**SUPPLEMENTARY FIGURE CAPTIONS**

**Figure S1:** The number of recruits per pot in the initial growth experiment at harvest is shown for each sediment shape treatment. The initial input of 350 seeds is shown for reference as a dashed line near the top of the figure. Recruitment varied significantly between sediment treatments, likely as a consequence of variation between treatments in the physical removal of seeds by the tides (F**2,123** = 30.64, n = 42, p < 0.001). Seeds rested on the surface of the sediment and were not buried due to the negative germination response of this species even to shallow burial (~ 0.5 cm).

**Figure S2:** The time series analysis of *S. procumbens* growth was performed using photographs of individuals taken periodically as shown here. Sediment topology in the square pots were altered by ± 1 cm to produce lowered, flat, and raised sediment surface treatments. Each pot contained a single individual seedling.

**Figure S3:** *S. procumbens* recruits from the initial growth trial against a high-contrast red base board in preparation for photo quantification of the total aboveground planform area. On the right is the photo result after binary plant classification. Black pixels represent area occupied by a plant.

**Figure S4:** The calibration curve used to calculate *S. procumbens* aboveground dry biomass based on the platform area of individuals taken from photographs. The rotational symmetry of *S. procumbens* recruits makes the species a particularly effective subject for this approach (R2 = 0.963, n = 126, p < 0.001).

**Figure S5:** A snapshot of the image generated by the planar optode experiment. For each image in the time series, every pixel in a row was averaged together to calculate an average oxygen saturation value at each depth in the sediment profile. In total a depth profile of 6.24 cm could be sampled at a resolution of 0.0106 cm.

**Figure S6:** The lower panels show various methods for quantification of episodic oxygenation events, contrasted between sediment shape treatments. The top panel displays three characteristic oxygen signals over the tidal cycle. Colors correspond with the three sediment shape treatments. (I) Oxygen profile patterns characterized by the ‘oxygen decline rate’ (see Figure 6) during the equilibrium state of low tide. (II) Oxygen profile patterns at the peak of the oxygenation event. (III) The duration of the oxygenation event, determined by the interval between the onset of high tide and the crossing of the (arbitrary) oxygen decline rate threshold, 4.2 O2 sat. % cm-2. Letters within panels correspond to statistically significantly separate contrast groups (p < 0.05).

**Figure S7:** The water content (%) of the sediment used in the first growth trials is displayed at depth in the sediment.Sediment water content was measured in 1 cm segments along the entire length of the sediment column. Colored bojxplots represent different sediment surface treatments (yellow: ‘lowered’, green: ‘flat’, but: ‘raised’). Sediment water content decreased rapidly over the first centimeter in all treatments but did not change significantly over the remainder of the sediment column (R2 = 0.020, n = 159, p = 0.104). Lowered sediment surfaces are on average wetter in the upper depth layers likely due to the pooling of surface water (p < 0.001, n = 38 for both raised-lowered and flat-lowered in depth layers 1 - 3), which can impact sediment consolidation. No significant differences between ‘flat’ and ‘raised’ sediment surfaces were detectable at any depth layer (Raised-flat: p = 0.418, n = 53 in depth layers 1 - 4).

**Figure S8:** The water content (%) of the sediment used in the first growth trials is displayed against sediment topology treatments. Treatment groups within the blue box were unable to drain vertically. Flat and raised sediment treatments were statistically indistinguishable in water content (p = 0.144, n = 42). Water build-up in the sediment as a consequence of differences in vertical drainage occurred only in lowered sediment treatments (p < 0.001, n = 42). There were no significant differences in the sediment water content between the various inundation duration treatments (p = 0.456, n = 42).

**Figure S9:** As seen also in Figure 7, this video displays a time series of oxygen profiles demonstrating a typical oxygenation event between the three sediment topology treatments in the three separate panels: lowered (a), flat (b), and raised (c). The video format allows for emphasis to be placed on differences in the event duration between sediment topologies. Within raised sediment surfaces the oxygenation event had a much greater duration before returning to an equilibrium (3.6 ± 0.7 hours) as compared to flat (1.3 ± 0.3 hours) and lowered (0.5 ± 0.3) sediment treatments.