

SUPPLEMENTARY MATERIAL

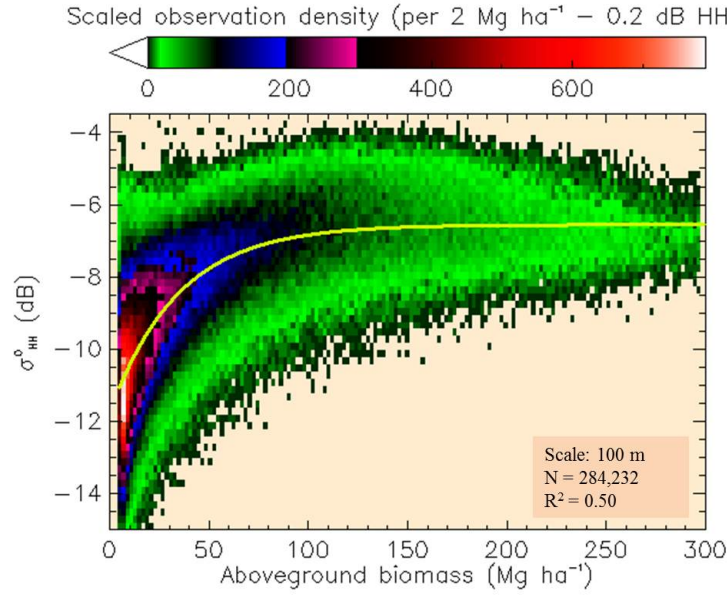


Figure S1: Relation of co-polarized backscatter signal, σ_{HH}^0 , to lidar-derived aboveground biomass across Denmark.

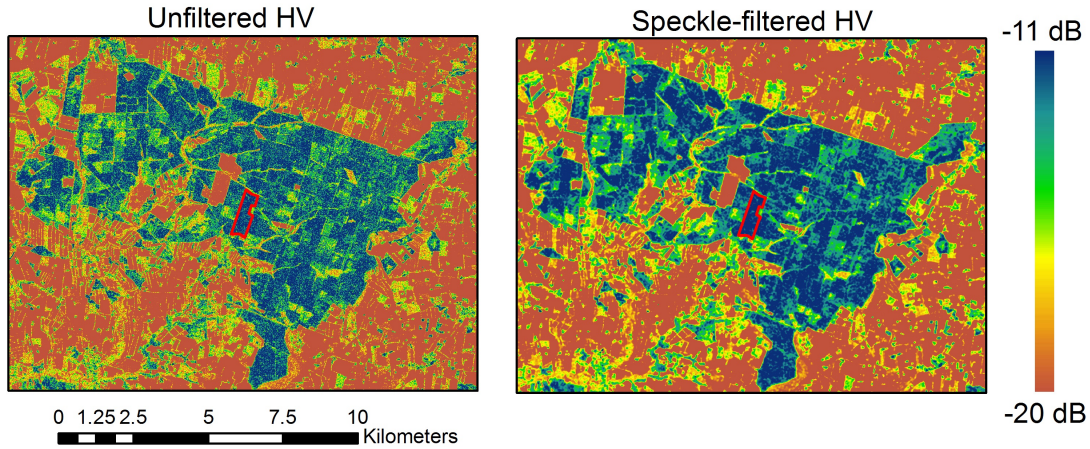


Figure S2: Unfiltered (left) and filtered (right) σ_{HV}^0 image at $12.5 \text{ m} \times 12.5 \text{ m}$ resolution for the forest stand shown in Figure 1 of main manuscript. Speckle noise was reduced using Enhanced Lee filter with a 5×5 pixel window size (e.g. the standard deviation of σ_{HV}^0 on a plantation outlined in red was reduced from 1.6 dB to 0.9 dB).

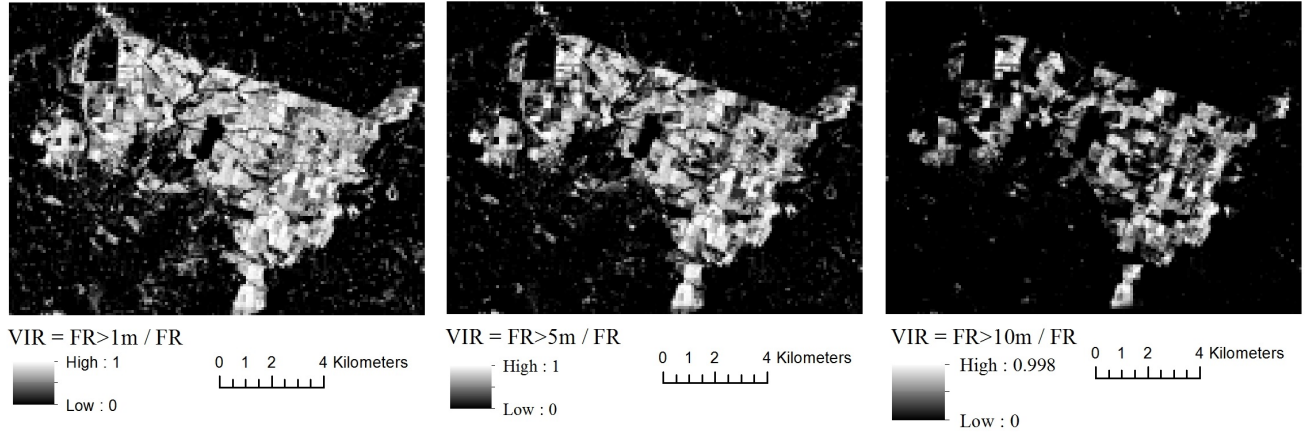


Figure S3: Different definitions of VIR over the plantation shown in Figure 1 of the main manuscript, mapped at 100 m scale. The definition $FR_{>1m}/FR$ most captured differences between plantations of different tree types, density and height.

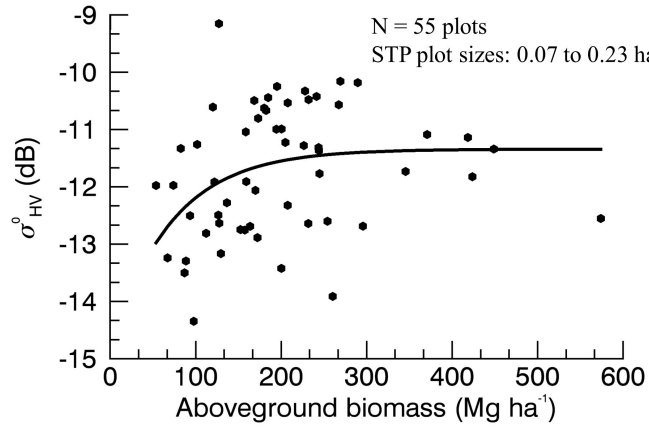


Figure S4: Relation between AGB_{STP} and σ^0_{HV} for the 55 STPs contained within the PALSAR extent across Denmark. Regression parameters are provided below.

Nonlinear regression model:
 $HV \sim c + a \cdot (1 - \exp(b \cdot AGB))$
 Estimated Coefficients:

Coefficient	Estimate	SE	tStat	pValue
a	3.4182	3.1556	1.0832	0.28371
b	-0.014392	0.012867	-1.1185	0.26849
c	-14.8	3.3595	-4.4054	5.2975e-05

Number of observations: 55, Error degrees of freedom: 52
 Root Mean Squared Error: 1.07
 R-Squared: 0.107, Adjusted R-Squared 0.073
 F-statistic vs. constant model: 3.13, p-value = 0.0522

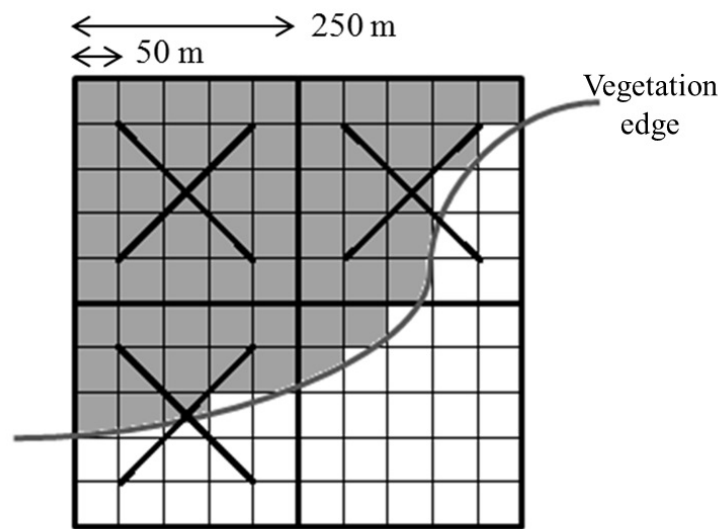


Figure S5: Inclusion and exclusion of forest edge pixels on sampling fine scale maps to coarser scales. Shaded pixels show where threshold criteria were met at 50 m scale. X show pixels selected for analysis at 250 m scale based on a overall AGB $> 5 \text{ Mg ha}^{-1}$ and $> 50\%$ of pixels with $> 5 \text{ Mg ha}^{-1}$ at 50 m scale threshold.

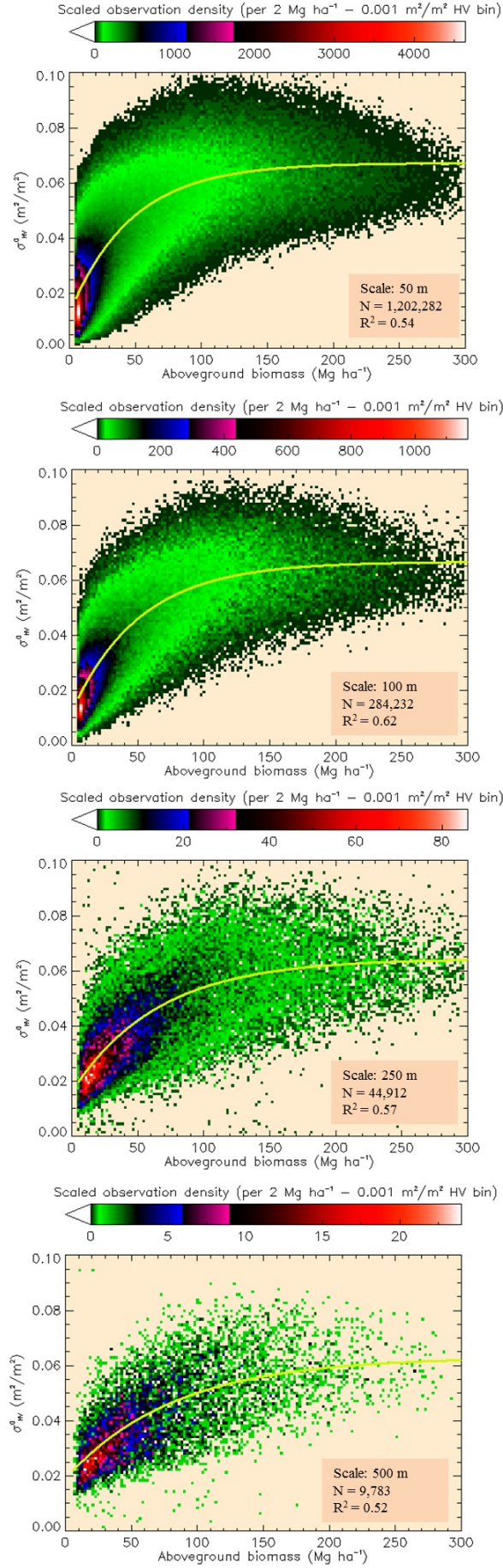


Figure S6: SAR-to-AGBL model with σ_{HV}^0 in power domain. Observations (N) are represented on a 2-D histogram density plot, with values byte-scaled (0 to 255).

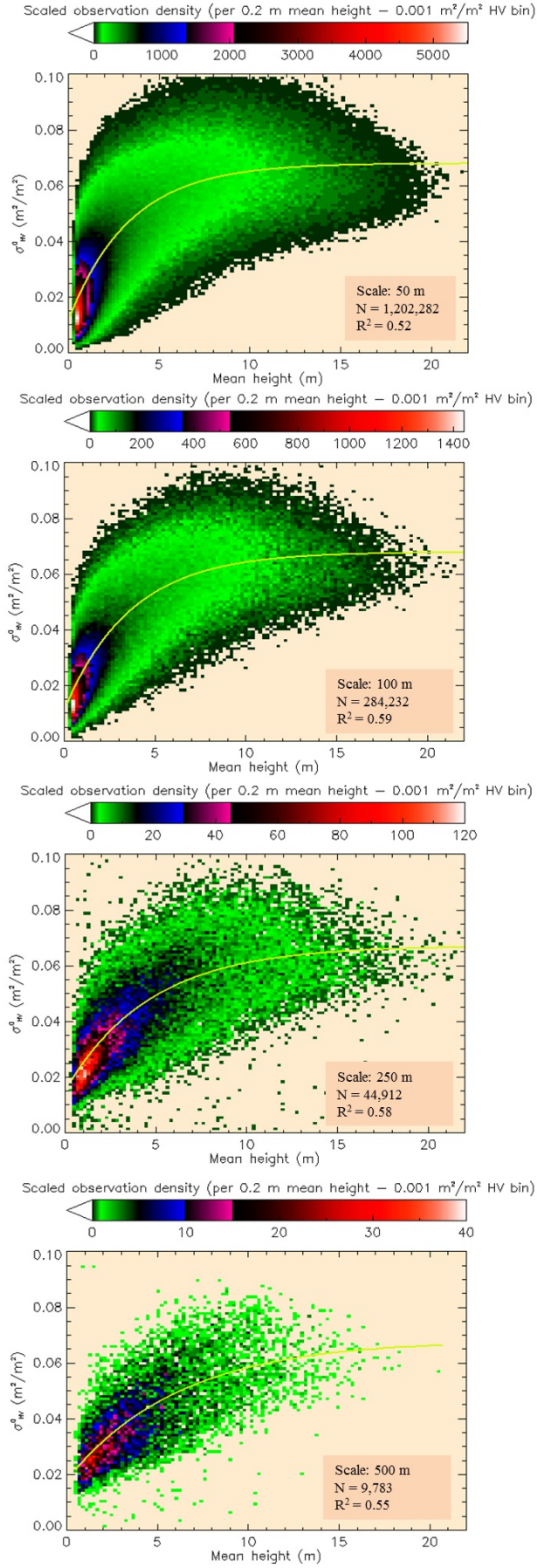


Figure S7: SAR-to-MH_L model with σ_{HV}^0 in power domain. Observations (N) are represented on a 2-D histogram density plot, with values byte-scaled (0 to 255).

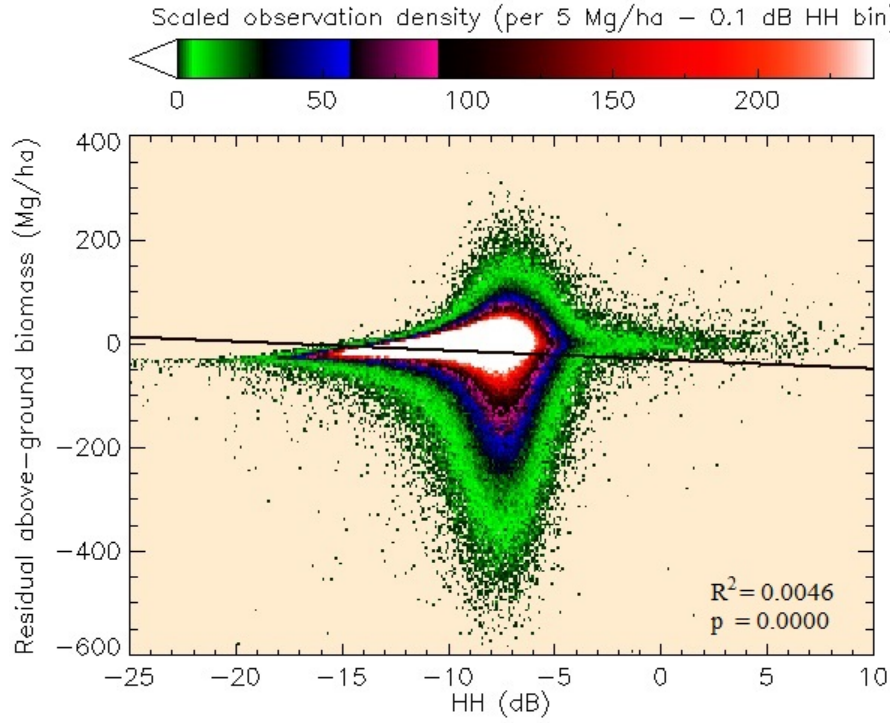


Figure S8: Relation between σ_{HH}^0 and residual AGB of the SAR-to-AGB_L model at 50 m scale. A significant linear trend is found, however, the R^2 value is very low ($=0.0046$), implying that σ_{HH}^0 cannot explain more than 0.46% of the scatter in the residuals.

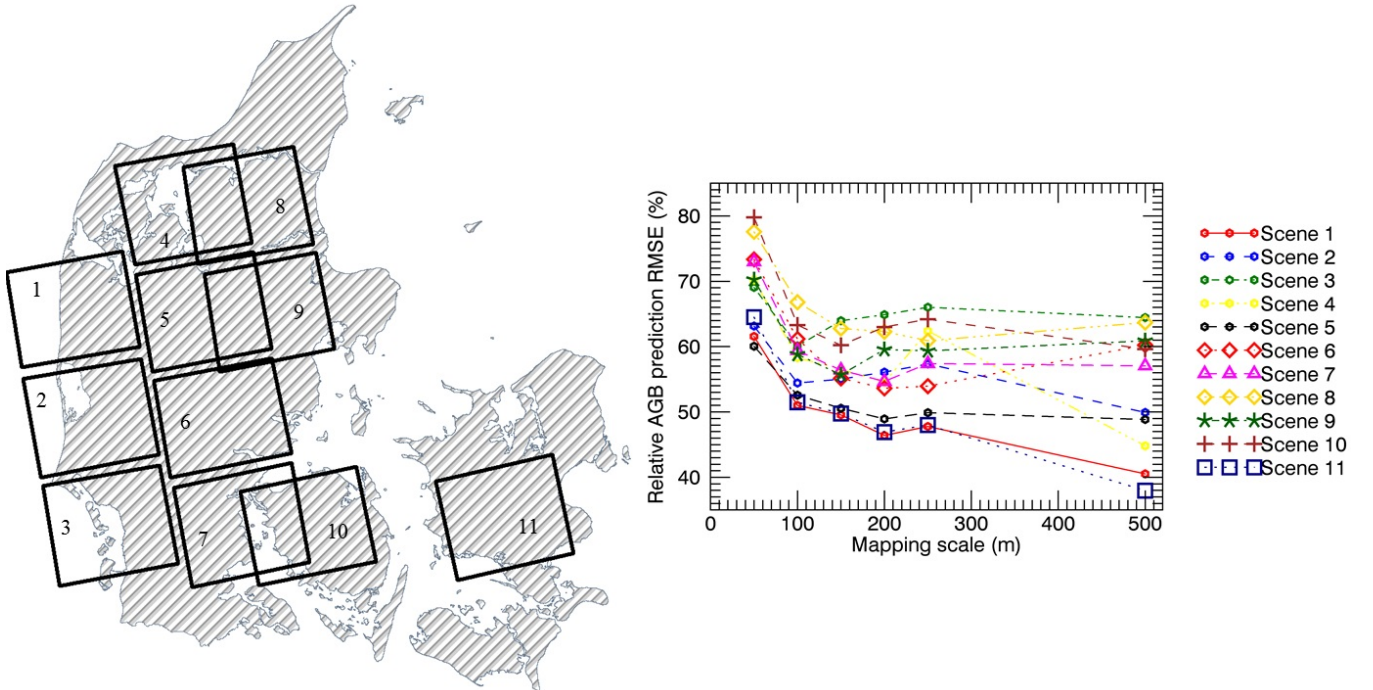


Figure S9: Relative AGB retrieval RMSE (before setting an MRV) for each scene used in the study. Scenes are labelled 1-11 in the map. We used all available data since at coarser scales (≥ 250 m) the number of observations in each scene is low.