ENHANCING RELIABILITY OF CARBON CREDITS: UAV-LiDAR CARBON ESTIMATION FOR REDD+ IN BRAZILIAN SAVANNA (CERRADO)

Silvio Henrique Menezes Gomes; Danilo Roberti Alves de Almeida; Leo Heiti Haneda; Arthur Kaufmann Sanchez; Bruna Pereira de Azevedo; Diego Ribeiro de Aguiar; Renan Akio Kamimura

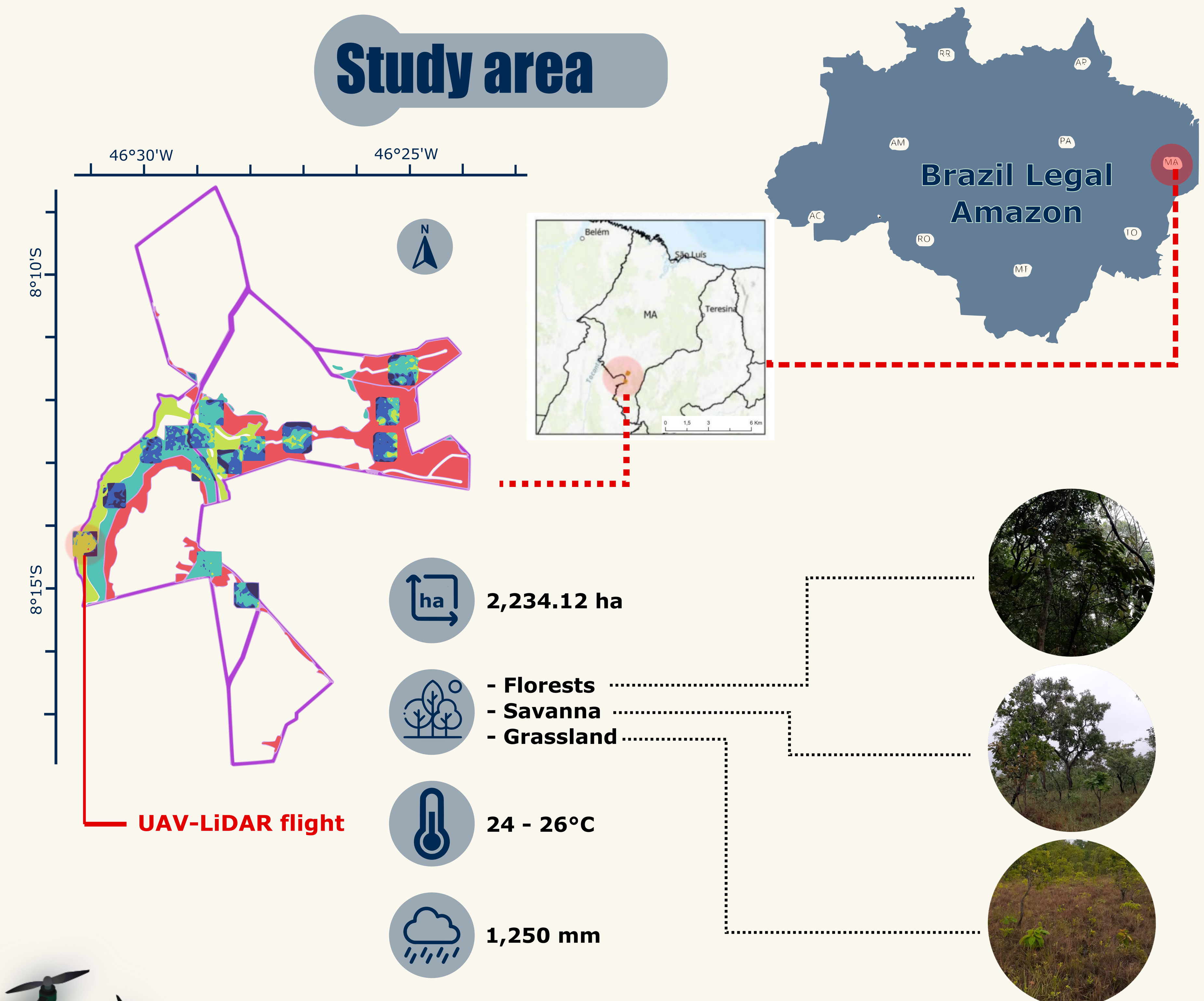
silvio@brcarbon.com.br

brCarbon Serviços Ambientais, Sao Paulo, Brazil

Context and problem

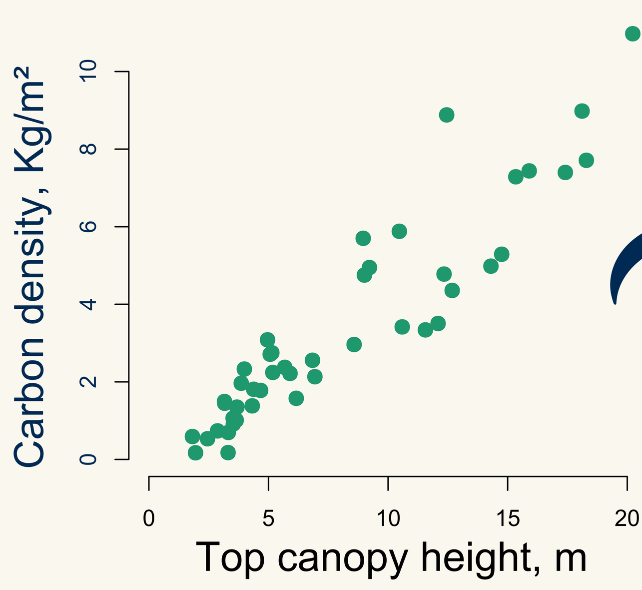
- Brazilian Savanna: a unique threatened domain and forest loss.
- Importance of REDD+ projects to mitigate climate change and conservation.
- The use of UAV-LiDAR technology to improve accuracy and transparency on carbon stocks estimation for REDD+ context.

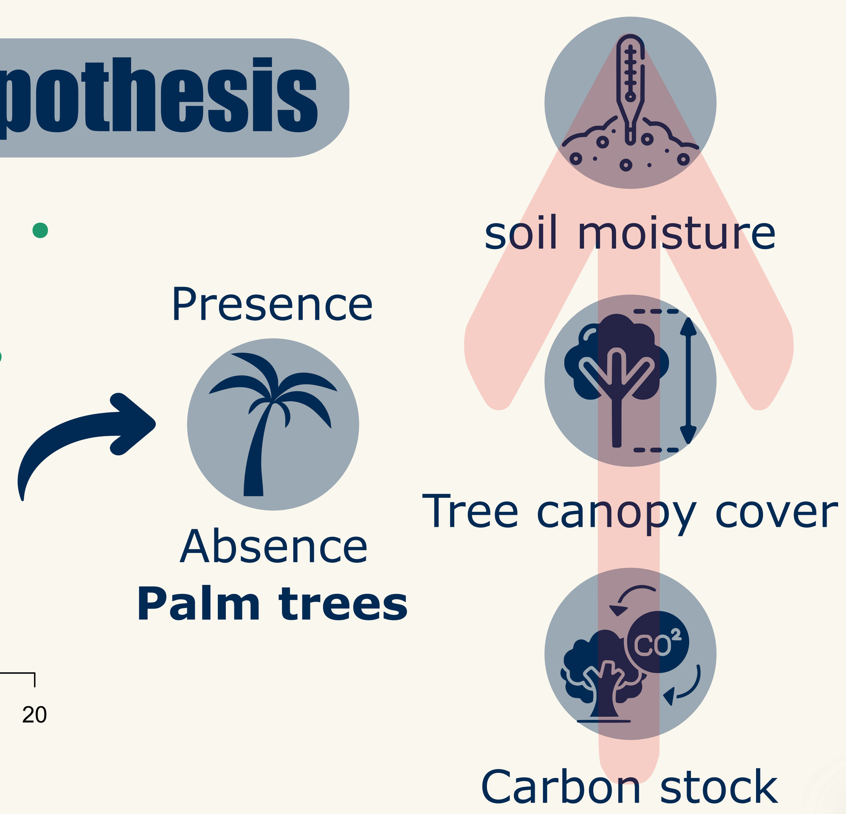
Study area



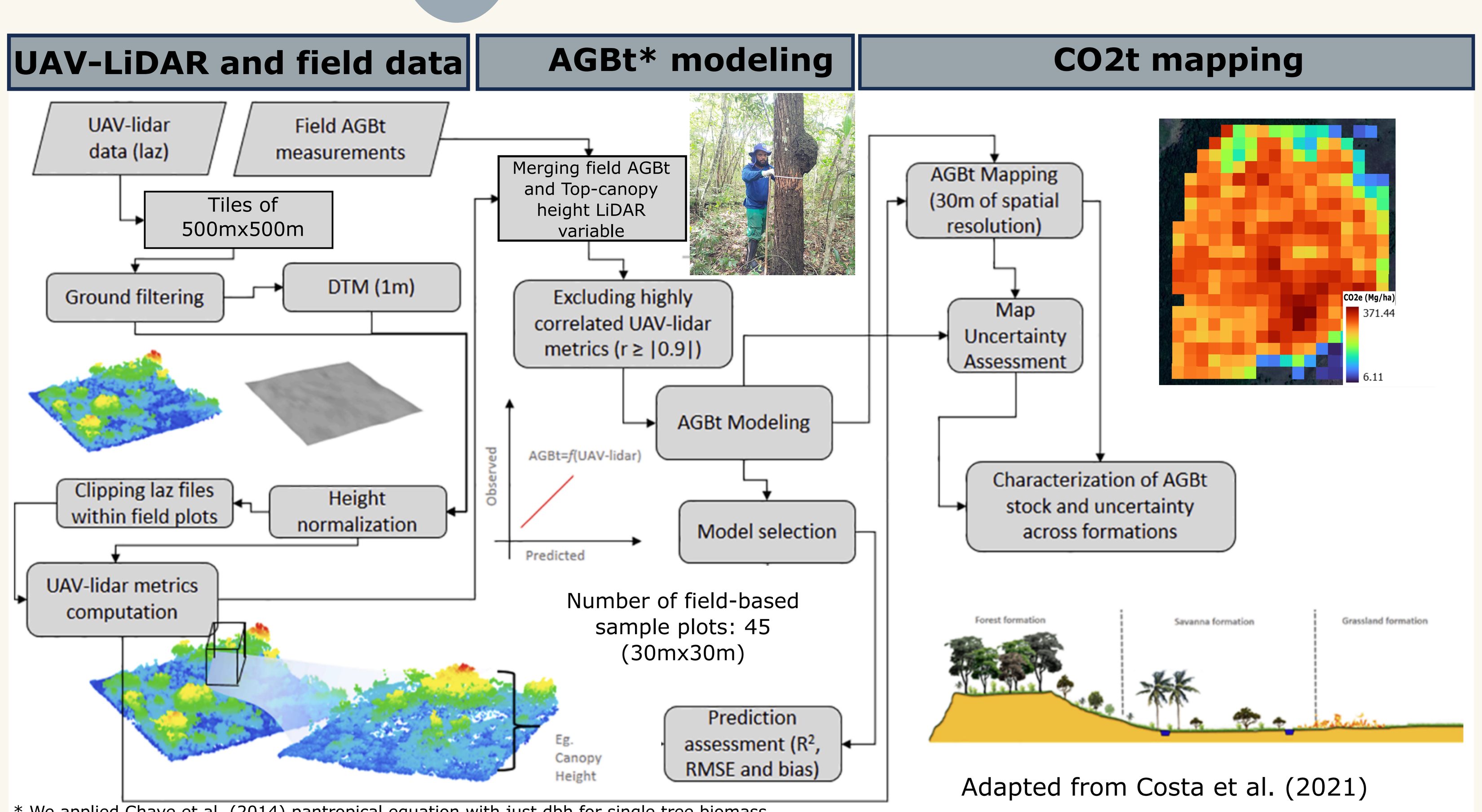
Question and hypothesis

Can elements of landscape enhance accuracy in field-based and LiDAR data relationship on modeling?



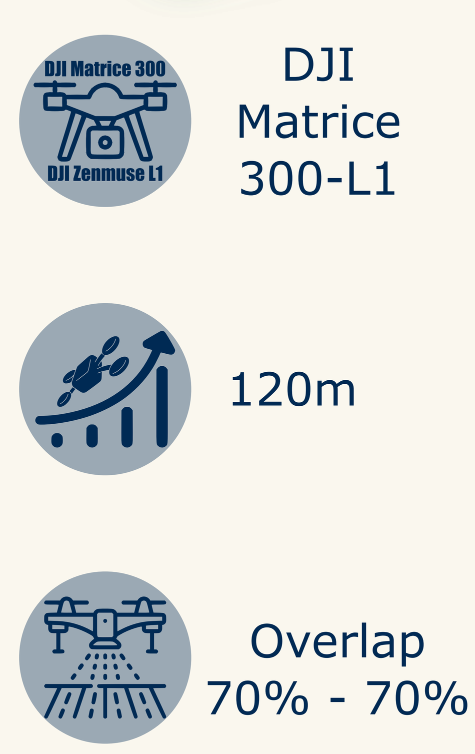


Methods

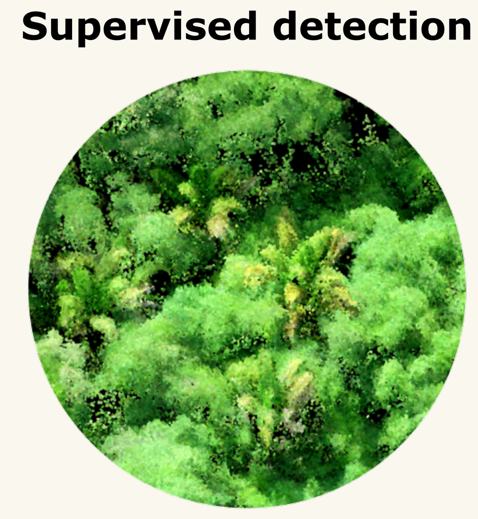


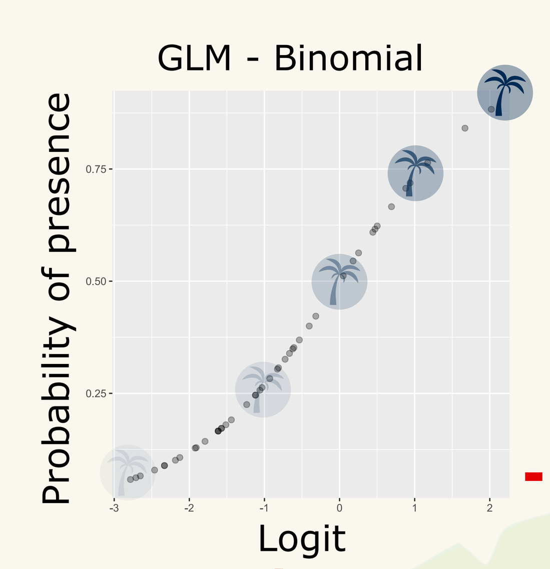
* We applied Chave et al. (2014) pantropical equation with just dbh for single tree biomass.

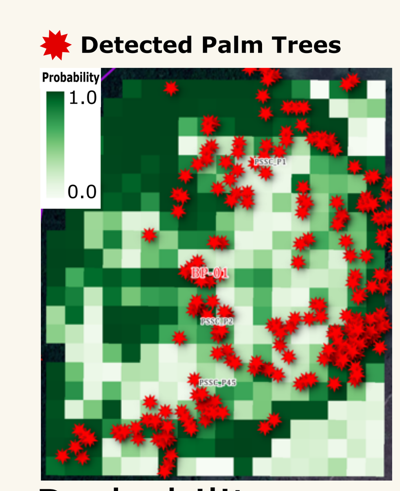
Model structure



Supervised detection







Probability map

M1 $f(x) = \beta_0 + \beta_1 TCH + \epsilon$

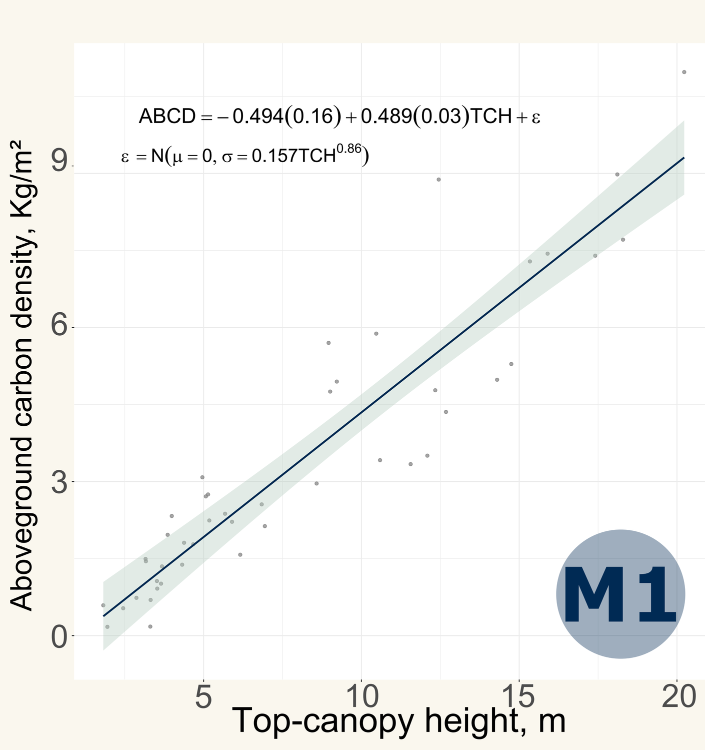
M2 $f(x) = \beta_0 + \beta_1 TCH + \beta_2 Index + \epsilon$

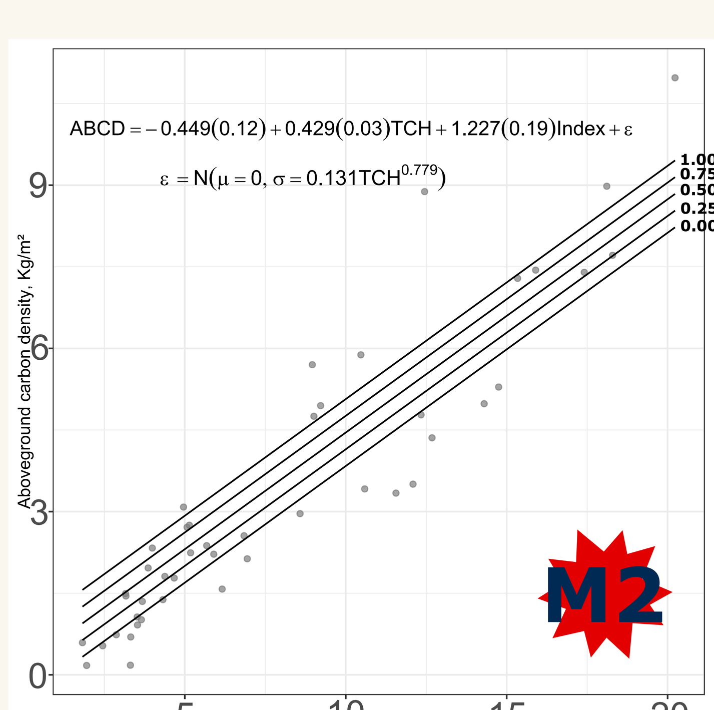
We used the standard deviation of TCH as lidar variable to detect palm trees in a generalized approach (logit).

Main findings

Goodness-of-fit for both model structures. n = 45.

Model	R^2	RMSE (%)	AICc
M1	0.86	29.6	115.23
M2	0.93	21.8	86.10





27%

Difference accuracy on RMSE (%)

Statistics of model prediction and accuracy considering the whole mapped area by forest type (CO2e Mg/ha).

Savanna Type	Field-based stock	N pixels	Model id	LiDAR stock	Uncertainty (%)	Relative Difference (%)
Forest	207.45	1482	M1	188.11	2.43	-9.32
			M2	**190.73**	**2.21**	**-8.06**
Savanna	120.22	3228	M1	108.22	2.05	-9.98
			M2	**110.47**	**1.99**	**-8.10**
Grassland	61.53	1427	M1	70.92	2.52	15.26
			M2	**70.77**	**2.40**	**15.01**
Global results	**125.56**	**6137**	M1	122.42	1.58	-1.35
			M2	**124.00**	**1.51**	**-1.16**

Consider presence/absence of palm trees as biological switch on model, improves in 27% the overall accuracy for carbon stock estimation in UAV-LiDAR data surveys. The methodology is an alternative when the tree heights in field-based data are unavailable for pan-tropical biomass equations, such as Chave et al. (2014), the main reason for heteroskedasticity in top canopy height relationship.