

K&C Phase 4 – Status report

*Measuring above ground biomass and changes over
Brazilian tropical secondary forests and savanna
woodlands (Cerrado) using L-band SAR data*

Shaun Quegan, João Carreiras

National Centre for Earth Observation (NCEO)

University of Sheffield

United Kingdom

Edson Sano

Institute of Environment and Renewable Natural Resources (IBAMA)

Brazil

Project outline and objectives

Assess the sensitivity of L-band SAR data to forest above ground biomass (AGB) in lower-carbon tropical regions of **Brazil** :
secondary forests and savanna woodlands (**Cerrado**)

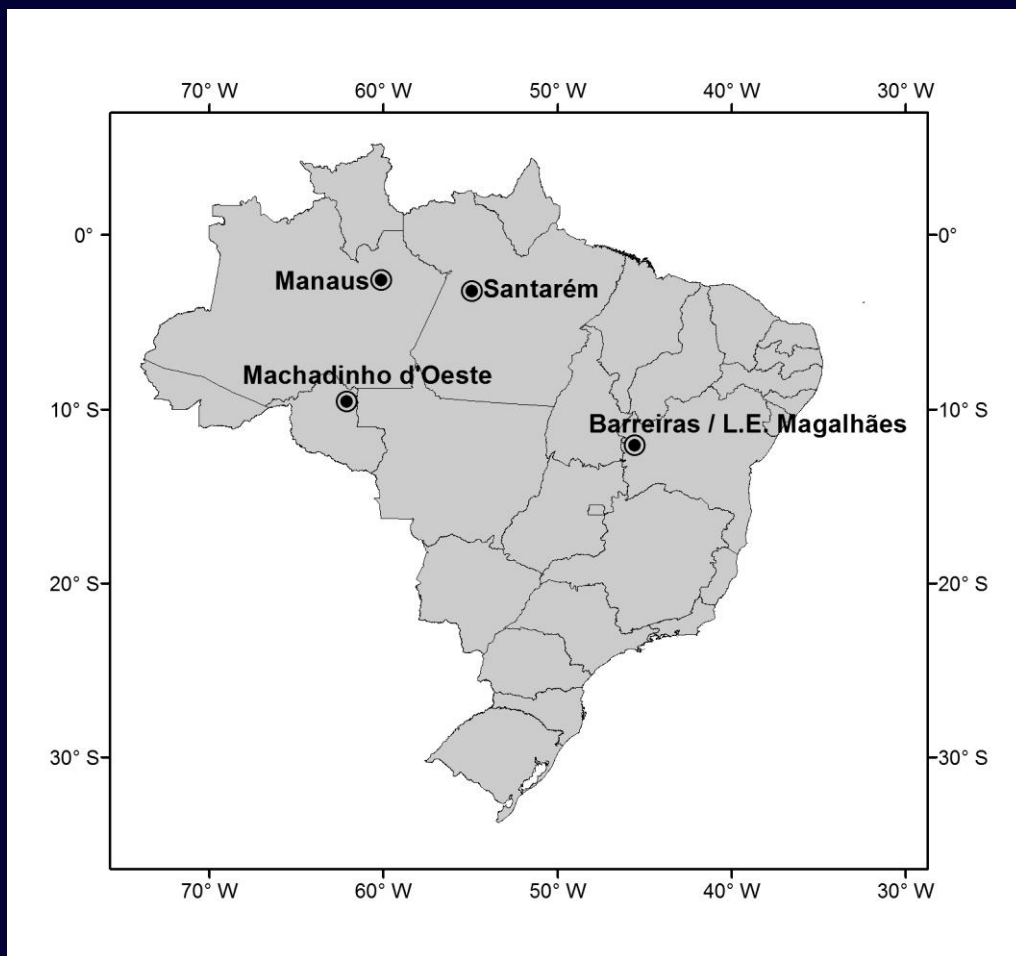
Mapping the age of tropical secondary forests as a proxy for AGB

Mapping AGB in tropical secondary forests and Cerrado

Support of K&C Thematic Drivers

- Tropical secondary forests are an important carbon sink, partially offsetting gross emissions due to land use change (mainly from deforestation), and also important at restoring biodiversity
- Still high uncertainty in the contribution of secondary forests to the global carbon budget (~50% in South America – Pan et al., 2011)

Study areas



Secondary forests

- Manaus (Amazonas)
- Santarém (Pará)
- Machadinho d'Oeste (Rondônia)

Savanna woodland (*Cerrado*)

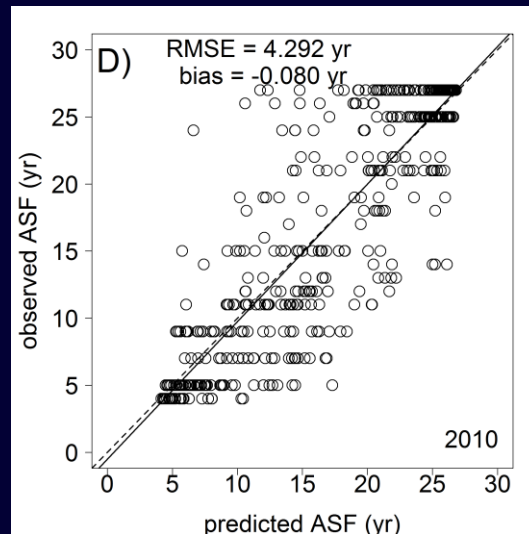
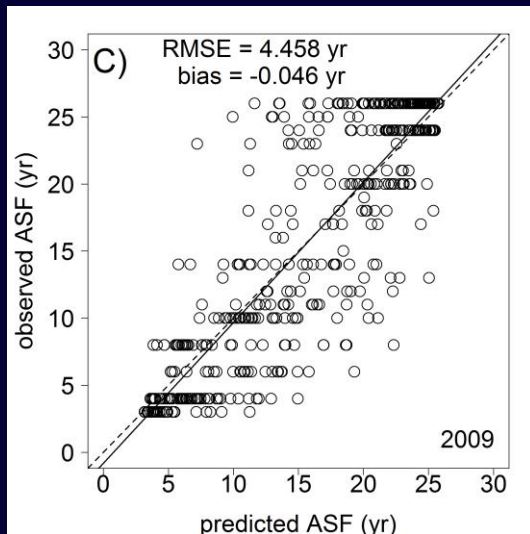
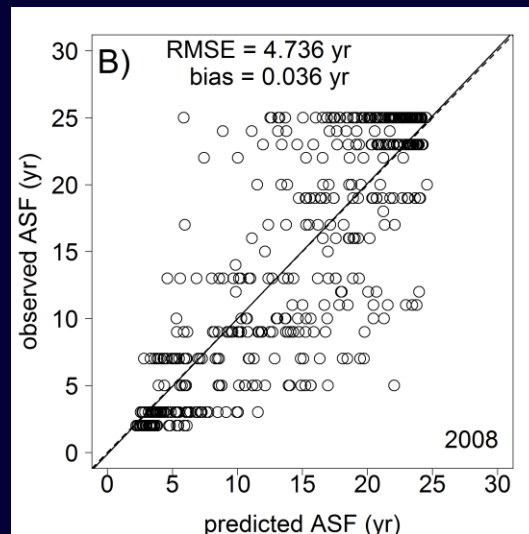
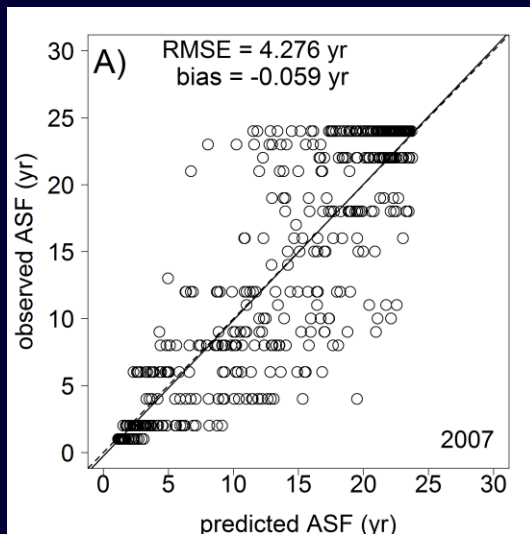
- Barreiras (Bahia)
- Luis Eduardo Magalhães (Bahia)

Results and significant findings

What is the capability of optical and L-band SAR data to discriminate the age of tropical secondary forests?

- Access to precise location of areas with secondary forests of known age
- ALOS PALSAR 2007-2010 catalogue: dual-pol (HH+HV) level 1.1
- Landsat 5 TM surface reflectance data 2007-2010 (USGS)
- Regression: machine learning (random forests)

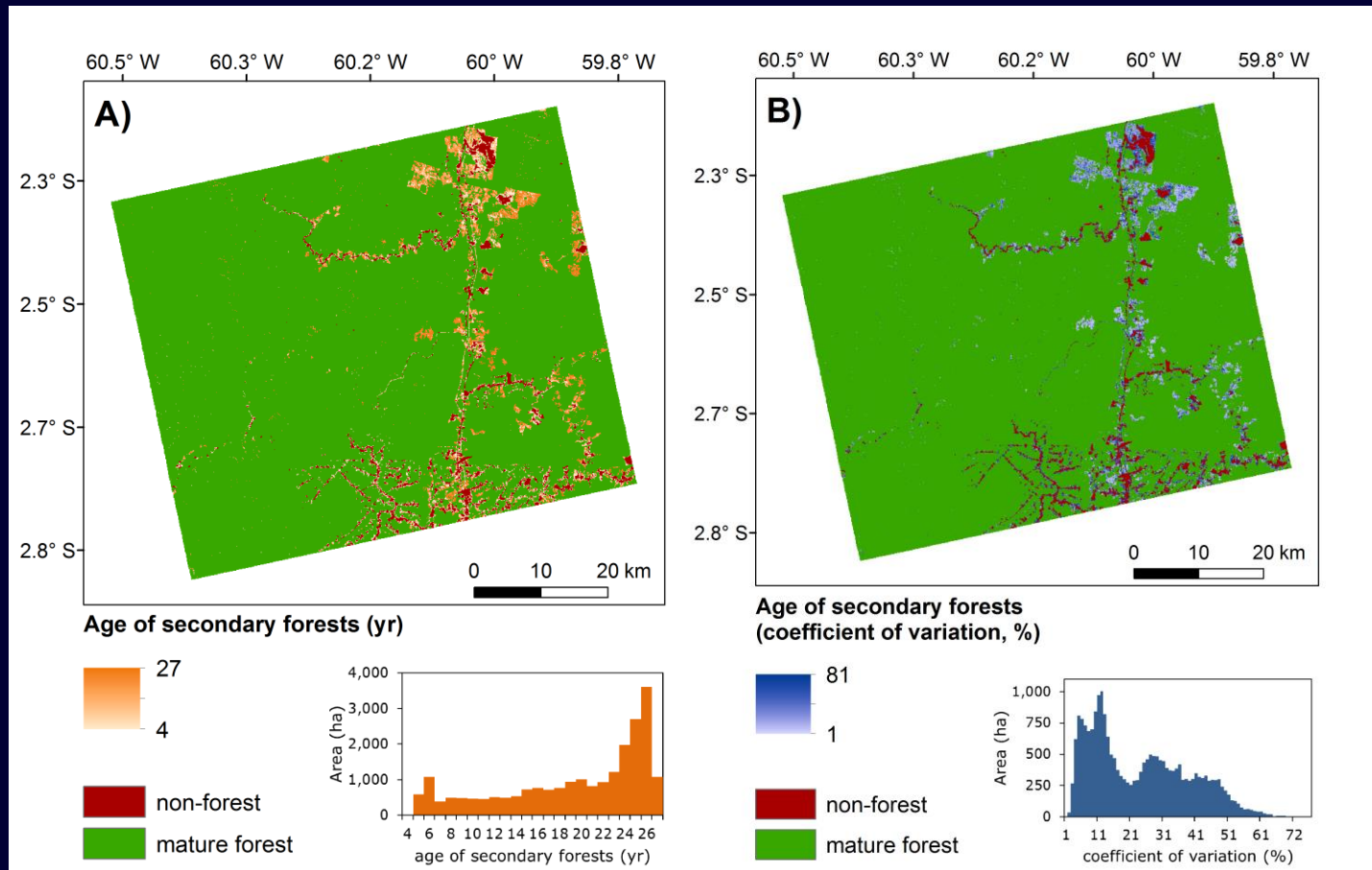
Results and significant findings



- RMSE ~4 yr and on averaged unbiased
- However, bias highly dependent on the age class
- Overestimation in younger age classes and underestimation in older age classes

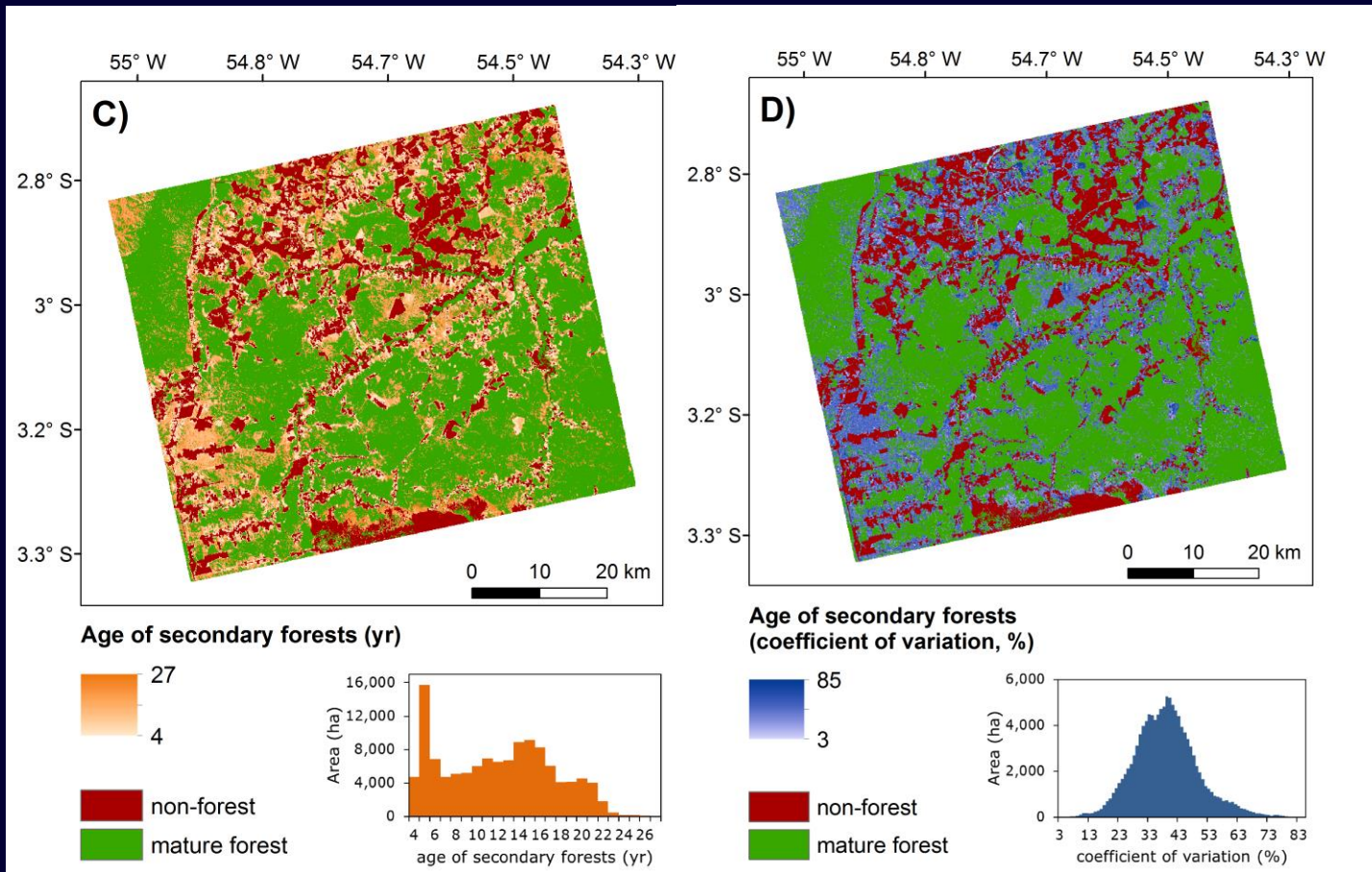
Results and significant findings

Manaus



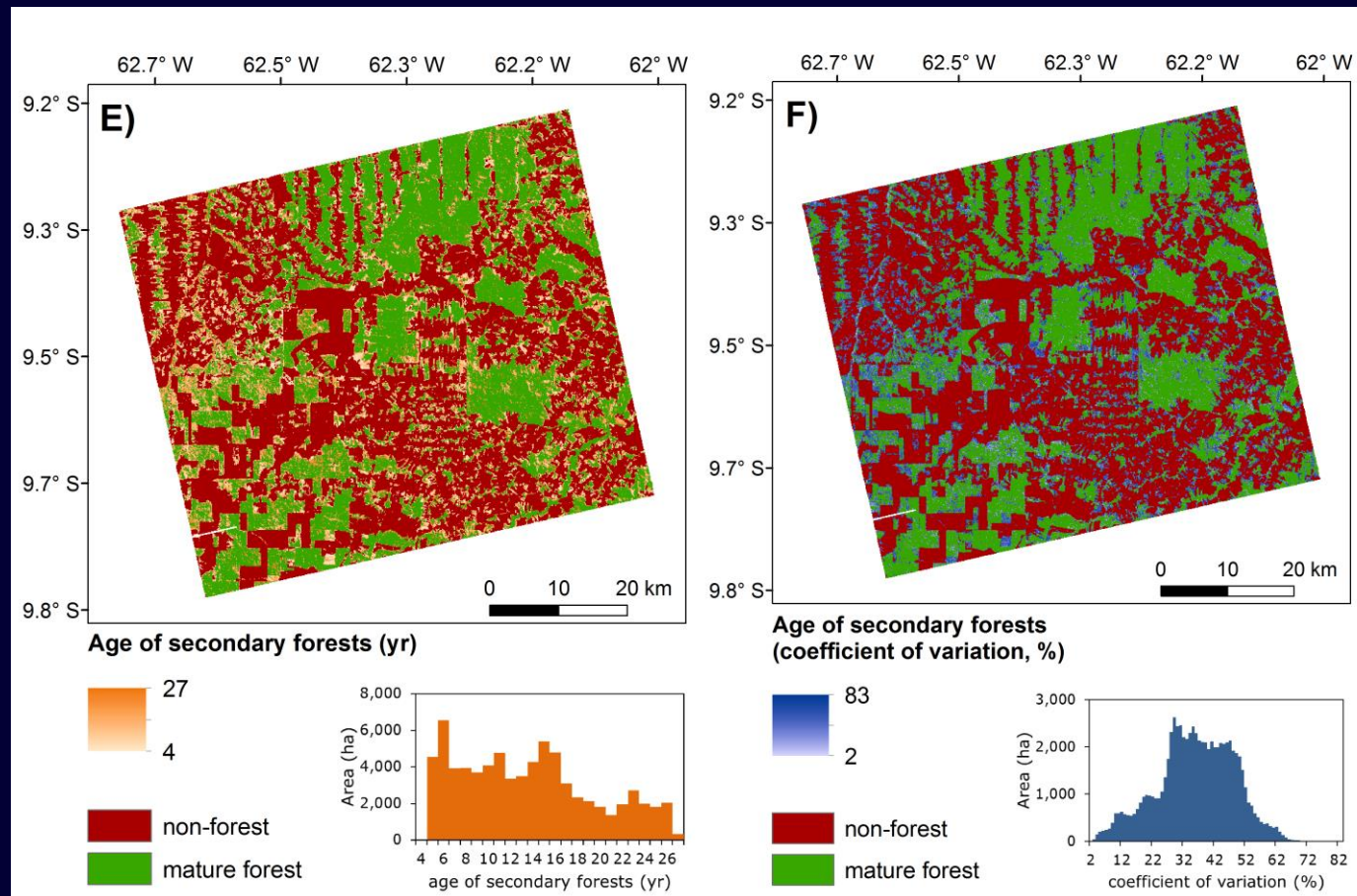
Results and significant findings

Santarem



Results and significant findings

Machadinho d'Oeste



Results and significant findings

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Mapping major land cover types and retrieving the age of secondary forests in the Brazilian Amazon by combining single-date optical and radar remote sensing data

João M.B. Carreiras ^{a,*}, Joshua Jones ^b, Richard M. Lucas ^c, Yosio E. Shimabukuro ^d^a NERC National Centre for Earth Observation (NCEO), University of Sheffield, Hicks Building, Hounsfield Road, Sheffield, S3 7RH, United Kingdom^b Department of Geography and Earth Sciences, Aberystwyth University, Ceredigion, Aberystwyth, SY23 3DB, Wales, United Kingdom^c Centre for Ecosystem Science, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney 2052, NSW, Australia^d Remote Sensing Division, National Institute for Space Research, Avenida dos Astronautas 1758, São José dos Campos, 12227-010 São Paulo, Brazil

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ABSTRACT

Secondary forests play an important role in restoring carbon and biodiversity lost previously through deforestation and degradation and yet there is little information available on the extent of different successional stages. Such knowledge is particularly needed in tropical regions where past and current disturbance rates have been high but regeneration is rapid. Focusing on three areas in the Brazilian Amazon (Manaus, Santarém, Machadinho d'Oeste), this study aimed to evaluate the use of single-date Landsat Thematic Mapper (TM) and Advanced Land Observing Satellite (ALOS) Phased Arrayed L-band Synthetic Aperture Radar (PALSAR) data in the 2007–2010 period for i) discriminating mature forest, non-forest and secondary forest, and ii) retrieving the age of secondary forests (ASF), with 100 m × 100 m training areas obtained by the analysis of an extensive time-series of Landsat sensor data over the three sites. A machine learning algorithm (random forests) was used in combination with ALOS PALSAR backscatter intensity at HH and HV polarizations and Landsat 5 TM surface reflectance in the visible, near-infrared and shortwave infrared spectral regions. Overall accuracy when discriminating mature forest, non-forest and secondary forest is high (95–96%), with the highest errors in the secondary forest class (omission and commission errors in the range 4–6% and 12–20% respectively) because of misclassification as mature forest. Root mean square error (RMSE) and bias when retrieving ASF ranged between 4.3–4.7 years (relative RMSE = 25.5–32.0%) and 0.04–0.08 years respectively. On average, unbiased ASF estimates can be obtained using the method proposed here (Wilcoxon test, p-value > 0.05). However, the bias decomposition by 5-year interval ASF classes showed that most age estimates are biased, with consistent overestimation in secondary forests up

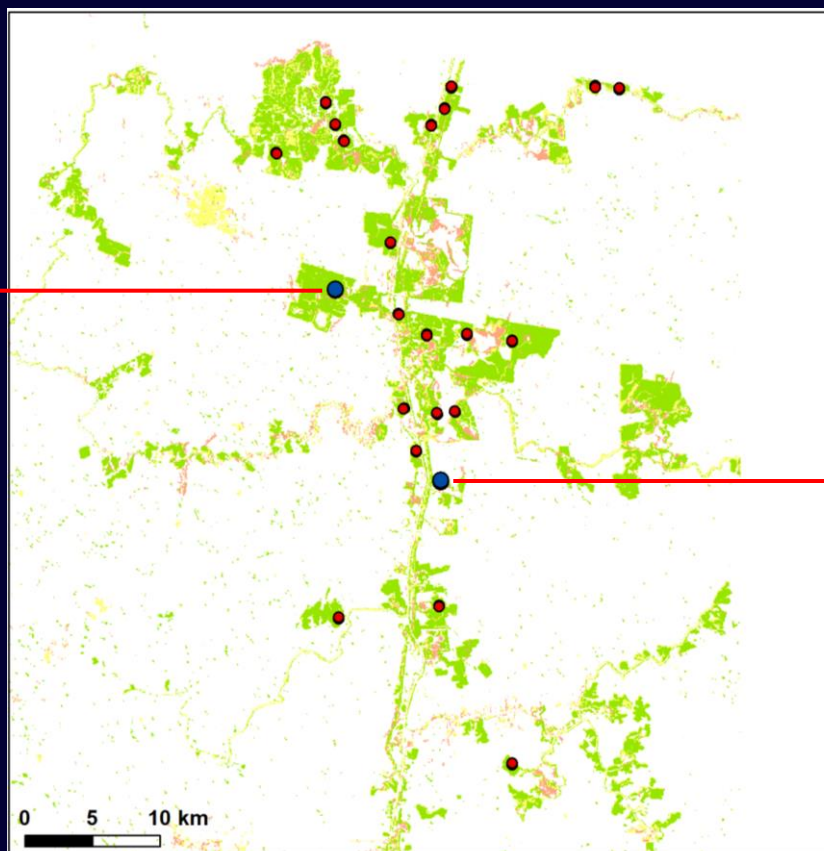
Data sharing



Manaus, August 2014, 23 plots measured in secondary forests



Adv22_18
19 years old



Age of secondary forests

- initial (< 6 yr)
- intermediate (6-15 yr)
- advanced (> 15 yr)



Adv12_2
22 years old

Project milestones

- Maps of age of secondary forests and biomass of savanna woodlands (*cerrado*) and their changes
- Validation of maps of age of secondary forests and biomass of savanna woodlands (*cerrado*), including error maps
- Contribution of full-pol ALOS-2 PALSAR-2 data to retrieve above-ground biomass of tropical secondary forests

Deliverables

- Maps of age of secondary forests over areas of approximately 200x200 km around each regrowth hotspot site (Manaus, Santarém and Machadinho d'Oeste)
- Maps of above-ground biomass in Cerrado in the eastern part of the municipalities of Barreiras and Luis Eduardo Magalhães, Bahia State
- Change maps for these regions and assessment of their implications for carbon and biodiversity
- Above-ground biomass maps of tropical secondary forests in Manaus

PALSAR/PALSAR-2 data access

- ALOS PALSAR and ALOS-2 PALSAR-2 over secondary forest and cerrado sites downloaded
- Also, downloaded ALOS-2 PALSAR-2 strip data over the same sites to upscale to larger areas
- Data already made available by JAXA is enough to complete the project