forests — MDPI

Supplementary Materials for:
Spatial Variation in Canopy Structure across Forest Landscapes

Overview: This supplement provides definitions of the 5 CS metrics employed on our analysis. (Table S1). We also provide additional figures illustrating patterns in landscape-scale variation of canopy structure for several of the sites in this study. Figure S1 illustrates a tendency for the value of each CS metric to converge toward a similar value across all sites with a sufficiently long transect. Figure S2 shows the relationship between CS metrics and stability points of CS metrics from Bayesian changepoint analysis. Figures S3–S6 show running means of CS metrics calculated using an averaging window varying in size from 10–150 m; large, sudden shifts in the value of a CS metric that persists across a range of averaging window sizes are hypothesized to indicate the presence of ecotones and/or edaphic gradients to which CS metrics are sensitive.

Table S1. Definitions of canopy structure metrics employed in this analysis.

CS Metric.	Definition
Maximum Outer Canopy Height (MOCH)	Mean of the column maximum canopy height
Vegetation Area Index (VAI)	Mean of column summed vegetation area index
Canopy Rugosity (R_C)	Transect variability of column variability of leaf density
Gap Fraction (GF)	Transect mean of column ratio of sky hits relative to total leaf returns
Canopy Porosity (P_C)	Ratio of bins with no leaf area to total bins

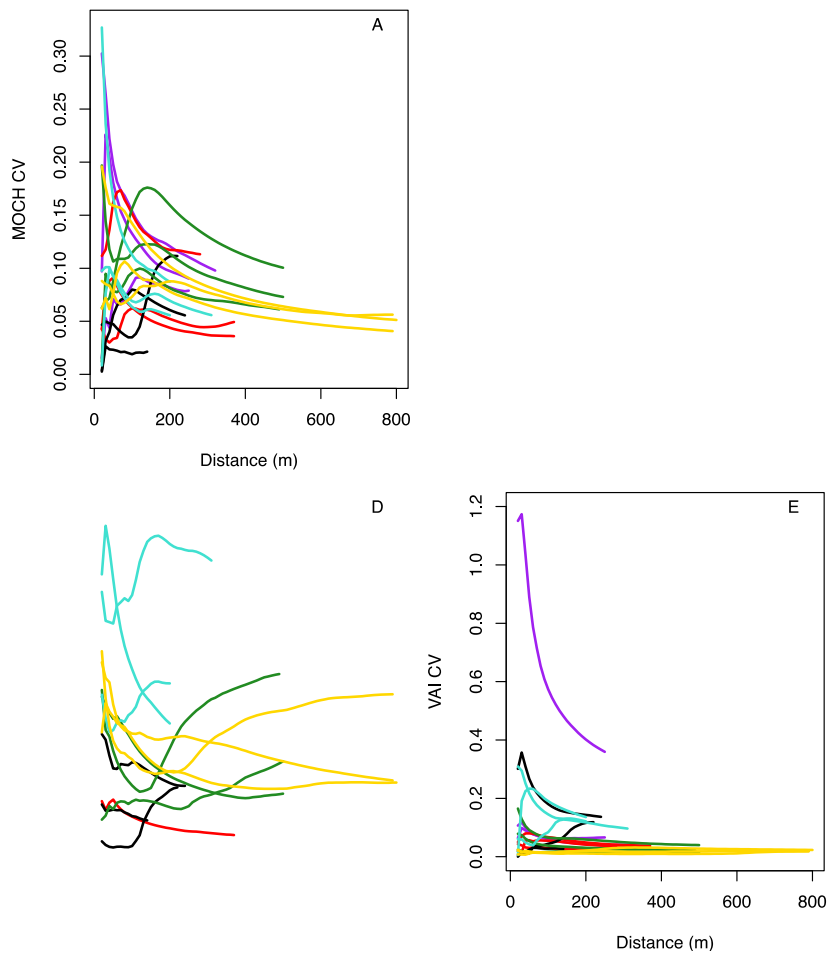Definitions are from (Atkins et al., 2018).

Figure S1. Coefficient of variation of canopy structural complexity metrics from *N* = 3 **individual transects at each of six forested landscapes in Eastern North America.** CS metrics included (**A**) mean outer canopy height (MOCH), (**B**) percentage of deep gap fractions (GF), (**C**) canopy rugosity, (**D**) porosity, and (**E**) mean vegetation area index (VAI).
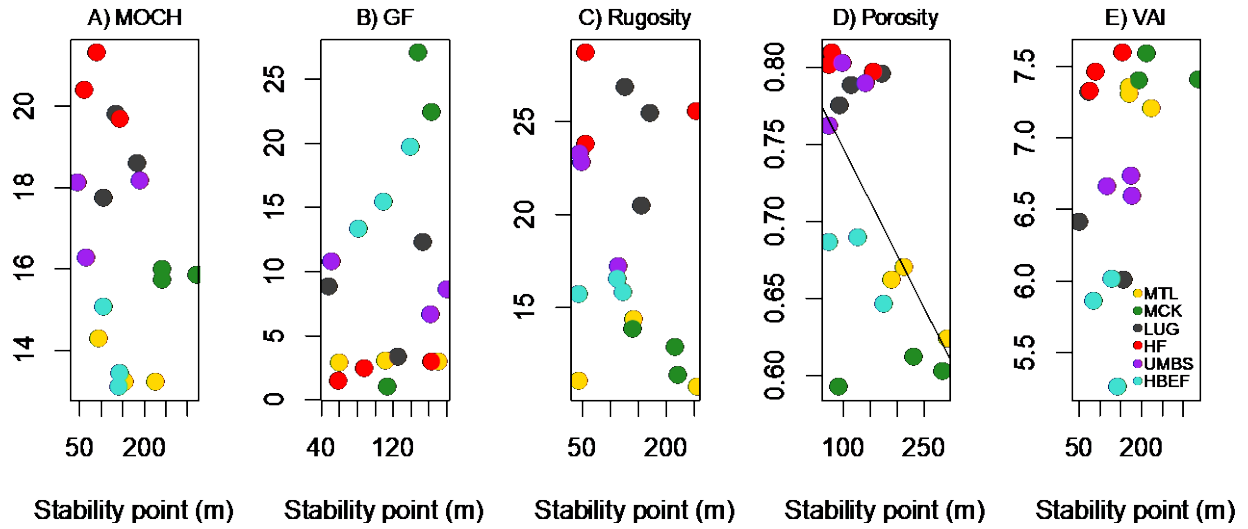
Figure S2. Univariate regression analysis between canopy structure metrics and stability points of CS metrics from Bayesian changepoint analysis along forested transects from six forested landscapes in eastern USA. CS metrics included (**A**) mean outer canopy height (MOCH, $R^2 = 0.04$), (**B**) percentage of deep gap fractions (GF, $R^2 = 0.00$), (**C**) canopy rugosity (R$_C$, $R^2 = 0.01$), (**D**) porosity ($R^2 = 0.32^*$), and (**E**) mean vegetation area index (VAI, $R^2 = 0.03$). $N_{Transects} = 3$ per forested landscape; CSC values plotted here were calculated from the entire PCL transect. The line of best fit is shown for a significant linear relationship between stability point and CS metric. An asterisk indicates a significant R^2 value with $P < 0.05$.
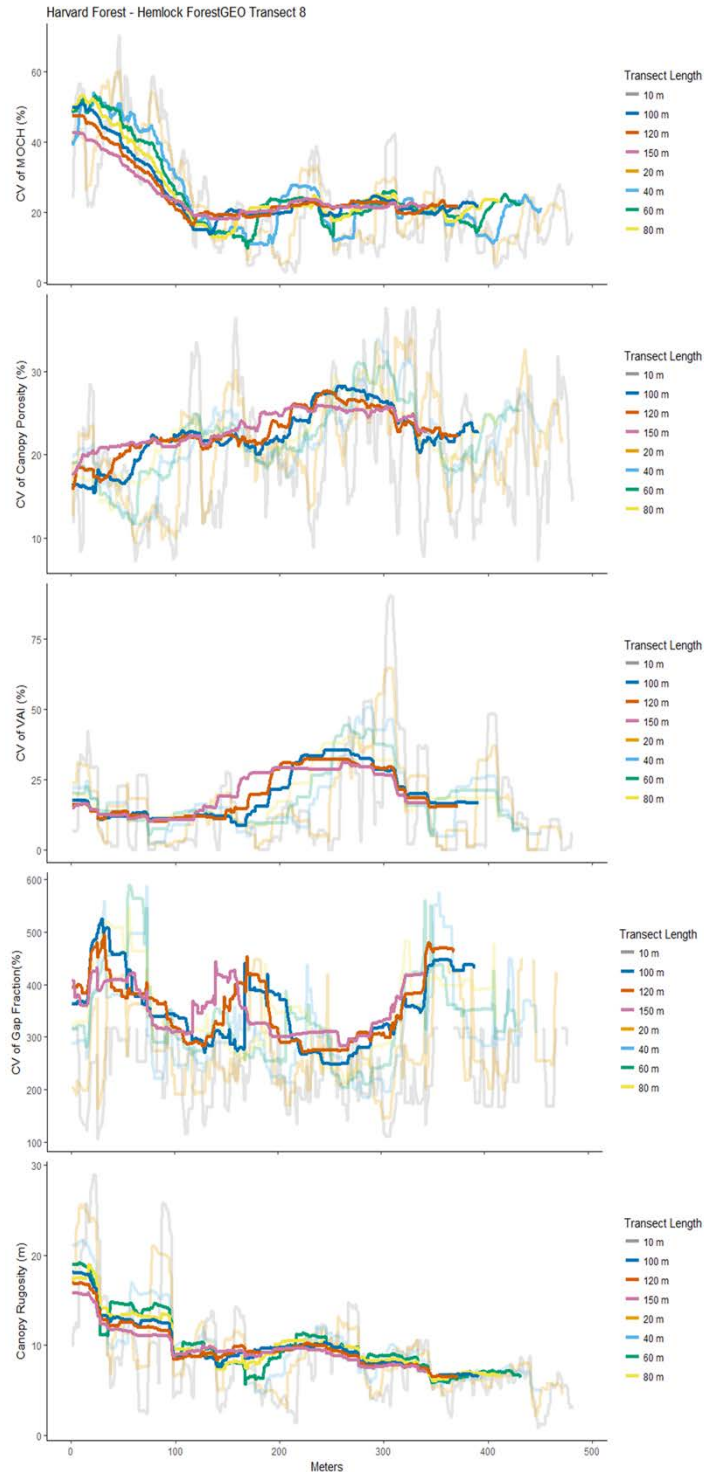
Figure S3. Variation in the value of CS metrics calculated at a range of scales at Harvard Forest. The running mean coefficient of variation of Mean Outer Canopy Height (MOCH), Canopy Porosity, Vegetation Area Index (VAI), Gap Fraction, and Canopy Rugosity were calculated using 10, 20, 40, 60, 80, 100, 120, and 150 m subsegments of the full transects. Shading and alpha levels are included to highlight more consistent calculation distances. Because rugosity is a measure of variance the CV of rugosity is meaningless; we therefore show the running mean calculated over varying distances.
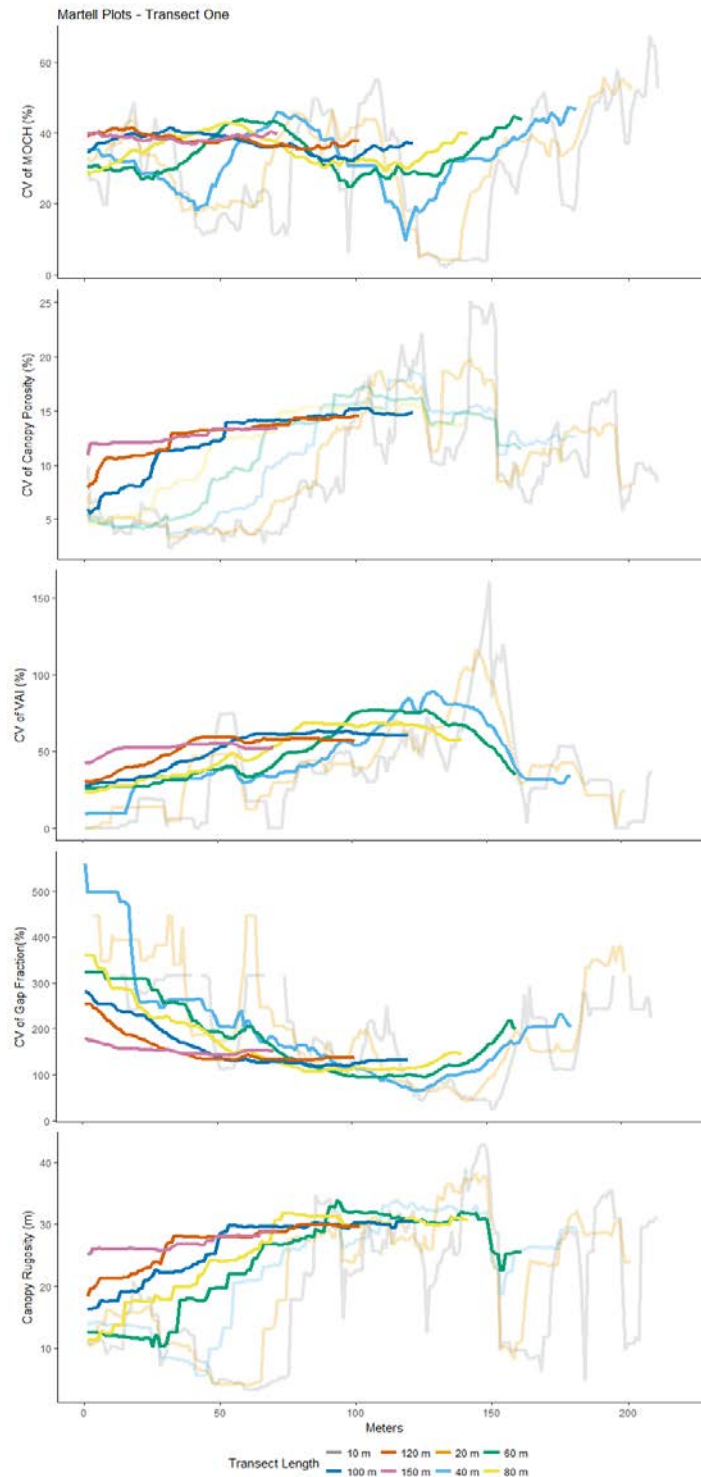
Figure S4. Variation in the value of CS metrics calculated at a range of scales at Martell Forest. The running mean coefficient of variation of Mean Outer Canopy Height (MOCH), Canopy Porosity, Vegetation Area Index (VAI), Gap Fraction, and Canopy Rugosity were calculated using 10, 20, 40, 60, 80, 100, 120, and 150 m subsegments of the full transects Shading and alpha levels are included to highlight more consistent calculation distances. Because rugosity is a measure of variance the CV of rugosity is meaningless; we therefore show the running mean calculated over varying distances.
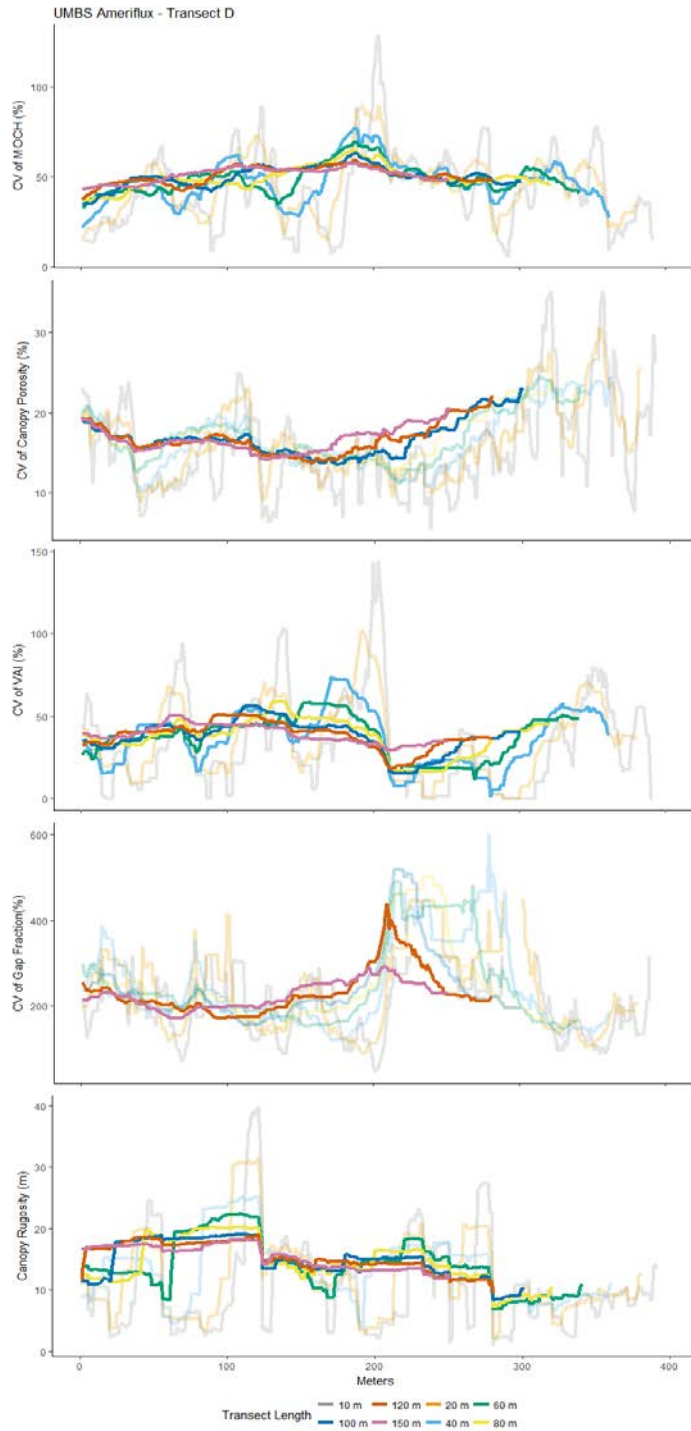
Figure S5. Variation in the value of CS metrics calculated at a range of scales at University of Michigan Biological Station (UMBS). The running mean coefficient of variation of Mean Outer Canopy Height (MOCH), Canopy Porosity, Vegetation Area Index (VAI), Gap Fraction, and Canopy Rugosity were calculated using 10, 20, 40, 60, 80, 100, 120, and 150 m subsegments of the full transects Shading and alpha levels are included to highlight more consistent calculation distances. Because rugosity is a measure of variance the CV of rugosity is meaningless; we therefore show the running mean calculated over varying distances.
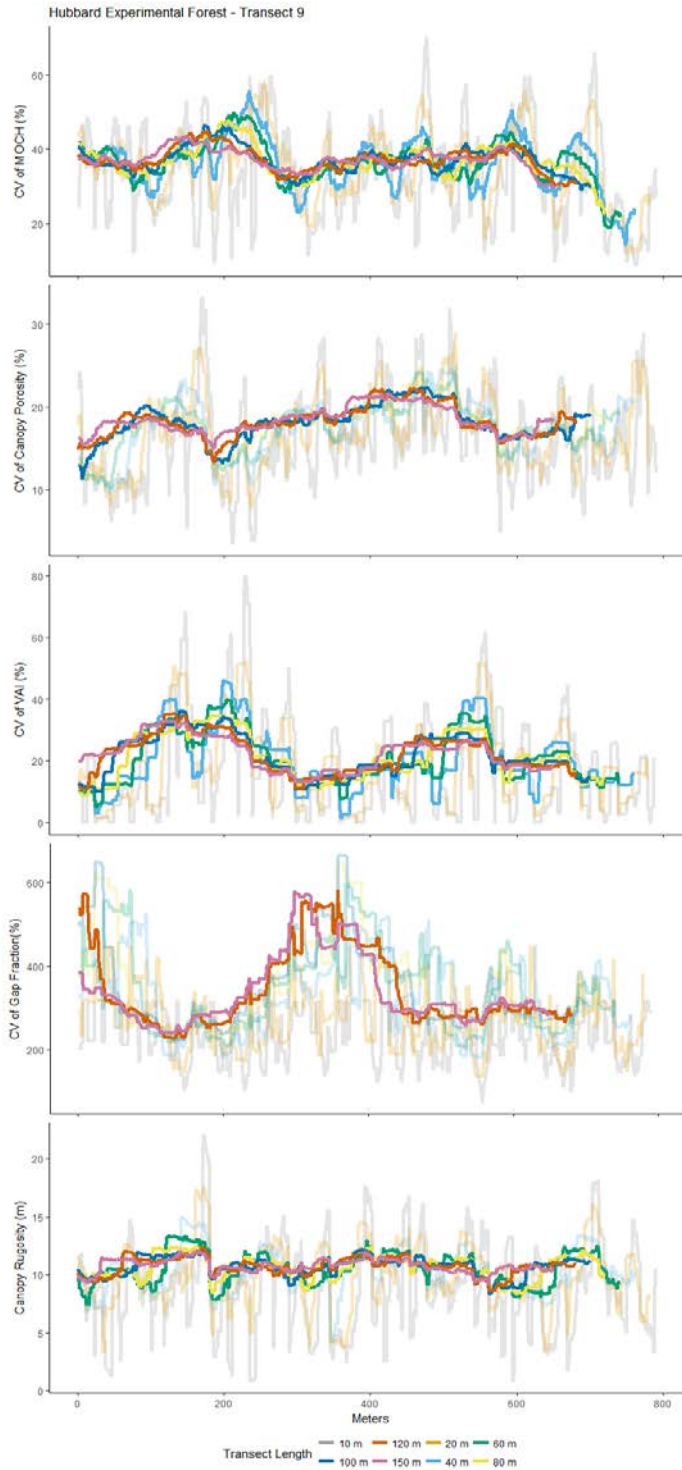
Figure S6. Variation in the value of CS metrics calculated at a range of scales at Hubbard Brook Experimental Forest. The running mean coefficient of variation of Mean Outer Canopy Height (MOCH), Canopy Porosity, Vegetation Area Index (VAI), Gap Fraction, and Canopy Rugosity were calculated using 10, 20, 40, 60, 80, 100, 120, and 150 m subsegments of the full transects Shading and alpha levels are included to highlight more consistent calculation distances. Because rugosity is a measure of variance the CV of rugosity is meaningless; we therefore show the running mean calculated over varying distances.