**Materials and Methods**

**Study site –** The Forestry Research Centre (FRC) of the Sabah Forestry Department is located in the Malaysian state of Sabah next to the Sepilok Forest Reserve (5° 10` N, 117° 56` E). The climate of Sabah is largely aseasonal (Maycock *et al.*, 2005; Born *et al.*, 2014; Margrove *et al.*, 2015), but there are relatively regular wetter and drier periods throughout the year (Fig. S2). The mean annual rainfall is 3136 (±921 SD) mm with an average annual temperature of 27.3°C (as measured at the nearby Sandakan airport ca. 15 km away). The climate also varies supra-annually, which is linked to changes in the El Niño Southern Oscillation (ENSO; (Moerman *et al.*, 2013).

**Shade enclosure –** We used a large shade house (25 x 15 m for a total of 375 m2) with a single shade cloth covering all sides (Philipson *et al.*, 2012, 2014; O’Brien *et al.*, 2013). The percentage of direct sunlight under the shade cloth was about 22.4% (±1.8 SD) of photosynthetically active radiation as measured by an LAI-2000 plant canopy analyser (LI-COR, Nebraska, USA), which is approximately similar to a large gap in the forest (Philipson *et al.*, 2012). We separated the shade house into five blocks of 5 x 15m to account for variation in environmental effects within the shade house and to control for sampling effects due to differences in the timing of destructive harvest. Within each block, seedlings were spaced at 0.5 m intervals and their positions fully randomised.

**Species seedling’s -** A total of 800 seedlings were used in this experiment from 10 species of the family Dipterocarpaceae collected from 92 different mothers across four locations in Sabah (Table. S1). We included as many mothers from as many locations in Sabah as possible to incorporate genetic diversity (Cheng Choon *et al.*, 2017). Mother were distributed as evenly as possible throughout the experiment by block and treatment. Seeds were collected directly from mother trees during the general flowering in 2014 using a big-shot (SHERRILLtree, USA) and rope to shake branches and release seeds. Seeds were germinated in wet jute sacks and grown in 9 x 15 cm polybags filled with a local alluvial soil and sawdust (specific to site). Seedlings were ca. 1 year old when the experiment began. Six weeks prior to the start of the experiment, seedlings were transferred to 15 x 20 cm polybags to ensure that root growth was not restricted during the experiment. Seedlings were placed inside a 5 L plastic water bottle with the top removed and were transferred from the nursery to randomised positions for 6 weeks of acclimation. The 5 L bottle allows each seedling to be independently flooded in accordance with its specific water inundation treatment.

**Treatments –**Seedlings were assigned different frequencies of water inundation to mimic natural water inundation cycles in the forest. Specifically, our treatments reflected aspects of the water inundation in the forest that vary depending on micro-topography, soil drainage and rainfall quantities that regulate the frequency and duration of water inundation. There were eight treatments ranging from constantly flooded over a 21 day cycle to never flooded (Fig. 1). These 21 day cycles were repeated four times. Because the eight levels of our treatments form a continuous distribution in water inundation frequency, we could use these frequencies of water inundation as a continuous explanatory variable.

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| **Figure 1 | The eight treatments water inundation frequencies over 1 cycle.** The flooding depth was ca. 2.5 cm above the soil line. These eight levels were combined to produce a single continuous explanatory variable used to regress against our various response variables. |

**Explanatory variables –** We used mixed effects models to subsequently analyse the data, and, in addition to water inundation frequency, we used five fixed effects variables: wood density, stomatal index, initial diameter, root: stem ratio, and leaf mass proportion. Wood density was taken from the global wood density database (Zanne et al., 2009). The mean wood density was calculated for species with more than one individual measurement. Stomatal index is a dimensionless index that incorporates the size and density of stomata (Sack *et al.*, 2003; Inoue *et al.*, 2015). It is calculated as the . We used the nail varnish technique whereby clear nail varnish is applied to the abaxial side of the leaf. Once dry, a hole punch was used to cut a leaf disk with the coating on. The coating creates an impression of leaf surface, which is transferred to a glass slide. A microscope with a video link was used to count the density of stomata and measure the length of guard cells (n = 6 samples per species). The initial diameter was measured at 5 cm above the soil line on the first day of the experiment with digital callipers. Two measurements were made perpendicular to each other and the average taken by calculating the area of an ellipse and recalculating the diameter using the area of a circle formula, this simplifies to: . Additionally, we measured the initial height and counted the number of leaves on each plant. These measurements were used to predict leaf, stem and root biomass portions of plants in the experiment using allometric equations.

The proportion of leaf mass to total biomass was used as a proxy for the total amount of potential carbon intake compared to the projected growth and maintenance costs of the plant. A week prior to the beginning of the experiment, additional seedlings not used in the experiment were measured for diameter at 5 cm above the soil, height and leaf number. These seedlings were destructively harvested. The woody tissues were oven dried at 105°C for 48 hours and leafy tissues were dried at 60°C for 48 hours and all material was then weighed. The number of individuals harvested per species depended upon quantities available (mean individuals per species was 19 ± 10 SD for a total of 194 individuals). A separate allometric model was constructed for all three biomass fractions, but the method was the same. Using forward model selection, we moved from the null model towards a maximal model with all interactions fitted with diameter, height, leaf number and species as predictors to the respective biomass quotient. Data was natural log transformed to meet assumptions of linearity and equal variance. This was the same case for all three divisions of biomass. The final models had ; ; and , and hence was suitable to calculate the initial stem, root and leafy biomass for all 800 seedlings in the experiment. The final model structure and all coefficients for prediction can be found in the SOM (Table S2).

**Response variables –** In this paper we provided an analysis of the effects of water inundation on four explanatory variables, growth, mortality, and two measures of gas exchange. At the end of the experiment (84 days), all alive seedlings had their diameters measured. The relative growth rate was calculated using the equation (Sheil *et al.*, 2008); where t1 and t2 are the sizes at the start and end of the interval respectively. We expressed the relative growth rates as mm 30 day month-1. At the end of the experiment, each seedling was recorded as alive (1) or dead (0). Photosynthesis and transpiration were measured using a LCpro-SD advanced photosynthesis measurement system with the leaf chamber attachment (ADC Bioscientific ltd., Herts, UK). Measurements were made on randomly selected plants in the shade enclosure between 10:00 and 15:00 over the course of 11 days. In total 548 measurements were made.

**Statistical analysis** – Generalised and linear mixed effects models were used for all response variables with binomial and Gaussian error distributions used respectively (R3.3.1 package = lme4; (Bates *et al.*, 2016)). Models were fitted with the variables wood density, stomatal index, treatment frequency, root: shoot ratio, proportion of leafy biomass and diameter and all two-way interactions. Log transformations were also tried for diameter, and treatments effects as exploratory graphs suggested such relationships. Using the dredge function from the R v3.3.1 (R Core Team, 2016) package MuMIn (Barton, 2016) all model combinations were implemented. We selected the model with the lowest AIC – 6 per additional variable. In all cases, the random effects were normally distributed. The model residuals were ; ; and ensuring our parameters are robust, and . Anova function from the lmerTest package (Kuznetsova *et al.*, 2016) was used to calculate linear mixed model p-values by calculating the degrees of freedom based on the Satterthwaite’s approximation. All analysis and graphics were completed in R v3.3.1 (R Core Team, 2016).

**Statistical analysis –** Generalised linear mixed effects model with binomial error distributions were used to model mortality. For all other responses a linear mixed model with a Gaussian distribution was used (R3.3.1 package = lme4; (Bates *et al.*, 2016)). The four responses variables we measured were mortality, growth rate, photosynthesis and respiration. The explanatory variables were initial diameter, treatment frequency and 5 traits. These traits were SLM, SI, leafy: total biomass ratio, wood density and root: shoot ratio. We found that the variance inflation factor (VIF) was greater than 2 for SI, SLM, and leafy: total biomass when all were included in the model as additive effects. However we found when SLM was removed all other parameter VIFs were below our threshold of 2. Hence we excluded SLM form the analysis due to its collinear effect on other variables. Random effects were species, mother and block, as well as date of measurement for the transpiration and photosynthesis variable. Species was treated as a random effect as our focus was on understanding how species traits effect survival, and the model would be unidentifiable if species was treated as fixed. We fitted a full model with all species traits and all three-way interactions including treatment frequency. This model set up was tested for every combination, and repeated the process where treatment was considered as a log transformed. The model with the lowest AIC was selected, validated and interpret. The model residuals were ; ; and ensuring our parameters are robust, and . For the binomial model, we binned residuals for evaluation. All random effects were considered normally distributed. All analysis and graphics were completed in R v3.3.1 (R Core Team, 2016).