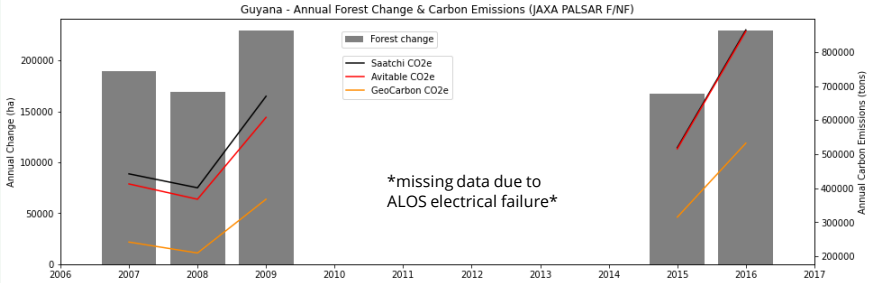
11,631.58 ha
Annual deforestation

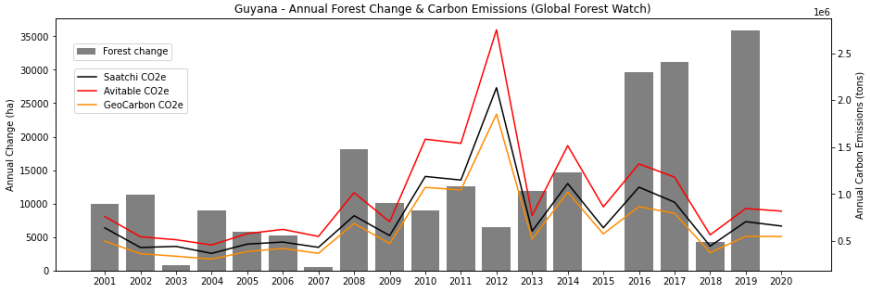
Activity Data - Guyana Results *global

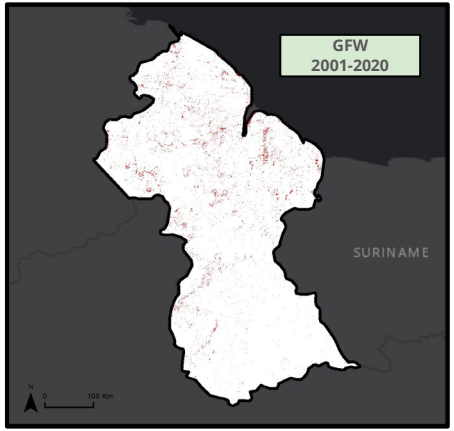










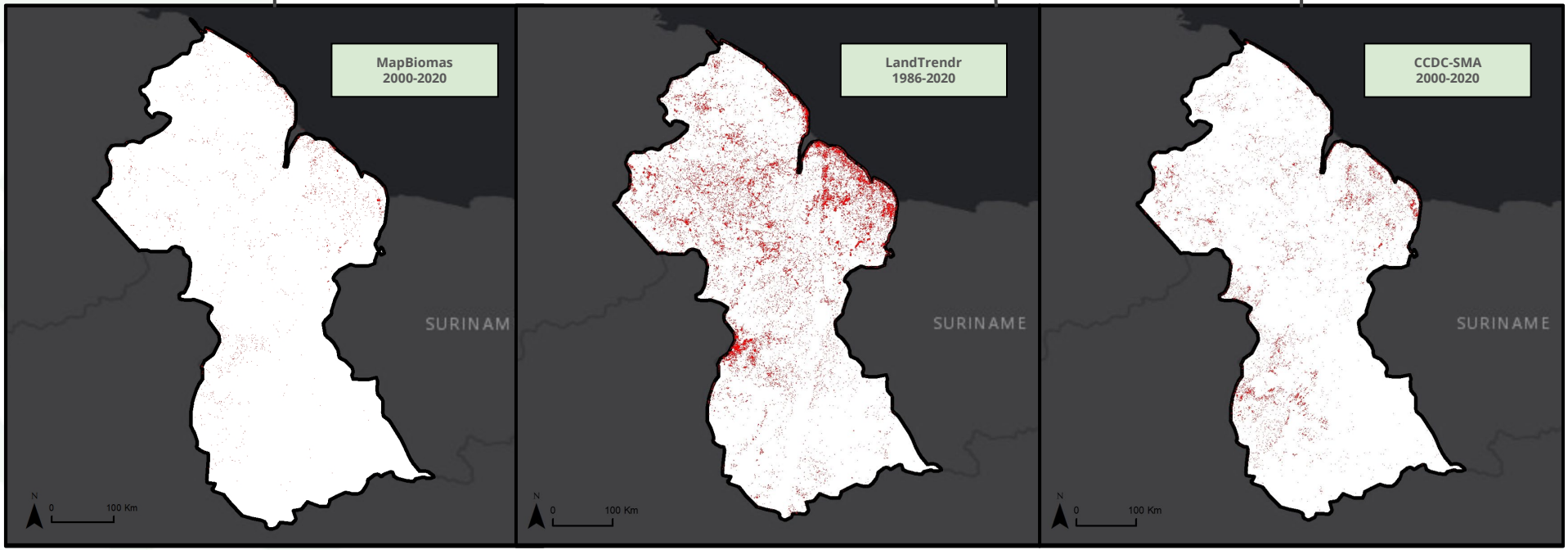


152.3% difference in CO_2e estimations using global land cover datasets

Activity Data - Guyana Results

Regional

Change Detection Algorithms

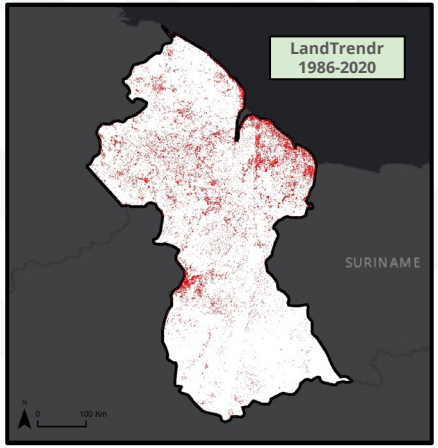


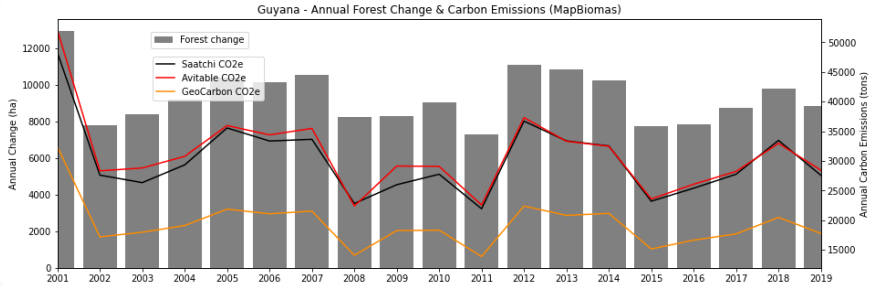
15,334.04 ha
Annual deforestation

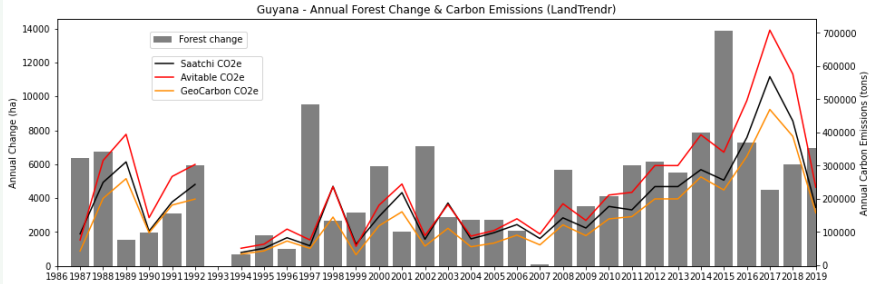
11,145.71 ha
Annual deforestation

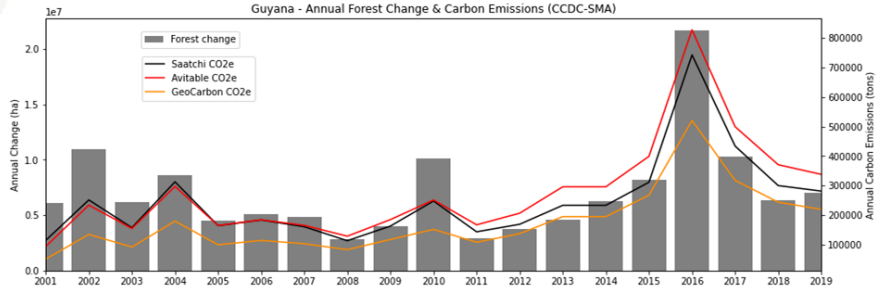
7,053.59 ha
Annual deforestation

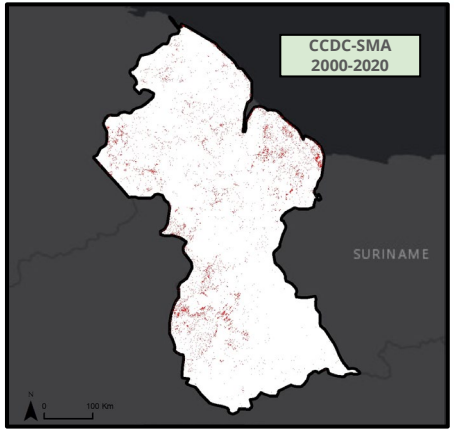
Activity Data - Guyana Results





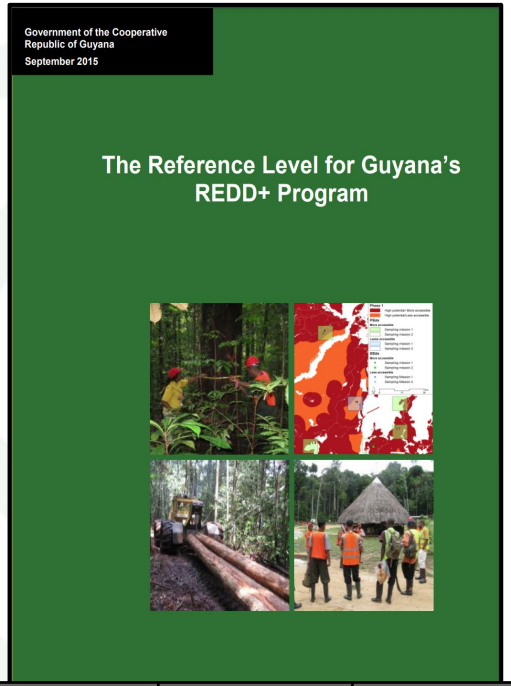






Increased to a 173.8% difference in CO_2e estimations when adding regional & change detection algorithms

CO_2e Comparison



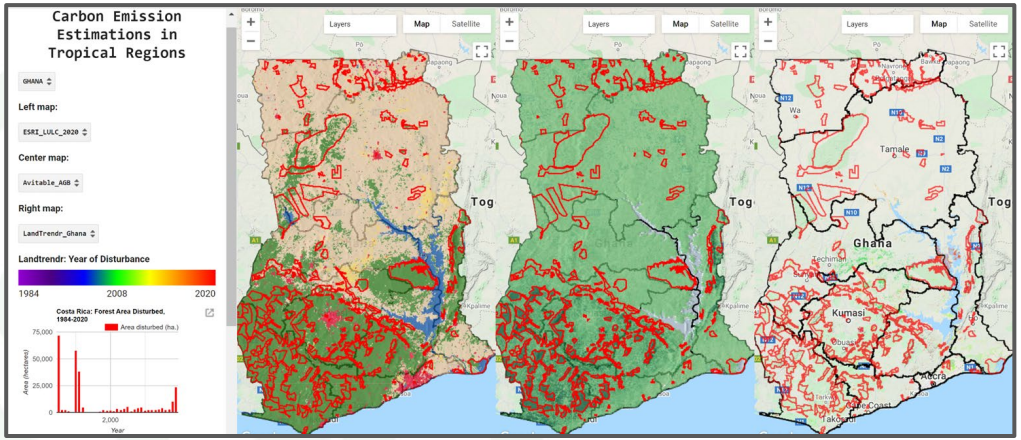
Average Change in Forest Area (ha./year)	AGB Carbon Stock (tons CO_2)	Emissions = Area x AGB (tons CO_2e per year)
5,791.67	198.57	1,150,070.83

"Guyana has established the time period for historic emissions to be from 2001-2012, a total of 12 years…Total deforestation over the historic period is estimated to be 69.5 thousand ha."

LC Dataset	AGB Dataset	Average Change in Forest Area (ha./year)	AGB Carbon Stock (tons CO2/ha.)	Emissions = Area x (AGBx0.48)
MCD12Q1	FREL	21,924.83	198.57	**2,089,770.06**
MCD12Q1	IPCC Tier 1	21,924.83	245.94	**2,588,252.49**
MCD12Q1	Saatchi et al 2011	21,924.83	182.83	**1,924,088.00**
MCD12Q1	Avitable 2015	21,924.83	220.66	**2,322,207.83**
MCD12Q1	GeoCarbon 2020	21,924.83	240.77	**2,533,843.83**
MCD12Q1	GEDI L4B	21,924.83	112.98	**1,188,992.30**
LandTrendr	FREL	11,145.71	198.57	**1,062,355.92**
LandTrendr	IPCC Tier 1	11,145.71	241.56	**1,292,331.81**
LandTrendr	Saatchi et al 2011	11,145.71	204.89	**1,096,149.46**
LandTrendr	Avitable 2015	11,145.71	263.32	**1,408,746.53**
LandTrendr	GeoCarbon 2020	11,145.71	294.35	**1,574,755.21**
LandTrendr	GEDI L4B	11,145.71	185.08	**990,167.13**
GFW code	FREL	11,631.58	198.57	**1,108,666.54**
GFW code	IPCC Tier 1	11,631.58	241.29	**1,347,160.17**
GFW code	Saatchi et al 2011	11,631.58	227.54	**1,270,391.75**
GFW code	Avitable 2015	11,631.58	298.66	**1,667,465.94**
GFW code	GeoCarbon 2020	11,631.58	326.13	**1,820,835.28**
GFW code	GEDI L4B	11,631.58	183.51	**1,024,565.31**
JAXA F/NF	FREL	37,705.40	198.57	**3,593,898.61**
JAXA F/NF	IPCC Tier 1	37,705.40	233.54	**4,226,745.18**
JAXA F/NF	Saatchi et al 2011	37,705.40	134.08	**2,426,659.22**
JAXA F/NF	Avitable 2015	37,705.40	136.69	**2,473,896.54**
JAXA F/NF	GeoCarbon 2020	37,705.40	179.60	**3,250,507.12**
JAXA F/NF	ORNL 2010	37,705.40	31.65	**572,820.44**
JAXA F/NF	GEDI L4B	37,705.40	58.71	**1,062,568.34**
MapBiomas	FREL	15,334.04	198.57	**1,461,567.71**
MapBiomas	IPCC Tier 1	15,334.04	237.44	**1,747,612.72**
MapBiomas	Saatchi et al 2011	15,334.04	171.50	**1,262,298.41**
MapBiomas	Avitable 2015	15,334.04	193.55	**1,424,593.92**
MapBiomas	GeoCarbon 2020	15,334.04	225.48	**1,659,609.59**
CCDC-SMA	FREL	7,053.59	198.57	**672,314.27**
CCDC-SMA	Saatchi et al 2011	7,053.59	96.47	**326,620.60**
CCDC-SMA	Avitable 2015	7,053.59	87.36	**295,776.67**
CCDC-SMA	GeoCarbon 2020	7,053.59	146.32	**495,398.84**
FREL	FREL	5,791.67	198.57	**552,034.00**
FREL	IPCC Tier 1	5,791.67	134.08	**372,742.40**

~40 estimates per country thus far

Web Platform



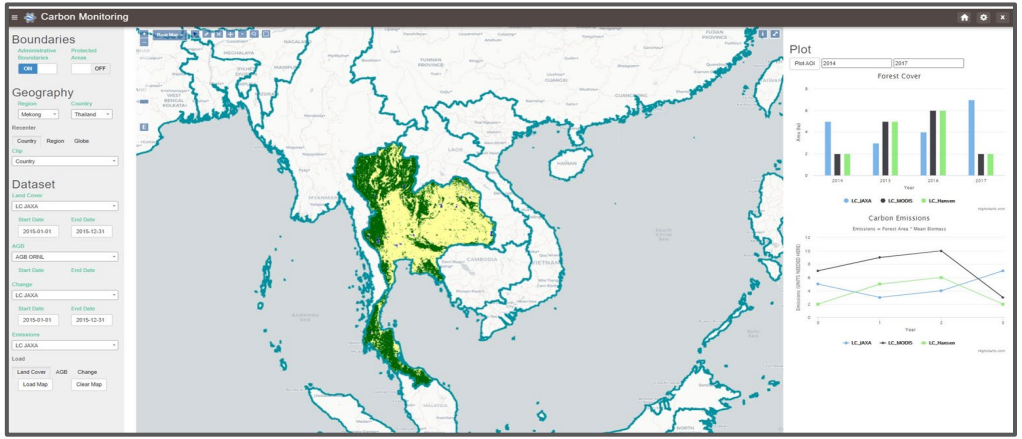
Interactive Global Web Mapper

Functions

AOI selection - Pilot Countries
Visualize data sets
IPCC climate zones
Global Land Cover / AGB
User Land Cover / Carbon Stock
Localized calculations

Plot Generation

Forest Distribution
Carbon distribution
Emission stock over time
Condensed finalized calculations after user input



SERVIR Hub Benefit

Uncertainties

Guide the users on which datasets are the most appropriate for their region

Capacity Building

Provide technical trainings on how to estimate CO_2e using different datasets

Hub Services

Work with the hubs to incorporate these methodologies into their current land cover services

Potential Financial Value

Theoretical value that is lost when tons of CO_2 are emitted: demonstrate how much it would be worth if the country could get those revenues

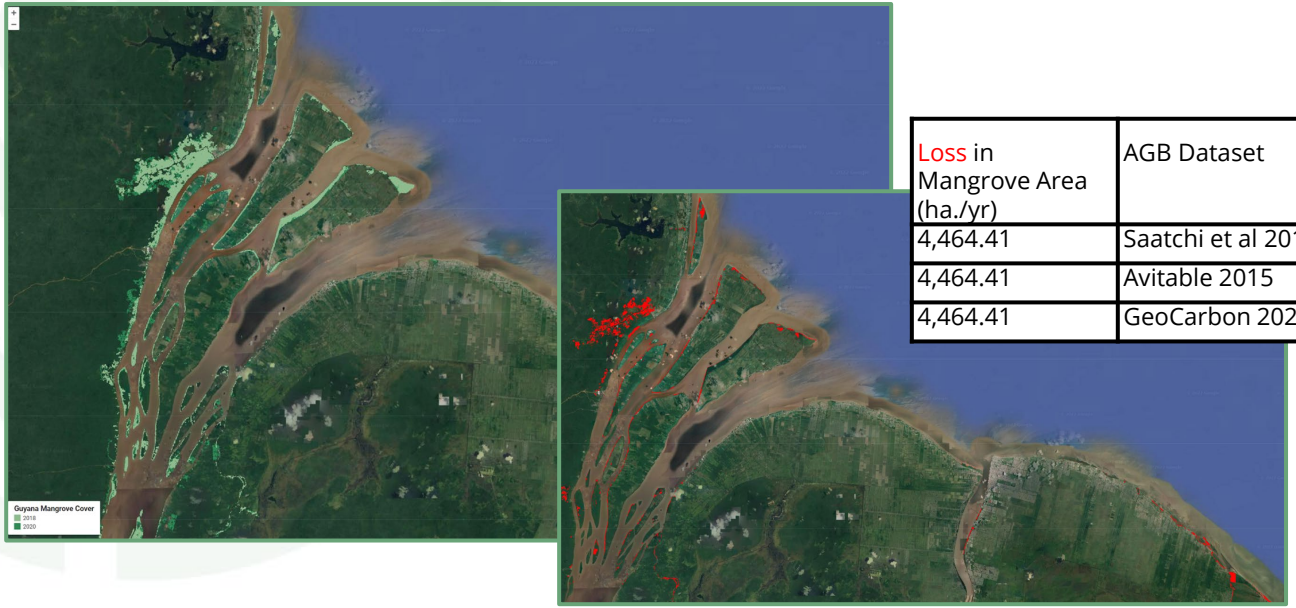
Web Platform

User-friendly, needs focused platform that hubs can use to familiarize various datasets to apply to their own work

Guyana Mangrove Monitoring Service

This service makes mangrove-related land-use change transparent and the resulting analysis publicly available for use by government and civil society to:

1) act on hotspots of deforestation and stop them on time
2) engage in land-use planning, policy-making and actions that protect mangroves from being converted to other land uses
3) plan mangrove protection efforts for farmers in low-lying coastal regions.



Loss in Mangrove Area (ha./yr)	AGB Dataset	AGB Carbon Stock (tons CO2/ha.)	Emissions = Area x AGB (per year)
4,464.41	Saatchi et al 2011	87.35	389,966.21
4,464.41	Avitable 2015	110.56	493,585.17
4,464.41	GeoCarbon 2020	131.65	587,739.58

Implications: Policy Relevance

Improved understanding of carbon dynamics (nationally, regionally)

USAID's Global Climate Change program's Sustainable Landscapes goal "to assist countries to reduce greenhouse gas emissions from deforestation and land degradation and to enhance sequestration of carbon associated with sound land use and management"

Glasgow Leaders' Declaration (COP26) goal of global net zero deforestation by 2030: "conserve forests and other terrestrial ecosystems and accelerate their restoration"

SDG Target 15.2: "By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally"

Questions?

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