Figure 1: Site map of Bonsai wetland, illustrating the equipment/sampling locations, the location of Fortress Mountain in province of Alberta (A/B), and LIDAR imagery of the basin with daily sun path and topography (C) (Hrach et al., 2021).

Figure 2: Weather data over the 2018 field season: A) incoming solar radiation (K↓,W/m^2, solid line) and hours of shade per day (open circles), B) air temperature (Ta, ^oC, red line) and surface soil temperature (Ts, ^oC, black line) at 2 cm, and C) precipitation (mm) defined by rain (plotted as bars), and soil moisture (volumetric water content, %) at 10 cm (plotted as the line). Vertical lines depict approximate temporal boundaries of the four phenological seasons experienced by the site during the study period, as described in more detail in text.

Figure 3: Daily average Evapotranspiration (ET) plotted alongside the average hours of shade per day (black dots) at Bonsai Wetland, Fortress Mountain, Alberta, 2018. Vertical lines depict approximate temporal boundaries of the four phenological seasons experienced by the site during the study period.

Figure 4: Average (a) Daily carbon dioxide fluxes (g C m^{-2} day), and (b) Cumulative carbon dioxide fluxes (g C m^{-2} day): Ecosystem Respiration (R_{eco}), Net Ecosystem Exchange (NEE), and Gross Primary Production (GPP), and Cumulative Evapotranspiration (dashed line) at the wetland study site, Fortress Mountain, Alberta, 2018.

Figure 5: Relationships between the Hours of Shade and Evapotranspiration (ET) and Carbon Fluxes (GPP: Gross Primary Production, R_{eco}: Ecosystem Respiration, and NEE: Net Ecosystem Exchange) on clear sky days during the periods of *Stable Shade* (a), and *Dynamic Shade* (b) at the wetland study site, Fortress Mountain, Alberta, 2018. Note the range of the x-axis is different between the two plot-panels.

Figure 6: 30-min averages of energy (Solar and Q* in W/m^2), water (ET in mm), and carbon (GPP g C/ m^2) fluxes displayed as spectrograms, showing the amplitude of the flux by colour intensity, the x-axis representing time of day and the y-axis representing the day of the year.

Figure 7: Diurnal carbon and water fluxes defined by gross primary production (GPP), Ecosystem Respiration (Reco), Net Ecosystem Exchange (NEE), and Evapotranspiration (ET) for *Stable Shade* (June 7th to July 30th) and *Dynamic Shade* (July 31st to September 10th). 95 % confidence intervals are shaded around each diurnal flux, while the average sunrise and sunset for Stable Shade (dashed) and Dynamic Shade (solid) are labelled as orange lines.

Table 1: Average daytime (Q* > 10 W/m^2) Water and carbon fluxes over the study period on clear sky days: Snow Melt (June 7-23), Green Up (June 24 to July 20), Peak Growing Season (July 21 to August 23), and Late Growing Season (August 24 to September 7). Standard deviations (S.D) are listed below in parentheses.

Table 2: Comparison of group means between *Stable* and *Dynamic* shade periods during *Peak growing* season for various variables (n=248 of which 168 belong to *Dynamic* and 80 to *Steady*), using the Wilcoxon rank test and Student t-test. $\dot{x}_D$ represents group mean for *Dynamic* shade and $\dot{x}_S$ for *Steady* shade).

Table 3: Analysis of the relative contribution to the explanatory power of key variables of the best-fitted GAM-model for observed daytime (Rg>50 mmol/mol) ET during the *Peak Growing* season.

Table 4: Analysis of the relative contribution to the explanatory power of key variables of the best-fitted GAM-model for observed daytime (Rg>50 mmol/mol) GPP during the *Peak Growing* season.