**Figure S1.** Map of the study area in Sierra de los Filabres (Almería), showing the World View-2 scene, the LiDAR dataset and the tree sampled field data

Class 0: non-damage	Class 1: slight damage
Class 2: medium damage	Class 3: hight damage

Figure S2. Examples of severity classes of individual trees as a function of defoliation percentage and pigment concentration (total Chlorophyll). Severity classes 0: non-damage 1: slight, 2: medium, and 3: Hight. Adapted from Lakatos et al. [57, see Table 3].
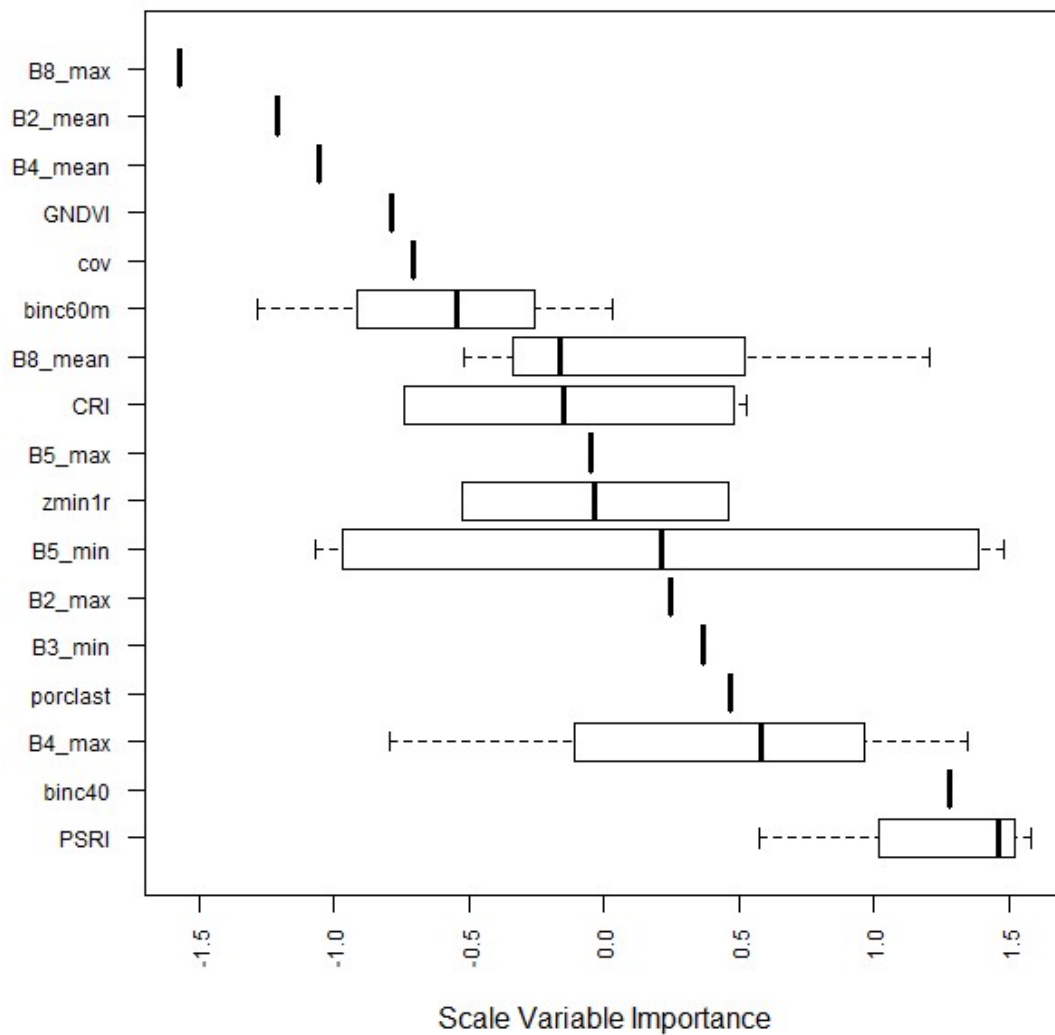
Figure S3. Scale variable importance of the variables used in selected models
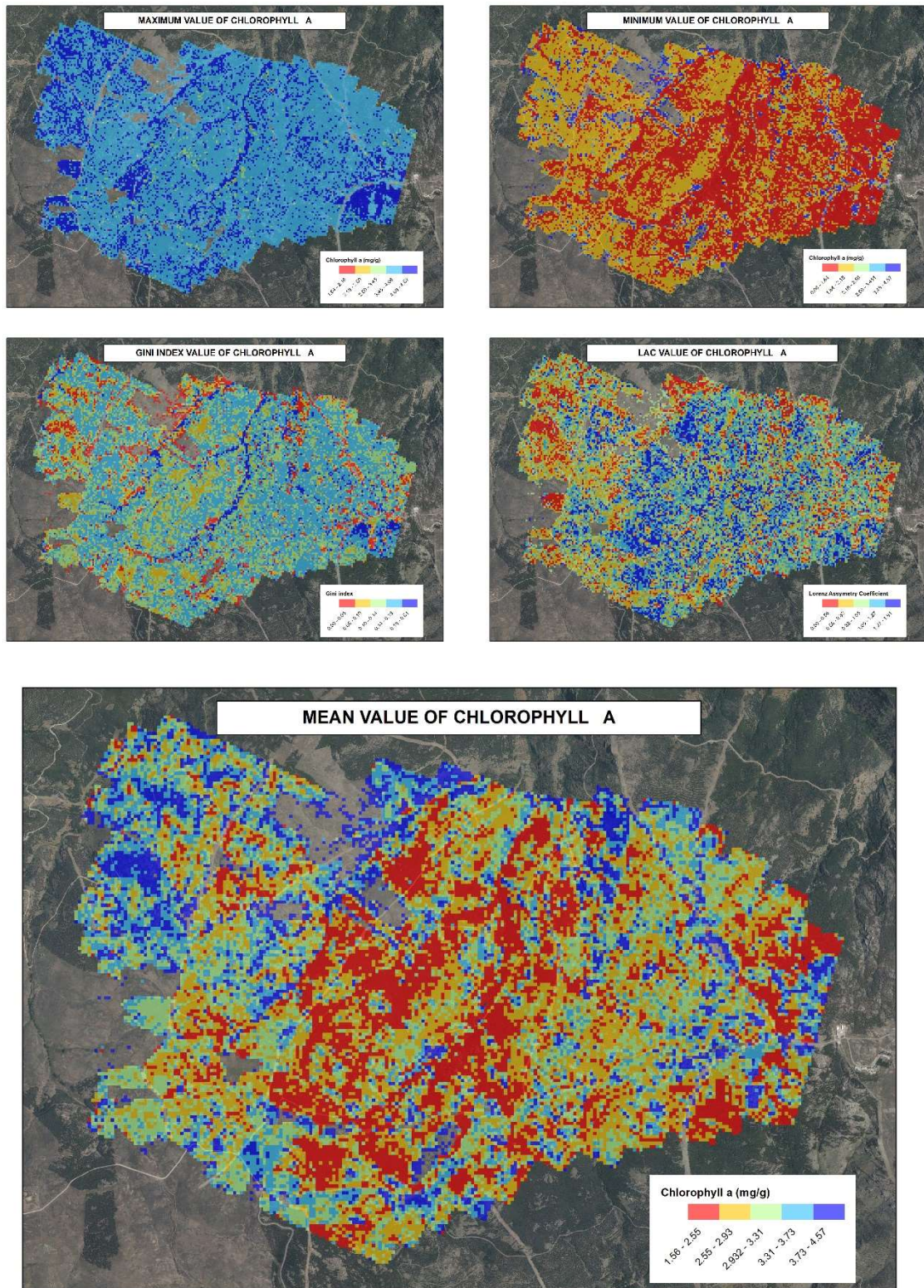
Figure S4: Summarizing raster layers for Chlorophyll a concentration in every individual tree.
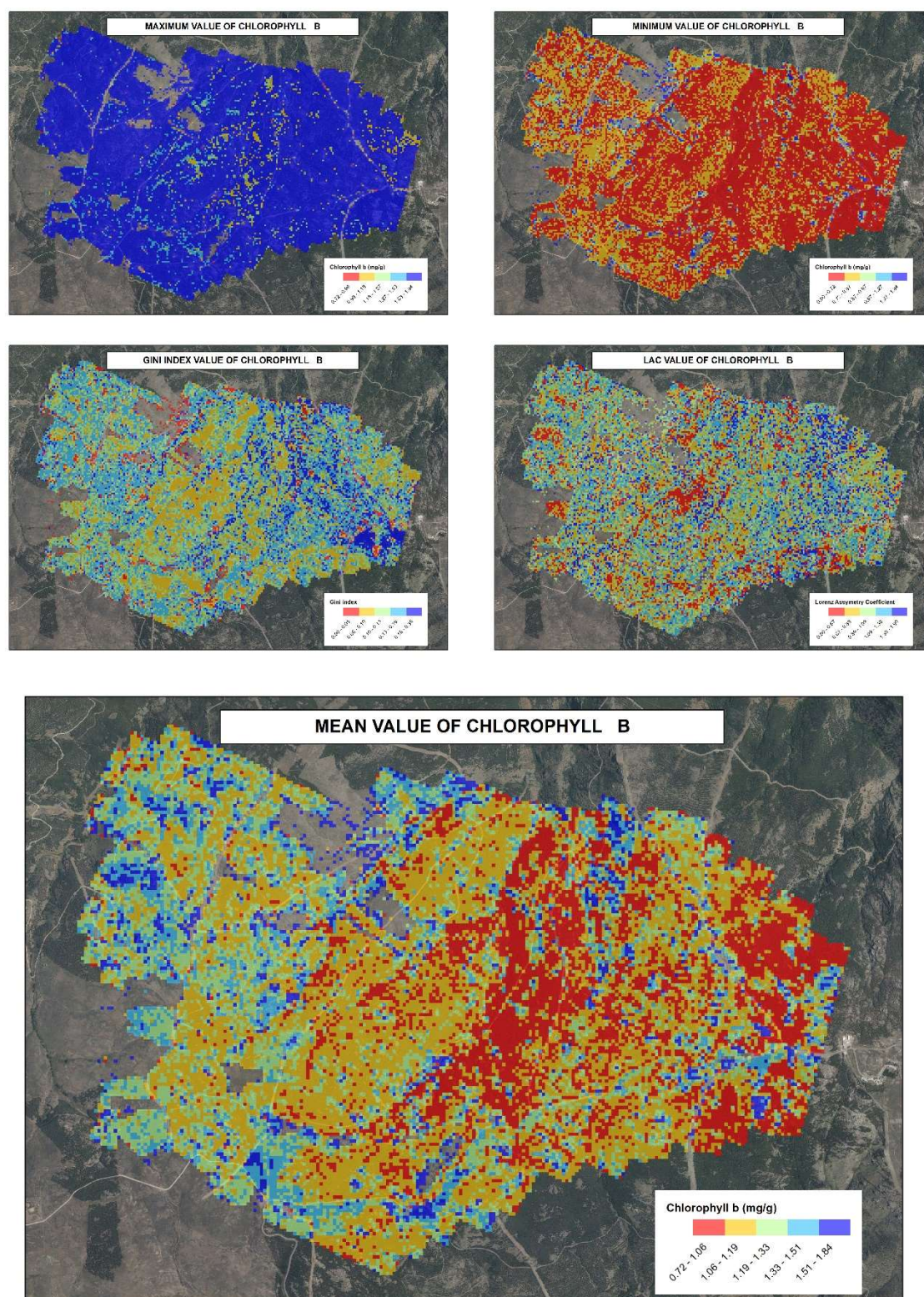
Figure S5: Summarizing raster layers for Chlorophyll b concentration in every individual tree.

Figure S6: Summarizing raster layers for Carotenoids concentration in every individual tree.
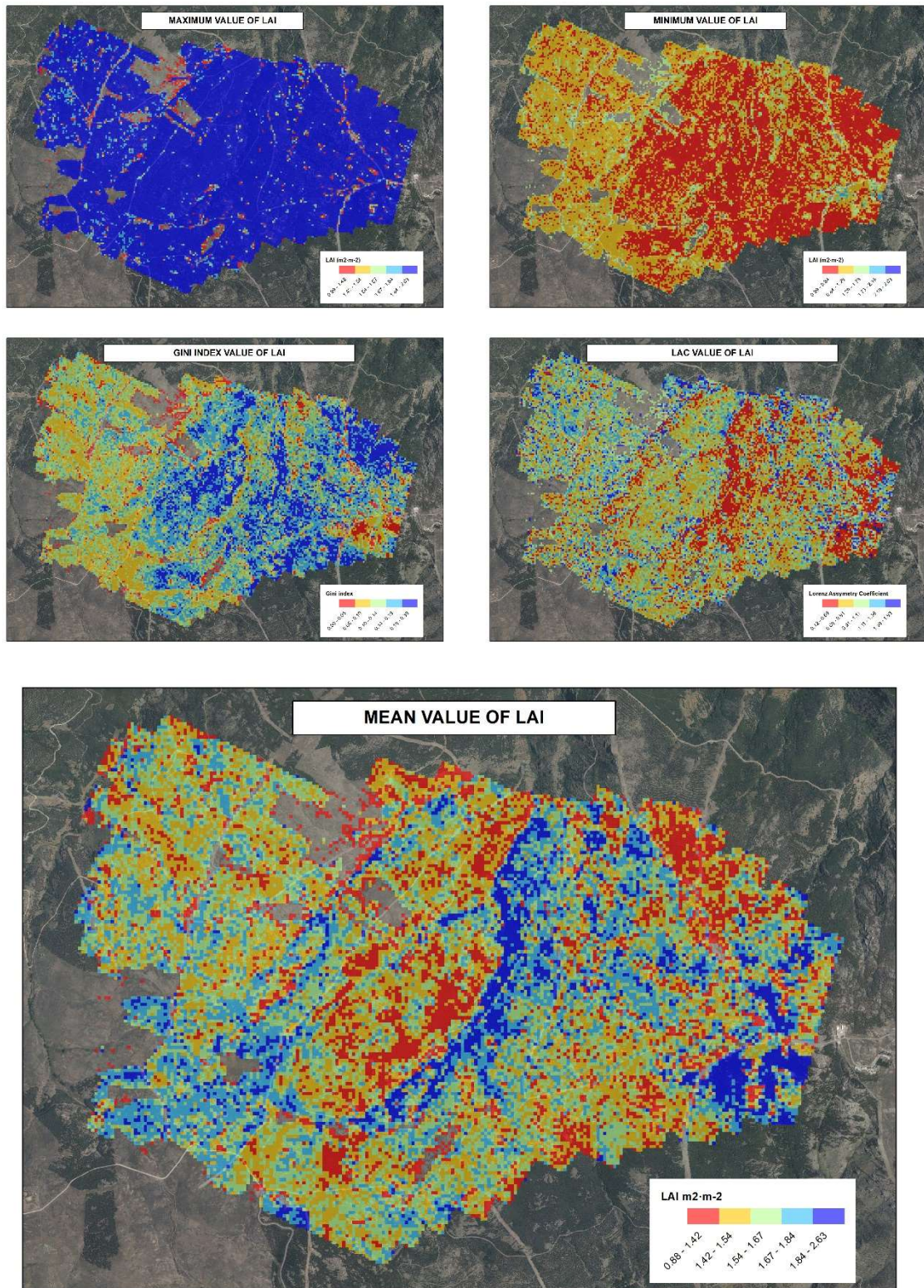
Figure S7: Summarizing raster layers for LAI in every individual tree.
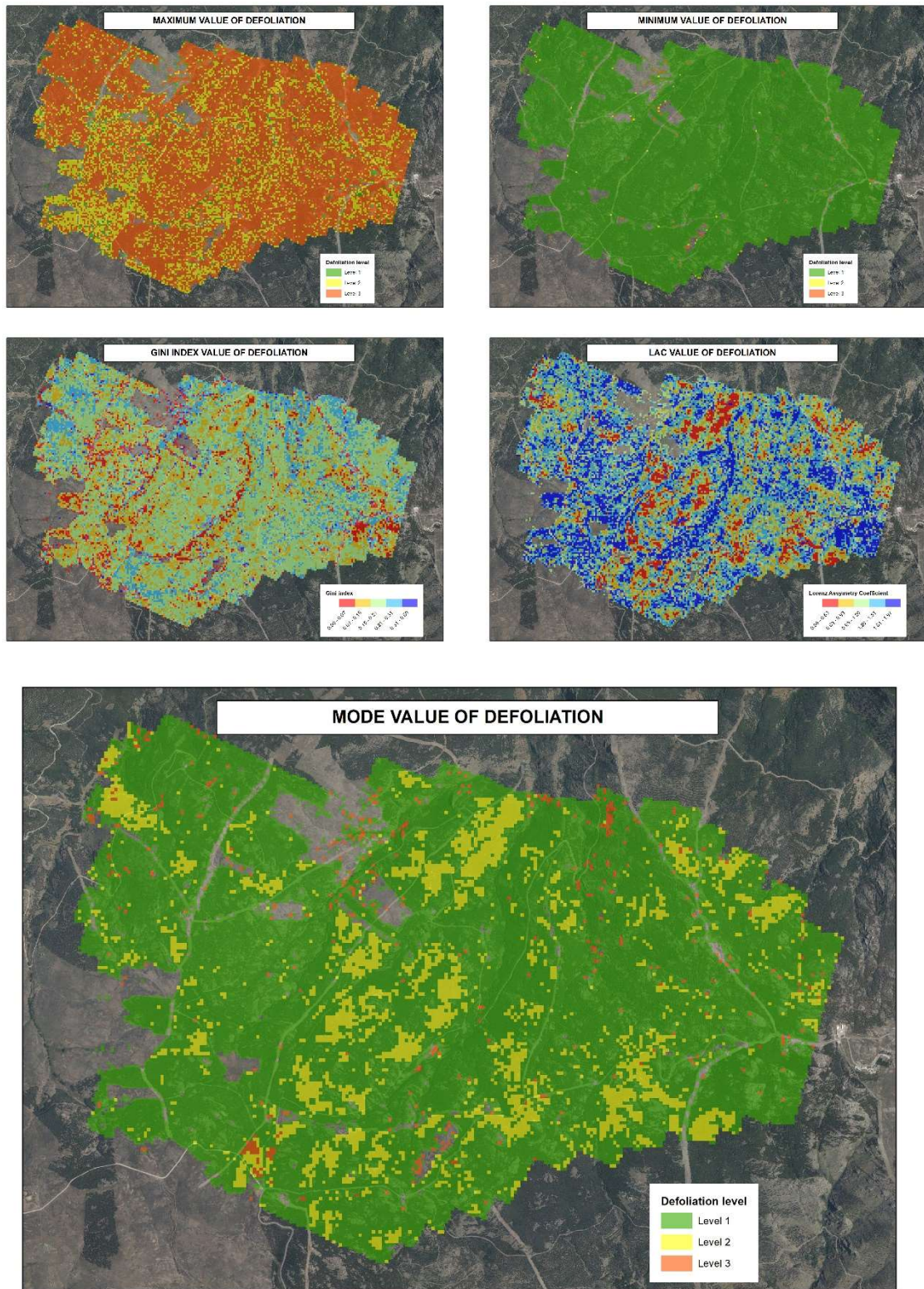
Figure S8: Summarizing raster layers for defoliation levels in every individual tree.

Table S1. Technical specifications of the ALS data.

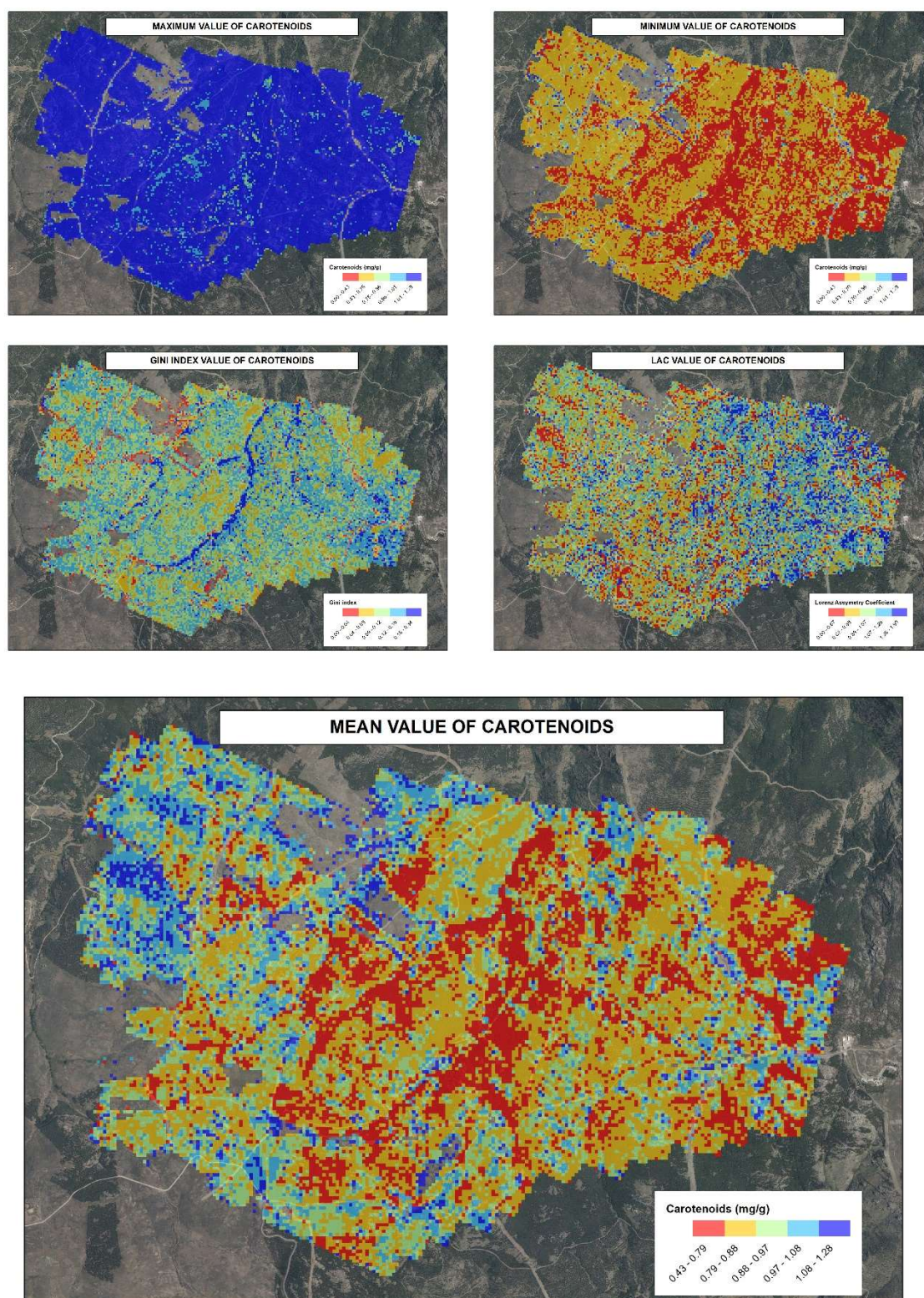| Characteristic	Value
Laser scanning system	Leica ALS60
Wavelength	1064 nm
Average flying altitude above ground level	11000 fts
Field of View	12°
Average point density	9.88 points/m^2
Across Track Accuracy	0.14 m
Along Track Accuracy	0.14 m
Accuracy of the point cloud (RMSEz)	≤0.07 m

Table S2. Selected LiDAR and WorldView2 metrics parameters to run statistical analyses and modelling of Chlorophyll a, Chlorophyll b, Carotenoids, LAI and defoliation.

Abbreviation	Metric
B1_mean	Mean value of pixels included in tree crown for band 1 in WorldView-2
B1_min	Minimum value of pixels included in tree crown for band 1 in WorldView-2
B1_max	Maximum value of pixels included in tree crown for band 1 in WorldView-2
B2_mean	Mean value of pixels included in tree crown for band 2 in WorldView-2
B2_min	Minimum value of pixels included in tree crown for band 2 in WorldView-2
B2_max	Maximum value of pixels included in tree crown for band 2 in WorldView-2
B3_mean	Mean value of pixels included in tree crown for band 3 in WorldView-2
B3_min	Minimum value of pixels included in tree crown for band 3 in WorldView-2
B3_max	Maximum value of pixels included in tree crown for band 3 in WorldView-2
B4_mean	Mean value of pixels included in tree crown for band 4 in WorldView-2
B4_min	Minimum value of pixels included in tree crown for band 4 in WorldView-2
B4_max	Maximum value of pixels included in tree crown for band 4 in WorldView-2
B5_mean	Mean value of pixels included in tree crown for band 5 in WorldView-2
B5_min	Minimum value of pixels included in tree crown for band 5 in WorldView-2
B5_max	Maximum value of pixels included in tree crown for band 5 in WorldView-2
B6_mean	Mean value of pixels included in segmented tree crown for band 6 in
B6_min	Minimum value of pixels included in segmented tree crown for band 6 in
B6_max	Maximum value of pixels included in segmented tree crown for band 6 in
B7_mean	Mean value of pixels included in segmented tree crown for band 7 in
B7_min	Minimum value of pixels included in segmented tree crown for band 7 in
B7_max	Maximum value of pixels included in segmented tree crown for band 7 in
B8_mean	Mean value of pixels included in segmented tree crown for band 8 in
B8_min	Minimum value of pixels included in segmented tree crown for band 8 in
B8_max	Maximum value of pixels included in segmented tree crown for band 8 in
GNDVI	Mean GNDVI value of pixels included in segmented tree crown
RENDVI	Mean RENDVI value of pixels included in segmented tree crown
NDVI	Mean NDVI value of pixels included in segmented tree crown
CRI	Mean CRI value of pixels included in segmented tree crown
PRI	Mean PRI value of pixels included in segmented tree crown
CSI	Mean CSI value of pixels included in segmented tree crown
PSRI	Mean PSRI value of pixels included in segmented tree crown
REY	Mean REY value of pixels included in segmented tree crown
$zperc_i$	i^{th} percentile (10-90) of all the return heights of the segmented tree crown
zmax	Maximum elevation from all returns of the segmented tree crown
zmean	Mean elevation from all returns of the segmented tree crown
zskew	Skewness of the elevation from all returns of the segmented tree crown
zkurt	Kurtosis of the elevation from all returns of the segmented tree crown
Half_height	Half the height of the tree
$zperc_i$m	i^{th} percentile (10-90) of the return heights from the upper half of the height
$binc_i$	i^{th} percentile (10-90) of all the return heights of the segmented tree crown
$binc_i$ m	i^{th} percentile (10-90) bincentile of the return heights from the upper half of
porc1r	Percentage of first returns of the segmented tree crown
porc1rabove	Percentage of first returns above 2 meters of the segmented tree crown

Abbreviation	Metric
porclast	Percentage of last returns of the segmented tree crown
porcunic	Percentage of unique returns of the segmented tree crown
zmin1r	Minimum elevation of the first returns of the segmented tree crown
zperc$_i$1r	i^{th} percentile (10-90) of the first return heights of the segmented tree crown
zmax1r	Maximum elevation of the first returns of the segmented tree crown
zmean1r	Mean elevation of the first returns of the segmented tree crown
zskew1r	Skewness of the elevation of the first returns of the segmented tree crown
zkurt1r	Kurtosis of the elevation of the first returns of the segmented tree crown
cov	Percentage of 1st returns above 2 m from among all 1st returns of the tree
dns	Percentage of all returns above 2 m from amongall returns of the tree