



LTS THE UNIVERSITY OF EDINBURGH Knowledge Transfer Partnerships

A tool for monitoring woody biomass (change) in woodland ecosystems

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Background

- Changes in forest area and biomass stock are altering the carbon cycle and the global climate [2]
- Causes of forest change: small-scale cultivation, charcoal production, selective logging
- Remote Sensing (RS) provides different techniques to monitor forest change from space

RADAR Remote Sensing

- Active RS systems (e.g. RADARS) offer cloud-free imagery and have day-or-night acquisition capability
- Long wavelength RADAR systems measure backscatter, a good indicator of forest carbon stock
- RADAR systems provide an alternative solution over optical systems (e.g. Landsat) to detect forest degradation

ForAST - Forest Radar Assessment Tool

ALOS PALSAR data

- Phased Array L-band Synthetic Aperture Radar (PALSAR) mounted on the Advanced Land Observing Satellite (ALOS) [6]
- Frequency: 1.27 GHz → $\lambda = 24\text{cm}$
- Lifetime: 2007 - 2010
- Terrain correction performed with the 90 meters resolution Shuttle Radar Topography Mission (SRTM) dataset

Field inventory

An inventory of ninety-six plots was used to calibrate RADAR data. Plots were ranging between 0.1 to 2.2 ha (mean ± 1.1, dev = 0.63 ± 0.33 ha), within an area of 1,160km² located in central Mozambique [5]

Main Findings

Biomass changes of 12 MgC ha⁻¹ were observed with 95% confidence. Although with high uncertainty, degradation contributed up to 67% of the changes.

Processing Chain

The ForAST is implemented through the execution of a processing chain that includes:

- Terrain correction: to account for terrain effects on geometric properties of radar data
- Merge, Average and Mosaic: to produce a noise-reduced year-average product of the backscatter values
- Intensity Calibration: to calibrate one year-average to another, using histogram matching
- Backscatter to Biomass (B-B): apply the B-B regression to the original radar backscatter to generate biomass maps
- Intensity Change Map (I): $I = B_{t_2} - B_{t_1}$, where B_{t_1} is biomass in 2007 and B_{t_2} is biomass in 2010

Classification of changes was applied to the I maps.

Deforestation & Degradation

Between deforestation and degradation, more than 96% of the total biomass loss, in the 2007-2010 period, was due to degradation. In some areas, about 40% of the total biomass loss was due to degradation. Selective logging has been identified as main cause of degradation.

Year	Biomass Stock	Biomass Loss
2007	100	0
2010	85	15
2013	70	15
2016	55	15

