

Greenness Indices from a Low-Cost UAV Imagery as Tools for Monitoring After-Fire Forest Recovery

Asier R. Larrinaga ^{1,2,3} Lluís Brotons ^{1,4,5}

S1. Field pictures of both sites.



Figure S1-1. A detail of a high-cover area within the Cal Rovira-Sanca area.



Figure S1-2. A detail of a low-cover area within the La Carral area.

S2. General workflow and software use

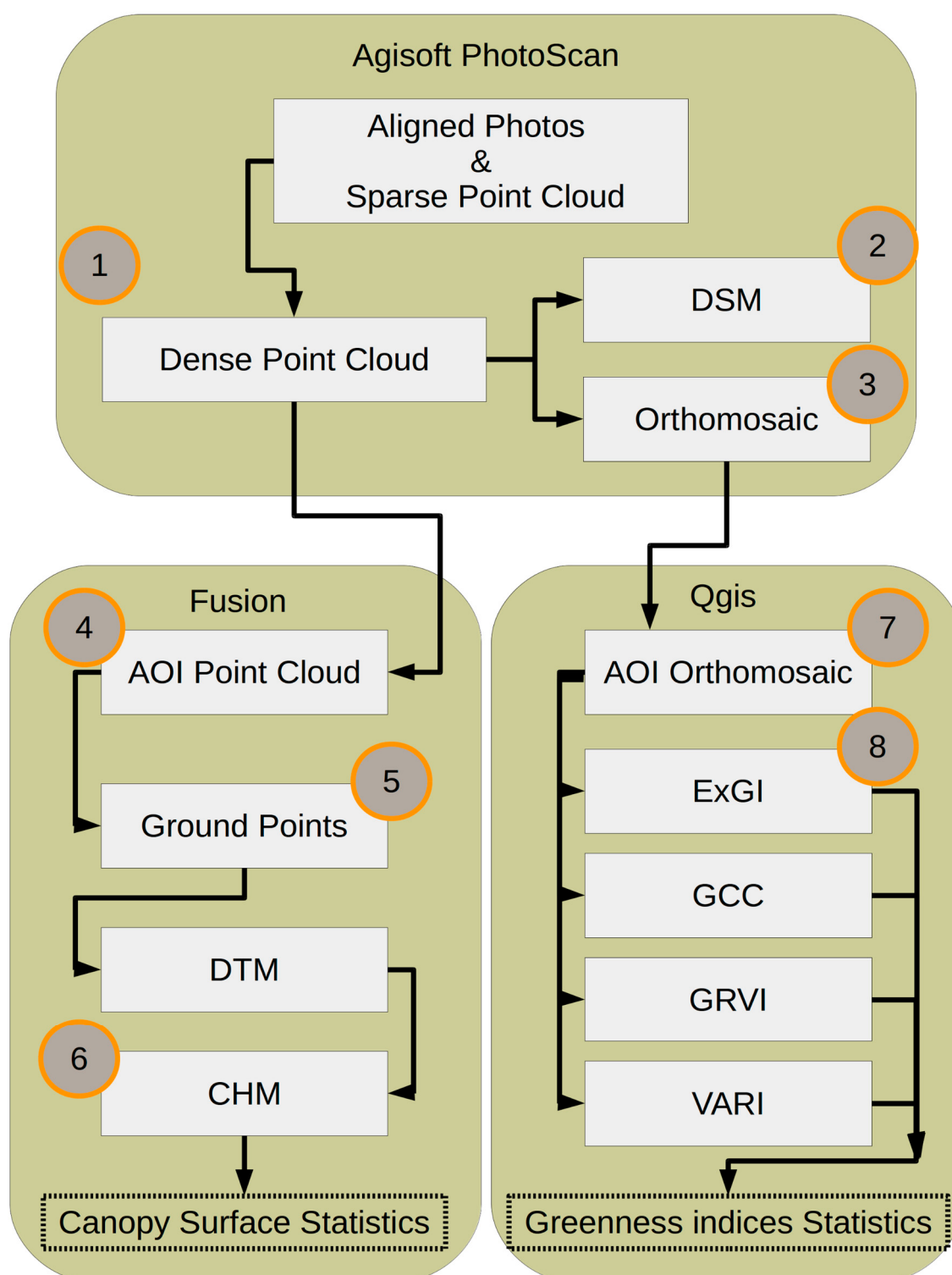


Figure S2-1. General workflow followed for the analysis of UAV imagery and the software frameworks used in each of the steps. Numbers refer to the different intermediate outputs shown in figure 2.

S3. Summary plots of DBH and height for the trees measured in the field.

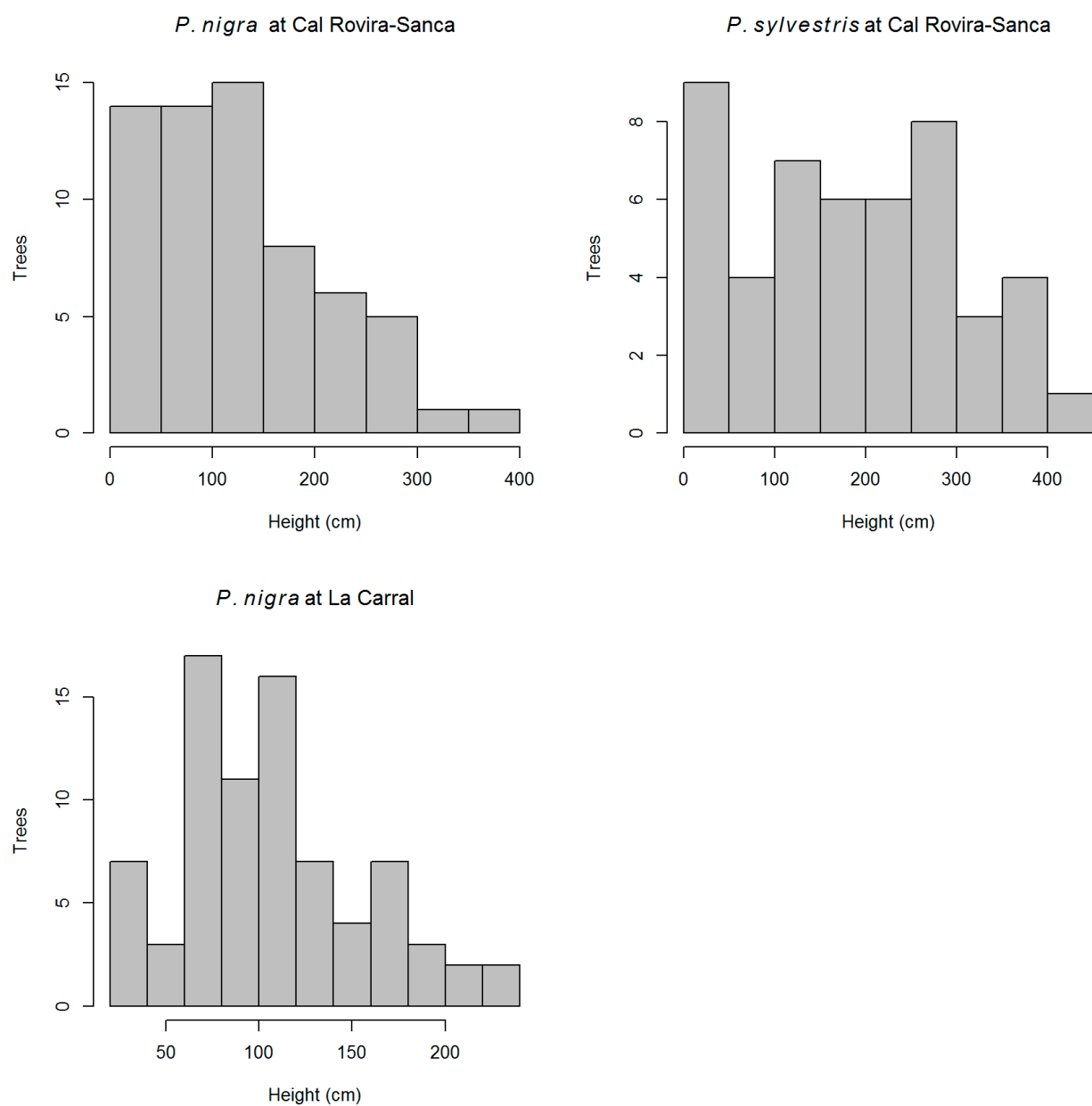


Figure S3.1. Height distribution of *Pinus nigra* and *Pinus sylvestris* in La Carral and Cal Rovira-Sanca, as measured in the field.

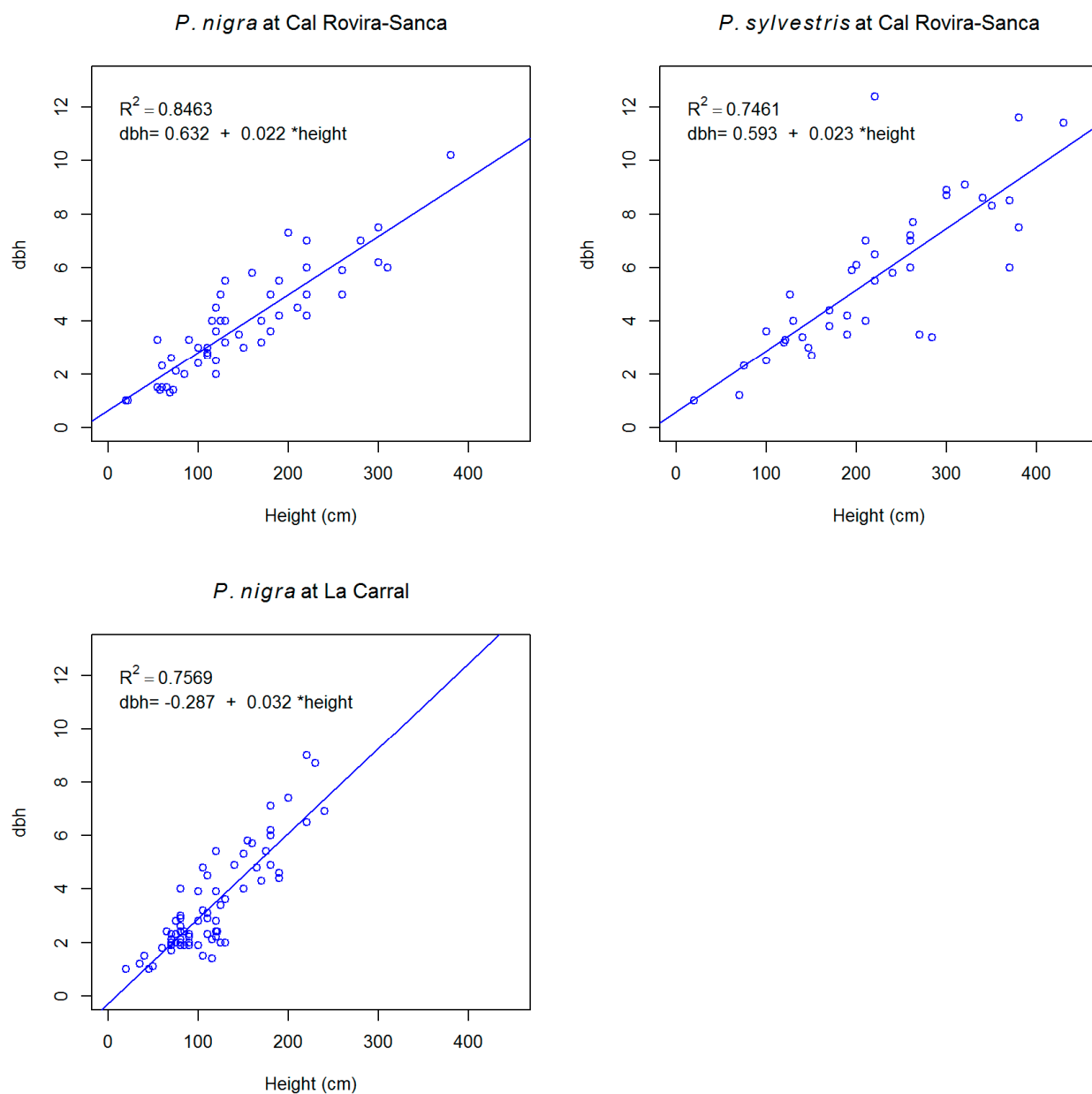


Figure S3.2. Regressions of tree height on DBH for both species in La Carral and Cal Rovira-Sanca.

S4. Comparative figures of quality assessment of the four flights.

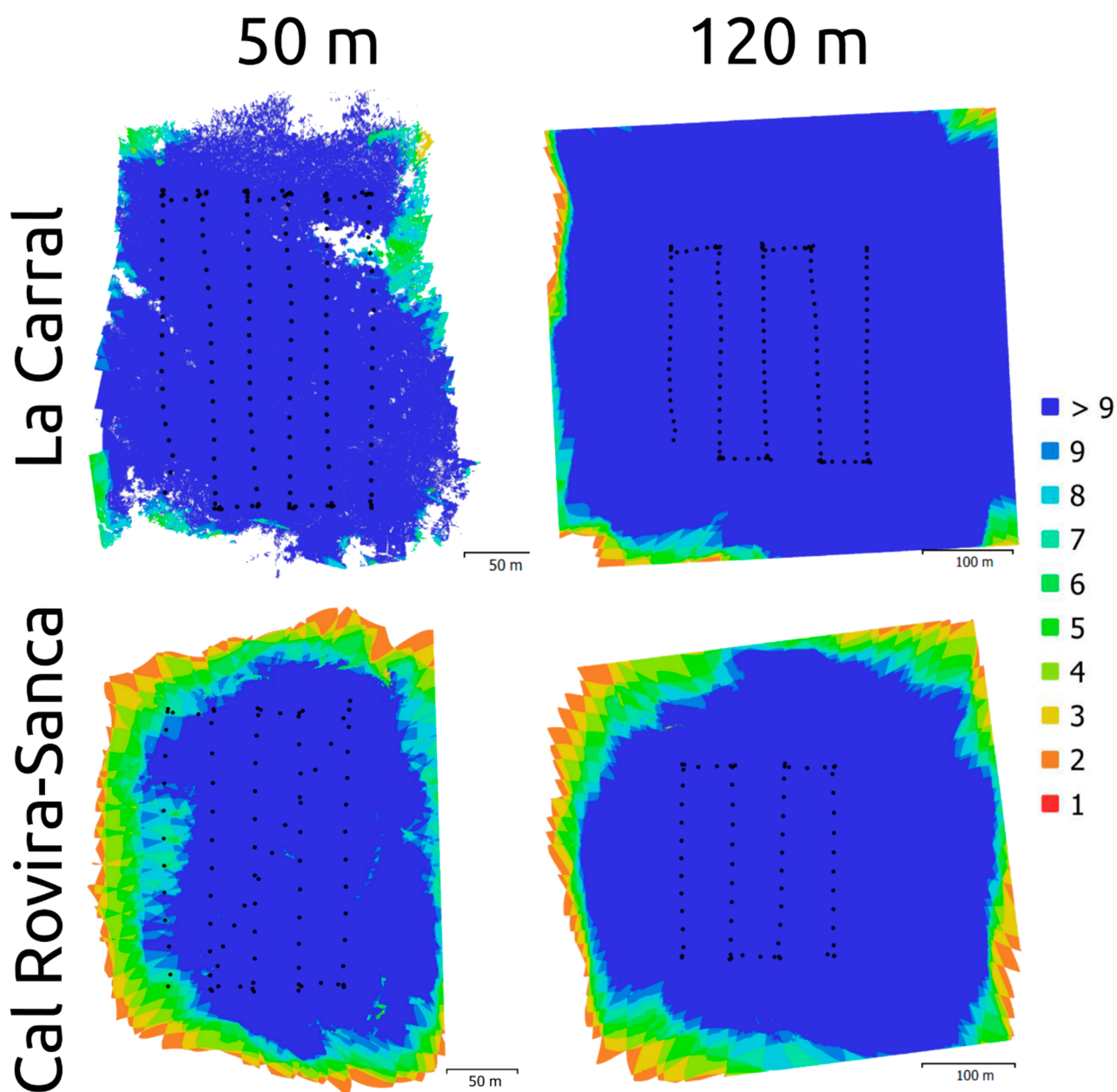


Figure S4-1. Image overlap obtained for the four flights. Figures depict the number of images where each point is present.

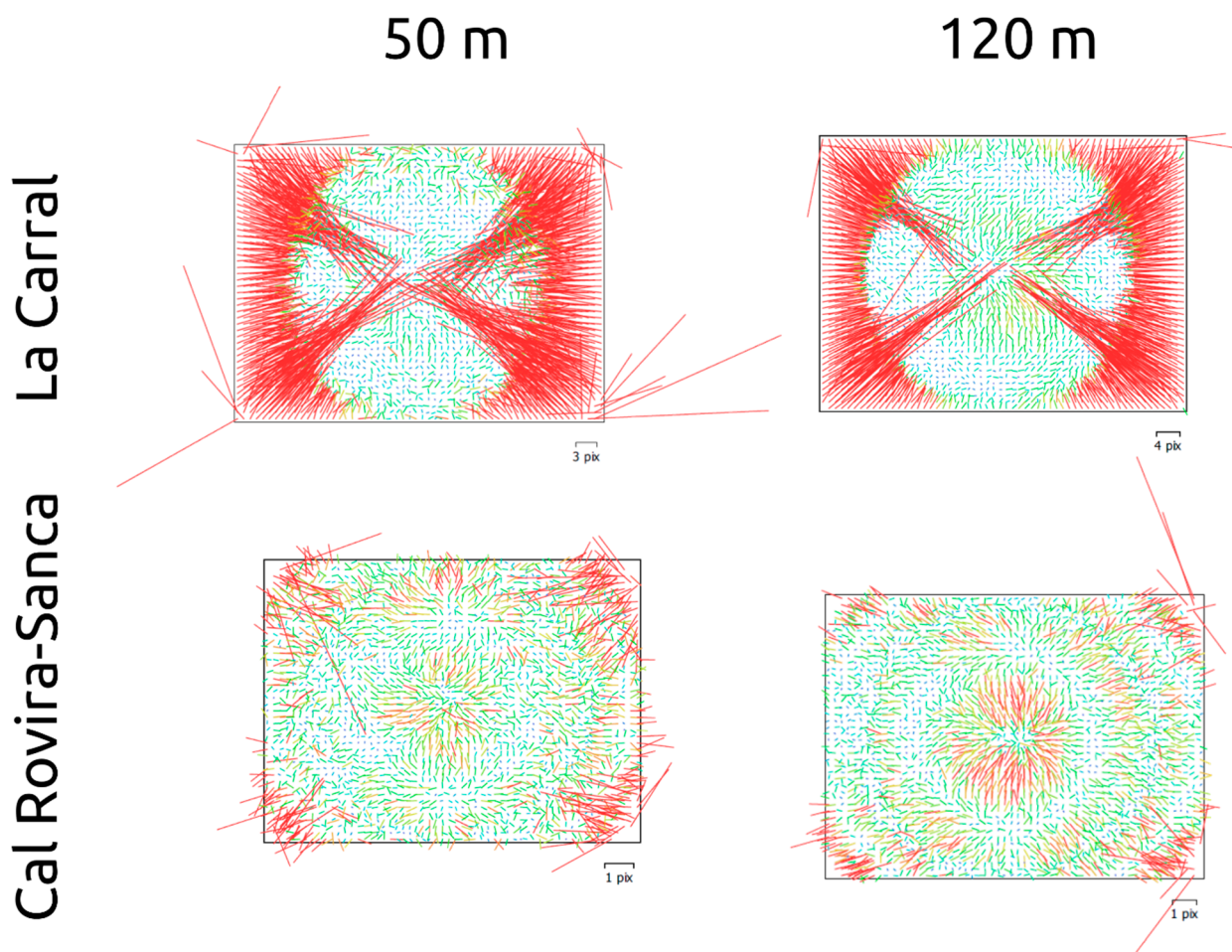


Figure S4-2. Image residuals for the Phantom Vision FC200 sensor after camera calibration performed within Agisoft PhotoScan software. Scale of residual lines is indicated in pixel units.

S5. Greenness indices and canopy height model maps

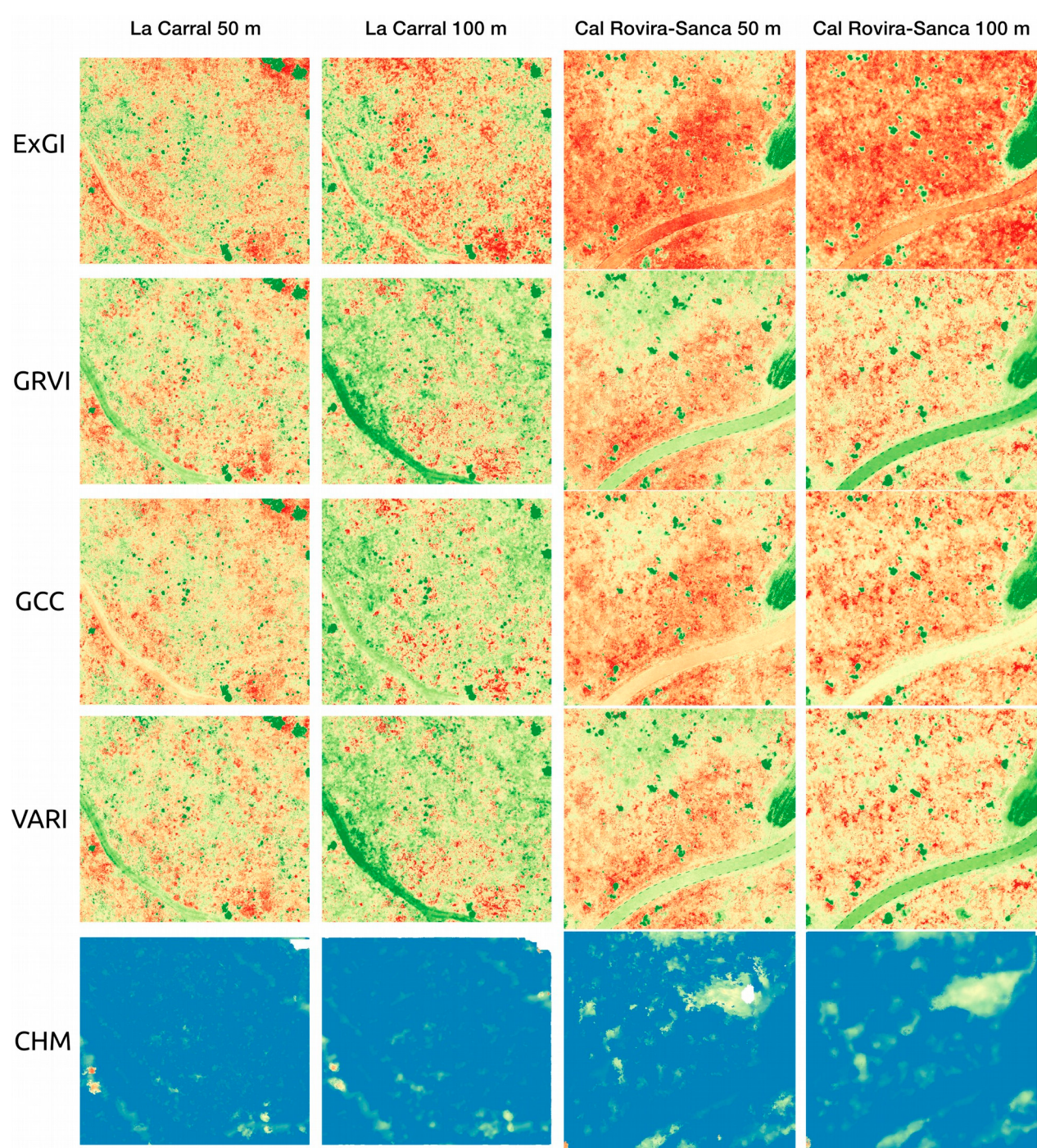


Figure S5-1. Maps of the four greenness indices and the estimated canopy model from the four flights carried out at two sites and two flight altitude. Colors have been differentially scaled for the four greenness indices and four flights, due to different value ranges, while the color scale is common for the four canopy height models (CHM).

S6. Results of the best fitting models for the four flights.

	Estimate	Std. Error	t	p
(Intercept)	-2.31055	0.235	-9.825	< 0.0001***
std(ExGI)	0.454	0.025	18.229	<0.0001***
median(CHM)	2.302	1.813	1.270	0.206
std(ExGI)*median(CHM)	-0.346	0.086	-4.019	<0.0001***

Table S6-1. Estimates of the best fitting model for the 50 m high flight in La Carral, with one greenness index (ExGI) and the pine canopy height model (CHM). Adjusted $R^2 = 61,82$.

	Estimate	Std. Error	t	p
(Intercept)	-1.293	0.190	-6.819	<0.0001***
std(GCC)	288.33	17.31	16.661	<0.0001***
median(CHM)	0.696	0.937	0.743	0.458
std(GCC)*median(CHM)	-97.45	41.780	-2.332	0.0206*

Table S6-2. Estimates of the best fitting model for the 120 m high flight in La Carral, with one greenness index (GCC) and the pine canopy height model (CHM). Adjusted $R^2 = 59,22$.

	Estimate	Std. Error	t	p
(Intercept)	74.793	196.571	0.380	0.705
mean(GCC)	-211.437	550.565	-0.384	0.702
count(CHM)	-0.071	0.090	-0.788	0.433
mean(GCC)* count(CHM)	0.206	0.251	0.821	0.414

Table S6-3. Estimates of the best fitting model for the 50 m high flight in Cal Rovira-Sanca, with one greenness index (GCC) and the pine canopy height model (CHM). Adjusted $R^2 = 44,99$.

	Estimate	Std. Error	t	p
(Intercept)	1.327	0.690	1.922	0.0577
sum(GCC)	0.018	0.002	9.264	<0.0001***
median(CHM)	1.149	0.715	1.608	0.1112
sum(GCC)* median(CHM)	-0.007	0.002	-3.743	<0.0001***

Table S6-4. Estimates of the best fitting model for the 120 m high flight in Cal Rovira-Sanca, with one greenness index (GCC) and the pine canopy height model (CHM). Adjusted $R^2 = 47,46$.

S7. The globally best fitting model

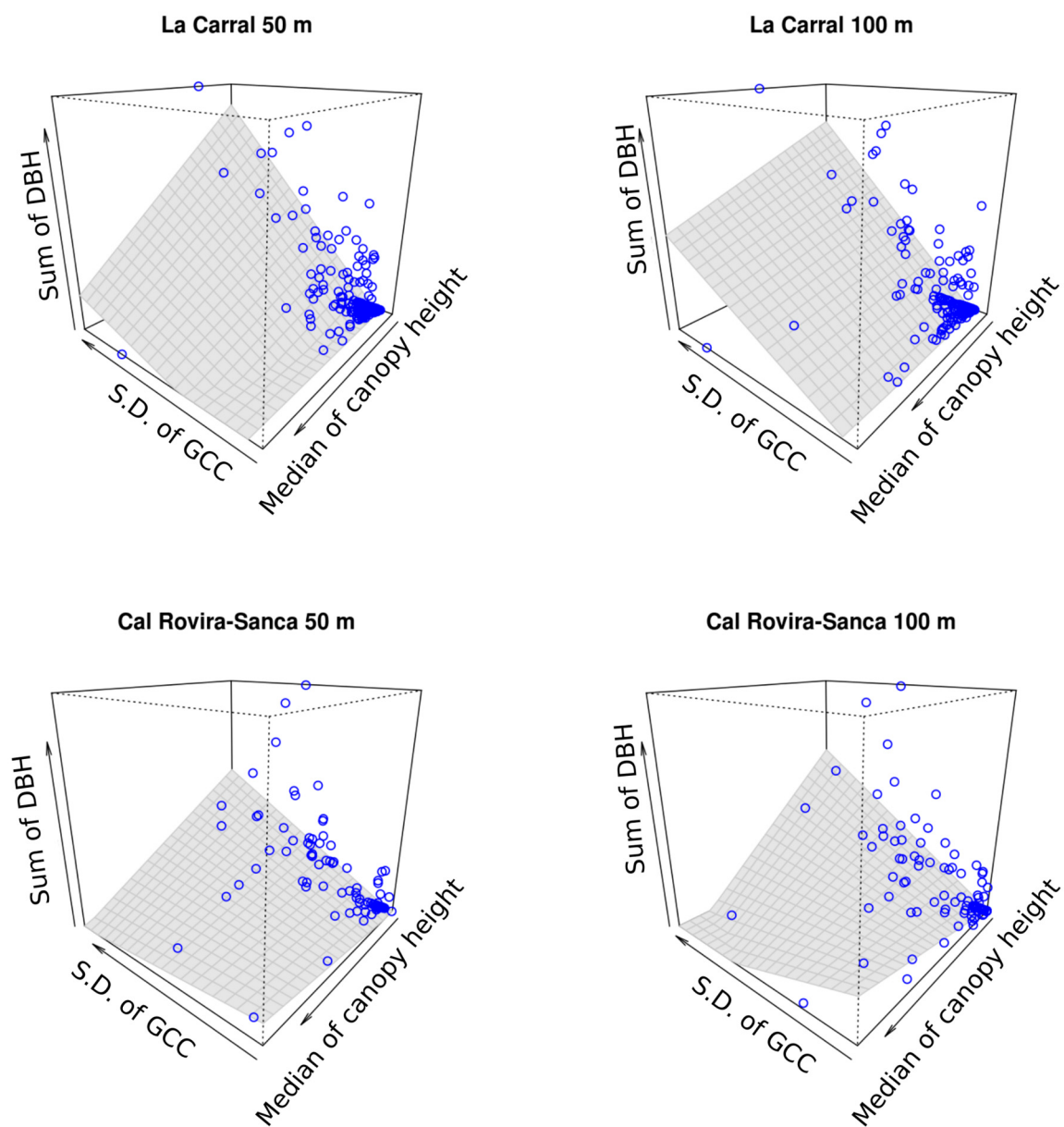


Figure S7-1. 3D scatterplots showing the overall best fitting model applied to each site and flight altitude.