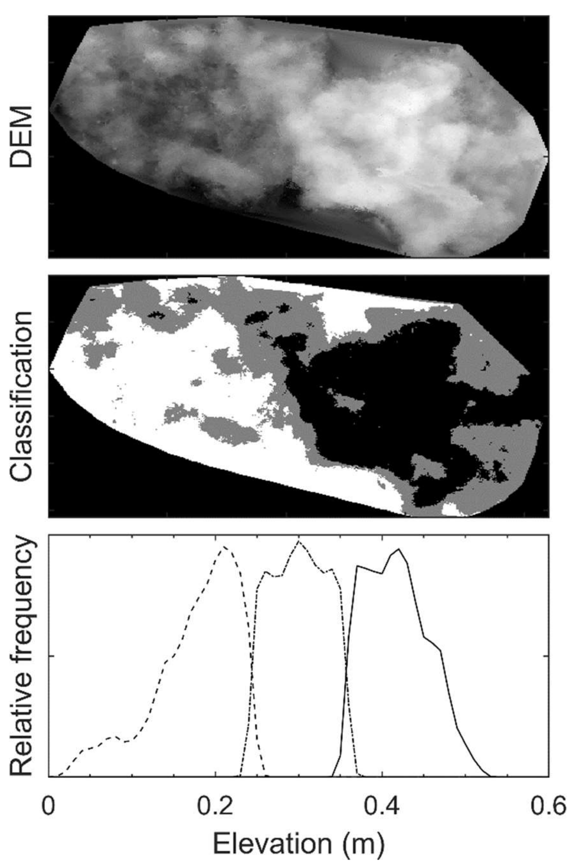
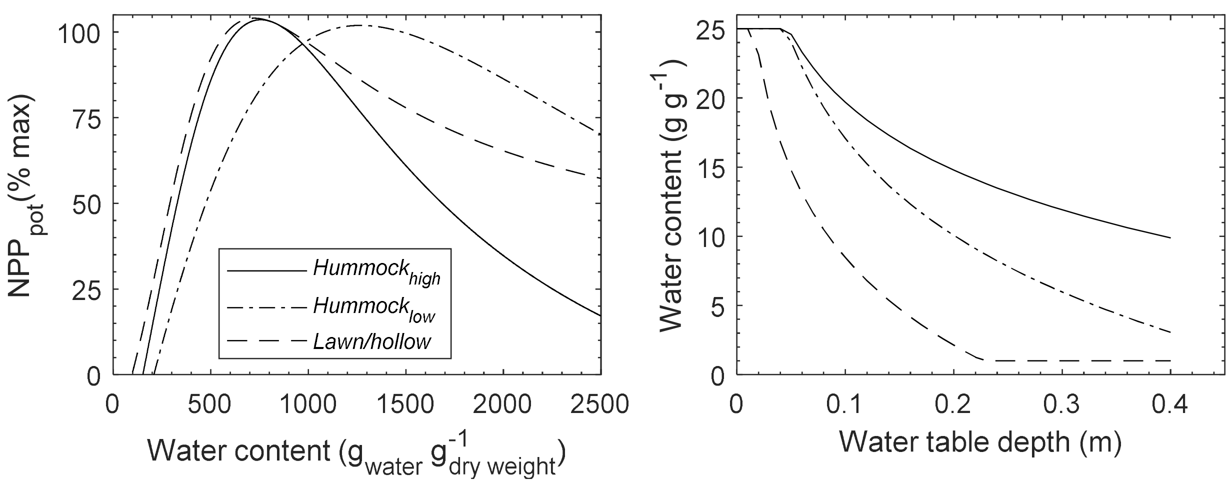
[Figure S1]

Example of unsupervised classification of microtopographic elevation for the Seney, MI *WET* site (top panel) using *k*-means clustering (middle panel). Black, grey, and white classifications correspond with high-, intermediate-, and low elevation classifications. Microtopography was classified using three clusters based on a post hoc analysis of elevation distributions by Gaussian mixture models. The lower panel shows the distribution of height in the high- (solid), intermediate- (dot-dashed), and low- (dashed) elevation classifications. We term these microtopographic classes as high hummock, low hummock, and hollow/lawn.



[Figure S2]

Empirical relations for normalized moss capitula net primary productivity (NPP_{pot} - % of maximum) (a), and moss water content ($g_{water}\ g^{-1}_{dry\ weight}$) (b). Empirical relations were parameterized for high hummocks, low hummocks, and lawn/hollows using *Sphagnum* species of the section Acutifolia, Sphagnum, and Cuspidata, respectively. NPP_{pot} was parameterized using data for *Sphagnum fuscum*[1], *S. papillosum*[1], and *S. cuspidatum*[1], respectively. Water content was parameterized using data for *Sphagnum fuscum*[2], *S. magellanicum*[2], and *S. tenellum*[3], respectively.



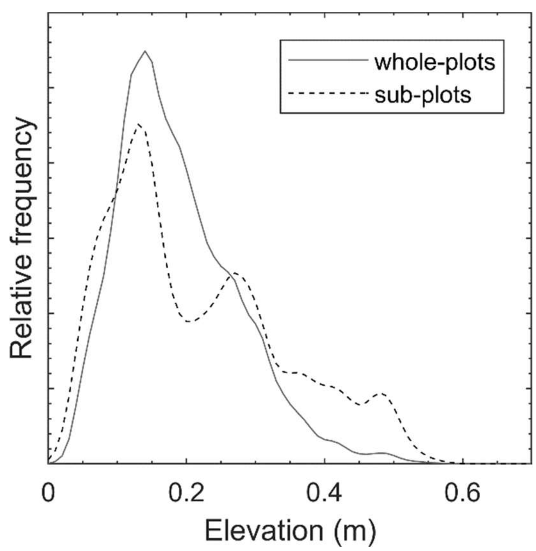
[1] – Schipperges, B., and Rydin, H.: Response of photosynthesis of *Sphagnum* species from contrasting microhabitats to tissue water content and repeated desiccation, New Phytologist, 140(4), 677-684, 1998.

[2] – Strack, M., and Price, J.S.: Moisture controls on carbon dioxide dynamics of peat - *Sphagnum* monoliths. Ecohydrology, 2(1), 34-41, doi: 10.1002/eco.36, 2009

[3] – Rydin, H.: Effect of water level on desiccation of *Sphagnum* in relation to surrounding Sphagna, Oikos, 45(3), 374-379, doi: 10.2307/3565573, 1985.

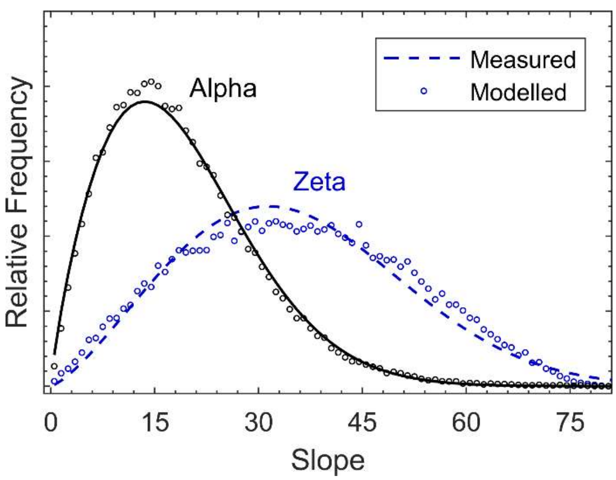
[Figure S3]

Combined relative frequency distribution of all plots (n=9) at the NOBEL, ON site (Table 1) compared to the combined distribution of all Nobel, ON hummock-hollow subplots. Whole plot locations at the NOBEL, ON site where chosen randomly, with a perceived hummock-hollow microform identified around the random point. For each subplot, a location for a hummock and hollow subplot was identified in order to compare morphometric properties at spatial scales typical of chamber flux measurement compared to the microform as a whole.



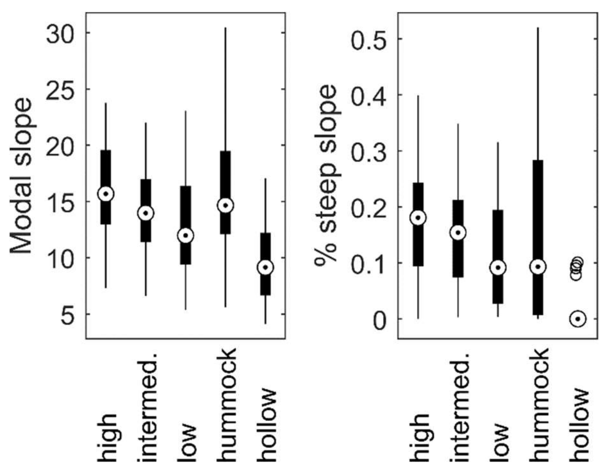
[Figure S4]

Frequency distribution showing goodness of fit of measured and modelled slope for two sample microtopography plots at NOBEL, ON site. Slope is derived from the surface normal of planar fit to elevation in a moving 0.03 m x 0.03 m window for the Alpha and Zeta DEM plots. A Weibull probability distribution is used to model slope distribution at the scale of interest. A Weibull distribution was chosen over other candidate models (i.e. Gamma, log-logistic, and log-normal) based on goodness of fit (AIC) across all plots (n=18).



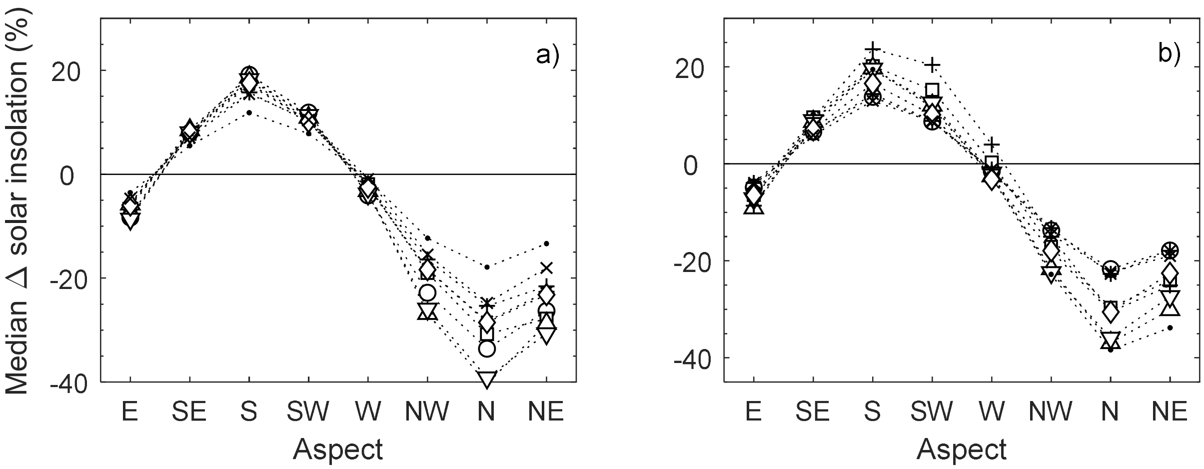
[Figure S5]

Comparison of modal slope from Weibull distribution fit (left panel) and frequency of steep slope (right panel). Boxplots show median (circle with dot), interquartile range (black box), and outliers (open circles) for hummock and hollow subplots as well as high-, intermediate-, and low-elevation GMM clusters.



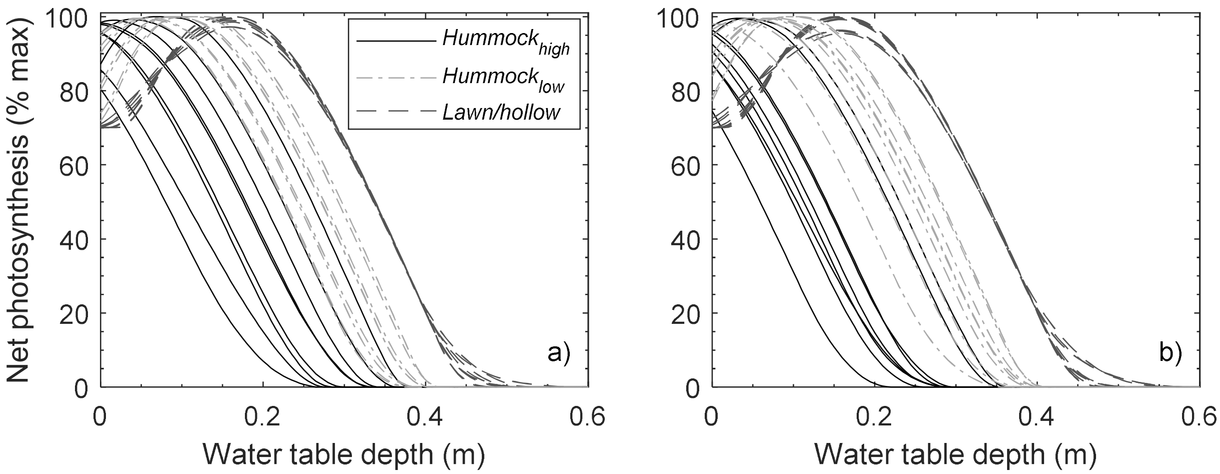
[Figure S6]

Variation in potential solar insolation relative to a flat surface based on aspect for randomly (a) and qualitatively chosen plots (b). Median of aspect-binned values are plotted.



[Figure S7]

Potential net photosynthesis (NPP_{pot}) for three microtopographic classes (e.g. see supplementary figure 1) for random (a) and qualitatively chosen (b) plots. NPP_{pot}-WC and WC-WTD relations are based on a common parameterization (see supplementary figure 2 — low hummock)



[Figure S8]

Modelled potential net photosynthesis (NPP) based on uniform parameterization (bottom row) and parameterization based on microtopographic class (middle row). Empirical relations are shown in supplementary figure S2, where the low-hummock relations are used for the uniform parameterization. Examples are modelled for three water table depths (wtd) relative to the average hollow/lawn elevation. Microtopographic parameterization is based on unsupervised k-means classification of elevation (upper left panel) with plot area classified as hollow/lawn (blue), low-hummock (black) and high-hummock (red) (upper middle panel).