# PA11A-0207: How to address a global problem with Earth Observations? Developing best practices to monitor forests around the world
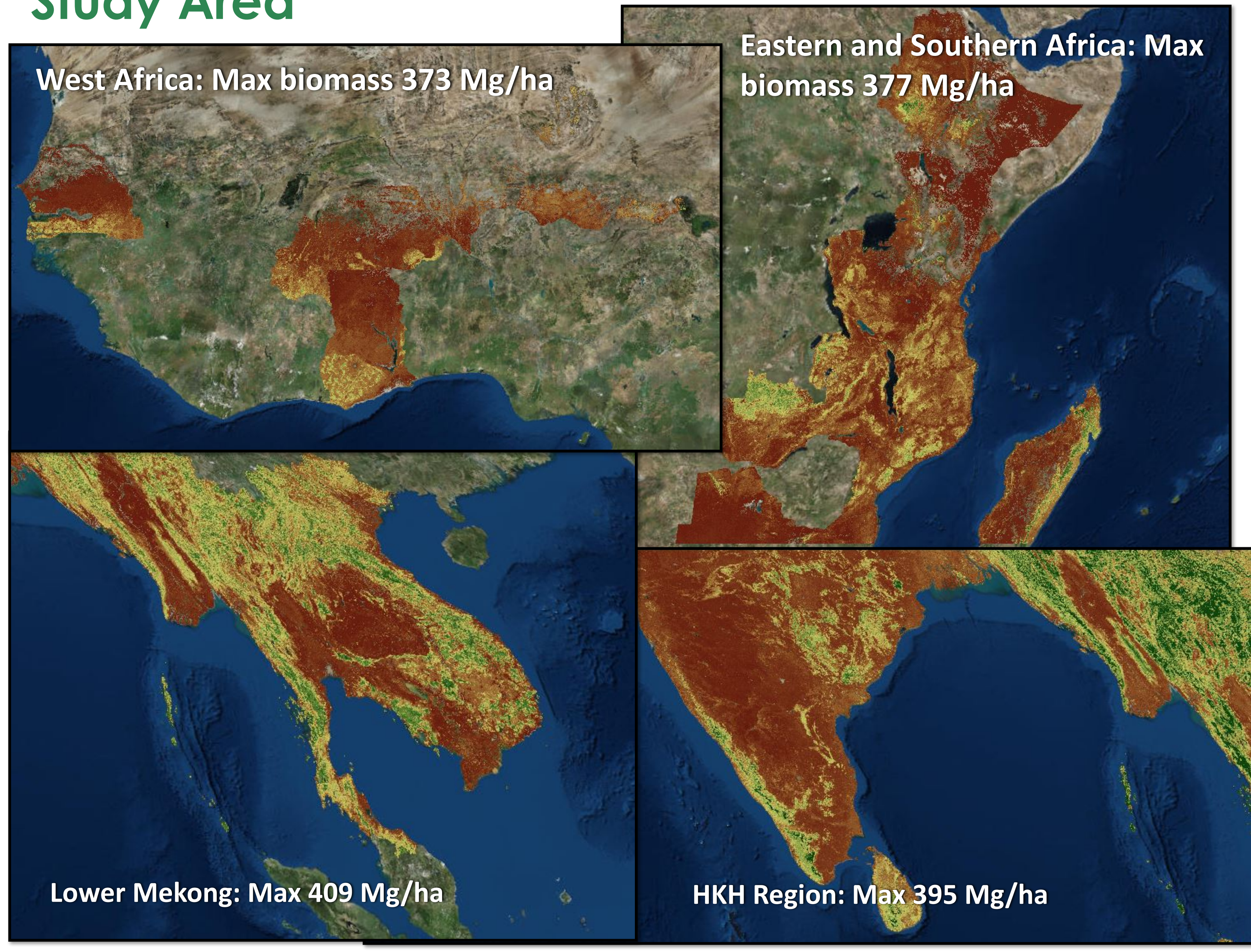
Africa I. Flores Cordova[1,3], Emil A. Cherrington[1,3], Krishna Vadrevu[2,3], Rajesh Bahadur Thapa[6], Phoebe Odour[4], Hamid Mehmood[7], Nguyen Hanh Quyen[7], David Saah[8,9], Kadidia Yero[5], Bako Mamane[5], Paul Bartel[5], Ashutosh S. Limaye[2,3], Raymond French[2,3], Daniel Irwin[2,3], Sylvia Wilson[10], Sasha Gottielb[11], Evan Notman[12]

Corresponding author: Africa.flores@nasa.gov

1. University of Alabama in Huntsville, 2. NASA Marshall Space Flight Center, 3. NASA-SERVIR, 4. Regional Centre for Mapping of Resources for Development (RCMRD) 5. Agriculture, Hydrology and Meteorology Regional Center (AGHRYMET) 6. International Center for Integrated Mountain Development (ICIMOD), 7. Asian Disaster Preparedness Center (ADPC) 8. Spatial Informatics Group, LLC, 9. University of San Francisco, 10. United States Geological Survey (USGS) 11. US Forest Service Washington DC, 12. US Agency for International Development
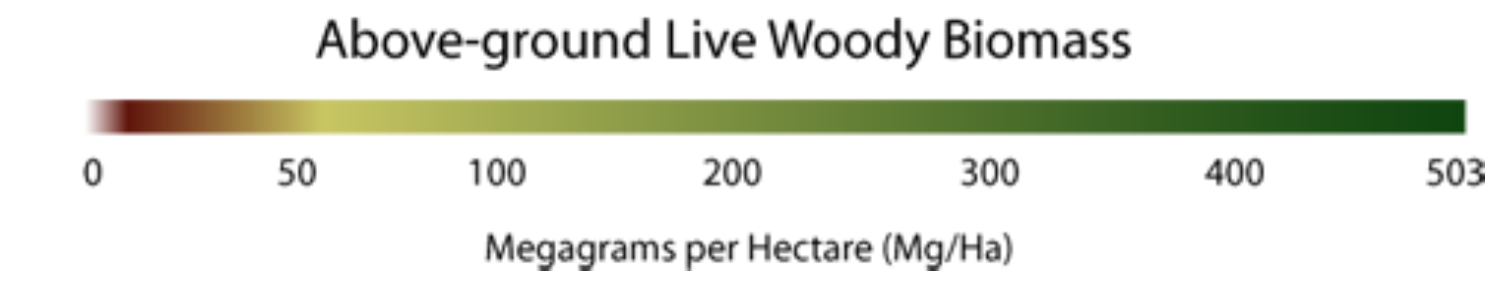
## Objectives

▸ Build capacity to process SAR datasets to monitor forests and estimate biomass

▸ Produce training materials on standard SAR processing techniques to monitor forests and estimate biomass

## Study Area



West Africa: Max biomass 373 Mg/ha
Eastern and Southern Africa: Max biomass 377 Mg/ha
Lower Mekong: Max 409 Mg/ha
HKH Region: Max 395 Mg/ha

A. Baccini, S J. Goetz, W.S. Walker, N. T. Laporte, M. Sun, D. Sulla-Menashe, J. Hackler, P.S.A. Beek, R. Dubayah, M.A. Friedl, S. Samanta and R. A. Houghton. Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. 2012 Nature Climate Change, http://dx.doi.org/10.1038/NCLIMATE1354, The Woods Hole Research Center | Esri, HERE, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Above-ground Live Woody Biomass

0   50   100   200   300   400   503
Megagrams per Hectare (Mg/Ha)

## Earth Observations

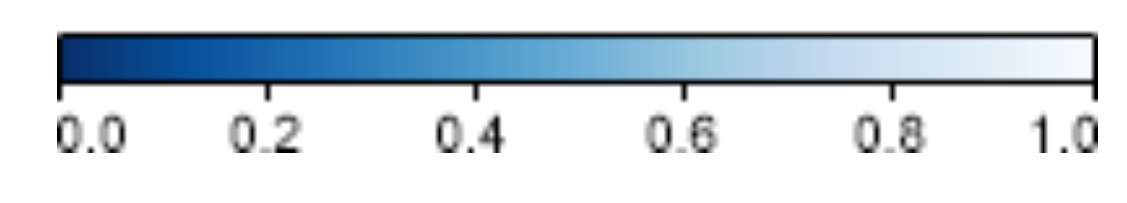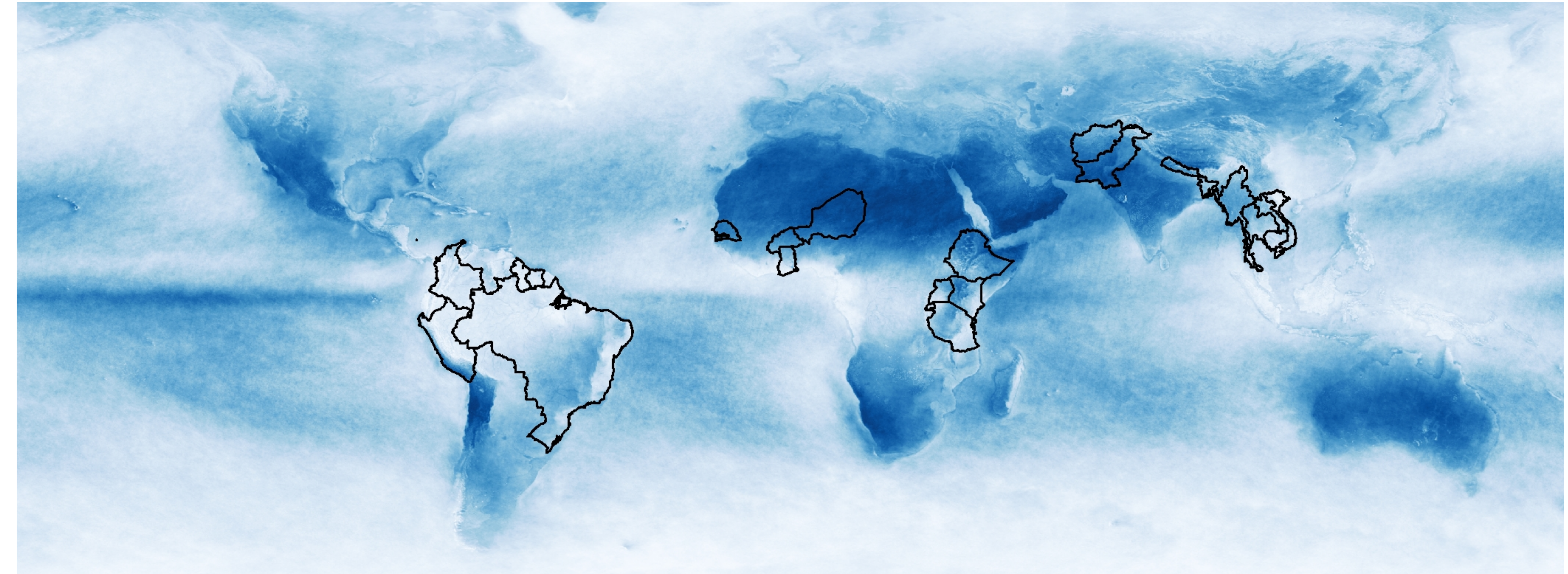| Satellite/Sensors | Period of Operation | Band | Wavelength (cm) | Spatial Resolution (m) | |
|---|---|---|---|---|---|
| RADARSAT-2 | 2007- | C | 5.6 | 3-100 | Not for operational purposes |
| Sentinel-1A Sentinel-1B | 2014-2016- | C | 5.6 | 9-15 | Freely available |
| ALOS/PALSAR | 2006-2011 | L | 23.6 | 10-100 | Freely available |
| BIOMASS | Scheduled 2020 | P | 69.0 | 50 | |
| NISAR | Scheduled 2021 | L, S | L-band: 24 S-band: 10 | | It will be freely available |

## Abstract

Forests represent a key natural resource, for which degradation or disturbance is directly associated to economic implications, particularly in the context of the United Nations program REDD+ in supporting national policies to fight illegal deforestation.

SERVIR, a joint NASA-USAID initiative that brings Earth observations (EO) for improved environmental decision making in developing countries, works with established institutions, called SERVIR hubs, in four regions around the world. SERVIR is partnering with global programs with great experience in providing best practices in forest monitoring systems, such as SilvaCarbon and the Global Forest Observation Initiative (GFOI), to develop a capacity building plan that prioritizes user needs. Representatives from the SERVIR global network met in February 2017 with experts in the field of Synthetic Aperture Radar (SAR) for forest applications to envisage this capacity building plan that aims to leverage the state-of-the-art knowledge on remote sensing to enhance forest monitoring for user agencies in SERVIR regions.

## Problem Statement

➢ Current methods to monitor forest rely mainly on the use optical satellite imagery

➢ Optical imagery has a limitation to monitor forest due to high cloud coverage in the areas of interest.

➢ Poor results on biomass estimations derived solely from optical imagery



Cloud fraction Terra/MODIS

0.0   0.2   0.4   0.6   0.8   1.0

## Approach

| Training | SERVIR-Hub Hosting training | Location | Dates, 2018 |
|---|---|---|---|
| SAR Basics and Forest Degradation and Deforestation | (1) West Africa (2) HKH | (1)Niamey (2)Kathmandu | (1) Jan 29-Feb 2 (2) Feb 12-16 |
| Forest height | Mekong | Bangkok | Mar 12-16 |
| Mangrove and Sampling design | E&S Africa | Nairobi | April 16-20 |
| Forest structure and biomass | HKH | Kathmandu | Apr 30 - May 4 |

## Expected Results

▸ Best practices: SAR Handbook

▸ Online training materials

▸ Filling the gap on:
- Concepts of Syntethic Aperture Radar Remote Sensing
- Use of SAR data for mapping forest degradation and deforestation
- Use of spaceborne SAR data for retrieving forest structural parameters and phenology. (Sassan)
- Exploring Forest Structure with SAR
- Radar Remote Sensing of Mangrove Forests
- Sampling Design for SAR –Assisted Forest Carbon Monitoring

## Project Partners

SilvaCarbon

GFOI