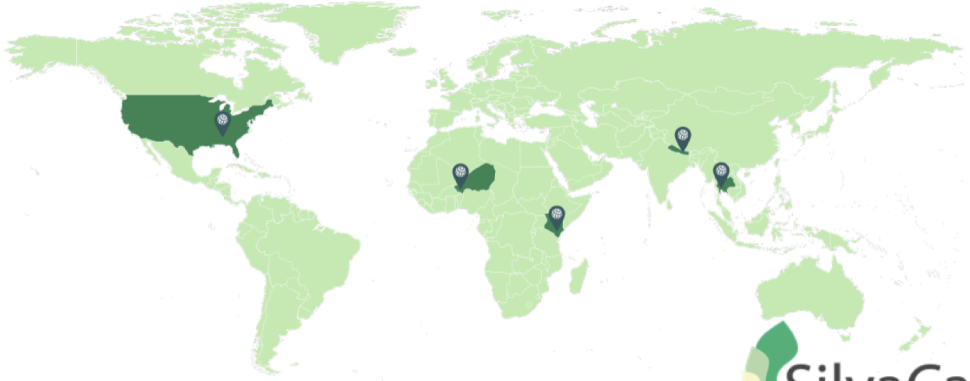
SAR Handbook: Background

Main objective: Build applied capacity in using SAR for Forest Monitoring and Biomass estimation using Synthetic Aperture Radar (SAR) technology.

TRAINING	DATE	HUB	PARTICIPANTS	SKILLS GAINED
SAR Basics and Forest Degradation and Deforestation	29 Jan – 2 Feb 2018 12 – 16 Feb 2018	SERVIR West Africa SERVIR Hindu Kush Himalaya	26 32	SAR processing using SNAP, Python scripts
SAR Forest Height	12 – 14 Mar 2018	SERVIR Mekong	23	SAR in forest/non-forest classification, biomass and forest stand height (FSH) estimation
SAR Training: Mangrove and Sampling Design	16 – 20 Apr 2018	SERVIR Eastern & Southern Africa	27	Mangrove mapping, above ground biomass estimation, forest sampling design
SAR Forest Structure and Biomass	30 Apr – 4 May 2018	SERVIR Hindu Kush Himalaya	24	Monitoring forest carbon stocks, SAR workflows



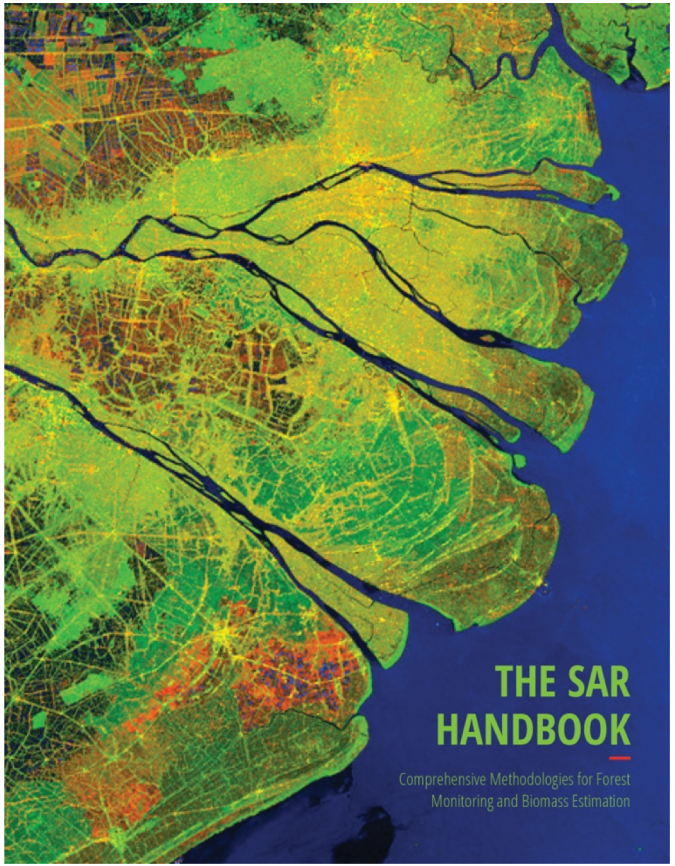
SAR Handbook: Comprehensive Methodologies for Forest Monitoring and Biomass Estimation

NASA e-Book with interactive PDFs. Includes applied theory and hands-on exercises.

- open-source scripts to process SAR data for particular forestry applications

Technical Chapters:

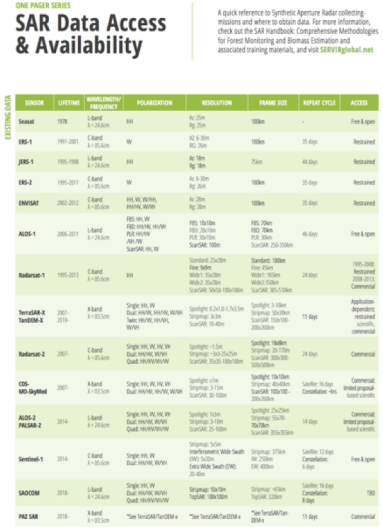
- **Spaceborne Synthetic Aperture Radar - Principles, Data Access, and Basic Processing Techniques**
  Author: Franz Meyer
- **Use of SAR Data for Mapping Deforestation and Forest Degradation**
  Author: Josef Kellndorfer
- **Forest Stand Height**
  Author: Paul Siqueira
- **SAR Methods for Mapping and Monitoring Forest Biomass**
  Author: Sassan Saatchi
- **Radar Remote Sensing of Mangrove Forests**
  Author: Marc Simard
- **Sampling Designs for SAR-Assisted Forest Biomass**
  Author: Hans Andersen

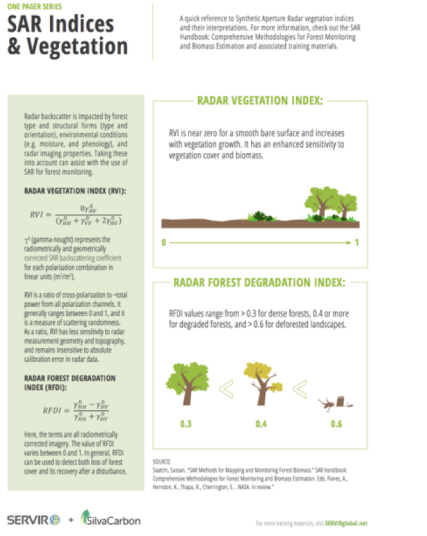


SAR Handbook: One-Pagers

Quick reference guides for essential SAR concepts

- SAR Data Pre-Processing Steps
- SAR Data Access and Availability
- SAR Vegetation Indices
- Forest Stand Height Estimation using SAR
- Biomass Estimation using SAR



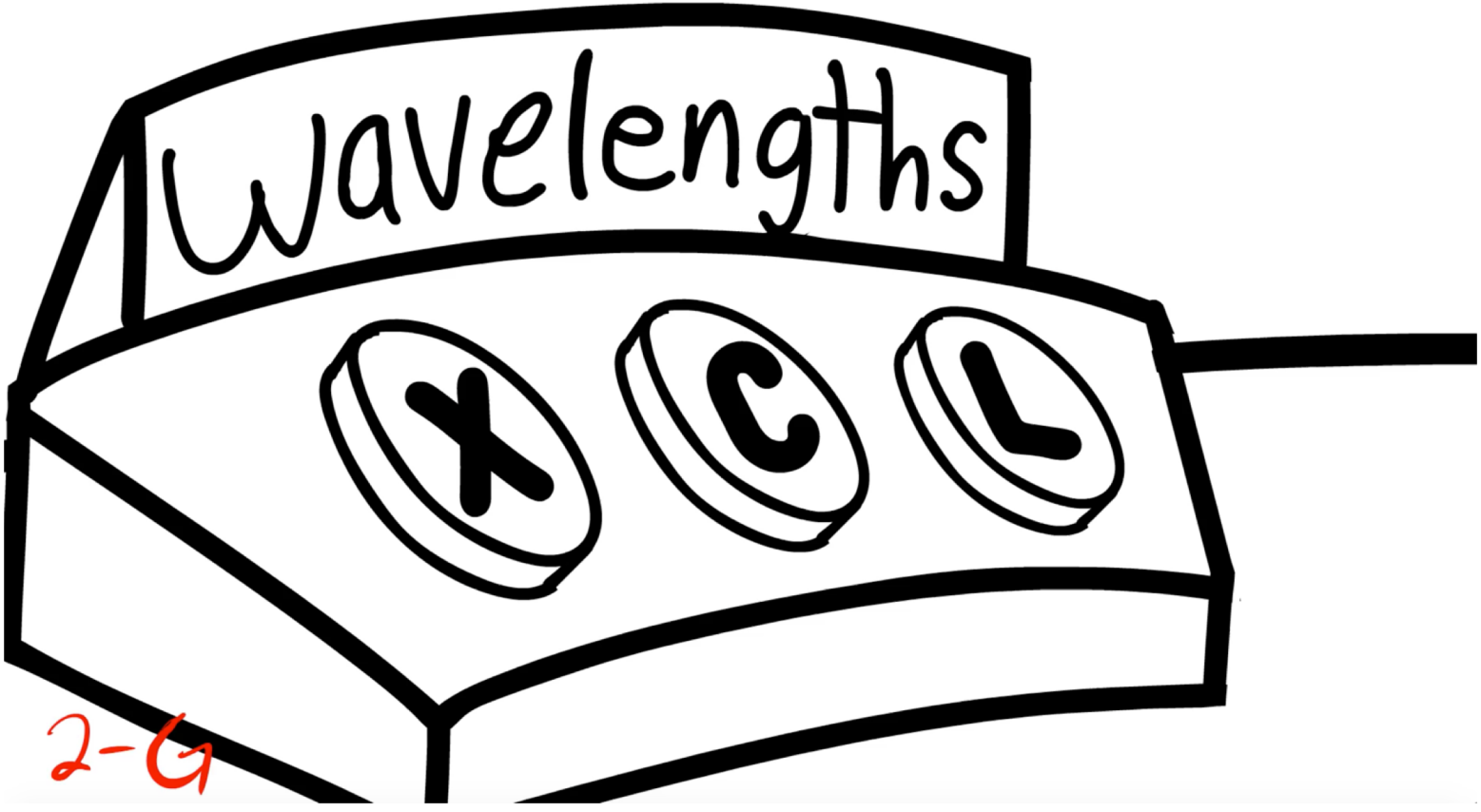


SAR Handbook: Forthcoming Technical Videos

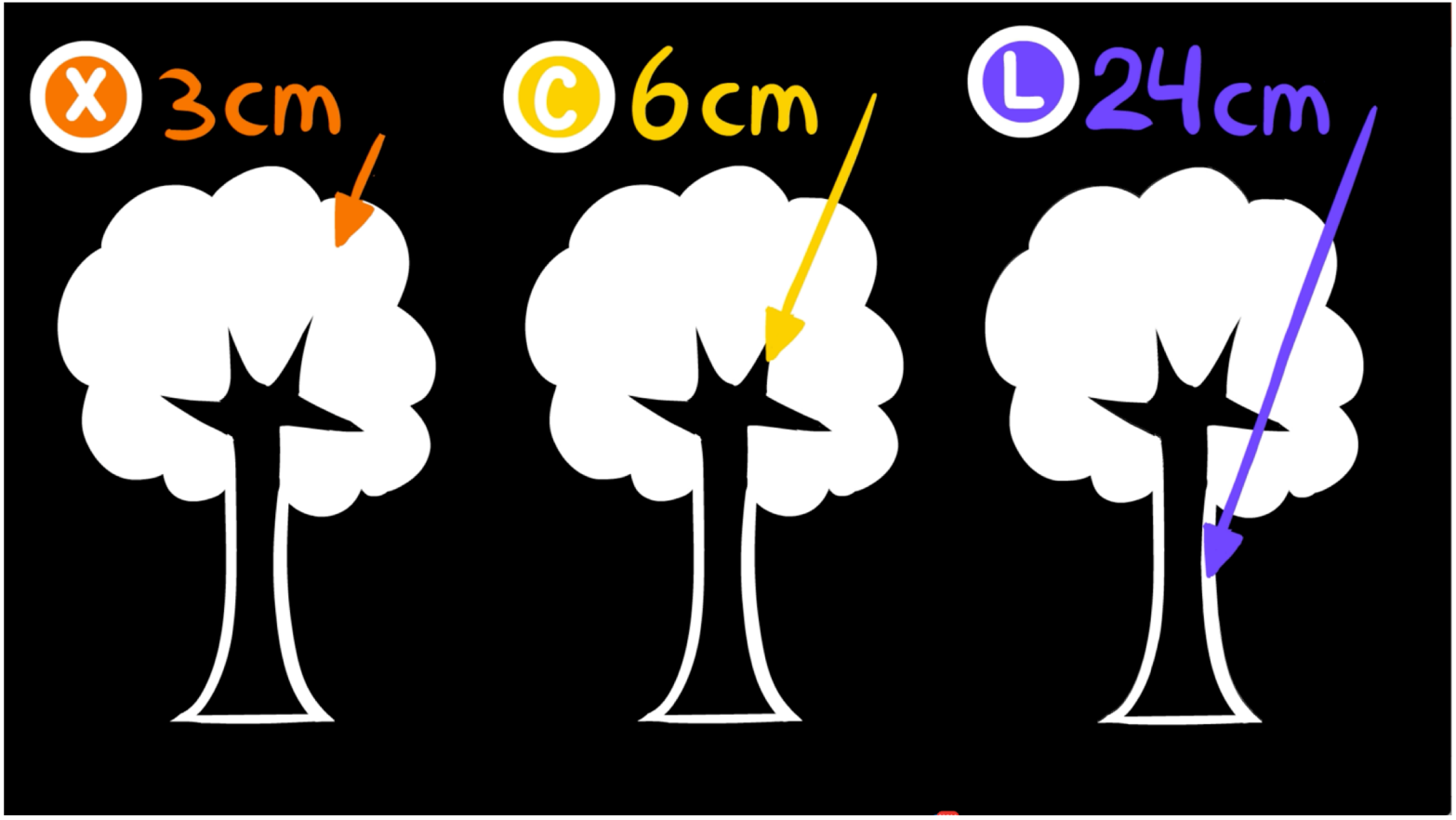
Three animated videos explaining technical content of the Handbook

- SAR Basics for Forest Monitoring
- Forest Stand Height Estimation with SAR
- Biomass Estimation with SAR

SAR Basics for Forest Monitoring
sneak-peek



SAR Basics for Forest Monitoring
sneak-peek-2



SAR Basics for Forest Monitoring
sneak-peek-3

SAR Basics for Forest Monitoring

Script-part1

INT. NASA Installation

SCIENTIST is flipping through a stack of pictures on her desk.

NARRATOR (V.O.)
When scientists need to know what's happening on the Earth's surface, they often look down from space.

Optical images of Earth dated through time: 1980- Flip-1990-Flip- 2000- Flip- 2010. Same view of Earth, with alternating images, with parts of visible continents being obscured by clouds.

SCIENTIST
These are great, but they don't give me everything. I need topography, I need forest structure. I need moisture conditions, I need to know more! I think this is a job for SAR!

Cut To: SAL, another Scientist standing in front of a console eating a piece of pizza. He is blocking a TV monitor behind him. Zoom into the name tag – "SAL"

SCIENTIST (O.S.)
Noooo! Out of the way Sal!

SAL looks confused and then steps out of the way.
Animation zoom into the TV screen behind him showing an image of a Satellite with the initials "SAR" on it.

NARRATOR (V.O.)
Optical images of Earth from space are great. Yet to protect our forests, we also have another technology we can use. Space-borne SAR, or Synthetic Aperture Radar, is an all-weather imaging technology. SAR is especially useful for checking in on the status of our forests and other types of land cover. It does more than take a simple image -- it collects data at different wavelengths and polarizations that help paint a more complete picture of what is happening down below. What's more, it can even see through clouds.

Cut to: The female scientist approaches a control panel. The Panel shows three buttons labeled X, C, and L. Below them is a label of the control panel that says "Wavelengths." Wavelength and Frequency information are displayed below the buttons. The Scientist hits all three buttons.

NARRATOR (V.O.)

SAR Basics for Forest Monitoring

Script-part2

SAR sensors have the capability to transmit signals at different wavelengths. In radar, these wavelengths are often grouped into “bands”. The most popular of these bands are referred to as X-, C-, and L-band. Depending on the band, the emitted signal can penetrate into forest canopies and provide information about the canopy structure or even about what lies below.

Cut to: Shooting out of the satellite are three human(ish) characters wearing similar capes/superhero costumes, emerging from three separate doors of the satellite. Each has a symbol representing X, C, or L. The paths of all three Wavelengths are animated behind them to demonstrate a Vertical or Horizontal polarization (different types of squiggly lines).

NARRATOR (V.O).
Let’s get deep here for a minute. Each of our superhero
wavelengths are specialists in monitoring a different aspects of our forests.

Cut to: WAVELENGTH X flying out of his door with a big H and V
on it. He is hovering in space then speeding towards Earth,
bursting through a cloud, and lovingly hovering over the canopy
of a healthy forest. An adorable Capuchin monkey that was peacefully eating a fruit is startled by WAVELENGTH X and disappears beneath the canopy. WAVELENGTH X pats a few of the top leaves.

WAVELENGTH X (V.O)
I monitor the tops of the forest. Some people call me shallow,
yet I can detect the forest canopy so people can spot
any new holes and protect forests against deforestation.

Cut to: WAVELENGTH C flying out of her door with a big H and V
on it. She is hovering in space then speeding towards Earth,
bursting through a cloud and towards a forest. She lands in an area of thick criss crossing branches and vines. Neither the canopy or ground can be seen. The same adorable Capuchin monkey is startled again and the fruit jumps out of its hands. The monkey frantically attempts to catch the fruit but it falls down and off screen. It screeches at WAVELENGTH C and then scrambles down the tree to get the fruit and disappears off screen. A bluebird lands on her shoulder. Both WAVELENGTH C and the Bluebird turn to look at each other and shrug.